ATTACHMENT SOC6/6.3/G

National Environment Protection (Assessment of Site Contamination) Measure 1999 National Environment Protection (Assessment of Site Contamination) Measure 1999 National Environment Protection (Assessment of Site Contamination) Measure 1999 National Environment Protection (Assessment of Site Contamination) Measure 1999 National Environment Protection (Assessment of Site Contamination) Measure 1999 National Environment Protection (Assessment of Site Contamination) Measure 1999 National Environment Protection (Assessment of Site Contamination) Measure 1999 National Environment Protection (Assessment of Site Contamination) Measure 1999 National Environment Protection (Assessment of Site Contamination) Measure National Environment

# Summary of Public Submissions and National Environment Protection Council Response

Amendment to the
National Environment Protection
(Assessment of Site Contamination)Measure

This document is also available on our website

http://www.scew.gov.au/nepms/assessment-of-site-contamination.html

or from:

NEPC Service Corporation

GPO Box 787

Canberra A.C.T 2601

Telephone: 02 6274 1819

Facsimile: 02 6274 2505

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# Summary of public submissions and NEPC response

# 1 INTRODUCTION

## 1.1 Background

Site contamination is recognised as a major environmental issue for Australia. Contaminated sites have significant economic, legal and planning implications in addition to posing a possible threat to public health and the environment.

The purpose of the National Environment Protection (Assessment of Site Contamination) Measure (NEPM) is:

- to establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry.

The desired environmental outcome for the NEPM is:

- to provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination.

The NEPM comprises a policy framework supported by Schedules A and B as shown in Figure 1.

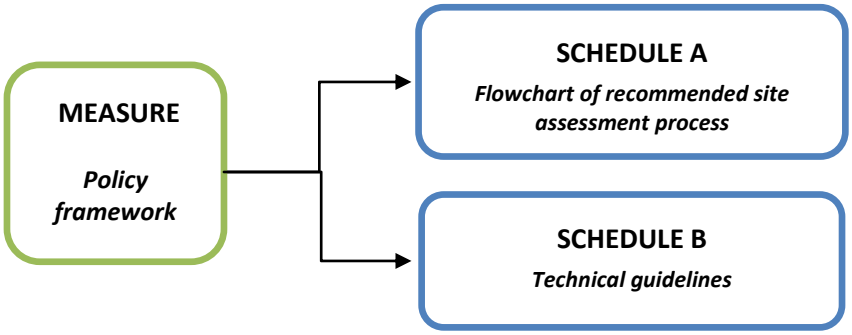


**Figure 1 Structure of the NEPM**

The guidelines making up Schedule B are listed in Table 1.

The NEPM has been in place since 1999 and is the premier guidance document in Australia for the assessment of site contamination. The NEPM has been recognised by regulators, environmental auditors, consultants, developers and others as a comprehensive source of guidance. It addresses a complex area that is particularly subject to new developments in scientific knowledge and technology.

With the high cost of site assessment and remediation, it is important that new scientific and technical information is incorporated into the NEPM to provide well-informed investigation levels, and provide clarification on the site investigation process to minimise unnecessary remediation. The benefits of assessment and remediation, in terms of safeguards for human health and environment protection as well as realising the commercial benefits of remediating degraded land, far outweigh the costs of appropriate assessment and remediation.

**Table 1 List of technical guidelines making up Schedule B of the NEPM**

| Schedule | Guideline | Title |
|---|---|---|
| B | 1 | Guideline on investigation levels for soil and groundwater |
| | 2 | Guideline on data collection, sample design and reporting |
| | 3 | Guideline on laboratory analysis of potentially contaminated soils |
| | 4 | Guideline on health risk assessment methodology |
| | 5 | Guideline on ecological risk assessment |
| | 6 | Guideline on risk based assessment of groundwater contamination |
| | 7 | Schedule B (7A) Guideline on health-based investigation levels<br>Schedule B (7B) Guidelines on exposure scenarios and exposure settings |
| | 8 | Guideline on community consultation and risk communication |
| | 9 | Guideline on protection of health and the environment during the assessment of site contamination |
| | 10 | Guideline on competencies and acceptance of environmental auditors and related professionals |

A review of the NEPM was carried out in 2005 - 2006. This review recommended changes to significantly improve the effectiveness and efficiency of the NEPM by addressing technological, scientific and health risk issues raised by site assessors, consultants, land developers, auditors, the public and jurisdictions. The amendment of the NEPM (also know as a variation) would provide improved certainty that human health and the environment are adequately protected and levels of site management which are commensurate with the risk that the contamination poses to human health and the environment.

## 1.2 Purpose of this document

This document outlines the consultation process and summarises the feedback received on the draft amended NEPM. A detailed summary of responses is provided in the appendices.

# 2 PUBLIC CONSULTATION

## 2.1 Background

In accordance with the requirements of section 18(1) of the NEPC Act, NEPC authorised the release of a draft amended Measure and Impact Statement (Consultation Regulatory Impact Statement or CRIS) for the assessment of site contamination. The purpose of this action was:

- to invite public comment on the appropriateness of the amendments to the NEPM and the impact statement
- to encourage public discussion on the development of appropriate guidelines for inclusion in the Schedules of the final Measure as varied
- to ensure the process of developing the amendment to the Measure was as open and transparent as practicable.

The NEPC sought comments, information and feedback about:

- the appropriateness of the amendments to the Measure
- the usefulness of the draft amendments to the Schedules
- the analysis of the potential environmental, social and economic impacts of the draft amendments to the NEPM as provided in the CRIS.

## 2.2 Consultation period

The consultation period on the draft amendment to the Measure and the CRIS was for two months from 24 September to 26 November 2010.

The consultation period was widely advertised, including through:

- Public notices in The Australian
- Public notices in a prominent daily newspapers in each State and Territory (e.g. details were advertised in the The West Australian in Western Australia)
- Details published on the EPHC website
- Email advice to the EPHC mailing list (in excess of 600 people)
- Other networks including the Association of Contaminated Land Consultants Australia and the Australasian Land and Groundwater Association.

To assist people who wished to make submissions, public meetings were held in every state and territory capital city. These meetings were advertised on the EPHC website at <www.ephc.gov.au> and advertised in each State and Territory.

## 2.3 Submissions received

Forty seven responses were received, and provided a representative range of individual business, industry, academic and government perspectives. No responses were received from the general public.

All written submissions received on the draft amendment to the NEPM and the CRIS were acknowledged by NEPC. The submissions have been collated and categorised into various sections of the draft amendment to the NEPM and the CRIS, as follows:

- comments raised on the draft amendment to the Measure
- comments on the draft amendment to the Schedules
- comments on the information included in the Impact Statement and additional information on the potential economic, health, social and environmental consequences of making the amendment to the NEPM.

The full list of submitters is provided in Appendix A and the detailed summary of responses are provided in Appendices B to K. A summary of the responses, guideline by guideline, is provided in chapter three.

# 3 SUMMARY OF RESPONSES

## 3.1 Measure

No comments were received on the proposed changes. Two comments were received on other issues: one noting that the documents did not have a strong focus on protection of water resources and a second that the hierarchy of options might be enhanced by reference to sustainability of treatment.

Changes to Principles 14 (Environmental impact) and 18 (Attainment of environmental outcomes) in the Measure have been made in response. Additional references to protection of water resources have been added to Schedules B1, B2 and B6.

## 3.2 Schedule A

The process flowchart in Schedule A has been modified to:

- focus on the decisions in the process to emphasise the multiple ways to reach the best outcome
- emphasise site-specific risk assessment rather than remediation
- incorporate management of site-specific risks.

The changes to Schedule A appear to be well supported. A number of responses were received to the effect that Schedule A could be improved by including specific reference to the assessment of asbestos contaminated sites. Minor edits have been carried out to improve consistency in terminology and inclusion of specific mention of asbestos contamination.

## 3.3 Guideline on investigation levels for soil and groundwater (B1)

Schedule B1 establishes a framework for the use of investigation levels. An investigation level is the concentration of a contaminant above which further appropriate investigation and evaluation will be required. The framework is based on a matrix of health, and environment-based soil and groundwater investigation levels. The appropriate use of investigation levels is an important component of site assessment. In particular, it is important to be able to select the most appropriate investigation levels for use from a range of environmental settings and land use scenarios that are based on considerations including the protection of health and the environment.

In the NEPM, investigation levels are health-based, ecologically-based or specific to groundwater.

### 3.3.1 Health investigation levels

The five-step risk assessment process central to the Australian health risk assessment procedure outlined by enHealth (enHealth, 2012)[1] was used to derive HILs for the existing contaminants and for additional priority soil contaminants. Uncertainty and sensitivity analyses were undertaken during their derivation to provide a 'reality check' for the derived values. The

[1] The draft HILs in the version released for public consultation were based on a near final draft of enHealth 2012, *Environmental health risk assessment; guidelines for assessing human health risks from environmental hazards*, Environmental Health Subcommittee (enHealth) of the Australian Health Protection Principal Committee, Canberra, Australia. The HILs were updated to take in to account information released during 2010 – 2012.

values were also peer reviewed by Australian health representatives and senior toxicologists with recognised expertise in the field. The amendment outcome is a revised suite of HILs that have used risk assessment methodologies consistent with Australian policy and best international practice.

The heath risk assessment methodology and details of the HIL derivation process are provided in Schedules B4 and B7 respectively. The number of HILs has increased from 31 to 41 substances consistent with the Review recommendations to include priority contaminants in the Stockholm Convention on Priority organic Pollutants (POPs). In addition, soil gas HILs have been produced for a number of widely used volatile organic chlorinated compounds (VOCCs) that can move as vapours from sub-surface sources into building interiors.

The responses were generally in favour of the revised HILs. The aspects favourably identified were;

- the increased number of contaminants on the list from 27 to 41 which includes common pesticides and herbicides used by the community such as persistent organochlorine pesticides and various phenoxyacetic acid herbicides, and
- the consistent HIL derivation process supported by the Australian Exposure Factor Handbook.

One submission questioned the numeric values of the HILs for inorganic mercury and methyl mercury and stated that the values were in excess of those required to protect human heath and were misleading. A clarification has been added to the relevant text and tables that the HILs are not applicable to elemental mercury. A site-specific health risk assessment will be required if the site history indicates that elemental mercury was used/is likely to be present.

Numerous helpful editorial comments were made which enabled improvements in the quality of guidance provided in the Schedule.

### 3.3.2 Health screening levels for petroleum hydrocarbons

The amendment proposes to adopt the Health Screening Levels (HSLs) for petroleum hydrocarbons developed by the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE).

Responses generally supported the inclusion of the HSLs in the amendment for the important vapour inhalation pathway. Industry and contaminated land consultants, auditors and Third Party Reviewers considered the adoption of the HSLs as a major step forward in addressing the inconsistencies in approach for sites affected by petroleum hydrocarbon contamination.

The technical complexity of the issue and the many physicochemical variables involved, which has historically been a major impediment in generating national guidance, led to many points of clarification and amendments to the draft guidance. Examples of the issues raised include:

- consistent basis for the description and classification of soils including aligning the US soil classification system with the Australian Standard
- limitations on the use of HSLs and the building variables and site-specific soil properties which must be considered prior to their use
- subtraction of the benzene, toluene, ethyl benzene and xylenes (BTEX) and naphthalene components from the relevant total measured recoverable hydrocarbon fractions in the use of HSLs
- consideration of the potential for groundwater associated risks other than that by vapour inhalation and

- appropriate linkage with other petroleum hydrocarbon screening levels (Ecological Screening Levels (ESLs) and 'management limits') for assessing risks to the environment and buried infrastructure and fire and explosion risk from the presence of LNAPLs.

Despite the caveats on the application of HSLs for direct contact exposure pathways included in the consultation draft, several objections were raised to their inclusion in the NEPM. The objections related to their magnitude and likelihood of creating objectionable odours on sites and that the exposure pathways considered were incomplete. The primary concern was that the levels could be applied incorrectly by practitioners. In response, the Direct Contact HSLs have been removed from the amendment and reference to where they can be found in the CRC CARE documentation included in Schedule B1.

The introduction of soil gas HSLs was also welcomed in feedback as this parameter is more directly related to vapour exposure in indoor air. It was raised that these HSLs in particular would involve an increase in assessment costs. Soil gas HSLs are supported with HSLs for soil and groundwater and the selection of the appropriate HSLs is site-specific. Soil gas sampling will not be required for all sites. The skills required to collect and analyse soil gas can be readily handled by Australian consultancies and chemical laboratories. Their use will improve delineation and site health risk assessment. While soil gas assessment will involve additional costs, remediation costs are likely to be lowered by the improved delineation of the areas of impact. Most submitters accepted that soil gas HSLs would be a valuable additional tool in site health risk assessment.

### 3.3.3 Asbestos in soil

The amendment proposes to adopt screening levels from WA Department of Health guidance on asbestos published in 2009 and emphasises the need for a pragmatic approach, given the limitations of quantifiable measurement of asbestos fibres in soil. The screening levels are supported by guidance on the identification and assessment of sites affected by asbestos contamination and appropriate responses to managing this contaminant in its different forms.

The guidance provided on asbestos in soil and the emphasis on commonly encountered bonded asbestos containing materials (bonded-ACM) in soil was welcomed by the great majority of submitters. Industry widely supported the pragmatic health risk approach to this issue based on the WA Department of Health guidance and scientific research in this area since the making of the original NEPM.

The comments were generally editorial and dealt with potential misinterpretation of the guidance and unnecessary use of detailed health risk assessment on individual sites. This has resulted in substantial revision of the text and clarification of the use of the screening levels for bonded-ACM in soil. For example:

- clarification of the equivalency of terms used in the ASC NEPM with that used in work, health and safety legislation and guidance and inclusion of the requirement that if visible asbestos is present, it must be removed if it may be disturbed during work activities
- case studies to illustrate appropriate procedures
- additional discussion of the procedure for determining asbestos in soil concentrations by gravimetric approach and clarification on when laboratory analysis may be required
- limitations on the use of laboratory methods for the qualitative and quantitative analysis of asbestos and clarification of the application of the screening level of 0.001% w/w asbestos in soil
- clarification that the systematic inspection of site test pits or trenches and soil samples for asbestos types should be undertaken by suitably qualified persons.

Some submitters raised concerns on potential inconsistencies between the application of workplace health and safety regulations relating to asbestos and the draft amendment guidance. Identified inconsistencies were addressed and further revisions undertaken to ensure consistency with the revised Work Health and Safety Act and Regulations and associated codes of practice published in 2011.

Submitters took the view that the guidance will reduce the costs to the community by reducing the need for detailed site and health risk assessment and greater use of pragmatic qualitative assessment by appropriately qualified persons. Lower costs of site excavation, removal and disposal of large quantities of soil with levels of bonded-ACM less than the screening level as currently occurs are beneficial outcomes. In addition the use of national health based screening levels for bonded-ACM will assist in alleviating public concerns about this commonly encountered form of asbestos.

For related comments on Schedule B2, refer to section 3.4.5.

### 3.3.4 Ecological investigation levels

The EILs proposed to be adopted in the amendment were derived using the method developed by CSIRO[2] for the NSW Environmental Trust to derive soil quality criteria. The draft amendment includes EILs for eight substances commonly found in the urban environment from anthropogenic sources. The EIL methodology provides a scientific basis for the derivation of EILs for other substances.

The adoption of the proposed methodology for derivation of EILs and the eight EILs was supported by most submitters. General concerns were raised regarding;

- complexity of EIL derivation
- site-specific derivation of EILs and related formulae and calculations
- depth below surface to which they apply
- additional laboratory costs of determining soil properties
- procedures for determining ambient background concentrations
- application of EILs particularly to industrial sites and
- restricted number of EILs derived.

These concerns were generally addressed by text clarifications and provision of more detailed information, including case studies, in Schedule B1. In addition a spreadsheet was developed for the NEPM 'toolbox' so that users can enter the analytical results and the EIL value is automatically calculated.

The issue of extra costs of assessment was identified as minimal as the EIL values are generally equivalent or higher than current practice which will reduce the overall cost via reduced costs for remediation and disposal of contaminated soil.

A specific concern was raised by the tanning industry regarding the EIL for trivalent chromium (CrIII) which was considered to be too low for soil application of tanning sludges containing this contaminant. The sludges have been applied to soils as a potential beneficial reuse process in some locations. The issue raised relates to potential beneficial reuse of a waste which is dealt with by separate jurisdictional legislative processes. The NEPM guidance states that EILs are

[2] Heemsbergen D, Warne MStJ, McLaughlin, MJ, & Kookana, R (2009) 'The Australian Methodology to Derive Ecological Investigation Levels in Contaminated Soils' CSIRO Land and Water Science Report 43/09, Adelaide, Australia.

for the assessment of existing contamination and are not to be interpreted as "condoning contamination to these levels". This approach has been maintained in the amendment. Notwithstanding this position, ecotoxicity tests could be carried out on an appropriate range of species and the data used to determine an EIL for this specific form of chromium.

### 3.3.5 Ecological screening levels

The amendment proposes to adopt ecological screening levels (ESLs) and 'management limits' based on the risk-based *Canada-wide Standard for Petroleum Hydrocarbons in Soil* (Canadian Council of Ministers of the Environment, 2008). Where sufficient data were available, the Australian methodology was used to derive ecological screening levels. Where this was not possible, a weight-of-evidence approach was used to derive criteria.

The adoption of the ESLs and associated 'management limits' was generally supported by submitters. Some major fuel companies were supportive provided specific clarifications were made. It was recognised that placement of ecological limits on petroleum hydrocarbon contamination was essential for environmental protection and to prevent gross contamination being left on sites when the vapour exposure pathway was a low risk of concern. Similarly it was supported that 'management limits' were required to prevent risks of fire or explosion or damage to buried infrastructure.

The main area of concern was how the ESLs and 'management limits' were to be applied and the inference they would be mandatory for all sites even when ecological risks were of low concern. There was some misinterpretation of Figure 1 in the Schedule.

Consequently text was amended in related sections to ensure that the application process was clear and robust. Major changes were made to Figure 1 to provide clear guidance on the use and interrelationship of all petroleum based screening levels for HSLs, ESLs and the management limits. Footnotes were added to the figure to clarify interpretation and use of the relevant screening levels. The process was then demonstrated in the case studies provided.

### 3.3.6 Groundwater investigation levels

The amendment proposes to update the GILs to be consistent with current Australian guidance for aquatic environments and drinking water. The application of these guidelines is standard Australian practice for human health and ecosystem protection.

Submitters did not identify any major concerns with the draft amendment of the GILs. Essentially, the GIL revision was recognised as a straightforward update of the well established practice of applying relevant Australian water quality guidelines to groundwater issues.

One submitter questioned the inclusion of the *Guidelines for managing risk in recreational waters* (GMRRW) as very few contaminated sites would contain recreational water bodies where the public or private individuals would swim. It is acknowledged that this is likely to be the case; however, this guidance is applicable where contaminated groundwater discharges to a surface water body which may be located on or off-site, hence the reference to GMRRW is retained.

### 3.3.7 Aesthetics guidelines

The NEPM contains no numeric aesthetic guidelines, providing only the fundamental principle that the soils should not be discoloured, malodorous (including when dug over or wet) nor be of abnormal consistency. The amendment provides additional guidance on the issues to be considered in reaching a balanced pragmatic approach for individual sites where aesthetics are an issue of concern.

Respondents generally supported the draft guidance and referred to the improved guidance dealing with the presence of small quantities of inert building rubble, unsightly low risk chemical staining and potential for offensive odours. However, one submitter was concerned

that the guidance did not follow a logical pathway and that it could be abused by either over-emphasising or under-emphasising the issue of aesthetics in contaminated site assessment.

The text has been restructured to provide a logical step-by-step description of the recommended assessment approach to improve consistency in its application. Minor amendments have also been made for clarification of the minor issues raised.

## 3.4 Guideline on data collection, sample design and reporting (B2)

Schedule B2 provides general guidance on the investigation of potentially contaminated sites in order to inform appropriate human health and ecological risk assessment. The issues considered include data collection, sample design and reporting of site assessments.

Schedule B2 was varied to:

- emphasise the importance of the iterative development of a CSM and appropriate application of the DQO process in site assessment
- incorporate additional information and guidance on the assessment of soil stockpiles, volatile substances, asbestos and dioxins
- update the guidance provided to reflect current Australian and international guidance.

The guideline was retitled 'Guideline on site characterisation' to emphasise the integrated process of site assessment.

No major objections were raised regarding the content of Schedule B2 and many helpful comments were made which enabled improvements to the clarity of guidance provided. A range of opinions was expressed with some indicating unreserved support for the changes whilst one indicated that the process had become over prescriptive and detailed and that key issues might get lost in the detail.

A number of requests for additional guidance (e.g. landfill gas, geophysical techniques and assessment of fractured rock aquifers) or for more detailed guidance (drilling practices and well construction, statistical analysis) were received. The importance of these issues is recognised, however, inclusion of more detailed discussion was beyond the approved scope of the amendment consequently these issues were addressed by including additional key references.

Specific issues have been addressed as follows:

### 3.4.1 Data quality objectives and issues concerning amount of investigation required

A number of comments were made regarding sampling program design and the development of data quality objectives (DQOs) and conceptual site models (CSMs). General concerns were raised regarding:

- the complexity of CSMs and DQOs
- DQOs addressing data quality rather than the broader issue of project objectives and the quantity and quality of data needed to achieve those objectives
- integration of information and assessing degree of compliance with DQOs.

The DQO and CSM sections have been revised in response to these concerns and a separate section on sampling requirements added. The latter includes detailed discussion of the alternatives to using sampling plans based on sampling density, including the limitations of the various approaches.

The text revisions encourage a more strategic approach to site assessment by placing more emphasis on:

- project planning, project objectives and the sampling and analysis quality plan required to meet those objectives
- developing a CSM of appropriate complexity to the scale and complexity of impacts and addressing data gaps which are critical to the assessment
- including reference to a simplified DQO process for simple screening assessments.

### 3.4.2 Collection of field data

Submitters did not identify any major concerns with the draft field check list included in the NEPM Toolbox. Several respondents commented that the requirements for field description of soils were not consistent across Schedules B1 and B2 and that a single method was desirable. Where a preference was indicated this was for the *Australian Standard for Soil Descriptions for Geotechnical Purposes* (AS 1726) and this has been adopted in the final draft.

### 3.4.3 Delineation and characterisation of contamination including groundwater investigation methods

The guidance on groundwater investigation was generally supported by submitters. The main area of concern was inappropriate sampling of groundwaters, particularly for dissolved metals. Issues raised included whether to filter samples in the field and the merits of different sampling techniques (including bailers and low flow pumping). The relevant text has been clarified, placing emphasis on low flow techniques and field filtering for dissolved metals.

### 3.4.4 Assessment of impacts from volatile substances

The inclusion of guidance on assessment of soil gas and vapours, including the vapour intrusion assessment framework, was uniformly supported by submitters. A number of submitters commented that the guidance should be extended to include ground gases (such as landfill gas) as this issue is now of major concern during many site assessments.

Several requests for clarification were submitted which included:

- specific recommendations on preferred sampling methods
- inclusion of leak testing for all 'active' vapour wells for QC purposes
- application of the 30m screening distance from a vapour source
- discussion of the advantages and disadvantages of passive soil gas sampling and their use for screening sites for source areas and for delineation of soil gas plumes.

Additional discussion has been added to clarify these issues and related considerations.

### 3.4.5 Asbestos

The inclusion of guidance on the assessment of asbestos in Schedules B1 and B2 and the emphasis on commonly encountered bonded-ACM in soil was welcomed by the great majority of submitters. A number of additional issues were raised in addition to the overlapping comments on Schedule B1. As a result, the guidance has been substantially revised, including:

- clarifying the competency of individuals able to undertake assessment of asbestos contamination in soil and
- the deletion of minimum cover requirements as being beyond the scope of the NEPM.

For related comments on Schedule B1, refer to section 3.3.3.

### 3.4.6 Dioxins and dioxin-like substances (dioxins)

The guidance provides contextual information on when site assessment may be required for dioxins and dioxin-like compounds.

Only one submission was received relating to dioxins. This response questioned the inclusion of this guidance section and recommended that it should be removed since a large number of other chemicals of concern could also be listed. Notwithstanding this comment, the section has been retained as it is provided in response to a specific recommendation in the Review Report.

## 3.5 Guideline on laboratory analysis (B3)

Schedule B3 of the NEPM provides general guidance on laboratory procedures, and provides specific guidance on which analytical methods should be used for some analytes. The amendment incorporates consideration of submissions to the review and consultation with laboratories, consultants and environmental auditors. Schedule B3 was varied to incorporate:

- industry standard reference methods in place of NEPM described methods.
- 'equivalent' methods in certain circumstances.
- leaching procedures for assessing the mobility of common metal contaminants as leachability is a more useful parameter for assessing site contamination.

The varied Schedule B3 provides quantitative laboratory methods for soil contaminants identified in the varied NEPM. Where possible, established 'standard methods' from recognised sources such as Standards Australia, US EPA, APHA, ASTM and International Standards Organisation (ISO) have been adopted. By utilising industry standard methods, the most recent and recognised relevant methods are applied. Cost-effective handling and analysis is achieved through the use of standard methods, and by allowing equivalent methods to be used (providing they meet appropriate criteria), maximising laboratory flexibility.

The responses were in favour of the changes to Schedule B3. Several common themes were raised by respondents:

- Australian laboratories should have a choice of accreditation body as the National Association of Testing Authorities, Australia (NATA) currently has a monopoly. Schedule B3 has been amended to include reference to other International Laboratory Accreditation Cooperation (ILAC) accreditation bodies as an acceptable alternative.
- several responses made suggestions to the recommended laboratory analysis methods and also proposed alternative methods. Where appropriate, these revisions and alternative methods have been incorporated.
- comments were received on the type of collection containers to be used and how the samples are packaged for transport to the laboratory. Text revisions have been made to clarify recommended procedures.
- comments were made referencing the consistency of the methods proposed with those referenced in other schedules of the NEPM. These inconsistencies have been addressed and a choice of method has been included where appropriate.

## 3.6 Guideline on health risk assessment methodology (B4)

Schedule B4 of the NEPM provides guidance on health risk assessment methodology. The Schedule has been updated from the previous NEPM and provides a national approach to conducting site-specific health risk assessments at contaminated sites. The amendment aims to:

- provide a framework for policy making and undertaking risk assessments that is transparent, logical and compatible with current scientific principles and practice
- provide a basis for deriving HILs
- provide guidance to allow departure from the standard approach to a site-specific one.

Additional guidance has been provided on quantitative carcinogenic risk assessment and the site-specific treatment of mixtures and bioavailability.

Responses received were generally supportive of the proposed revisions to the current methodology for deriving health investigation levels (HILs) to reflect international best practice, the additional guidance dealing with the risk assessment of carcinogenic substances and complex chemical mixtures, and the use of bioavailability data. No major issues of concern were raised.

The comments are largely suggestions of editorial changes, several requests for additional references to be inserted, and requests for clarification of passages of text. An overwhelming majority of these requests were addressed; references, including to other Schedules, Appendices, or sections of the NEPM or documents in the NEPM toolbox were inserted as appropriate.

The non-availability of the final version of the enHealth (2012) guidance was raised in some submissions. It is noted that most submitters had access to the near final draft of the document which underwent very few changes leading to the final version approved by enHealth in 2012. Similar comments were raised for Schedule B7.

The issue of the appropriate 'acceptable risk level' to be used in deriving HILs was raised but only noted as there is no generally agreed level either nationally or internationally. In response to some comments, changes were made to text to ensure consistency with other Schedules of the NEPM. Comments requesting clarification of the definitions dealing with bioavailability were addressed by the addition or revision of the appropriate sections. Similarly, comments concerning the approach for dealing with mixtures were addressed as appropriate.

## 3.7 Guideline on ecological risk assessment (B5)

Schedule B5a provides a consistent and clear framework for ecological risk assessment (ERA) which can be used nationally by jurisdictional environmental agencies and risk assessors. The EIL methodology, detailed in Schedule B5b, provides a sound basis for the derivation of EILs for other substances. The draft amendment includes EILs for eight substances commonly found in the urban environment from anthropogenic sources; the derivation of these EILs is detailed in Schedule B5c.

The responses were generally supportive of the proposed EIL methodologies and the new EILs with no major issues of concern identified. The comments were largely editorial or seeking clarification on the EIL methodology and the application of the EILs.

These concerns have been addressed by clarifying the intention of the text, inserting additional cross referencing to assist navigation within the documents and providing an EIL spreadsheet to assist the derivation of site-specific EILs.

## 3.8 Guideline on risk-based assessment of groundwater contamination (B6)

The NEPM Schedule B6 provides a risk-based framework to assess groundwater impacts associated with point-source site contamination. It is proposed to update the GIL referred to in Schedule B6 to more recent published national guidelines. These guidelines have been adopted nationally and used by various stakeholders since their release.

The responses received were supportive of the changes and comments received requested clarifications and/or greater consistency with terminology and procedures used in other schedules. The main changes in response to these comments are:

- Reorganisation of text, deletion of figure 1 and the framework discussed in the context of the tiered approach to assessment to improve clarity and consistency with other schedules

- Additional information provided on assessment of background water quality
- Discussion of groundwater environmental values expanded to include groundwater dependent ecosystems
- revised title for the schedule: '*The Framework for Risk-Based Assessment of Groundwater Contamination'*.

### 3.9 Guideline on health based investigation levels B7a & Guideline on exposure scenarios and exposure settings B7b

Schedules B7a and B7b have been updated and combined into one Schedule B7. The revised Schedule presents an expanded list of HILs and sets out the revised and updated methodology adopted to derive the HILs. The methodology presented is also designed for use in site-specific risk assessment noting that additional guidance on site-specific risk assessment is provided in Schedule B4.

Responses were generally supportive of the proposed revisions to the HILs which are based on the best available scientific information. The comments were largely suggestions of editorial changes, several requests for additional references to be inserted, and requests for clarification of passages of text. An overwhelming majority of these requests were addressed; references, including to other Schedules, Appendices, or sections of the NEPM or documents in the NEPM toolbox were inserted as appropriate.

The non-availability of the final version of the enHealth (2011) guidance was raised in some submissions. It is noted that most submitters had access to the near final draft of the document which has underwent very few changes leading to the final version approved by enHealth in 2012. There were some general requests for an 'Australian' exposure model to be used in the HIL development process; it was considered that the chosen methodology for HIL development was internationally accepted as best practice. Some issues were raised with specific HIL values e.g. arsenic, cyanide, mercury, nickel and others, and these were dealt with on a case-by-case basis with appropriate revisions to the text and/or rationale for the derivation of the values.

### 3.10 Guideline on community consultation and risk communication (B8)

Schedule B8 of the NEPM provides a framework for consulting, or engaging, with the community and communicating risks associated with site contamination.

The varied Schedule B8 incorporates current principles and practices of community engagement and risk communication with the aim being to promote a clear framework that can be used nationally by jurisdictional regulatory agencies, practitioners and managers for site contamination issues. The amendment also incorporates updated and additional guidance and references for jurisdictional regulatory agencies, site practitioners and managers in relation to issue-specific risk communication.

The responses received were supportive of the continued inclusion of the guidance and proposed changes. The comments largely requested editorial changes and clarifications, greater consistency with terminology and procedures used within the guideline and other schedules, and the updating of listed references.

### 3.11 Guideline on protection of health and the environment during the assessment of site contamination (B9)

Protection of the environment and the health and safety of site personnel and other potentially impacted stakeholders is an essential consideration in site assessment. A guideline containing a uniform methodology for health and safety management on sites was included in NEPM Schedule B9 to ensure a minimum level of protection and to ensure that responsibility for such

protection was undertaken by industry during assessments. Since the introduction of the original NEPM, specific legislative requirements regarding occupational health and safety obligations and responsibilities have been introduced both nationally and at a jurisdiction level. These legislative instruments have greater authority than the NEPM and, therefore the NEPM guideline is seen as redundant.

Only one response was received on the proposed deletion of the guidance on occupational health and safety. The respondent did not appear to be aware of the rationale for the action and no further change is necessary.

### 3.12 Guideline on competencies and acceptance of environmental auditors and related professionals (B10)

Schedule B10 of the NEPM (1999), *Competencies and acceptance of environmental auditors and related professionals*, identifies the competencies that are essential in undertaking site contamination assessments. It also provides a general framework for acceptance by regulatory authorities of auditors and similar professionals who are required to certify site assessments.

The amendment to Schedule B10 (varied to be designated Schedule B9) incorporates revised and updated guidance for jurisdictional regulatory agencies in relation to: the range of professional and technical competencies in the assessment of site contamination; assessment criteria including addressing the technical basis of applications, knowledge and understanding of relevant national and jurisdictional legislation and guidelines, minimum requirements for experience and expertise, qualifications, professional societies, professional experience, and ongoing commitment to professional development; and ongoing practice by jurisdictions.

The responses received were supportive of the proposed changes. The comments largely requested clarification regarding the application of the guideline to the various environmental professionals.

The main changes in response to the comments received are:

- editing of text clarifying the intended application of the guideline
- clarification of requirements in relation to technical competencies, professional memberships and training
- consolidation of the minimum years of experience required for auditors.

# APPENDIX A - List of submitters

| Number | Submitter | Type |
|---|---|---|
| 1 | WorkSafe Victoria | State government agency |
| 2 | Contaminated Land & Water Environmental Risk Assessment Pty Ltd | Environmental consultant |
| 3 | CH2M Hill Australia | Environmental consultant |
| 4 | Envirolab Services | Analytical laboratory services |
| 5 | GHD Pty Ltd | Environmental consultant |
| 6 | Douglas Partners | Environmental consultant |
| 7 | Catherine Money Consulting on behalf of:<br>• Casino Hide Tanners,<br>• Gunnedah Leather Processors Pty Ltd,<br>• Walfertan Processors Pty Ltd | Industry |
| 8 | Gilbert and Sutherland | Environmental consultant |
| 9 | Sutherland Shire Council | Local government |
| 10 | WA Health | State government agency |
| 11 | Australian Laboratory Services | Analytical laboratory services |
| 12 | Hg Recoveries Pty Ltd | other |
| 13 | School of the Environment, Flinders University | University |
| 14 | URS Australia | Environmental consultant |
| 15 | Environmental Earth Sciences | Environmental consultant |
| 16 | Port of Melbourne Corporation | State government enterprise |
| 17 | NATA (National Association of Testing Authorities) | other |
| 18 | CRC CARE | other |
| 19 | Energy Networks Association | Industry peak body |
| 20 | Australian Institute of Petroleum (AIP) general comments on behalf of:<br>• BP Australia Pty Ltd,<br>• Caltex Australia Ltd,<br>• Mobil Oil Australia Pty Ltd<br>• The Shell Company of Australia Pty Ltd | Industry peak body |
| 21 | Master Builders Australia | Industry peak body |
| 22 | BP Australia | Industry |
| 23 | NSW Department of Environment & Climate Change (NSW DECC) on behalf of:<br>• NSW DECC,<br>• NSW Department of Housing<br>• NSW WorkCover | State government agencies |
| 24 | ENVIRON Australia | Environmental consultant |
| 25 | OTEK | Environmental consultant |

| | | |
|---|---|---|
| 26 | Caltex | Industry |
| 27 | Environmental Strategies | Environmental consultant |
| 28 | *Confidentiality requested* | Environmental consultant |
| 29 | Shell Company of Australia | Industry |
| 30 | Peter J Ramsay & Associates | Environmental consultant |
| 31 | Coffey Environments | Environmental consultant |
| 32 | Urban Development Institute of Australia | Industry peak body |
| 33 | Australasian Land & Groundwater Association | Industry peak body |
| 34 | PACIA (Plastics and Chemicals Industries Association) | Industry peak body |
| 35 | Rio Tinto | Industry |
| 36 | Cavvanba Consulting | Environmental consultant |
| 37 | ERM Australia (personal view) | Environmental consultant |
| 38 | Centre for Mined Land Rehabilitation, University of Queensland on behalf of:<br>• Environmental Technical Group, NATA | other |
| 39 | WA DEC on behalf of<br>• WA DEC,<br>• LandCorp<br>• WA Department of Water | State government agencies |
| 40 | Johns Environmental on behalf of:<br>• Northern Cooperative Meat Company | Industry |
| 41 | Beacon Environmental Services Inc. | Environmental consultant |
| 42 | Australian Sustainable Business Group | Industry peak body |
| 43 | SA Health | State government agency |
| 44 | NT Department of Natural Resources, Environment, The Arts and Sport | State government agency |
| 45 | RCA Australia | Environmental consultant |
| 46 | EPA Division, Department of Tourism, Arts and Environment Tasmania | State government agency |
| 47 | ACLCA (Australian Contaminated Land Consultants Association) | Industry peak body |

**DETAILED RESPONSE TO COMMENTS**

| Appendix | Schedule | GUIDELINE TITLE |
|---|---|---|
| **B** | B1 | Guideline on investigation levels for soil and groundwater |
| **C** | B2 | Guideline on data collection, sample design and reporting |
| **D** | B3 | Guideline on laboratory analysis of potentially contaminated soils |
| **E** | B4 | Guideline on health risk assessment methodology |
| **F** | B5 | Guideline on ecological risk assessment |
| **G** | B6 | Guideline on risk based assessment of groundwater contamination |
| **H** | B7 | Schedule B (7A) Guideline on health-based investigation levels<br>Schedule B (7B) Guidelines on exposure scenarios and exposure settings |
| **I** | B8 | Guideline on community consultation and risk communication |
| **J** | B9 | Guideline on protection of health and the environment during the assessment of site contamination |
| **K** | B10 | Guideline on competencies and acceptance of environmental auditors and related professionals |
| **L** | | Consultation Regulatory Impact Statement |

Note Attachments to individual submissions and typographical or editorial comments are not included in the tabulated compilations.

## APPENDIX B – Issues and responses - Measure and Schedule A

| Submitter number | Section | MEASURE AND SCHEDULE A - ISSUES | RESPONSE |
|---|---|---|---|
| 39 | | *State government agency*<br>My department's key focus is contaminated site risk to water supply sources (particularly those used for human consumption after disinfection).<br>In the 12 page document, Part 4 it would be useful to state: 'where a preliminary site evaluation indicates that contaminants are at or above investigation levels and sensitive water resources are present in area (see attachment), detailed investigations should include appropriate scientific modelling to assess potential for leached contaminants to harm the values of water resources or be detrimental to water users'. | Reference to the 'risks to water resources' has been added to principle 14 in Part 4 of the Measure. Additional references to protection of water resources have also been added to Schedules B1, B2 and B6. |
| 29 | | *Industry*<br>Part 4 Sec18. Page 6; The hierarchy of options might be enhanced by reference to sustainability of treatment, as the impact caused by remediation may not be warranted for the risk reduction targeted. Or does the last bullet "where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect" imply this?<br>Adding sustainability concept earlier in hierarchy for consideration. | Text amended to reflect consideration of the sustainability of remediation in attaining the environmental outcome. |
| 23 | | *State government agency*<br>"Preliminary investigation and laboratory analysis Schedules B2, B3" does not cover adequately the situation of bonded asbestos in good condition (good explanation in Schedule B1 pages 10–11). | Noted. The Schedule A flowchart is a general process for site contamination. A note has been added to refer to Schedule B1 for detail on the recommended assessment process for asbestos. |
| 34 | | *Environmental consultant*<br>Again this process flow chart is easy to read and follow therefore its application should be superior | Noted. |

| | | | |
|---|---|---|---|
| 18 | | *Other*<br>Consider a consistent approach with all decision (diamond) boxes on this page<br>The statement 'Undertake risk assessment to develop site-specific criteria for proposed land use' does not pose a question, unlike all others in the decision (diamond) boxes.<br>Suggest rewording to pose a question such as: 'Do you need to undertake a risk assessment to develop site-specific criteria for proposed land use?' | Boxes reviewed for consistency. |

## APPENDIX C – Issues and responses - Schedule B1

| Submitter number | Section | SCHEDULE B1 - Issues | Response |
|---|---|---|---|
| | 1 | **Introduction** | |
| 35 | 1 | *Industry*<br>p 3, Para 2; This paragraph (and subsequent sections) refers to the need for assessment of sites with petroleum hydrocarbons to consider the "potential formation of phase separated hydrocarbons". Petroleum products in common use exist as a separate (non-aqueous) phase, and when they are released to the subsurface they are by definition present as LNAPL (or PSH). The reference to "formation" of PSH as a contaminated site phenomenon is misleading. The use of the term "PSH" is usually used loosely to mean the entry and accumulation of observable LNAPL in monitoring wells, although the significance of PSH in wells is a matter of debate (see comments below).<br>Clarify and revise references to "formation of phase separated hydrocarbons"<br>Include definitions of L (&D) NAPL and PSH in the Glossary. | PSH replaced by LNAPL in all sections of B1 for clarification and consistency. |
| 39 | 1 | *State government agencies*<br>p3, L9, The meaning of the phrase 'infiltration of infrastructure' is unclear. It is assumed that the intended meaning is regarding effect of some contaminants on structures. '…the risk to buried structures including underground services and building footings…' | Text amended to clarify potential damage or risk to in-ground services. |
| 39 | 1 | *Environmental consultant*<br>p3, L8, '…Assessment of sites with petroleum hydrocarbons contamination will need to also consider the presence or potential formation of PSH and the risks that may arise…' | PSH replaced with "observable LNAPL" for consistency. |
| | 2 | **Derivation of investigation levels** | |
| 28 | 2 | *Environmental consultant* | The proposed amendment is based on consideration |

| Submitter number | Section | SCHEDULE B1 - Issues | Response |
|---|---|---|---|
| | | pp4 to 10 (human health criteria)<br>The changes are not consistent with NEPM Review Report Recommendations 2006. The recommendations of the NEPM Review Report 2006 should be considered for inclusion in the NEPM. | of the review recommendations. |
| 35 | 2.1 | *Industry*<br>and Glossary; p5 and p57; The definition of Petroleum hydrocarbon 'management limits' says "They are maximum values that should remain in a site following evaluation of human health and ecological risks and risks to groundwater resources…". This is potentially misleading.<br>Revise text | Text amended on application of management limits (refer Section 2.5 and Fig1). |
| 39 | 2.1.1 | *State government agencies*<br>Definitions<br>P4, L19, Application of GILs as response levels should specify at the 'point of use and point of discharge'. This would be more explicit in encompassing groundwater abstraction for human use and discharge of water to aquatic ecosystems. | Further details provided in Section 2.6 and the amended Schedule B6 |
| 5 | 2.1.1 | *Environmental consultant*<br>Unnecessary complexity<br>The EILs are considered to generally apply to 2 m depth yet the ESLs and HILs are 3 m depth. Within arid regions plant root depth often extends to greater depths and it is recommended to consider applying EILs to 3 m depth. | Text amended to reflect site-specific consideration for arid regions. Clarification has been added to 3.4.1.1 |
| | 2.2 | **Human health-based soil and groundwater criteria** | |
| 5 | 2.2.1 | *Environmental consultant*<br>Pg 5; HIL categories – the former HIL B and C have been removed and all subsequent categories shuffled down (eg. former HIL F is now HIL D). This will cause a lot of confusion, as people have become used to the HIL categories that have been in use for about 10 years, and these categories are cross referenced in numerous other documents. | Noted. The revised terminology is preferred for simplicity reasons. |

| Submitter number | Section | SCHEDULE B1 - Issues | Response |
|---|---|---|---|
| | | Keep categories the same as they have been, and just say why B & C are not further considered. | |
| 5 | 2.2.1 | *Environmental consultant*<br>pg 5; HIL C<br>The HIL C excludes undeveloped public open space. Why has this been excluded and what is the benefit of excluding it? | Refer to Schedule B7 for clarification and details. |
| 31 | 2.2.1 | *Environmental consultant*<br>p5 Subsurface workers not included in any of the scenarios or as a separate scenario. It is inconsistent with HSLs to exclude this receptor population. Important as many drive risk in some instances<br>Include as a separate scenario. | The NEPM does not deal with occupational exposure. Text amended at several relevant locations to clarify this issue. |
| 31 | 2.2.1 | *Environmental consultant*<br>It is not clear as to whether senior schools are assessed as a recreational settings or commercial setting…or both<br>Clarify school buildings include teachers who are considered to be commercial workers therefore commercial setting relevant. | Text revised.<br>Secondary schools are in setting C, however, for consideration of vapour intrusion, secondary school buildings should be considered as HIL A. |
| 39 | 2.2.1 | *State government agencies*<br>Definitions—refers to EILs as sometimes being referred to as "soil quality guidelines"—this may result in confusion as the EILs are not remediation levels | Text reordered for clarification. |
| 5 | 2.2.2 | *Environmental consultant*<br>pg 6; 1st para- the term "soil gas" is more correctly "soil vapour"<br>Suggest replacing references to soil gas with "soil vapour" in reference to volatile hydrocarbons. | Text revised. |
| 31 | 2.2.2 | *Environmental consultant*<br>Pg 6, Line 4 It would be helpful to bulletize the site conditions where the interim HILs for volatile organic chlorinated compounds apply | These are listed in the text and amended in the Table 1A(2) to 0-1m subsurface. |

| Submitter number | Section | SCHEDULE B1 - Issues | Response |
|---|---|---|---|
| | | Please clarify the following statement in this section: "The values may be applied for general site assessment...". If EPHC is supporting the use of these interim HILs when evaluating soil gas data collected at a site during general site assessment, qualifications should be included. Specifically, for built sites, soil gas data collected adjacent to an existing structure may not correspond to sub-slab data and therefore may not be appropriate data to compare to these interim HILs. For sites planned for redevelopment, if either (1) the future development includes sub-grade floor(s) or (2) future site soil conditions such as moisture content change following site redevelopment, the comparison of current soil gas data to these interim HILs may not be relevant. | Noted. Case study 4 provides a worked example of the use of the interim HILs. Site-specific consideration in the iterative process of development of a conceptual site model is required including the most appropriate sampling location when these contaminants are suspected. |
| 31 | 2.2.3 | *Environmental consultant*<br>p7; There is a very large potential these tables will be used incorrectly or inappropriately.<br>Recommend their use in site assessment is reviewed by a senior experienced environmental professional. | Noted<br>Additional text and case studies added to clarify application. |
| 31 | 2.2.3.1 | *Environmental consultant*<br>Page 8, Para 1<br>HSLs have not been presented for MTBE<br>Consider presenting values for MTBE in soil and groundwater or providing guidance on alternative sources of guidelines for assessment. | Clarifying text added to 2.4.3 |
| 35 | 2.2.3.2 | *Industry*<br>p 8; Rio Tinto strongly supports a weight of (or multiple lines of) evidence approach to site assessment and management. | Noted |
| 31 | 2.2.3.2 | *Environmental consultant*<br>Pg 8, Line 22; It is plausible that the sub-grade level in a high-density residential building may include residential occupancy or another sensitive use (e.g. a daycare facility). Therefore, the presence of a basement in a high-density residential building should not automatically require the application of commercial/industrial HSLs. If these criteria are applied, the site management plan should stipulate that | Residential A which includes a day care facility applies to low density residential uses including in a basement with relevant contaminants. |

| Submitter number | Section | SCHEDULE B1 - Issues | Response |
|---|---|---|---|
| | | the basement level(s) are not to be used for residential occupancy or other sensitive uses. | |
| 31 | 2.2.3.2 | *Environmental consultant*<br>Pg 8, Line 24; Some research has been performed studying the movement of vapours between floors in multi-storey buildings (e.g. "Reduction of Environmental Tobacco Smoke Transfer in Minnesota Multifamily Buildings Using Air Sealing and Ventilation Treatments," Center for Energy and Environment, Minneapolis, Minnesota, November 2004). It is suggested that EPHC review available references on this topic and discuss in reference to sub-slab and soil gas guideline values and their potential application to upper floors in multi-storey buildings.<br>"Reduction of Environmental Tobacco Smoke Transfer in Minnesota Multifamily Buildings Using Air Sealing and Ventilation Treatments," Center for Energy and Environment, Minneapolis, Minnesota, November 2004 | Noted. |
| 37 | 2.2.3.2 | *Environmental consultant*<br>Soil classification in 2nd paragraph seems incorrect, eg SILT=clay and CLAY=silt. Table 1A(3) seems to show the correct classifications. | Text revised.<br>For Tier 1 soil assessment, the HSL classifications of sand, silt and clay may be broadly applied to the AS 1726 soil texture classification system. |
| 5 | 2.2.3.2 | *Environmental consultant*<br>pg 8 Are the silt and clay descriptions reversed? Soils under "Silt" include clay (but not silt), and soils under "Clay" include silt (but not clay).<br>Check and correct if required. | Text revised.<br>For Tier 1 soil assessment, the HSL classifications of sand, silt and clay may be broadly applied to the AS 1726 soil texture classification system. |
| 24 | 2.2.3 | *Environmental consultant*<br>The HSLs (as summarised in the NEPM) do not include guidance for what is considered a "hotspot". However, in the case study in Section 3.3, the results are not considered to be a "hotspot" since "all results less than x2 the relevant investigation and screening levels". I note that the CRC Care Report No. 10 identifies in Step 7 in Appendix A, a hotspot when the maximum concentration exceeds the HSL by 1-2 orders of magnitude. Clarify the case study to | Noted.<br>The example is illustrative only and does not include a full statistical analysis of the sample data to determine whether hotspots are present. Guidance on statistical procedures to identify outliers (hotspots) has been added to s. 13 Schedule B2. |

| Submitter number | Section | SCHEDULE B1 - Issues | Response |
|---|---|---|---|
| | | accurately reflect the "hotspot" consideration for the HSLs. | |
| 15 | 2.2.3 | *Environmental consultant*<br>The classification of soil particle size varies between the United States and Australian/International classification systems. Specifically the particle size specified for silt and sand.<br>In addition, there are differences between the soil texture triangles adopted by United States and Australia.<br>The pore size distribution (PSD) system and soil texture triangle must be specified in the NEPM otherwise a source of error and ambiguity exists.<br>Reference of the Australian System should be through the Australian Soil and Land Survey – Field Handbook McDonald et al. (1990). | Text revised.<br>For Tier 1 soil assessment, the HSL classifications of sand, silt and clay may be broadly applied to the AS 1726 soil texture classification system. |
| 15 | 2.2.3 | *Environmental consultant*<br>P8; The NEPM groups soil texture classes derived from the USDA soil texture triangle into three broad groups for the HSLs which is questionable:<br>- SAND: sand, sandy clay loam, sandy clay, sandy loam, loamy sand, loam;<br>- SILT: silt loam, clay loam, clay; and<br>- CLAY: silty clay, silty clay loam, silt).<br>A better method is required to convert PSD into the three broad classes.<br>A silt only exists as a soil texture class in the USDA texture triangle, it is suggested that this term be removed and clarification of the system be made.<br>Due to the variability in PSD measurements we also recommend that the NEPM include a statement that these are a guide only and with consideration of the landscape, other soil properties, and entire soil profile by a suitably qualified soil scientist (ie CPSS) a soil texture falling or near the border of two broad groups can be placed in the most appropriate. | Noted.<br>Text revised. For Tier 1 soil assessment, the HSL classifications of sand, silt and clay may be broadly applied to the AS 1726 soil texture classification system. Additional text added. |
| 15 | 2.2.3 | *Environmental consultant*<br>Soil particle size is measured a number of ways including via the feel method, the | Noted.<br>Text revised. For Tier 1 soil assessment, the HSL |

| Submitter number | Section | SCHEDULE B1 - Issues | Response |
|---|---|---|---|
| | | hydrometer method and wet sieving. The NEPM currently does not provide any recommendation on soil texturing methodology.<br><br>It is suggested that NEPM include a statement that "only suitable qualified soil scientist (ie Certified Professional Soil Scientist, CPSS) should undertake the 'feel method'(ie field texturing) and it is recommended that at least one sample from each soil type on a site be analysed by a suitable qualified laboratory for particle size distribution". | classifications of sand, silt and clay may be broadly applied to the AS 1726 soil texture classification system. Methodology information is provided in AS 1726. |
| 31 | 2.2.3.1 | *Environmental consultant*<br><br>p8; Text suggests High density residential basement is to be assessed using land use category D (commercial). However, there is no distinction made regarding usage of the basement, therefore could assume would also (incorrectly) apply to a basement residence. Clarify further. | Noted. The selection of the correct HSL to apply should be informed by consideration of the conceptual site model and the generic exposure scenarios. Sensitive land uses will require application of more stringent criteria. For example Residential A would apply to a day care centre in a basement setting.<br><br>The supporting documents provide clear guidance on limitations, and application of the HSLs. Practitioners and reviewers must become familiar with these limitations. |
| 31 | 2.2.3.4 | *Environmental consultant*<br><br>p9; HSLs are not appropriate for vacant land or sites likely to be redeveloped in the future where basements are possible. Include as a separate bullet point in existing list on this page | All HSLs apply to depths below the finished land surface and are otherwise limited if the final land form or size of the building concrete slab is not known<br><br>The supporting documents provide clear guidance on limitations and application of the HSLs. Practitioners and reviewers must become familiar with these limitations. |
| 28 | 2.2.3 | *Environmental consultant*<br><br>p7, The HSLs have been developed for the "predominant vapour pathway". Petroleum hydrocarbons may reach receptors via a number of pathways, not just via vapour inhalation. The "predominant" pathway of exposure for heavier chain hydrocarbons may be dermal contact or ingestion where these compounds lie in | Noted.<br><br>Exposure pathways for the HSLs are detailed in Friebel & Nadebaum 2011. Neither the HILs nor HSLs consider leaching to groundwater or aesthetic issues. |

| Submitter number | Section | SCHEDULE B1 - Issues | Response |
|---|---|---|---|
| | | surface or near-surface soils. The use of the term predominant is unclear and misleading and will depend on the nature of the exposure scenario being considered. Removal of the word "predominant" and inclusion of the word "only" to read “vapour pathway only”. In addition, the NEPM should be explicit that the HSLs do not account for leaching to groundwater, aesthetic issues, dermal contact or ingestion. | Direct contact HSLs have also been developed which include consideration of ingestion, dermal and inhalation exposure pathways. The direct contact HSLs have been deleted from the NEPM, however, they can be found in the supporting document if required. |
| 22 | 2.2.3 | *Industry*<br>and Table 1A; Page 6; Health Screening Levels (HSL) for Petroleum Compounds. BP strongly support the work of the CRC CARE in preparing the quality submission on Health Screening Levels which form part of this Schedule B1. The data used to generate the information was based on available Australian and international scientific data and best practice, was prepared specifically for Australian soil types and conditions, and internationally peer reviewed.<br>No additions or changes are proposed to the HSLs.<br>We consider that commentary should be included within NEPM to allow for an update of the HSL values as more accurate or updated Australian and international scientific data is produced. This is particularly important where new information becomes available which may provide greater protection for human health or the environment. | Noted.<br>The NEPM process allows for minor variations should the need arise.<br>The relevant HSL documents are available on the from the CRC CARE website and also from the ASC NEPM toolbox. This provides flexibility to update guidance provided as more relevant research is conducted. |
| 33 | 2.2.3 | *Industry peak body*<br>p6 HSLs for petroleum hydrocarbons, The derivation of HSLs is limited to the inhalation pathway only (same as for VOCs - section 2.2.2). Even though this is a very important and often critical pathway, intake through other pathways (i.e. ingestion, dermal, dust inhalation) as used for the HILs is possible if not highly likely. Therefore it would be desireable to develop separate HSLs (or HILs) for petroleum hydrocarbons and VOCs for other exposure pathways, which would also take into account possible exposure by maintenance and construction workers (where direct exposure is possible). | The derivation of the HSLs is not limited to the inhalation pathway only. Direct contact HSLs have also been developed which include consideration of ingestion, dermal and inhalation exposure pathways. These can be found in the supporting documents (Friebel & Nadebaum 2011).<br>Consideration of maintenance and construction workers is included in Friebel & Nadebaum 2011; however, the NEPM does not deal with occupational exposure so these values have not been adopted.<br>Assessors must comply with relevant jurisdictional |

| Submitter number | Section | SCHEDULE B1 - Issues | Response |
|---|---|---|---|
| | | | WHS requirements. |
| 28 | 2.2.3 | *Environmental consultant*<br>p7, The principal references for the methodology and the application and sensitivity of derived HSLs are in other documentation.<br>As with the HILs, all the derivations, assumptions and limitations associated with the HSLs should be included in the appendices to schedule B7, or in a separate schedule on the HSLs themselves. It is not appropriate to separate the critical information on HSL assumptions/limitations from the HSLs as it leaves them open to mis-use. | Noted<br>The relevant documents are available from the CRC CARE website and also from the ASC NEPM toolbox. This provides flexibility to update guidance provided as more relevant research is conducted. |
| 28 | 2.2.3 | *Environmental consultant*<br>p7, Reference is made to the Australian Exposure Factor Guidance 2010 which has not been released yet. This has not been included in the reference list to Schedule B1. Is NEPC certain that the exposure factors relied on to derive the HSLs will not vary in the final enHealth guidance?, Extend the period of time for feedback comments on the NEPM to allow review of the Guidance (enHealth) documentation. | Noted.<br>Reference updated. The NEPM process allows for minor variations should the need arise. |
| 11 | 2.2.3.1 | *Analytical laboratory services*<br>P8: "The values for BTEX must be subtracted from the TRH analytical result to obtain the F1 value". 2.2.3.2 states the same but also includes the subtraction of naphthalene from F2.<br>Make it clear, wherever quoted and tabulated that the HILs for F1 are derived from (C6 – C10) minus BTEX and F2 as (>C10 – C16) minus Naphthalene. This must be clear for EILs and HSLs too. | Footnotes added to relevant tables. |
| 11 | 2.2.3.1 | *Analytical laboratory services*<br>P8: "F4 >C34". The agreed fraction (per technical working group on the method) is >C34 – C40. Referenece to >C34-C40 is made in Table1a(6) p 44.<br>Reference to this heavy fraction must be consistent in this and other schedules. Alternatively, a statement needs to be made, somewhere, that recognized the equivalence of the terminology. | Text amended. |

| Submitter number | Section | SCHEDULE B1 - Issues | Response |
|---|---|---|---|
| 28 | 2.2.3.1 | *Environmental consultant*<br>p7, Interim HILs have been developed for some volatile chlorinated solvents. The NEPM acknowledges in Schedule B7 that "there are limitations and uncertainties associated with the assessment of volatile contaminants on the basis of soil concentrations. As these limitations are significant, interim HILs for soil have not been derived." In contradiction with these statements, HSLs on the basis of soil concentrations have been included in Schedule B1.<br>Re-consideration of the HSLs for soil is required and consistency in the approach and language used to derive the HSLs and interim HILs is needed.<br>The use of interim HILs for soil gas is appropriate and supported, provided the limitations and exclusions of these interim HILs (other pathways, aesthetic issues, etc) are explicit. | Noted.<br>The methodology for developing the interim HILs for VOCCs is not as advanced as for the HSLs, hence only soil gas HILs have been produced at this time.<br>The limitations on HILs, including the interim HILs, are discussed in Schedule B7. The limitations applying to the HSLs are discussed in Schedule B1 (2.4.12). |
| 5 | 2.2.3.2 | *Environmental consultant*<br>pg 8; Third para in this section states "it is essential that BTEX and naphthalene results are subtracted from TRH values…". The paragraph at the top of page 8 states "The values for BTEX must be subtracted from the TRH analytical result to obtain the F1 value".<br>Provide specific clarification as to what naphthalene should be subtracted from (i.e. which fraction range), and make sure this is consistent between sections. | Section 2.4.5 amended to clarify BTEX and naphthalene issues. Footnotes added to relevant tables. |
| 5 | 2.2.3.2 | *Environmental consultant*<br>pg 8, soil types<br>The soil classifications are incomplete. What is the applicable guideline for heterogeneous fill, gravels, rock, etc?. | Further information is provided in Friebel & Nadebaum (2011a and 2011b) in the ASC NEPM "toolbox". |
| 6 | 2.2.3.2 | *Environmental consultant*<br>under second paragraph.<br>The groupings are not geotechnically correct (e.g. clay should belong to clay, silt should belong to silt). Friebel & Nadebaum (2010a) was probably misquoted as their report did not reclassify the 12 soil texture categories into three soil groupings | Noted. Refer revised text.<br>For Tier 1 soil assessment, the HSL classifications of sand, silt and clay may be broadly applied to the AS 1726 soil texture classification system. |

| Submitter number | Section | SCHEDULE B1 - Issues | Response |
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| | | as sand, silt and clay as presented in page 8 of Schedule B1. Also this grouping is not consistent with Table1A (3).<br><br>If this grouping is maintained in the report, consultants who have undergone field investigations wherein they classified the site to be underlain by say clay may get things wrong by choosing a HSL that is appropriate for silt rather than clay. | |
| 28 | 2.2.3.2 | *Environmental consultant*<br><br>and Table 1A(6), p8, Direct soil contact HSLs - seems more applicable to remediation and maintenance worker exposure than to land use settings. Also, do these values consider acute toxicity? They appear to be an extrapolation of "low dose" chronic toxicity considerations to acute, short term exposure scenarios which is not appropriate.<br><br>Remove land use setting and use exposure scenarios i.e. recent spill (up to 5 days), worker exposure during remediation or service trenches etc. Evaluate the acute toxicity implication of such values else remove them as they can be misleading and may not be based on sound scientific methodology. | Noted. The HSL dermal contact values include consideration of ingestion, dermal and inhalation exposure pathways. Soil HSLs for direct contact are relevant where direct contact with soils is likely, for example in surface soils (0 – <1 m) and also for deeper soils where uncontrolled excavation could result in deeper contaminated soils being brought to surface (e.g. low density residential where excavation of soils for swimming pools, a cellar or other building works is feasible).<br><br>The direct contact HSLs have been deleted from the NEPM, however, they can be found in the supporting document if required. |
| 28 | 2.2.3.3 | *Environmental consultant*<br><br>p9, The sentence: "Application of the biodegradation factor may result in levels on TPH, BTEX and naphthalene that are acceptable for human health risk assessment for the specific land use" is misleading as the protection of human health should be based on all exposure pathways (ingestion, dermal and inhalation), whereas the HSLs consider only the inhalation pathway. Remove sentence or reword to reflect that it may affect the degree of exposure to this chemical through this pathway and hence alter the overall health risk assessment. | Text (s. 2.4.10) amended to clarify that the exposure pathway is limited to vapour exposure. |
| 31 | 2.2.3.2 | *Environmental consultant*<br><br>Page 8, Line 9 and 10<br><br>Current soil categories do not make sense conceptually (and are not consistent with those shown in Table 1A). Keep in mind that these classifications will be made | Noted. Refer revised text.<br><br>For Tier 1 soil assessment, the HSL classifications of sand, silt and clay may be broadly applied to the AS 1726 soil texture classification system. |

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| | | based on field logs, which are developed based on soil behaviour. Perhaps 3 categories are not justified. Silty clay and clay should not be in 2 different categories, as they are indistinguishable in the field.<br><br>Replace the last word "clay" by "silt" included in the SILT soil type category. Replace the last word "silt" by "clay" included in the CLAY soil type category<br><br>Reassess soil categories and make consistent with logging system provided throughout the NEPM. | |
| 39 | 2.2.3.2 | *State government agencies*<br><br>HSLs and multiple-lines-of-evidence approach<br><br>P8, L24, Why would these compounds be subtracted from TRH when this would reduce conservatism and hydrocarbons in soil are inherently heterogeneous? | Compound-specific HSLs apply to BTEX and naphthalene.<br><br>Section 2.4.5 amended to clarify BTEX and naphthalene issues. |
| 31 | 2.2.3.3 | *Environmental consultant*<br><br>p9 Application of a biodegradation factor is inappropriate for undeveloped land where the size of any future building is not known and/or where conditions under a slab (on ground or basement) is unknown or a basement structure possible. State in text the limitations/exceptions.<br><br>Oxygen infiltration to the subsurface will not occur where surface coverings such as concrete/paving exist around a building hence limiting the potential for biodegradation. State in text the limitations/exceptions. | All HSLs apply to depths below the finished land surface and are otherwise limited if the final land form or size of the building and concrete slab are not known.<br><br>The limitations to slab size in application of the biodegradation factors are provided in section 2.4.10 |
| 13 | 2.2.3.3 | *University*<br><br>Published data suggest that the presence of oxygen in hydrocarbon contaminated soil below a depth of 30cm is negligible. This is true also for uncontaminated soils. I find it hard to believe that 5% oxygen would be found at 1 m depth. If it were present in contaminated soil at that depth it would more likely be an indication that no biodegradation was taking place as there was no microbial respiration of the available oxygen. The arbitrary application of 1 and 2 log multiplications of HILs on the basis of the presence of oxygen at depth is not substantiated by any literature relating to health risks and should be re-considered.<br><br>The assumption that vapour at depth will biodegrade as it travels to the soil surface | Further information regarding oxygen levels in soil gas relevant to the assessment of contaminated sites may be found in Davis, et al 2009 and reference therein. The application of the biodegradation factors requires confirmation of the presence of oxygen at 1m depth. |

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| | | is dependant on their being sufficient nutrient ( N,P,S) in the soil column to facilitate this. Persistent contamination at depth will deplete these nutrients very rapidly, and so this assumption will become invalid. Since published reports have demonstrated that the major route for TPH degradation is via oxidative respiration and that the majority of this activity occurs in the top 30-45cm of soil this assumption is extremely questionable.<br><br>Revise consideration of oxygen presence as an indicator of biodegradation and multiplication factors.<br><br>Revise assumptions surrounding biodegradation of pollutants in soil.<br><br>Brock:Biology of Microorganisms 12th edn, Madigan et al 2009.<br><br>Atlas RM and Bartha R (1992). Hydrocarbon biodegradation and oil-spill bioremediation. Advances in Microbial Ecology12: 287-338 | |
| 31 | 2.2.3.3 | *Environmental consultant*<br><br>Pg 9, Line 6; It would be helpful to bulletize the site conditions where biodegradation of vapours associated with TPH-related compounds apply. | Text amended. Refer section 2.4.10 |
| 31 | 2.2.3.3 | *Environmental consultant*<br><br>Pg 9, Line 9<br><br>Is there a specific requirement for the "...oxygen access on both sides of the slab..." allowing application of the biodegradation factors (e.g. a specific distance of unpaved surface adjacent to the slab)? | An area the size of a garden bed is sufficient (refer Davis et al 2009 in the ASC NEPM toolbox). |
| 31 | 2.2.3 | *Environmental consultant*<br><br>Page 10, Para 1; Text states "... (other than of short, temporary duration) ...". The use of "short temporary" is ambiguous and open to interpretation.<br><br>Suggest quantifying "short, temporary" and/or providing a reference example. | Noted. The direct contact HSLs have been deleted from the NEPM, however, they can be found in the supporting document if required. |
| 30 | 2.2.3.4 | *Environmental consultant*<br><br>Page 9, Line 22 ; The intent of the soil and groundwater HSLs is unclear and is contradictory to the intent of the HSLs as defined elsewhere in the document. | Noted. Text amendment for clarification of issue to this section. |

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| | | Ensure that the intent of the HSLs is clear and consistent throughout the document. | |
| 31 | 2.2.3.4 | *Environmental consultant*<br>Page 9, Para 2; Text states " ... contamination is present in buildings or utilities which indicates ...". The use of term "utilities" is unclear.<br>Suggest deletion "utilities" and replace with "utility trenches or pits". | Text amended |
| 29 | 2.2.3 | *Environmental consultant*<br>pp6 - 7; Use of API's BioVapor Model could be referenced, as it enhances the J&E model by assessing biodegradation.<br>This is key for petroleum hydrocarbons since these constituents are known to biodegrade. | Refer to section 2.4.10 for application of biodegradation factors.<br>Additional modelling may be carried out as a Tier 2 or 3 risk assessment. Reference to the API 'BioVapor' model has been added to Schedule B2. |
| 39 | 2.2.3.4 | *State government agencies*<br>Use and limitations of HSLs<br>P9, L23-24, '…evaluating all contaminant phases will provide the most accurate site assessment (see Schedule B2).' | Noted |
| 5 | 2.2.3.4 | *Environmental consultant*<br>p 9; Requirement for site-specific approach<br>The second dot point recommends that a site-specific approach be utilised when PSH is present in groundwater. Shouldn't this be required only after the results have exceeded the HSLs. | A site-specific approach, if required, would follow a screening assessment. PSH may not present a risk of vapour exposure in a building. PSH would then need to be assessed in consideration of ESLs and "management limits" (Refer Fig 1 in Schedule B1). Note, the term "observable LNAPL" has replaced PSH in the revised text. |
| 28 | 2.2.3.4 | *Environmental consultant*<br>p9, The sentence: "Soil and groundwater HSLs provide the principal assessment criteria for open excavations (such as tank removal operations) …." Is not appropriate as tank removal operations also need to consider that the residual concentrations of hydrocarbons in soil do not pose a source to groundwater, or an odour issue. Remove sentence. There should be a clear emphasis on the use of appropriate occupational hygiene measure when evaluating risk due to potential | Refer revised text in Section 2.1.4.5.<br>Occupational exposure is not in the NEPM scope and all work practices must comply with jurisdictional requirements. |

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| | | short term exposure scenarios to consider the acute risks over the chronic and potential scientifically incorrectly assessed risks. | |
| 28 | 2.2.3.4 | *Environmental consultant*<br>p9, The list of circumstances that limit the application of HSLs does not include those where the soil may be a source to groundwater, where odourous soil may be an issue and where soil appearance and function are important, Should the HSLs be included in the NEPM (not recommended, see below), then the HSL limitations, assumptions and derivation need to be included in the NEPM in a separate schedule and footnoted below the HSL tables. | Refer revised text in Section 2.4.1.<br>Neither the HILs nor the HSLs consider soil being a source of contamination to groundwater.<br>HSLs are not the only criteria to be used for assessment of TPH contamination. Refer to Fig 1 and to amended footnotes regarding assessment of groundwater contamination.<br>Guidance on aesthetics related to odour and appearance (staining) is provided in Section 3.6. Function of soil is considered in the ESLs. |
| 28 | 2.2.3.4 | *Environmental consultant*<br>p10, The sentences :"Direct contact HSLs relate to dermal exposure only and have limited application in site assessment." and "Any exposure to a contaminated surface at the levels of the direct contact HSLs would cause a vapour exposure risk." are limitations to the HSLs that should be explicit in the footnotes to table 1A(6). Remove table 1A(6) or add extensive footnotes as to their limitations. We question the value of their inclusion in this NEPM given the title and purpose of the NEPM and this statement. For the reasons given above there are issue relating to what they actually represent in terms of risk as acute exposure scenarios and toxicological effects appear not to have been considered. | Note, there was an error in the draft document, as the direct contact HSLs include consideration of the ingestion, dermal and inhalation exposure pathways.<br>The direct contact HSLs have been deleted from the NEPM, however, they can be found in the supporting document if required. |
| 35 | 2.2.3.4 | *Industry*<br>p10; This section refers to situations where a " measurable separated layer of free phase petroleum hydrocarbon in any borehole or monitoring well is present" and suggests that "In these cases a site-specific approach will need to be developed which is likely to involve direct intervention".<br>See below for comments on "management limits" | Noted. Text on PSH revised and reference to PSH replaced with LNAPL. The presence of observable LNAPL is a site issue that needs appropriate assessment in line with jurisdictional requirements regarding the management of LNAPLs. |

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| | | Given that the shortcomings of measurable PSH thickness in wells as a measure of subsurface LNAPL contamination are well established in the literature, and that this is beginning to be reflected in regulatory guidance in other jurisdictions such as the US, the reference to PSH in wells does not reflect best practice and should be revised. | |
| 37 | 2.2.3.4 | *Environmental consultant*<br>3rd dot point; How was the potential presence of preferential migration pathways taken into consideration when deriving the HSLs? It does not seem adequate to say 'hydrocarbon odour… in buildings… indicates a preferential migration pathway', as the converse is not true (that is, absence of hydrocarbon odour does not necessarily equate to absence of a preferential pathway). | Refer to Friebel & Nadebaum 2011a and 2011b for details of movement of volatiles from the sub-surface to building interiors. |
| | 2.3 | **Asbestos** | |
| 31 | 2.3 | *Environmental consultant*<br>Page 10, Para 1; The last sentence is ambiguous and open to interpretation, particularly reference to demolition materials stacked on the surface.<br>Suggest providing clarification on whether "demolition materials stacked" precludes or includes stockpiled demolition materials. | Amended |
| 5 | 2.3 | *Environmental consultant*<br>pg 10; Environmental protection<br>The second dot point implies that asbestos presents an environmental risk. Suggest that it states protection of human health only. | Noted. Text amended. |
| 5 | 2.3 | *Environmental consultant*<br>pg10; Para 1 of this section states the guidance does not apply to asbestos materials as wastes such as demolition materials stacked on the surface or asbestos materials in buildings. What about underground services? (eg. AC pipes)<br>Provide specific guidance with regard to buried services (whether in use or not, provided they are substantially intact). | Refer amended asbestos text. |
| 1 | 2.3 | *State government agency* | Refer amended asbestos text |

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| | | Asbestos cement material should not be referred to as "ACM". "ACM" is generally used to describe "asbestos containing material". In addition use of asbestos cement material does not include other bonded material such as vinyl tiles that contain asbestos.<br><br>Replace Asbestos cement material with "bonded asbestos containing material "or "non-friable asbestos containing material". | |
| 1 | 2.3 | *State government agency*<br><br>1st sentence states that the guidance does not address asbestos issues related to occupational health and safety. This is incorrect as it places duties on people in occupational settings.<br><br>Delete comment or acknowledge that the document does overlap into areas of occupational health and safety. | Refer revised text in s.4.1.3 |
| 1 | 2.3 | *State government agency*<br><br>The guidance appears to be only in relation to asbestos in the soil. It should clarify whether this means asbestos on the soil as well as in the soil. In addition it should require that any visible asbestos on the soil be removed.<br><br>Require any visible asbestos on the soil be removed. | Refer amended asbestos text which includes reference to removal of visible asbestos. |
| 1 | 2.3 | *State government agency*<br><br>Do not support leaving visible ACM and placing a 30 cm layer of topsoil over it. This is consistent with current Victorian OHS requirements and is inconsistent with proposed national OHS requirements.<br><br>Any visible ACM must be removed. Note where trenching work is required to be performed on a site where visible asbestos contamination had been removed it would be expected that such a site have a management plan requiring any uncovered ACM, as a result of the trenching work, be removed. | Refer amended asbestos text which includes reference to removal of visible asbestos. |
| 1 | 2.3 | *State government agency*<br><br>Reference is made to a "systematic visual assessment". There should be more guidance on what this entails—a reference to the WA 2009 Guidelines is not | Refer amended asbestos text in Schedule B2 (s. 11.2.2). |

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| | | sufficient.<br>Provide more guidance – reference to WA guidelines is not sufficient. | |
| 1 | 2.3 | *State government agency*<br>Use of 0.001% is nonsense, as there is no practical sampling and laboratory method to quantify dispersed FA at this level.<br>Do not apply a number that can not be measured. | Refer amended asbestos text and clarification on the application of the screening levels. |
| 1 | 2.3 | *State government agency*<br>Use of percentages in relation to asbestos contamination requires clear explanation/understanding of how to test so as to be able to produce a percentage for the site being investigated. This is not clear from the produced guidance.<br>Provide clear guidance on how to perform the tests related to the percentages. Note that it may be better to only use one or two numbers - too many different percentages will cause confusion and raise unnecessary angst among employees and the public. | Refer amended asbestos text and clarification on the application of the screening levels. |
| 5 | 2.3 | *Environmental consultant*<br>pg 11; 10 times factor of safety from Netherlands criteria<br>A factor of ten has been applied to the results of the studies undertaken in the Netherlands due to drier conditions in Australia. The level of disturbance in the Netherlands is likely to be greater than Australia due to the higher population density. How has this been taken into consideration? | The level of site disturbance in urban areas is considered to be comparable in developed countries. |
| 44 | 2.3 | *State government agency*<br>Asbestos in soil<br>This section could usefully be clarified by inclusion of a flowchart or table describing the appropriate responses to the presence of asbestos on a site. The following sequence is an interpretation of the approaches that seem to be recommended in this section and questions/clarifications.<br>Site history of possible asbestos ➔ preliminary site assessment ➔ responses as | Refer amended asbestos text in Schedules B1 and B2, including case studies (B1). |

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| | | follow:<br><br>1. If there is only scattered ACM ➔remediate until free of visible ACM in top 10cm or add 30 cm layer of topsoil – Question: Does this situation require that sampling be undertaken? Section 2.3 – paragraph beginning with "If site history.." implies that sampling and analysis would not be required in this circumstance but "Assessment criteria" provides a level for ACM thus potentially creating confusion on this point.<br><br>2. If unbonded asbestos detected by visual inspection ➔ensure appropriate remediation and management as it is impractical to test to 0.001% w/w FA Question: what is the purpose of providing a criteria for this ie 0.001% w/w if it is stated in the next paragraph that it is an impractical number?<br><br>3. If AF (ie ACM <7mm) is easily visible ➔quantify by w/w and if exceeds 0.001%w/w take investigation and management action. Question: this is not achievable in a lab – is it likely to be achievable in the field?<br><br>Cases studies would also be useful – perhaps one that addresses the situation where asbestos is identified at the surface on a demolition site and the site history indicates that release or burial of asbestos historically is unlikely, and therefore it is acceptable to simply remove it or to cover with topsoil. A second case study addressing the situation where sampling and analysis is necessary would also be useful. | |
| 10 | 2.3 | *State government agency*<br><br>p 12 paragraph 5 – It is not clear what the following means:<br><br>"These small fragments may need to be considered as FA if an evaluation of their structural integrity reveals a capacity to generate free fibre." | Refer amended asbestos text. |
| 10 | 2.3 | *State government agency*<br><br>• B1 page 12 last paragraph—Following sentence needs amendment:<br><br>"The %w/w asbestos in soil estimates of FA and AF provide an acceptable screening approach only for those sites which contain small ACM fragments | Refer amended text |

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| | | and/or visible fibre bundles."<br><br>These are likely to be associated with free fibre or small fibre bundles and therefore laboratory analysis will be required and likely to be the primary determinant. | |
| 10 | 2.3 | *State government agency*<br><br>• B1 page 11 paragraph 1 under Assessment criteria. This is not strictly correct and at this stage is not substantiated or explained by the text. It also refers to criterion rather than investigative criterion. It would be best deleted and the full table of criteria which appears shortly after be expanded to include AF and FA as per the original WA Guidelines table. In doing so the 0.001% criteria that applies to both AF and FA can qualify to say that it applies regardless to the site's type of use. | Refer amended asbestos text |
| 10 | 2.3 | *State government agency*<br><br>page 12 paragraph 3 – The following sentence should be amended:<br><br>"A systematic visual assessment (see WA 2009 guidelines) by a qualified and experienced assessor (refer Schedule B9) is required to determine if FA or AF are present." Although reference is made to the WA Guidelines to provide clarity, this may not be obvious in the first instance and the sentence is misleading. Concerns with it are: role of a desktop, is this surface and subsurface visual assessment, what if the AF is as fibre or small material, what if there is vegetation cover?<br><br>• B1 page 12 paragraph 4—some similar reservations as above are made in regard to the visual assessment of FA. | Refer amended text in Schedules B1 and B2. |
| 28 | 2.3 | *Environmental consultant*<br><br>p12, Gravimetric methods for asbestos in soil are not specified and are poorly developed—will this be rectified?, | Considered to be a basic field or laboratory procedure. Refer amended text in Schedules B1 and B2. |
| 28 | 2.3 | *Environmental consultant*<br><br>p12, What is the basis for the ACM differentiation from 0.01%w/w to 0.05%w/w across differing land uses?,<br><br>B1–13, 2.3, 12, How can friable fibres in soil that are not visible be assessed against inhalation exposures?, | Refer amended text (s. 4.1.7 and 4.1.8 in Schedule B1). |

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| 10 | 2.3 | *State government agency*<br><br>The NEPM Schedules of course do not need to reflect the WA Guidelines however since the documents share common criteria and the WA Guidelines are often referenced in the NEPM asbestos sections in regard to terms and procedures, consistency between the two as far as possible is desirable. This is particularly so if there is no apparent good reason for differing from WA. Some of the differences include:<br><br>• B1 page 11 paragraph 4 - indicates an alternative to cleaning the top 10cm of soil would be applying 30cm of clean surface cover. However, B2's alternative is a 5-10cm skim. WA advises alternatives of a 10cm clean cover or long-term hardcover;<br><br>• B1 page 12 - Addresses assessment and quantitation of FA and AF half way down the page and subsequently at the bottom of the page. These would be best rationalised and centralised at the bottom of the page and coming after the outline of how to assess the level of ACM contamination which is much more common and can be used as a surrogate for AF and FA in certain cases;<br><br>• B1 page 12 paragraphs 4 & 5 – The following sentences are inconsistent:<br><br>"If FA is detected, there is no practical sampling and laboratory method to quantify dispersed FA at this level and the focus should be to ensure that asbestos is appropriately remediated or managed."<br><br>"More detailed investigation and appropriate management action may be required if the w/w AF exceeds the 0.001% w/w criterion across a significant area of the site"; | Refer amended asbestos text |
| 10 | 2.3 | *State government agency*<br><br>Definition of Terms<br><br>B1 only defines Asbestos Containing Material (ACM) after about 3 pages after extensively using the term. It defines it simply as asbestos cement material making no reference to size or soundness and which leaves out things like vinyl tiles. It also references ACM in the context of the Dutch work and the Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (Guidelines) as published by DOHWA. The Dutch do not use | Refer amended asbestos text. |

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| | | the term but refer to bound asbestos material and WA use the phrase asbestos containing material and define it as Products or materials that contain asbestos in an inert bound matrix such as cement or resin. Here taken to be sound material, even as fragments and not fitting through a 7 x 7 mm sieve. | |
| 10 | 2.3 | *State government agency*<br>Asbestos<br>The NEPMs draw upon and acknowledge the Western Australian Asbestos Guidelines in proposing investigation levels for asbestos contaminated soils. These comprehensive Guidelines and criteria have been in place for 18 months together with a package of supporting documents and have worked well. In sourcing criteria from elsewhere, DOHWA considers that it is important not to change the borrowings too much lest they be inconsistent with the original material which people may wish to consult for additional information.<br>As they stand, the relevant NEPMs, B1 and B2, differ in a key definition and some of their guidance from the Guidelines, as well as being internally inconsistent, and use generalisations which have the potential to be misleading.<br>The important definition is for Asbestos Containing Material (ACM) which is by far the most important source of asbestos contamination. The Guidelines express this as asbestos containing material with a precise definition which includes all firmly bonded asbestos material such as asbestos cement sheeting and asbestos vinyl tiles. The NEPMs use the phrase asbestos cement material and with a looser and variable definition. At the very least, the NEPM should firm up their definition and extend it to include the vinyl tiles even if they retain the term asbestos cement material. Full details of the issues that DOHWA has identified are provided in the attachment.<br>DOHWA also consider it worthwhile for the Schedules not just to refer to the Guidelines but also the supporting regulatory package of documents, and by using the website for all that material. This is because the Guidelines are made much more usable by the additional material especially the Summary document which provides an overview to the Guidelines cross-referenced to key parts of the text. DOHWA also intend to develop further practical tools such as asbestos in soil | Refer amended asbestos text. |

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| | | contamination calculator and a risk assessment methodology for deriving site-specific cleanup goals. Both these and other documents will be more easily identified under the webpage.<br><br>Given the extent of the changes that DOHWA consider worthwhile, we are willing to provide further comment on subsequent Drafts if you see fit. | |
| 27 | 2.3 | *Environmental consultant*<br><br>Page 10 , The section on Asbestos is in our view very good. It has clear statements of fact about asbestos risks and we have no objection with what has been proposed. However the information is at odds with work cover and with general building / construction industry and general public beliefs and this has potential to cause great angst and dispute at some sites.<br><br>An industry and community consultative process should be planned to discuss, inform stakeholders of the proposed guidelines and thoughts on asbestos.<br><br>Table 1A, No comment on the methods used and the guideline values proposed however we do see potential major concerns with aesthetic issues and odours (particularly with hydrocarbons). We are certainly aware of sites that have had far lower surface and subsurface soil hydrocarbon impacts that have later become significant site issues on the basis of odour and aesthetic acceptability.<br><br>We believe that it will be a real challenge to communicate the risks to the general public particularly when the odour and other aesthetic issues manifest themselves at sites. | Noted, refer revised text with respect to work, health and safety issues.<br><br>Aesthetics and odours are a consideration for site assessment. Refer to aesthetic guidance in 3.7. |
| 24 | 2.3 | *Environmental consultant*<br><br>P12 para 5; "easily visible" is a subjective term. Does this mean visible to the naked eye or under microscopic examination?<br><br>Suggest replacing with a more objective terminology and clarifying if this is visible by naked eye or microscopic examination. | Refer to amended asbestos text. Unless qualified, 'visible' means 'visible to the naked eye'. |
| 5 | 2.3 | *Environmental consultant*<br><br>pg11; 0.01% for ACM in sound condition – NSW WorkCover guide "Working with Asbestos" (2008) states with regard to asbestos contaminated soils "a competent | Refer amended asbestos text. |

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| | | occupational hygienist should assess the site to determine: - if the asbestos material is bonded or friable; - the extent of asbestos contamination…".<br><br>Provide advice that local jurisdictional issues should be taken into account, if possible resolving such issues. | |
| 9 | 2.3 | *Local government*<br><br>11, paragraph 6<br><br>Where the term ACM is first used in paragraph 6 of 2.3, the full term 'asbestos cement materials' is not placed before the abbreviated term, whereas the full wording for 'fibrous asbestos' and 'asbestos fines' has the shortened form in brackets after the full wording. | Refer amended asbestos text. |
| 5 | 2.3 | *Environmental consultant*<br><br>pg 12 Visual assessment for fibrous asbestos – if it is not detected then further laboratory analysis is not required. Friable asbestos may not be visible to the naked eye but could still be present. The absence of required quantification is explained in paragraph 3 by the statement "it can be assumed that the soil level of FA is <0.001%w/w".<br><br>The last paragraph on page 12 states "the %w/w asbestos in soil estimates of FA and AF provide an acceptable screening approach only for those sites which contain small ACM fragments and/or visible fibre bundles". What does this mean? The intent is unclear.<br><br>Clarify by adding "…which contain visible evidence of small ACM fragments…" and cross reference to paragraph 3, eg "(As noted previously, if FA or AF is not visible, it can be assumed that the soil level of FA is <0.001%w/w"), so that this is clear and unambiguous (if indeed this is the intent, and if this assumption is valid). | Refer amended asbestos text. The intent of the proposed approach is to discourage laboratory analysis in certain circumstances. |
| 31 | 2.3 | *Environmental consultant*<br><br>Page 10, Para 2, 2nd bullet point<br><br>Text states "... protection of human health and environment ...". The basis for protecting the environment from asbestos is unclear.<br><br>Suggest providing clarification on what environmental aspects need to be protected | Refer amended asbestos text |

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| | | from asbestos (generally considered a human health issue). | |
| 24 | 2.3 | *Environmental consultant*<br>P12 para 4; "visual inspection" Does this mean the naked eye or under microscopic examination?<br>Suggest clarifying if this is visible by naked eye or microscopic examination. | Refer amended asbestos text. Unless qualified, 'visible' means 'visible to the naked eye'. |
| 24 | 2.3 | *Environmental consultant*<br>As a general comment we note that the WA guidelines have been generally endorsed although only some parts of the guideline have been adopted in the NEPM. This is confusing and sections appear to have been "cherry picked" from the WA guidance.<br>Suggest adopting the WA guideline in its entirety. | Noted.<br>The WA guidance includes some jurisdictional matters that are not within the ASC NEPM scope. The WA guidance includes extensive information on management and remediation which would not be appropriate to include in the NEPM on site assessment. |
| 24 | 2.3 | *Environmental consultant*<br>Assessment Criteria; P12; We question the appropriateness of setting a criterion of 0.001%w/w FA or AF asbestos when the current quantitative analytical methods cannot reach this quantitation limit.<br>The use of a criteria for FA or AF does not seem warranted when quantitative analytical techniques are not available. The focus on should be on management of the problem. | Noted. The 0.001% is applied to weathered and small fragments of cement bonded asbestos containing materials and calculated using gravimetric procedures not laboratory analysis.<br>Refer amended asbestos text |
| 23 | 2.3 | *State government agencies*<br>(and B2 Sec 9.1)<br>We support the inclusion of information relating to the investigation and assessment of asbestos issues and the referencing of the enHealth documents. However, in reading the information included in Schedules B1 and B2, we find there are many inconsistencies.<br>(NSW) DECCW offers its assistance to the Project Team in editing the asbestos-related sections of B1 and B2 to ensure that the advice provided there is consistent. | Refer amended asbestos text |
| 23 | 2.3 | *State government agencies* | Noted |

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| | | p9; First paragraph of Section 2.3 is good as it explains clearly when this guidance is applicable and when it is not. | |
| 23 | 2.3 | *State government agencies*<br>Inconsistent use of terminology.<br>Repeated reference is made to 'fibrous' materials or asbestos. All asbestos is 'fibrous' and therefore this term can be misleading and confusing.<br>Also, It is unclear whether the section refers to the assessment of asbestos containing material other than asbestos cement materials, such as vinyl floor tiles.<br>Please ensure terminology is in line with standard industry usage.<br>For example, 'Friable' may be more appropriate than 'fibrous'; 'ACM' versus 'fibro'.<br>Clarify whether or not the approach applying to asbestos cement material also applies to other materials containing bonded asbestos. | Refer amended asbestos text |
| 23 | 2.3 | *State government agencies*<br>P10; The introduction of the assessment criteria does not appropriately explain when they should be applied.<br>The introduction should explicitly describe when the criteria should applied and provide added perspective on their use:<br>"In light the guidance provided above, it would be unusual to require more than a thorough visual inspection to determine the appropriate management actions. However, in the unusual circumstances that a gravimetric technique is required…"<br>10, last paragraph; Reference is made to the 'forms' of asbestos. Consider specifying the 'forms', i.e. blue, white, brown. | Refer amended asbestos text |
| 23 | 2.3 | *State government agencies*<br>11, 3rd paragraph; Clarification is needed when discussing FA that is not detected by a systematic visual inspection. It should be noted that the levels only relate to small quantities of asbestos fines, etc. that are derived from ACM, that is, they are | Refer amended asbestos text |

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| | | not the principle form of asbestos present.<br>It should also be added that capping is an appropriate option for sites with FA (in addition to remediating and managing. And it should be added that actions taken on a site with FA should aim to "mitigate the release of fibres." | |
| 23 | 2.3 | *State government agencies*<br>p11, 4th paragraph;<br>The NEPM comments that soils containing free or fibrous asbestos cannot be assessed and so it is unclear of the benefit of the inclusion of the numerical criteria. The 'assessment' of FA, as described in the NEPM, is based on visual inspection; therefore there is no need for sampling and thus no need for criteria.<br>Please clarify the asbestos sampling information in the NEPM documents.<br>The capacity for generating free fibres from AF/small bundles should be qualified: "…their structural integrity reveals a likely capacity to generate…"<br>This information may be better presented in a separate guideline format, outside of the NEPM. See Comment 15 below. | Refer amended asbestos text |
| | 2.4 | **Ecologically based criteria** | |
| 35 | 2.4 | *Industry*<br>Rio Tinto supports the approach taken to develop EILs based on a species sensitivity distribution model | Noted |
| 5 | 2.4 | *Environmental consultant*<br>pp 13-17; Unnecessary complexity<br>The methodology for applying EILs requires that site-specific values be determined. This is therefore effectively a Tier 2 assessment rather than a Tier 1 assessment. It is suggested that conservative generic EILs are provided for a Tier 1 assessment and if these are exceeded than a Tier 2 assessment should be undertaken. Further research to determine regional EILs is required - how will this be implemented into the NEPM? | Noted. EIL determination is not considered a Tier 2 activity as the methodology is soil specific for many contaminants. Information and tools are available to assist practitioners. |
| 6 | 2.4 | *Environmental consultant* | In general, background concentrations should be |

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| | | More guidance should be stated on obtaining background measurement specially when fill materials are present. | obtained from areas with similar soil types. Depending on site-specific circumstances, including heterogeneous fill, it may be appropriate to provide greater emphasis on added contaminant limits (ACLs) in site assessment.<br><br>The EIL methodology in B5b provides guidance on the hierarchy of determining background concentrations and application of EILs. |
| 39 | 2.4 | *State government agencies*<br><br>Ecologically based soil criteria<br><br>It should be noted in this section that EILs are largely derived for protection of 'soil processes, plant species and organisms that inhabit or contact soil, and may not necessarily be protective of groundwater resources for all contaminants. Site-specific groundwater conditions must be investigated where the potential for groundwater contamination exists.' | Noted.<br><br>Schedule B6 provides guidance for the assessment of groundwater contamination and the protection of resources and receptors.<br><br>A methodology for deriving EILs that protect aquatic ecosystems (from leaching of contaminated soils to groundwater) is provided in Appendix B of Schedule B5b |
| 40 | 2.4 | *Industry*<br><br>The current NEPM measure (1999) set "interim urban EIL" in Table 5-A of the 1999 Sch B1 document.<br><br>In the 2010 Variation, 3 new EIL land use scenarios are proposed in Sch B1. We believe that the case for a "Commercial/Industrial" EIL is inadequately argued, and inconsistent especially in light of the Variation's comments that the focus is on:<br><br>• Reuse of decommissioned industrial sites in urban Australia (Impact Statement, page 6, line 6); and<br><br>• Minimising financial impacts from unnecessary remediation works in doing so (Impact Statement, page 17, Section 6.1.4, last paragraph 6).<br><br>Setting a Commercial/Industrial EIL is unnecessary and likely to impose significant penalty to industry and the redevelopment of such sites. Where decommissioned industrial land is to be rebirthed for residential or parkland developments, then the Residential EIL covers this situation. | Noted. Schedule B5 provides the basis for ecological protection for all land use scenarios including commercial/industrial. Section 3.4 provides context on the use of EILs and it is acknowledged that some sections of industrial sites will have limited ecological value. Other areas still provide habitat for a range of species.<br><br>Further text has been added to 3.4 to clarify the use of ecological soil levels in commercial/industrial settings. |

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| | | Where decommissioned industrial land is to be rebirthed for Commercial developments, the reality is that such developments typically destroy any (remaining) natural ecology on the site in any case and restores little, if any significant ecology at all. Further, most urban commercial developments essentially cover the redeveloped area in hardstand (concrete traffic areas and buildings) which minimises metal/metalloid migration by almost all pathways.<br><br>Applying a Commercial/Industrial HIL is rational, since during construction and redevelopment, humans on the site can be exposed to contaminants and their protection should be a priority.<br><br>Applying a Commercial/Industrial EIL is irrational, since a). There is no ecology of significance on most urban commercial sites and any soil used for landscaping is typically imported;<br><br>b). The final site is effectively encapsulated by hardstand in the vast proportion of urban commercial and industrial developments.<br><br>The EIL category for "Commerical & Industrial" should be removed on the grounds that the justification for introducing such a category is inadequately reasoned and defended in the Variation and appears entirely vestigial.<br><br>Remove the EIL category "Commercial and industrial" from the proposed Variation. | |
| 33 | 2.4 | *Industry peak body*<br><br>p13<br><br>EILs for selected metals only, The fact that no EILs were developed for a number of metals which have an EIL in the 1999 NEPM is extremely concerning. Some of the metals without new EIL are commonly found as contaminants on sites and in this case without new EILs practitioners will default back to the 1999 EIL values, which are at best irrelevant, but nothing better is around. Because the development of site-specific EILs is way beyond the budget of small to medium scale contaminated site assessments (and defeats the purpose of generic EILs in the NEPM), this situation is a step backwards.<br><br>Auditors have to use and consider EILs on Audit site, which has caused significant | Noted. EIL development is constrained by availability of relevant ecotoxicity data and financial considerations. |

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| | | difficulties since the introduction of the 1999 EILs and probably lead to frequent unnecessary and expensive remediation of sites with values above EILs (even though the guideline is clear that the EILs should not be used as clean up levels but in reality they are used as such). It is inconceivable that such and unsatisfactory situation was allowed to be created and it jeopardises the usefulness of the new NEPM quite significantly. I demand the development of EILs for all other metals which were initially covered in the 1999 NEPM for the new 2011 version. | |
| 28 | 2.4 | *Environmental consultant*<br>p13, RIVM have developed EILs for petroleum hydrocarbons - were these considered?, A review of other jurisdictions and their approaches should be considered to benchmark the proposed Australian approaches with those adopted by others. | International approaches to developing EILs were reviewed as part of the development of the Australian methodology, including that of RIVM (see Appendix A of Schedule B5b. |
| 31 | 2.4.1.1 | *Environmental consultant*<br>Pg 13, Line 11; The following statement is included in this section: "EILs apply principally to contaminants in the top 2 m of soil at the finished surface/ground level which corresponds to the root zone and habitation of many species." Therefore, should EILs not be compared to soil greater than 2 metres below ground except under special/unique site conditions? | Refer revised text in section 3.4 for further guidance on application of EILs |
| 33 | 2.4.1.4 | *Industry peak body*<br>p14<br>Ambient background concentrations, Ambient Background Concentrations (ABCs) determination is a difficult and complex undertaking, especially in urban environments and can by no means be achieved by taking a few off-site samples (if this is possible at all), since many (if not most) urban areas and sites contain heterogeneous fill, with various levels of elevated contaminant levels, which cannot be easily attributed. Hence a detailed guideline on the determination of ABCs is essential. | Noted. Schedule B5b provides further detail on the determination of ABC. |
| 39 | 2.4.1.4 | *State government agencies*<br>The ABC is described as being from naturally occurring background and "diffuse or non-point" anthropogenic activity. It is not clear what types of anthropogenic | Noted.<br>Refer to amended definition. |

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| | | activity may have resulted in the ABC, as industrial, commercial and agricultural activities are excluded. It would be useful if some examples of "diffuse and non-point source anthropogenic activities" were provided. | Schedule B5b provides more detail on ABC and its determination. |
| 31 | 2.4.1.5 | *Environmental consultant*<br>Pg 15, Line 14<br>This section states that "An area of ecological significance is one where the planning provisions or land use designation is for the primary intention of conserving and protecting the natural environment." It is assumed that EILs for areas of ecological significance may be applicable at a site nearby such an area if contamination at the site is effecting the area of ecological significance (e.g. through contamination transport in stormwater or groundwater). Please clarify if this is the case. | See revised section 3.4 for further guidance on application of EILs |
| 37 | 2.4.1. 7A | *Environmental consultant*<br>It currently seems like freedom of choice of location for sampling ABC is rife for abuse, as choosing a location which is already impacted (potentially from off-site activities) will result in a higher allowable EIL for the study site.<br>Further guidelines are required to direct how the ABC ('background' level) for metals is determined. | A hierarchy for determination of ABC is provided, with the preference being for assessment of an appropriate reference site where available. Schedule B5b and associated references provide more detail. |
| 37 | 2.4.1.7 | *Environmental consultant*<br>and Schedule B5c; Having site-specific EILs for fresh contamination seems onerous. How will this work in practice? | In practice most site assessments deal with aged contamination. Consideration of the site history and interviews with relevant personnel will inform the decision on the age of the contamination. References and Schedule B5 provide more guidance for determination of fresh contamination EILs when necessary. |
| 35 | 2.4.2 | *Industry*<br>The CSIRO review of CWS notes that the Canadian standards do not account for ageing and leaching – and makes it clear that use of the CWS in the revised Australian NEPM should only be for application to fresh contamination. This distinction has been made elsewhere in the NEPM, but not with respect to the ESLs. | Noted. Further clarification added to Section 2.6.5.<br>More advanced analysis using silica gel cleanup, GC-MS and other advanced analytical methods can assess the quantity of relevant fractions and MAHs for aged and weathered TPH. Aging is a |

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| | | Add a clear limitation on application of the ESLs to fresh (<2 years) petroleum releases. Add a clear limitation on application of the ESLs to fresh (<2 years) petroleum releases.<br><br>Add a clear limitation on application of the ESLs to fresh (<2 years) petroleum releases. | consideration in use of investigation and screening levels but does not invalidate appropriately tested soils. |
| 22 | 2.4.2 | *Industry*<br><br>Page 16 ; Ecological screening levels (ESLs) for petroleum hydrocarbons compounds: BP have very real concerns over the derivation and application of the ESLs in the NEPM. Our primary concerns are as follows:<br><br>• The ESLs were not derived from investigations or research on Australian species or soil types. The derivation of the ESLs for Australian conditions do not appear to have been internationally peer reviewed.<br><br>• The ESL data is based on Canadian guidance for petroleum hydrocarbons in soil (CCME 2008) which is clearly identified in the document as a low reliability data set, with moderate reliability only for the F1 and F2 TPH values.<br><br>• Given the low to moderate reliability of the data set, we are concerned that there will be inconsistent application and acceptance of the ESLs in the various jurisdictions, and by key stakeholders (such as environmental auditors, environmental consultants, landowners, regulators etc). Communication with external parties during the period of the NEPM review has confirmed significant confusion amongst key stakeholders as to the significance of the ESLs when characterising properties for due diligence and ongoing management purposes.<br><br>• The landuse settings used for the ESLs (and EILs) do not align with those used for assessment of human health (HILs and HSLs). We consider that this will lead to confusion in the application of the ESLs (when used in combination with the EILs, HSLs, and HILs). We also consider that the ESL (and EIL) landuse category applicable referred "Urban residential/public open space land use" is simply far too broad because it effectively combines the HIL A, HIL B and HIL C landuse categories into one landuse category. This effectively means that a high density residential property (HSL B) is classified as having the same inherent environmental value as open recreational space (HSL C) and must be assessed as | The adoption of ESLs from Canadian guidelines follows a review by CSIRO for compatibility with the Australian EILs methodology. The Australian methodology was applied to the Canadian data set (vascular plants and soil invertebrates) as far as possible to derive the ESLs using the same species protection levels as for the EIL landuse settings. The data are derived from international studies and include species relevant to the Australian setting.<br><br>The limitations of the toxicity data set are recognised and the levels are adopted as Tier 1 guidance only. Further assessment and interpretation (see Section 3.4) may be necessary for specific site conditions.<br><br>The ESL landuse settings have similarities with but are not the same as for human health assessment and closely align with the EIL landuse settings. |

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| | | such. This approach undermines the validity of entire process. | |
| 22 | 2.4.2 | *Industry*<br>Further to this, we note the commentary on p27 of Schedule B1 that "in applying EILs and ESLs in commercial and high-density residential settings, greater emphasis is placed on soil levels in open landscaped areas or surface exposed areas compared to areas permanently under buildings and large concrete hardstands." This is clearly an appropriate and commonsense consideration which should made much clearer in the document, and practical worked examples where this is applied should be therefore be provided in the document. An example that might be appropriate would be a service station facility located in a commercial area which is entirely covered with concrete pavement that will continue to be used for service station use. In our view, application of ESLs as site assessment criteria on this type of property, and in this scenario, is entirely unnecessary. | Noted.<br>Additional text provided for clarification. |
| 35 | 2.4.2 | *Industry*<br>p 16—Para 1, Line 5; The ESLs are adopted from the CWS. The ESLs apply from surface to 3m depth. However, the Canadian "surface terrestrial ecological criteria" apply "between 0 and 1.5 meters below ground level." (CWS 2008 Tech Supplement p4 and Tables). The example on p27 says ESLs apply to the top 3m of soil due to the volatility and mobility of the contaminant type. It's unclear why this should be the case in Australia, but not Canada, and is not relevant to F3 and F4 fractions. There appears to be insufficient justification given for extending the reach of the ESLs to 3m depth, and this is unlikely to be appropriate in an Australian context.<br>Revise the application (depth) for the ESLs, based on Australian data. | The *CWS for Petroleum Hydrocarbons (PHC) in Soil – Technical Supplement* (Jan 2008) states on page 4 that *"surface terrestrial ecological criteria apply to all sites between 0 and 1.5m bgl. For depths greater than 3m bgl, a management limit was developed that may be applied in place of the surface ecological criteria. Due to jurisdictional differences in interpreting requirements for management practices, no guidance is given for depths between 1.5 and 3m bgl. Guidance for application of the criteria may be developed by the jurisdiction for these depths."*<br>For consistency with the EILs, the depth of application has been changed to 0-2m below ground level. |
| 22 | 2.4.2 | *Industry*<br>A practical worked example of application of ESLs in a scenario where a site is entirely covered with a building or pavement should be provided in Schedule B1. | Noted.<br>Text has been added to Section 3.4 regarding large industrial sites that are covered in buildings and |

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| | | This example should provide sufficient detail to represent a typical urban commercial scenario where a HSL is not exceeded, but where an ESL is exceeded, and should clearly specify the management measures that would be expected (if any) to be taken in response. A substantial number of property due diligence activities would be addressed with such an example. | sealed pavement. |
| 22 | 2.4.2 | *Industry*<br>Definition of fine and coarse soils to be included in Schedule B1. Ideally, soil types should match those used for HSLs. | Noted. Refer revised text.<br>For Tier 1 soil assessment, the ESL classifications of coarse and fine may be broadly applied to the AS 1726-1993 soil texture classification system. |
| 22 | 2.4.2 | *Industry*<br>The soils types differ between ESLs (coarse and fine grained) and the HSLs (clay, silt and sand), which may cause confusion. A definition for a fine and coarse soil is also required in the document. eg Soils where >50% of particles have a diameter of < 75µm are classed as fine, and soils where >50% of particles have a diameter of > 75µm are classed as coarse. | Noted. Additional guidance added for soil texture classification for HSLs and ESLs to relate to AS 1726-1993 soil texture classification system. |
| 22 | 2.4.2 | *Industry*<br>The ESLs must be thoroughly peer reviewed and determined to be appropriate for Australian soil types and species before they are adopted. The ESLs should only be considered "interim ESLs "until an appropriate scientific review and research has been undertaken to verify their applicability. We note that this approach has been adopted for the interim HILs derived for volatile organic chlorinated compounds, where it is recognised that further scientific work is required. | Noted.<br>The ESL review is referenced and has been reviewed for consistency with the proposed EIL methodology (review available from the ASC NEPM toolbox).<br>The Australian methodology has been applied where data requirements are met and, where applied, these ESLs are considered moderate reliability. |
| 22 | 2.4.2 | *Industry*<br>Commentary should also be included within NEPM to allow for an update of the ESL interim values as more accurate or updated Australian and international scientific data is produced. | The NEPM process allows for minor variations should the need arise. |
| | 2.5 | **Physical and aesthetic management limits** | |
| 28 | 2.5 | *Environmental consultant* | A site-specific approach may be adopted when the management limits are applicable and exceeded |

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| | | p17, Management limits appear to have been derived on the basis of "free phase formation, fire and explosive hazards, effects on buried infrastructure and aesthetic considerations". However the derivation of the management limits is not included in this Schedule. The footnotes to Table 1A(6) do not provide any insight into their derivation. Provide clarity on the derivation of the management limits in either a separate schedule or extensive footnotes to the table. It is insufficient to reference external documentation. In addition what were the assumptions about the composition of the TPH and some guidance should be provided on how to apply these limits where the properties of the TPH assessed at a site differs from these assumptions. For example, there are some basic laboratory tests that can asses the flammability of a TPH composition which may be much more direct and valuable from a risk characterisation perspective than a theoretical number derived based on a lot of assumptions. | based on more detailed site-specific information. Further detail on their application is provided in amended Section 2.9 and Fig 1. References are provided for the Canadian source documents regarding their derivation. |
| 28 | 2.5 | *Environmental consultant*<br>p17, The inclusion of both Direct Contact HSLs and Management Limits is confusing. The Direct Contact HSLs would appear to have no application as the Management Limits are lower for C6-C10 for commercial and residential land uses. In addition, the Direct Contact HSLs do not consider other exposure pathways (eg ingestion, dust inhalation), free phase formation, fire and explosive hazard, etc, which are important considerations, Remove Direct Contact HSLs as they could pose a vapour risk and do not consider free phase formation and a number of other important considerations. | Noted.<br>The direct contact HSLs include consideration of ingestion, dermal and inhalation exposure pathways.<br>The direct contact HSLs have been deleted from the NEPM, however, they can be found in the supporting document if required. |
| 28 | 2.5 | *Environmental consultant*<br>p17, Neither the Management Limits nor the Direct Contact HSLs consider soil as a source of contamination to groundwater. Both the USEPA and RIVM have included this important consideration in their soil criteria for some time. It is disappointing that Australian national guidance has not progressed to consider protection of groundwater from soil sources. Include protection of groundwater as part of the derivation of soil guidelines for hydrocarbons. | Noted. A method for deriving EILs that protect aquatic ecosystems is provided in Appendix B of Schedule B5b. A footnote has been added to Fig 1 to flag the requirement to consider groundwater. Site assessment should include components to determine whether or not groundwater contamination should be assessed in accordance with Schedule B6. |
| 35 | 2.5 | *Industry*<br>"Management limits": There is inconsistency with the NEPM framework which is | Noted.<br>Clarification and amendment has been provided in |

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| | | otherwise restricted to "assessment", so potential for confusion and misapplication.<br><br>The Canadian Standard (CWS 2008) from which these are drawn is explicitly a "remediation standard". It makes it clear that "Whereas the primary focus in PHC CWS standard development is prevention of toxic effects to the receptors in Table 1, in certain situations these pathways may be of little immediate concern and PHC management is driven by these management considerations and other policy factors…. At depths greater than 3 meters, it is expected that the ecological surface soil criteria will no longer be relevant but that the management factors will still apply to site cleanup." Thus, the Canadian "management limits" are framed as remediation goals (response levels) and may not be appropriate for use as "interim screening levels" in the Australian context.<br><br>For many petroleum affected industrial sites there may be no short term health or ecological concerns, but those with PSH will likely have sub-soil concentrations exceeding the proposed "management limits".<br><br>For example, some industrial facilities at mine sites are in remote locations, have no significant ecological receptors within the industrial zone and limited or poor quality groundwater. Health risks (under an industrial land use scenario) are managed by tightly controlled access and site health and safety management systems. Under this scenario, if there are also no aesthetic, physical or other concerns arising from subsurface petroleum hydrocarbons which need to be addressed in the short term (such as spreading or migration of contaminants via vapours or groundwater) the site can be safely managed during the life of operations. Remediation can then take place as part of planned restoration activities for the intended future land use (pastoral or ecological, etc) before or at the time of mine closure.<br><br>Remove management limits<br><br>If "management limits" are retained in NEPM, the intended purpose and limits of their application should be made clearer. To some extent this is addressed in Section 2.2.3.4 but additional guidance on the assessment requirements for "LNAPL sites" would be preferable to the "management limits". Rio Tinto is supporting research on petroleum hydrocarbon LNAPL issues (with CSIRO and through CRC CARE), and is aware of similar work in the US, such as that | Sections 2.1.1, 2.9 and in Fig 1 regarding the use of management limits. These changes include limitations on their application for sites that do not have any subsurface receptors or off-site migration of contamination. They are relevant considerations for site decommissioning and are applied similarly to Tier 1 evaluation. |

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| | | published by ITRC in 2009. This research would be more appropriate for application and incorporation in Australian guidance for assessment of LNAPL sites, rather than the "management limit" approach.<br><br>Another name could be used to be clear that the intended use is only as Tier 1 assessment levels for concerns other than human health and protection of ecological receptors. It should be made clear that these limits are not to be interpreted as levels which are "not acceptable under any circumstances" | |
| 35 | 2.5 | *Industry*<br><br>p 18, Line 4; "…values provide interim screening levels as Tier 1 guidance for residual petroleum hydrocarbon contamination"<br><br>To be consistent with the rest of the NEPM framework, screening levels (whether "interim" or not) should be based on risk. If the aesthetic and other risks addressed by "management limits" are not amenable to quantitative risk evaluation, then an alternative risk assessment approach is preferable to the use of arbitrary concentration limits at Tier 1. It is more appropriate for these issues to be addressed in a (Tier 2 or 3) risk evaluation which can better account for the current and intended land use(s), the role of natural attenuation including LNAPL depletion processes and other site-specific factors. | Noted.<br><br>Clarification and amendment has been provided in Sections 2.1.1, 2.9 and in Fig 1 regarding the use of management limits. These changes include limitations on their application for sites that do not have any subsurface receptors or off-site migration of contamination, consistent with a risk-based approach. |
| 35 | 2.5 | *Industry*<br><br>p18 (lines 6-8); The meaning of paragraph 3 of section 2.5 is unclear: "…or for residual contamination to be reexcavated in the use of the land in order to determine the maximum depth of application."<br><br>Revise text to clarify intent | Noted. Text amended. |
| 22 | 2.5 /3.7 | *Industry*<br><br>Pages 17-18<br><br>BP have significant concerns over the application of the physical and aesthetic 'management limits" for petroleum hydrocarbon compounds proposed. Our primary concerns are:<br><br>• there is no scientifically valid justification for the implementation of the physical | Clarification and amendment has been provided in Sections 2.1.1, 2.9 and in Fig 1 regarding the use of management limits. These changes include limitations on their application for sites that do not have any subsurface receptors or off-site migration of contamination.<br><br>Jurisdictions may have specific policies relating to |

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| | | and aesthetic "management limits" proposed. The Canadian approach has simply been adopted without justification or application to Australian conditions, soil types or consideration of other management approaches already in place to address such issues within the Australian context (such as the presence of free product etc).<br><br>• there is no clear indication how the management limits would be adjusted for site-specific conditions, following the "risk based" intent of the remainder of the NEPM document.<br><br>• Communication with external parties during the period of the NEPM review has confirmed significant confusion amongst key external stakeholders (property purchasers, environmental consultants, auditors) as to the significance of the proposed 'management limits' when characterising properties for due diligence and ongoing management purposes.<br><br>It is recommended that the proposed physical and aesthetic 'management limits" for petroleum hydrocarbon compounds be removed from the Schedule B2. In our view, the proposed HSLs, HILs, EILs, ESLs and GILs address primary health risk and environmental issues affecting contaminated sites, and that the inclusion of arbitrary "management limits" for hydrocarbon compounds that have not been scientifically validated for Australian conditions is entirely inappropriate. Instead of including the "management limits" in the document, there is a clear opportunity in the NEPM review to simply update Section 3.7 of Schedule B1"Aesthetic Considerations" to include additional guidance on the key physical and aesthetic concerns that relate specifically to petroleum hydrocarbon compounds. Examples of this might include the presence of residual free product at a site, or areas of obvious hydrocarbon soil staining. This approach would represent a far more practical approach to the management of physical and aesthetic concerns associated with petroleum hydrocarbon compounds, particularly in circumstances where human health and environmental concerns have already been assessed and found to be acceptable.<br><br>If the NEPM review considers that "management limits" for petroleum compounds are required, then we consider that they should only be considered "interim management limits "until appropriate research has been undertaken to verify their applicability to Australian conditions and jurisdictions. We note that this approach | the management of LNAPLs.<br><br>The NEPM process allows for minor variations should the need arise. |

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| | | has been adopted for the interim HILs derived for volatile organic chlorinated compounds, where it is recognised that further scientific work is required. Further to this we consider that commentary should be included within Schedule B1 to allow an update of any "management limit" value as more accurate or updated Australian and international scientific data is produced. | |
| 26 | 2.5 | *Industry*<br><br>Caltex's comments with regard to the guidance documents are restricted to the application of 'management limits' for petroleum hydrocarbons described in Schedule B1. It is unclear on how these management limits are meant to be interpreted and used with the assessment process. Issues include whether these are a trigger for clean up, a trigger for specific further risk assessment activity or serve some other purpose. Collecting together references within the document appear to give conflicting advice regarding application of these limits and how site-specific considerations particularly with regard to soil depth are applied. I have collected these references below:-<br><br>(2.1) Petroleum hydrocarbon 'management limits' are limited to petroleum hydrocarbon compounds. They are maximum values that should remain in a site following evaluation of human health and ecological risks and risks to groundwater resources and apply to all soil depths based on site-specific considerations. These limits are to consider the formation of phase separated hydrocarbons, fire and explosion risks, damage to buried infrastructure and aesthetics.<br><br>(2.2.3.3) However, site results should be considered with reference to relevant ecological and 'management levels'which may become the predominant consideration. Management levels should be applied after human health, ecological risks and risks to groundwater resources have been assessed.<br><br>(2.5) These values provide interim screening levels as Tier 1 guidance for residual petroleum hydrocarbon contamination. Application of the management limits will require consideration of site-specific factors such as the depth of building basements and services or for residual contamination to be re-excavated in the use of the land in order to determine the maximum depth of application. | Noted.<br><br>Refer to the amended Sections 2.1.1, 2.9 and Fig 1 for revised definition and use of management limits which addresses the multiple issues raised.<br><br>The term PSH has been replaced with "observable LNAPL" for consistency. |

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| | | (3.1) Physical and aesthetic 'management limits 'consider the potential effects of: free phase formation; fire and explosive hazards; effects on buried infrastructure including infiltration of services; and aesthetic considerations. Management limits are considered to apply at all soil depths based on site-specific considerations. Jurisdictional policies will apply to the presence of phase separated hydrocarbons.<br><br>Caltex would request further clear guidance on the application of 'management limits' for petroleum hydrocarbons.<br><br>It is also noted that 3.1 contains a reference to phase separated hydrocarbons and defers recommendations to jurisdictional policies. Caltex would prefer to see a uniform approach to the issue of PSH and for the NEPM to reflect a risk based assessment and management approach.<br><br>Caltex appreciates the enormous amount of work clearly evident in the revision of the Assessment of Site Contamination NEPM. We are hopeful that it will result in significant economic, societal and environmental benefits as well as improved jurisdictional alignment in the management of contaminated sites. | |
| | 2.6 | **Groundwater investigation levels** | |
| 35 | 2.6 | *Industry*<br><br>p18; "Contaminated groundwater may also affect groundwater resources."<br><br>Since the guideline values in Table 1C define acceptable water quality at the point of use, this text should be revised to refer to effects on identified beneficial uses of groundwater resources. | Text amended |
| 31 | 2.6 | *Environmental consultant*<br><br>Page 18, Para 3<br><br>Text refers to applicability of guideline values to groundwater dependent ecosystems, recreational waters and agricultural use, whereas Table 1C only provides values for fresh and marine aquatic ecosystems and drinking water.<br><br>Suggest providing clarification on how the values presented in Table 1C apply to the groundwater dependent ecosystems, recreational waters and agricultural use settings. | Text amended.<br><br>The commonly used AWQG are provided for ease of reference. The remainder are readily available in the source documents.<br><br>Refer Schedule B6 for assessment of groundwater contamination. |

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| 28 | 2.6 | *Environmental consultant*<br>Further information required about application of GILs as the settings in Table 1C do not match those outlined in Section 2.6 (i.e rural uses etc.) | Noted.<br>All AWQG tables have not been reproduced; further information may be found in the source documents. |
| 28 | 2.6 | *Environmental consultant*<br>We continue to fail to provide risk based numbers for many toxicants in groundwater for recreational settings, preferring to default to drinking water.<br>We are able to provide scenario based values for many other human exposures, why is it that we cannot achieve this for groundwater. | Noted.<br>Refer to the *Guidelines for Managing Risk in Recreational Waters* (NHMRC 2008) for further information. |
| 28 | 2.6 | *Environmental consultant*<br>Need rural setting GILS to be able to apply for areas with coal seam gas. Develop risk based GILS for recreational exposure that consider the likely exposure pathways and inputs. | Noted. Site-specific considerations are relevant for this use and are beyond the scope of this amendment. |
| 39 | 2.6 | *State government agencies*<br>Groundwater investigation levels<br>P18, L24, Discussion could be added here on the assessment of groundwater used for domestic non-potable uses and irrigation of garden and public open space. Does the Schedule imply that ADWG should be used for any urban setting, even if the use is not for drinking? Reference could be made to further guidance in: WA Department of Health (2006) Contaminated Sites Reporting Guidelines for Chemicals in Groundwater; WA DoH (2009) Draft Guidelines for the Use of Recycled Water in WA; and EPHC (2006) Australian Guidelines for Water Recycling. This may be a good place to note that agricultural irrigation guidelines are not applicable to an urban setting as they are largely protective of soils, not of human exposure (non-drinking) to contaminated groundwater. | Noted. Detailed discussion of non-potable uses of water is beyond the scope of the amendment. The guidance and application of GILs relates to the identified use of water at the receptor which includes irrigation water. |
| 33 | 2.6 | *Industry peak body*<br>p18<br>Groundwater Investigation Levels, Groundwater Investigation Levels: A number of overseas jurisdictions include soil to groundwater investigation levels (e.g. USEPA | Schedule B6 provides detail on assessment of groundwater contamination. A methodology for deriving EILs that protect aquatic receptors is included in Appendix B of Schedule B5b. |

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| | | RSLs) to provide for a screening level tool for groundwater protection. It is not clear why such values (for soil) have not been included and it is considered appropriate for inclusion. | |
| | 3 | **Application of investigation and screening levels** | |
| 33 | 3 | *Industry peak body*<br>p19<br>Application of investigation and screening levels, Application of EILs to 2m depth and ESLs to 3m depth. The guidelines should make it clear that below 2/3m the application of EILs/ESLs is generally not required, to avoid any mis-application of EILs/ESLs where it is not needed. | Noted. Refer section 3.4 for further guidance on use of EILs. |
| 39 | 3.1 | *State government agencies*<br>General<br>P19, L14, The sentence on consideration of various guidelines does not read well. 'a combination of HILs and EILs, as well as HSLs, ESLs and management limits when petroleum hydrocarbon contamination is present.' | Noted.<br>Refer to the amended Fig 1 for use of relevant TPH investigation and screening levels. |
| 39 | 3.1 | *State government agencies*<br>P19, L16 on, The bordered section does not mention groundwater assessment. | Groundwater is addressed at the end of the first paragraph. |
| 35 | 3.1 | *Industry*<br>p19; The meaning of the last sentence on p19: "ESLs typically should be applied to 3 m below the surface to maintain an adequate level of ecosystem protection" – is potentially misleading.<br>Revise text to clarify intent | Noted.<br>For consistency with EILs, the ESLs are now applied to 0-2 m below ground level. |
| 35 | 3.1 | *Industry*<br>p20. Figure 1 – footnote 2; The meaning of "Management limits are considered to apply at all soil depths based on site-specific considerations" is unclear. "All depths" leaves no room for site-specific considerations?<br>Revise text to clarify intent | Footnotes clarified and amended.<br>The depth to which the management limits apply is a site-specific consideration. |

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| 28 | 3.1 | *Environmental consultant*<br>Figure 1, p20, The flowchart does not provide any point of reference to the Direct Contact HSLs. Remove Direct Contact HSLs. | Noted. The direct contact HSLs have been deleted from the NEPM, however, they can be found in the supporting document if required. |
| 28 | 3.1 | *Environmental consultant*<br>Figure 1, p20, There are no Management Limits for BTEX or BaP, despite the flow chart indicating so. Remove reference to BaP and BTEX in the decision box for Management Limits. | Noted. Figure amended |
| 28 | 3.1 | *Environmental consultant*<br>Figure 1, p20, The flow chart implies that soil concentrations less than HSLs, ESLs and Management Limits could be left in situ ("No further management required.") However, none of the HSLs, ESLs or Management Limits consider ingestion of soil, inhalation of dust, protection of groundwater or soil functioning. There are also concerns as to whether HSLs address acute exposure scenarios and hence no further management is misleading. Review and amend accordingly. | The Direct Contact HSLs include consideration of the soil ingestion, dust inhalation and dermal contact pathways. The direct contact HSLs are available in the supporting document s if required.<br>The remit of the NEPM does not include occupational exposure to hydrocarbons e.g. in deep trenches.<br>Text added clarifying occupational exposure issues. |
| 28 | 3.1 | *Environmental consultant*<br>Figure 1, p20, The flowchart does not enable an assessment of C16-C34 as there are no HSLs for this TPH group. -<br>B1 - 25, Figure 1, 20, It is unclear whether the "HSLs" referred to in the first decision box of the flow chart are the HSLs in Table 1A(3) or the HSLs in Tables 1A(4)-1a(6). Provide clarity on which HSLs are to be used in the flow chart. | Noted. ESLs and "management limits" are applicable to these fractions.<br>The relevance of the soil, soil gas and groundwater HSLs should be considered on the basis of the site conceptual model and the current or proposed land use. |
| 28 | 3.1 | *Environmental consultant*<br>p19, It is unclear why EILs would apply to soil under a pavement where an ecosystem would not be present. Remove "under pavement" example | Noted. The EILs are protective of soil invertebrates as well as plants etc. EILs need to be considered in context (see Section 3.4) including the lateral extent of any paved/sealed areas. |
| 28 | 3.1 | *Environmental consultant*<br>p19, It is unclear why EILs would apply to common garden areas, but HIL A (and not EILs) would apply to ground floor yards of individual apartments. The | Both HILs and EILs apply in residential settings with garden areas. Text added to clarify application of EILs in this setting. |

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| | | protection of soil ecosystems is a value in residential yards where produce may be grown. , Be consistent in the approach. | |
| 39 | 3.2 | *State government agencies*<br>In relation to the application of the investigation levels; for the GILs and HSLs, if residents occupy the ground floor the text states that HSL-B should be applied, if commercial activities are located on the ground floor with apartments above, then the HSL-D should be applied. Whereas with soil contaminants the text states that HIL-B is to be applied to high-rise buildings and flats. It would make application of the assessment levels easier if the criteria were applied consistently i.e for an apartment block which has commercial properties on the groundfloor with residences above why can't HIL-D be the appropriate criteria for both HILs and HSLs? For any open space/paved areas associated with an apartment block, HIL-C would apply. | Text revised.<br>The issue which caused the different application relates to the HSLs applying to the vapour exposure pathway only. HIL D and HSL D is the appropriate land use setting for commercial occupation. |
| 35 | 3.2.1 | *Industry*<br>p21; This paragraph asserts that further actions should be taken "where exceedance of investigation and screening levels indicates there is the likelihood of adverse effects on human health or ecological values for that site." This appears to contradict the guidance given elsewhere that a mere (minor) exceedence is not sufficient to indicate the likelihood of adverse effects.<br>Add "significant" before "exceedance" | Noted. Refer revised text (s.3.2)<br>The text indicates that the exceedence must be *likely to cause an adverse effect*. This would be determined within the context of the site conceptual model and consideration of the results of a statistical analysis of the site data. |
| 35 | 3.2.1 | *Industry*<br>p 20; "Land is usually remediated to an extent which optimises current and future land use." This NEPM, and risk-based management, aims to protect human health and the environment for current and future land uses. The extent to which land is remediated is driven by factors outside the scope of this NEPM.<br>Delete text | Noted. This is a general statement which provides context to the discussion in this section. |
| 5 | 3.2.2 | *Environmental consultant*<br>p21; Inconsistent methodology<br>The suggested method for statistical analysis differs from that recommended in B7 | Text across all relevant schedules revised to be consistent. |

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| | | Section 1.3.2. | |
| 24 | 3.2.2 | *Environmental consultant*<br>Table 1A(1); Section 3.2.2/ Table 1A(1) does not reference the full criteria with respect to statistical tests/ application of the HILs from Section 1.3.2 of Schedule B7.<br>Recommend clarifying criteria for application in Section 3.2.2<br>Recommend adding criteria for application to footer of Table 1A(1) (and also Table 2 in Schedule B7). | Refer revised section 3.<br>Text across all relevant schedules revised to be consistent. |
| 28 | 3.2.2 | *Environmental consultant*<br>p21, Unlike the HILs, where guidance on the use of site data (average, standard deviation and maximum concentrations) is provided, no guidance is provided on how to use TPH data from a site and compare that data to HSLs. Provide guidance on the use of site data to compare with HSLs. | Refer revised section 3. |
| 28 | 3.2.2 | *Environmental consultant*<br>p21, Analyses of data should consider data distribution and all underlying assumptions of the use of parametric or non-parametric statistical analyses, The statistical approaches for the assessment of contaminated land should be assessed and discussed as there may be more appropriate techniques to assess data sets. | Noted.<br>Refer Schedule B2 on use of statistics and the revised use of summary statistics in Sections 3.2 in Schedule B1. |
| 28 | 3.2.2 | *Environmental consultant*<br>p21, The simplistic use of average, standard deviation and maximum concentrations is fine for Tier 1 screening approaches. The NEPM needs to recognise that there are other statistical methods that are just valid, particularly where large data sets are available to better understand the data population and distribution and hence derive the exposure concentration. The NEPM should encourage there use by experienced practitioners. Silence on this matter suggest s that the average, standard deviation and maximum concentrations are the only valid methods, which is not correct. Include text recognising this issue. | Noted.<br>Refer Schedule B2 on use of statistics and the revised use of summary statistics in Sections 3.2 in Schedule B1. |
| 5 | 3.2.2 | *Environmental consultant*<br>pg 21; Compare HILs with arithmetic mean – to what confidence level? | Noted.<br>Refer Schedule B2 on use of statistics and the revised use of summary statistics in Sections 3.2 in Schedule |

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| | | Clarify whether HILs should be compared only to the arithmetic mean, or whether this should be to a 95% confidence level of the arithmetic mean (as indicated by NSW EPA 1995 Sampling Design Guidelines). | B1. |
| 5 | 3.2.2 | *Environmental consultant*<br>pg 21; Should ecological assessment be on the same basis as HILs? What about HSLs vs HILs?<br>Clarify whether data should be compared with EILs on the same basis as HILs (or if not, why not and what is the alternative). Also for HSLs. | Noted.<br>Refer Schedule B2 on use of statistics and the revised use of summary statistics in Sections 3.2 in Schedule B1. |
| 24 | 3.2.2, | *Environmental consultant*<br>The criteria for application of the HILs include "no single value exceeds 250%..". However, in the case study in Section 3.5, it states that "the upper range of individual site values did not exceed twice the GM". It is not clear how this relates to the 250% "hotspot" or other criteria required for application of the HILs.<br>Clarify the case study to accurately reflect the "hotspot" consideration for the HILs. | Noted.<br>Refer Schedule B2 on use of statistics and the revised use of summary statistics in Sections 3.2 in Schedule B1. |
| 24 | 3.2.2 | *Environmental consultant*<br>p 21, line 11; It is not clear what is the statistical basis for the limitation that "the standard deviation of the results must be less than 50% of the values given in Table 1A(1)" and why this is necessary to ensure data quality. | Noted.<br>Refer Schedule B2 on use of statistics and the revised use of summary statistics in Sections 3.2 in Schedule B1. |
| 35 | 3.2.2 | *Industry*<br>p 21, Para 5; The text correctly indicates that TRH analysis does not discriminate between petroleum hydrocarbons and some other naturally occurring organic compounds, but refers to these collectively as "hydrocarbons" – it should be noted that organic acids and sterols are in fact not hydrocarbons.<br>Revise text | Noted.<br>Text amended |
| 15 | 3.2.2 | *Environmental consultant*<br>Pg 21, Line 7<br>Does EPHC recommend a minimum number of data points to calculate statistical | Refer Schedule B2 on use of statistics and the revised use of summary statistics in Sections 3.2 in Schedule B1. |

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| | | parameters (e.g. mean and standard deviation) for comparison to the criteria included in this section? | |
| 31 | 3.2.2 | *Environmental consultant*<br>It is not clear why 95% upper confidence limits (UCLs) of the arithmetic average concentrations have not been included. This statistical test (one-sided Student's t-test) is a logical method of applying some correlation between the "sample mean" and the "population mean", and is widely accepted in the industry, at least in NSW and Victoria.<br>A very simple yet rigorous method of determination is using the USEPA freeware ProUCL, which can deal with non detects and provided as range of normal and log normal tests.<br>Strongly recommended over the simple arithmetic mean.<br>http://www.epa.gov/osp/hstl/tsc/software.htm<br>Also NSW DECCW sampling guidelines, Australian Standard and Victorian EPA soil sampling guidelines. | Refer Schedule B2 on use of statistics and the revised use of summary statistics in Sections 3.2 in Schedule B1. |
| 37 | 3.2.2 | *Environmental consultant*<br>We cannot expect site assessors to decide when generic HSLs do not apply or to go back to the original HSL calculations to determine what is appropriate.<br>The Schedule (and the tables) need to clearly state when the generic HSLs do not apply. Eg, if the air exchange rate assumed is non-conservative for cold or warm climates then the NEPM should define where in Australia these climates are. | All investigation and screening levels have limitations and apply to generic exposure scenarios. It is the responsibility of the assessor to determine whether the site conditions, in the context of a site conceptual model, are compatible with the generic exposure scenarios.<br>The NEPM provides Tier 1 guidance only. Site-specific considerations and jurisdictional decisions about variables that affect the HSL may be relevant. |
| 5 | 3.3 | *Environmental consultant*<br>p22; Why is "geometric mean" used here when the previous page refers to "arithmetic mean"? (Also in section 3.5, case study 3)<br>Clarify use of geometric mean in this example. (also in case study 3) | Refer Schedule B2 on use of statistics and the revised use of summary statistics in Sections 3.2 in Schedule B1. |
| 5 | 3.3 | *Environmental consultant* | Values in the tables and case examples have been |

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| | | p 22; Table of groundwater values - HSLs for F1 (6.8) and benzene (5.3) - not clear where these numbers come from, as they are not in the tables<br><br>Provide clarification | rounded. |
| 28 | 3.3 | *Environmental consultant*<br><br>p22, There are no HSLs provided for F3 and F4 in Table 1A(3), yet these are included in Step 1 of the example. -<br><br>B1 - 32, 3.3, 22, The HSLs provided in step 1 for F1 and benzene in groundwater do not match the values in Table 1A(4), -<br><br>B1 - 33, 3.3, 23, The example has adjusted the HSLs by 10 (for soil) and by 100 (for groundwater) to account for biodegradation of vapours. Guidance on when this rule can be applied is not included in the Schedule. Provide guidance in an explicit manner. | The F3 and F4 fractions are relevant in the case study for ESLs.<br><br>Contaminant values have been rounded.<br><br>Refer Section 2.4.10 for use of biodegradation factors in relation to slab size and soil oxygen levels and depth to soil/groundwater source. |
| 28 | 3.3 | *Environmental consultant*<br><br>p23, The example (and Table 1A(4)) imply that free phase hydrocarbons in groundwater are acceptable (based on vapour intrusion) and that "no further action would be required".<br><br>Many sites will require consideration of extractive uses of groundwater, and source migration, where further action would be required if free phase was present. Such extraction of free phase may have acute toxicity implications. Instead of "no further action required" the example should indicate that other considerations may need to be made. | Noted.<br><br>Refer 'Evaluation and Conclusion' at the end of the case study which provides further context to this statement and addresses consideration of groundwater contamination. |
| 31 | 3.3 | *Environmental consultant*<br><br>Case studies seem out of place (and in the way). Consider moving to an appendix of B1. | Noted. |
| 28 | 3.3 | *Environmental consultant*<br><br>pp22 to 24, Case studies - generic application of degradation is problematic and may not be appropriate for all site conditions. | Noted. The concrete slab size limitation forms part of the case study. |
| 28 | 3.3 | *Environmental consultant* | The case studies are illustrative only. |

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| | | p22, Why has the example used the geomean of site data, when the HILs use the arithmetic mean? | |
| 5 | 3.4 | *Environmental consultant*<br>p25, The HSLs provided in Step 1 of Case study 2 do not match the HSLs in Table 1A(5) for benzene, toluene, xylenes or C6-C10, | Contaminant values have been rounded. |
| 5 | 3.4 | *Industry*<br>pg 25; HSL for benzene shown as 3.7 mg/m3 - does not match tables (Table 1A(5) says 4 or 5)<br>Provide clarification | Values have been rounded |
| 35 | 3.4.1.1 | *Industry*<br>p 27, para 6; This paragraph notes that soil may inherently have poor properties and recommends a pragmatic approach, but it is not clear why this is limited to "existing residential and urban development sites and residential areas."<br>Revise text to include all land use types where soil is poor | Noted. Refer revised text |
| 31 | 3.5.1 | *Environmental consultant*<br>Heading; What is minor? Provide a definition or test for "minor". | The guidance on the statistical evaluation of site data provides more information about the range of acceptable values for interpretation in site assessment (refer to 3.2of this schedule). A case study is provided with an example of a minor exceedance (see Section 3.3) |
| 9 | 3.5.1 | *Local government*<br>p30; The term 'minor exceedance of investigation levels has not been defined. Even though it is explained this should be risk based, it is still open to interpretation and could lead to larger companies 'bullying' smaller or less resourced council's into accepting results that are somewhat more than a minor exceedance.<br>Provide a range of exceedances that may be suitable to give a guidance to Councils when assessing results and remediation action plans for contaminated lands. | What is considered minor depends on the context. Refer revised text in section 3. Case study provided with example of a minor exceedance (see Section 5) |
| 31 | 3.5.2 | *Environmental consultant* | Noted. Refer revised text in s. 2.4.4. The best |

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| | | Page 22, line 1.<br>Silica gel clean-up is not a reliable method of distinguishing between natural organic matter and anthropogenic sources. Silica gel removes all polar compounds, which can include weathered petroleum products.<br>Remove reference to silica gel clean up, or describe the limitations. | available and most practical analytical technology is proposed for evaluation of TPH. The limitations of the technique are recognised and are discussed in Schedule B3. |
| 33 | 3.6 | *Industry peak body*<br>p31<br>Groundwater assessment, It appears that the GMRRW apply a 10-fold increase to the ADWG for recreational water quality. This is a departure from previous practice where such a factor is only applied to metals, and not organics, which have the potential to be taken up through dermal contact. What is the scientific justification for this departure? Further guidance should be provided on the derivation of recreational water quality criteria and maybe included in the GIL table. | Noted<br>Text revised – 'The GMRRW apply a factor of 10- to 20-fold to the ADWG for the purposes of recreational water quality.'<br>Refer to the GMRRW for rationale and detailed justification. |
| 28 | 3.6 | *Environmental consultant*<br>p31, The reference to Table 1C (and Table 1C itself) should be removed and instead reference should be made to the primary documentation for groundwater assessment. Inclusion of Table 1C into the Schedule means that updates to the ADWG, AWQG cannot be reflected in the Schedule, and the Schedule quickly becomes out of date. Remove reference to Table 1C and Table 1C and instead provide reference to the primary documentation, which will then enable the most recent versions (and updates) of the documentation to be used. | Noted<br>The NEPM process allows for minor variations should the need arise. |
| 15 | 3.6 | *Environmental consultant*<br>p31; The GMRRW 'factor' from ADWG should be 10-20 fold not 10-fold, as the extrapolation is 2L/day consumption for drinking and 100-200mL/day for recreational use.<br>"The GMRRW apply a factor of 10- to 20-fold to the ADWG for the purposes of recreational water quality."<br>For reference, see GMRRW Table 9.3, p155, table footnote 'a'. | Text amended including expansion of abbreviations. |

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| 15 | 3.6 | *Environmental consultant*<br>p31; It should be pointed out that recreational criteria should not have 'guideline' values applied for aesthetic drinking water criteria from ADWG. See Table 9.3 of GMRRW.<br>"The GMRRW apply a factor of 10- to 20-fold to the ADWG Health values for the purposes of assessing recreational water quality." | Amended |
| 31 | 3.6 | *Environmental consultant*<br>Para 5; The GMRRW does not apply a factor of 10 to the DWGs. It recommends site-specific assessment and lists one of the potential options as increasing DWGs by a factor of 10. This may be an appropriate method for some analytes, where DWGs were derived based on oral toxicity but would not be appropriate in all cases. Remove reference to 10 times. | Noted. Refer revised text. |
| 35 | 3.6 | *Industry*<br>p 31, para 630; This paragraph refers to exceedances "at the point of use, or in the discharge environment of the groundwater…" This leaves it unclear where assessment or compliance measurements are to be taken in groundwater/surface water discharge zones. As per ANZECC (2000) the appropriate measurement point is the surface water (and/or sediment).<br>Clarify text to indicate that it is inappropriate to apply surface water quality criteria as groundwater investigation or response levels. | Generally, the WQG apply to groundwater including for the maintenance of underground aquatic ecosystems, however, they should be applied with care as the fate of chemicals in groundwater may differ from that in surface waters<br>Schedule B6 provides detail on the assessment of groundwater contamination (other than hydrocarbon vapour exposure) and the use of GILs for investigation and response. |
| 29 | 3.6 | *Industry*<br>p31; Is this an opportunity to introduce the "sentry well" concept rather than just point of use? | Noted. Schedule B1 provides a broad overview of groundwater assessment. The sentry concept is included in the more detailed discussion of delineation of groundwater contamination in Schedule B2. |
| 5 | 3.7 | *Environmental consultant*<br>p32; Beyond scope of NEPM<br>The first dot point states that the general assessment is to consider risks from sharp | Aesthetics are considered to be part of the scope for assessment of contaminated land. For further information see recommendations of review report. A fence is not considered as part of site assessment. |

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| | | objects. Whilst aesthetics need to be considered this is beyond the scope of the NEPM. What happens when there is a barbed wire fence or trip hazard? Are the hazardous materials specifically intended to apply to foreign inclusions in the soils as per Vic EPA? | Barbed wire in soil would be an aesthetic consideration. |
| 31 | 3.7 | *Environmental consultant*<br>Pg 32, Line 28; In relation to the general assessment consideration, "the depth of any residue in relation to the final surface of the site," does EPHC provide guidance on the depth of residue for different land uses that may raise the issue of aesthetic concerns?<br>Para 5; It is misleading to suggest that the "management limits" consider aesthetics. Visual aesthetics possibly, but certainly not odour. | Aesthetics involve site-specific considerations including intended land uses and the risk of exposing material of aesthetic concern during site development. This would include a consideration of the depth of relevant material<br>Refer the amended Section 3.6 for further context. |
| | 4 | **Additional considerations in the use of investigation and screening levels** | |
| 16 | 4.3 | *State government enterprise*<br>P34, L33; Specialised Assessments<br>It is noted that "explosive gas mixtures" has replaced the term "contaminated sediments" as the fourth dot point used in Section 19 of the Measure<br>If the term 'contaminated sediments" is replaced by "explosive gas mixtures" "then it should be amended in Section 19, "National Environment Protection (Assessment of Site Contamination) Measure as varied" to reflect consistent wording in "Schedule B1 Guideline on Investigation Levels For Soil and Groundwater" | Text and NEPM amended. |
| 16 | 4.4 | *State government enterprise*<br>P35, L6; Sediments<br>This schedule clearly identifies that sediments are not included as part of the NEPM and that relevant guidelines specifically developed for assessment and management of sediments should be referenced. The distinction between freshwater sediments and marine sediments would assist in clarifying the appropriate assessment guidelines.<br>Include confirmation that the Australian Government's 'National Assessment Guidelines for Dredging' (2009) is the appropriate current document for dredging- | Noted. Assessment of sediments is a specialised area and is generally excluded from the NEPM. |

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| | | related sediment assessment. | |
| | | **Tables** | |
| 31 | | *Environmental consultant*<br>pp36-55; Tables are poorly titled and have inconsistent formatting<br>Add as many footnotes as possible regarding the limitations associated with each chemical or process in order to highlight. This is vital given the text will not be read by all who use the tables. People are more likely to look at a footnote than look up the chemical or process in a different section. | Noted<br>All investigation and screening levels have limitations and apply to generic exposure scenarios. It is the responsibility of the assessor to determine whether the site conditions, in the context of a site conceptual model, are compatible with the generic exposure scenarios. |
| 34 | Table 1A(1) | *Industry peak body*<br>PACIA questions the need to have a limit on biodegradability for substances such as 2,4 –D and other pesticides. | Noted |
| 28 | Table 1A(2) | *Environmental consultant*<br>37, Interim HILs for VOCs have been developed using attenuation factors from overseas data - how do Australian data compare?, Consider review of Australian vapour intrusion data Revise tables to match | Australian data are consistent with the US EPA database on attenuation factors. |
| 28 | Table 1A(2) | *Environmental consultant*<br>p37, There are no footnotes to Table 1A(2) to indicate that where the interim HILs apply - eg subslab, at 1 m depth. , Provide footnotes to Table 1A(2) to indicate how the interim HILs are to be applied. | Footnote added to Table for clarification. The tables need to be used in combination with the accompanying text. |
| 28 | Table 1A(2) | *Environmental consultant*<br>p37, It is not understood why oral or dermal exposures to chlorinated hydrocarbons are not considered significant. Should present a clear reason as to why the inhalation pathway is only considered for these chemicals (e.g. Soil gas interim HILs only - what about oral and dermal exposure to soils) | Footnote added to Table for clarification.<br>Detailed information of exposure pathways included is presented in the appendices to Schedule B7. |
| 28 | Table 1A(3) | *Environmental consultant*<br>pp38-39, The HSLs have been developed without a field validated model, the author of the model does not recommend this and it cannot be guaranteed that | Noted. The model author has reviewed the multiple lines of evidence approach and comments made have been considered and addressed in the HSL |

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| | | these may be protective of human health. Further, the JEM for vapour intrusion is limited to a specific exposure scenario and does not cover others that are relevant in Australia. Further justification and discussion on the use of the JEM model is required. | development. |
| 28 | Tables | *Environmental consultant*<br>pp36-50, There is no classification for heterogeneous fill which is most common for contaminated land situations. Suggest sand or silt criteria would apply depending on the level of fines in the fill. | Site assessors will have to make a determination for each fill profile and select the most relevant soil classification. |
| 28 | Tables | *Environmental consultant*<br>pp36-50, How do the criteria based on insitu depths relate to final finished levels at a site due to cut and fill operations i.e. if a site currently has contamination at 2m and 2m fill is placed over the top - what does that mean for application of HIL and HSL?, Suggest finished levels should apply for application of site criteria. | Noted. Refer to 'definitions' in section 2.1.1 and the application section. |
| 28 | Tables | *Environmental consultant*<br>pp36-50, The TPH fractions adopted are not consistent with the information presented at the TPH Technical Workshop and the workshop recommendations, nor are they consistent with previous NEPM work. Reconsider the TPH fractions. | Noted. The workshop recommendations were considered during the development of the HSLs. Adopted fractions align with available toxicity data. |
| 40 | Table 1A(1);= | *Industry*<br>p36; We agree that human health should be the primary concern in addressing soil contamination issues. In that respect we support the elimination of trivalent chromium from all categories of HIL in the 2010 Variation.<br>There is extensive scientific data to indicate that risks to human health from trivalent chromium in soils are negligible. The HIL values in Table 5-A of the 1999 Sch B1 document were inappropriate in comparison to all other metals in the same table.<br>None required. | Noted |
| 28 | Table 1A(3) | *Environmental consultant*<br>pp38-39, The limitations, assumptions and derivation of the HSLs are not included in the NEPM, which is inconsistent with the HILs and could easily lead to the | Noted.<br>The limitations, assumptions and derivation of the |

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| | | inappropriate use of HSLs. , It is strongly recommended that the HSLs are removed from the NEPM. Instead reference to the HSL external documentation can be included in Schedule B1. This approach ensures that the HSLs are not separated from the information that describes their derivation and limitations and that guides their use. | HSLs are fully documented in the referenced supporting texts and a summary is included in the NEPM. The NEPM requires that practitioners become familiar with the limitations of HSLs and their application before use. The HSL documents are available in the Toolbox. |
| 28 | Table 1A(3) | *Environmental consultant*<br>pp38-39, The implication that non-limiting (soil saturation concentration) concentrations of hydrocarbons can remain in soil (as per Figure 1 of Schedule B1 and Table 1A(3)) is misleading and disingenuous. The soil HSLs consider only vapour inhalation by people. They do not consider other pathways of exposure to people, nor contamination migration pathways (eg soil leaching to groundwater). They do not include aesthetic or acute exposure considerations of soil. There is high potential for misuse of the soil HSLs as these limitations are not explicitly made. There is a high potential for incorrect assessment of risk to human health. It is strongly recommended that the soil HSLs are removed from the NEPM. Instead reference to the HSL external documentation can be included in Schedule B1. This approach ensures that the HSLs are not separated from the information that describes their derivation and limitations and that guides their use. | Noted.<br>There is no implication in Schedule B1 and Fig 1 that HSLs are to be used in isolation. It is emphasised that ESLs, management limits, groundwater impacts and aesthetics must be considered when TPH values are denoted as NL. Note direct contact HSLs consider soil inhalation, ingestion and dermal contact and are relevant if there is potential direct contact with soil. Schedule B4 provides the basis for health risk assessment and Schedule B6 is essential to assess groundwater contamination. |
| 28 | Table 1A(3) | *Environmental consultant*<br>p38, Soil HSLs for TPH - no differentiation into aliphatic and aromatic which have differences in fate and transport and toxicity, Suggest that the TPH aliphatic and aromatic fractions are considered. | Noted.<br>The HSL tables clearly differentiate between the TPH fractions, monocyclic aromatic hydrocarbons and naphthalene for vapour exposure. Refer to the HSL Technical Report for further discussion of aliphatic and aromatic fractions. |
| 37 | Table 1A 3 | *Environmental consultant*<br>TRH HSL Tables<br>If the TRH criteria in these tables exclude BTEX and naphthalene (as seems to be indicated in Section 2.2.3.2 text), then this needs to be spelled out in the table as a reminder to subtract these results. It is also suggested that a specific method of undertaking this is described as a footnote to the tables. | Section 2.4.5 amended to clarify BTEX and naphthalene issues. Naphthalene should not be subtracted from F2.<br>Text amended to further emphasise this issue. |

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| | | Include method and example of subtracting BTEX and naphthalene from TRH values | |
| 37 | Tables 1A(3) and 1A(4) | *Environmental consultant*<br>Tables 1A(3) and 1A(4);<br>'Key limitations in developing HSLs' – these are important in knowing when generic HSLs are not applicable and should therefore be included in the schedule rather than as a footnote which refers to a reference document assessors are unlikely to read.<br>Include the limitations directly in the tables. | Noted. The HSL documents are available in the Toolbox and contain detailed information on limitations and applications of the HSLs. A summary of the limitations is included in Schedule B1. |
| 36 | Tables 1A(3) to 1A(5) | *Environmental consultant*<br>Rather than adopting an overseas soil classification system (see below Sch. 2 Comment 8), would it not be more logical to use the triaxial plot scaled approach and the HSL values proposed using "pure" sand, silt and clay?<br>As currently proposed, whilst trivial in some cases, in cases where a large range of values are proposed, a significant change in the "acceptance criteria" would result from a minor change in the soil type. By using a sliding scale, a minor change in soil type would result in a minor change in the HSL.<br>The existing tables could be used, the USDA descriptors would simply be removed, and a description in text would be included on the need to create plots based on the data for "pure" material types.<br>From an audit perspective, I see numerous arguments with consultants about whether it is a sandy clay or a clay etc.<br>An example is shown below.<br>(refer to Submission by Cavamba Consulting) | Noted. Refer revised text.<br>For Tier 1 soil assessment, the HSL classifications of sand, silt and clay may be broadly applied to the AS 1726 soil texture classification system. This also applies to the ESLs. |
| 37 | Tables 1A(3) and 1A(4) | *Environmental consultant*<br>Why are the HSL-B levels lower than the HSL-A levels? Is this due to assumptions about building size etc.? | Refer revised HSL tables for vapour inhalation pathway – HSL-A and HSL-B are amalgamated as they now have the same indoor air exposure conditions. |

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| | | Need to do a reality check on this, as low density residential can include a wide range of building types and sizes. Perhaps it is better to define criteria according to proposed building types rather than generic land use? | |
| 5 | Table 1A(4): | *Environmental consultant*<br>pp40-41;Note 3 refers to a soil-vapour source concentration. Should this be "groundwater" for this table? | Wording is correct as it refers to partitioning from groundwater to soil vapour. |
| 5 | Table 1A(4): | *Environmental consultant*<br>p 40; Clarification required Is Table 1A(4) only for vapour risks from groundwater contaminated with hydrocarbons? What are the guidelines for groundwater <2m depth? | The HSLs are developed for vapour exposure risks. There is no Tier 1 guidance available for groundwater <2m. Site-specific approach will need to be considered which may include soil vapour assessment. |
| 5 | Table 1(A) 3 | *Environmental consultant*<br>p38, The move to derive HSLs for volatile compounds for different depth ranges is welcomed. However, there are situations where the 0-1m HSL has a value, and the 1-2m HSL is "no limit", eg for naphthalene (HSL B, Sand). It is assumed that the 0-1 m HSL is derived at a very shallow depth (eg 0.01 m) in order to be adequately protective. This leaves a gap of at least 0.9 m to the next HSL, and somewhere in this depth the HSL becomes 'no limit'. Given that much of the sampling carried out for contaminated land investigations is carried out between 0-1 m (often 3 samples in this range) it would be useful to know the depth where hydrocarbon HSLs reach "no limit" under each scenario, or alternatively could a 0.5 m value be provided? | Information may be found in Friebel & Nadebaum (2011).<br><br>Note that ESLs for TPH are also relevant for site assessment and apply to the top 2m of soil. |
| 5 | Table 1A(1) | *Environmental consultant*<br>p37; Foot note 5 Further clarification is required on the statement "B(a)P occurs in bitumen fragments it is relatively immobile and does not represent a significant health risk." | The footnote is considered to be self explanatory. Bitumen fragments in soil are not considered a health risk but may present an aesthetic concern. |
| 37 | Tables 1A(3) and 1A(4) | *Environmental consultant*<br>Biodegradation footnote: With the current approach and wording it seems the biodegradation factor will be often applied inappropriately. Suggest that | Refer revised text. Application of the biodegradation factors is dependent on a number of conditions including measurement of oxygen at 1m depth. The guidance in 2.4.10 and the reference (Davis et al 2009) |

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| | | biodegradation footnote is reworded to make the use of a biodegradation factor the exception (when site-specific evidence for significant biodegradation is strong) rather than the rule (which will happen if assessors always just assume that suitable conditions for biodegradation are present and will be present in the future). | provide detail on the limitation of the biodegradation factor in Tier 1 screening. |
| 37 | Tables 1A(3) and 1A(4) | *Environmental consultant*<br>Is it really necessary to have so many different criteria based on soil type, depth, site use etc? In some cases the criteria are very similar (eg, groundwater for various depths) and it would simplify the assessment by combining these columns and using the most conservative criteria, without having a significant effect in terms of cleanup/management required. Reduce number of different criteria where derivation has produced very similar criteria across different depths, soil types etc. | Noted. The methodology places emphasis on multiple lines of evidence and the effect of soil type and depth below surface. In some settings the differences in soil types have little effect on the HSL. |
| 40 | Table 1B(3) | *Industry*<br>p47; We do NOT support inclusion of EILs for trivalent chromium. Our argument is developed in the subsequent table. It is our view that the application of CSIRO SSD modelling to trivalent chromium is flawed, based on seriously inadequate and deficient toxicity data set for this metal and represents poor modelling practice. In our view, the NEPM Variation fails to support a case for setting EILs for trivalent chromium in Australian soils based on sound science – rather it smacks of the over-reaching application of a risk model using a poor data set. The US EPA failed to satisfy Court review on this issue in 1994 and we do not believe the data set has improved since this time for trivalent chromium.Remove Trivalent chromium (Cr(III)) EILs from Table 1B(3) for all land use categories | Noted.<br>Site-specific ecological risk assessment may be conducted when a specific chemical form of CrIII is present e.g. chromium hydroxide. |
| 37 | Table 1B(5) | *Environmental consultant*<br>Why are there no F3-F4 criteria for National Parks? If no values are given then the default assumption is any level is acceptable, which is obviously incorrect.<br>Can conservative interim values be included? Or note to default to other land use criteria in the interim? | Insufficient data was available to apply the Australian methodology to derive ESLs for F3 and F4. |
| 31 | Table 1C | *Environmental consultant*<br>Pages 50-55, Columns 4 & 5<br>The Table footnotes are silent on applicability of the GILs presented, where a | Text amended. Refer revised Table 1C. |

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| | | potential bioaccumulation risk is present.<br>Instead of simply specifying the 95% species protection values from the ANZECC & ARMCANZ 2000 for GILs, we suggest that for GILs, in most cases, the 95% species protection trigger values listed in Table 3.4.1 of ANZECC & ARMCANZ (2000) should apply to typical slightly-moderately disturbed ecosystems. However for a few chemicals, the 99% protection are recommended as default GILs for these ecosystems as specified in the shaded boxes in Table 3.4.1 of ANZECC & ARMCANZ (2000).<br>Refer to Section 3.4.2.4 and Table 3.4.1 of ANZECC & ARMCANZ (2000)<br>Guidance should be provided on the limitations of selected values and that values for protection of 99% of species may need to be considered (ref: ANZECC (2000)) | |
| 11 | Table 1C | *Analytical laboratory services*<br>P52;<br>Are the concentrations and/or units correct for dioxins? The following are examples of regulated levels:<br>a. California OEHHA = 1 pg/L<br>b. Canada = 15 pg/L TCDD TEQ<br>c. Japan = 0.001 ng/L<br>d. Sweden = 250 ng TEQ/kg for groundwater extraction<br>e. UK = 0.01 ng/L<br>f. US EPA = 0.03 ng/L<br>Select a more appropriate investigation level for dioxins in fresh water. | Text amended, the values apply to PCBs and not dioxins. |
| 31 | Table 1C | *Environmental consultant*<br>1) The Table footnotes are silent on the need for adjustment of the GILs for selected metals, with respect to receiving water hardness.<br>Guidance should be provided on the limitations of selected values and that values may need to be adjusted to achieve 95% protection of species, depending on | Noted<br>Table and footnotes revised. Refer amended table |

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| | | receiving water hardness.<br>2) The Table footnotes are silent on the need for adjustment of the ammonia GILs, with respect to the pH of receiving waters.<br>Guidance should be provided on the limitations of selected values and that values may need to be adjusted to achieve 95% protection of species, depending on the pH of receiving waters.<br>3) Lists a nitrate IL for freshwater of 0.7mg/L. This value was rescinded in 2005. Not aware of a replacement trigger value.<br>http://www.mincos.gov.au/__data/assets/pdf_file/0015/316122/gfmwq-guidelines-vol1-errata.pdf | |
| 5 | Table 1C | *Environmental consultant*<br>p50; Additional assessment criteria required<br>It is recommended to include guidelines for all protected values, i.e. irrigation and industrial use. | Text added for clarification. The requested information can be found in the ANZECC Water Quality Guidelines. The most commonly used guidelines values for drinking water and marine and fresh water have been included only for ease of reference. |
| | | **General comments** | |
| 39 | | *State government agencies*<br>The amendments to this schedule have over-complicated the assessment of contaminated sites. LandCorp is aware that through the consultation process "look up tables" were requested, however the now 12 look up tables, and the specific instances when each should be used e.g. soil depths; EILs to 2mbgl, HILs to 3mbgl and ESLs to 3mbgl will likely result in confusion and mis-use of the tables and therefore mis-interpretation of data. This will result in increased auditor and regulator involvement, which will in turn increase the cost and duration of site investigations. Although flow charts and examples are provided, more clear guidance in the form of further flow charts as to when each table should be used may assist in reducing their mis-use. | Noted.<br>Some simplification has been carried out.<br>The HSL Direct contact tables have been deleted and the ESLs and EILs now both apply to 0-2m bgl.<br>Each investigation and screening level type has its own derivation methodology and limitations. |
| 22 | | *Industry* | Noted. |

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| | | General<br>Landuse types referenced throughout the NEPM documents should be consistent for all proposed ESLs, EILs, HILs, and HSLs. | The HILs and HSLs land use settings are consistent as are the EILs and ESLs. The HSLs are restricted to the vapour exposure pathway which affects the land use settings. The EIL and ESL settings have similarities but are not the same as the HILs and HSLs due to differences in their derivation.. |
| 6 | | *Environmental consultant*<br>General<br>Geometric mean not clearly defined. Is this applicable for both ecological and human health under normal distribution? We note that most field data are non-parametric rather than normal distribution. | Noted. Refer revised text in S. 3.2 in Schedule B1 and also Schedule B2 for further information. |
| 13 | | *University*<br>General<br>In the review documentation discussion is presented on the toxicity of benzene. The opinion of Prof Brian Priestly that there is insufficient evidence for benzene as a mutagen is contradicted by the published literature. It is also in conflict with data presented in MSDS's by Australian petrochemical companies. The literature also documents cases of leukemia in workers exposed to 50-500mg/m3 in air.<br>Resolve conflicting opinions regarding benzene toxicity.<br>Huff J (2007). "Benzene-induced cancers: abridged history and occupational health impact". Int J Occup Environ Health 13 (2): 213–21.<br>Rana SV; Verma Y (2005) "Biochemical toxicity of benzene". J Environ Biol 26 (2): 157–68.)<br>S N Yin, et al. (1987) Leukaemia in benzene workers: a retrospective cohort study. Br J Ind Med. 44(2): 124–128. | Noted.<br>Both threshold and non-threshold effects of benzene have been considered. Refer to Appendix B of the HSL Technical Development report (Friebel & Nadebaum, 2011) which includes discussion of the adverse effects from prolonged exposure to benzene, including evidence for mutagenic effects. |
| 13 | | *University*<br>General<br>I note that the NEPM does not address biodiesel as a soil contaminant. Biodiesel is | For contaminants not included in the NEPM, a site-specific assessment process will be required (text added to 2.4.3). |

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| | | not a petroleum hydrocarbon but an esterified long chain fatty acid. It is more phytotoxic than diesel, and has a different degradation pathway to aliphatic TPH.<br>NEPM be modified to include biodiesel /biofuels | Text added to 2.4.4 to clarify that biofuels, if present will be included in the TRH test and that they may lead to false positives as do other polar hydrocarbons of non petroleum origin. |
| 13 | | *University*<br>General<br>The land classifications used in the document (eg 'commercial' ) appear to be arbitrary and not clearly defined. It seems from these classifications that significant proportions of metropolitan residential areas could come under the 'commercial' classification.<br>The notion that exposures would be less in commercials settings is erroneous. This would mean by the nature of the classification all petrol stations (a leading source of TPH soil and ground water contamination globally) would be 'commercial' and therefore subject to 10-fold or 100-fold multiplication of HILs. Would this also mean that schools and residential care facilities which are 'high risk' locations were also considered commercial and subject to the same HIL multiplication factors?<br>I am unsure how recreational areas could become hydrocarbon contaminated, but are not subject to the multiplication factors. As a result the classifications seem to suggest that areas that are most likely to be associated with contamination should be treated less stringently than those that are not. This seems counterintuitive to the notions of Environmental Protection or health based investigations. I note a similar comment re: arbitrary classifications from the International reviewers<br>Define clearly the rationale for deciding upon land classifications and explain the relationships between these classifications and susceptible populations in determining HILs. | Land use exposure scenarios are defined in Schedule B7, including how schools and residential care facilities are defined.<br>The application of the biodegradation factors is a function of the ability of oxygen to penetrate the sub surface and apply to a limited underslab distance at Tier 1 level application. The factors apply independent of land use classifications (Refer section 2.2.3.3).<br>HSLs apply to the vapour exposure pathway only. Refer to the use of ESLs (Section 2.6) and Fig 1 as amended (Section 3.3) for clarification. |
| 10 | | *State government agencies*<br>General<br>Schedule B(1) is generally well presented, logical and well structured. It is however evident that it attempts to integrate some disparate elements that which could be done somewhat better. There is some variation in the terminology used which | Noted<br>Screening levels to apply should be informed by consideration of the conceptual site model (CSM). Additional text added to 2.1 regarding CSM development. This is intended to direct the assessor |

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| | | should be standardised and where lists of abbreviations or chemicals are used they should be done in alphabetical order, at least in sub-groups and noting that the source material may not necessary permit this.<br><br>To make the Guideline more usable, more work in particular should be put into organizing, simplifying, explaining and integrating the Tables at the back which list the investigation levels. There are 14 or so different tables which are: presented differently; covering varying groupings of chemicals; for soil, ground water or soil gas, depending; sometimes with health and environmental parameters together and sometimes not; and not including asbestos except in the main text. Examples where guidance may be warranted: for benzene in ground water do you apply both the GIL and HSL? For vinyl chloride do you apply the GIL and Interim HIL?<br><br>To address the above, it would be good to have some type of user guide at the front end of the set of Tables so help users know where to go in finding guidance for their issue. The Tables will be the primary reference point as so making them usable is crucial.<br><br>As this document will be the main reference for investigation criteria, it should be as far as possible self-sufficient without the reader having to go to the source document for fine detail or application guidance. | to the correct application of soil investigation and screen levels. GILs and HSLs are applied to different risk elements.<br><br>Schedule A, the case studies and Figures provide the practical framework and examples for application of investigation and screening levels.<br><br>Use of the references and relevant schedules are an essential part of the assessment process. Refer to Schedule A. |

## APPENDIX D – Issues and responses – Schedule B2

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| | **1** | **Introduction** | |
| 31 | 1 | *Environmental consultant*<br>p1; Schedule covers only soil, soil vapour and groundwater investigations. Should also include landfill and ground gas as integral part of site assessments (from preliminary investigation). Extensive guidance on this matter is available from the UK (e.g. CIRIA Guidance C665, British Standard BS8485, etc). | Noted.<br>The scope of the amendment (Recommendations adopted in the Review Report) did not include landfill and other ground gases; however, key references have been added to section 9. |
| 47 | 1 | *Industry peak body*<br>p1; Schedule covers only soil, soil vapour and groundwater investigations, Should also include landfill and ground gas as integral part of site assessments (from preliminary investigation). Ground gas has many sources (landfills only being one major of them) and overseas experience (e.g. UK) has shown that ground gases (e.g. methane and carbon dioxide emissions from the ground) can be significant factor requiring management for site development. Extensive guidance on this matter is available from the UK (e.g. CIRIA Guidance C665, British Standard BS8485, etc). | Noted.<br>The scope of the amendment (Recommendations adopted in the Review Report) did not include landfill and other ground gases; however, key references have been added to section 8. |
| 5 | 1 | *Environmental consultant*<br>p1; Site history should be included in list of components. Include site history | Text revised. |
| 36 | 1 | *Environmental consultant*<br>P1, Dot 3; Should include comment of CSM in text and graphical format. | Text revised. |
| | **2** | **Stages of investigation** | |
| 47 | 2.1 | *Industry peak body*<br>2nd para—2nd sentence, "sufficient information is available to inform…" Amend | Text revised. |
| 30 | 2.1 | *Environmental consultant* | Text deleted from section 2.1. Note heritage issues are dealt with in section 12. |

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| | | Page 2, line 2; Refers to Aboriginal Heritage Issues, however, this is irrelevant for a contamination report. Aboriginal heritage is a specialised area to be considered by planners and archaeologists. Delete the words 'Aboriginal Heritage Issues' | |
| 47 | 2.1 | *Industry peak body*<br>p2; Aboriginal heritage; Incorporation of Aboriginal heritage considerations is beyond the scope of site contamination and should be removed. Leaving this wording unchanged will require all site contamination assessments to investigate the significance of aboriginal heritage at the site. It should be the responsibility of the development approval authority not as part of site contamination assessment. | Text deleted from PSI section. Note, heritage considerations are included in Section 11. |
| 36 | 2.1 | *Environmental consultant*<br>1st Para, L2; Why is Aboriginal heritage germane? If so, why not European? However, they both relate to heritage, which is administered by different agencies, under different legislation, by different specialists. Is this now an expectation that auditors must assess heritage? Does this mean auditor acceptance is based on knowledge of these issues? In short, this one phase raises a raft of related issues and problems and should be removed. (This is not to say it is an unimportant issue, however there are other processes and people to deal with this). | Text deleted from PSI section. Note, heritage considerations are included in Section 11. |
| 29 | 2.1 | *Industry*<br>p2; ASTM has developed very comprehensive guidance for Tier 1 (PSI) and Tier 2 (DSI) investigations that should be considered in this document; Add ref to ASTM | Noted, however, the relevant ASTM standards contain numerous prescriptive items which limit their usefulness in an Australian setting. |
| 37 | 2.1 | *Environmental consultant*<br>Lst sentence; Is the intent of theis sentence to say that a PSI involving only a desktop study and no sampling may be sufficient so that no sampling is required? | If a thorough PSI has been carried out and a site inspection indicates that there is no suspicion of contamination, than sampling is not required. |
| 37 | 2.2 | *Environmental consultant*<br>Similarly to previous comment, a DSI (or at least some site sampling and analysis) would normally also be undertaken if contamination MAY be present. In practice some sort of sampling program is usually required to confirm that there is no imported fill, for example. | Noted. |

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| | **3** | **Basic site information** | |
| 39 | 3.1 | *Stage government agencies*<br>I suggest adding information on services to the property to the list of details required for a site e.g. location and depth of sewer, communication infrastructure — as these can act as contaminant migration pathways. | Text revised. |
| 39 | 3.1 | *Stage government agencies*<br>4, 1st of 3.1, The example "lot on plan" is not clear<br>Change to "lot number X on Plan XX" | Text revised. |
| 29 | 3.3 | *Industry*<br>p4, Also helpful in identifying preferential pathways; agreement | Noted. |
| 33 | 3.3.1 | *Industry peak body*<br>p4; Only current site plan requested, Aside from historical aerial photos other historical maps and plans are at times available and of great value (e.g. Melbourne Metropolitc Board of Works maps, historical Melways editions, old topo maps, old geological maps, old mining maps, and records of the mining department (where appropriate) etc) | Text revised. |
| 33 | 3.3.17 | *Industry peak body*<br>p6; History of adjacent land uses restricted to neigbouring properties, Site history review needs to be completed for areas say 200m from the boundary of the site to capture possible sources of groundwater and/or ground gas contamination, which could impact on the site (e.g. Dry Cleaners, landfills etc) | Text revised. |
| 29 | 3.3.2 | *Industry*<br>p 5; Should identify any institutional control, not just zoning; Consider institutional controls as well as Zoning (eg groundwater restrictions etc) | Noted. Information included in 3.4 |
| 39 | 3.3.3 | *State government agencies*<br>5, Not always possible to identify responsible party. Add "if possible" | Text revised. |

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| 47 | 3.3 | *Industry peak body*<br>4; DQOs; Section 3.3 is misplaced—should be part of Section 4. Data quality objectives must be appropriate to and stem from the investigation objectives. For example highest standard DQO's are needed for investigations for compliance or audit purposes. DQO's for an initial screening assessment need not be of such high standard. The Schedule should provide some guidance about this. | Text revised to include reference to a simplified planning process for simple screening assessments. |
| 36 | 3.3 | *Environmental consultant*<br>Site history should specifically require an integrity assessment requirement, and describe the need to clearly document any information gaps and an assessment of the accuracy provided. | Text revised. |
| 47 | 3.3 | *Industry peak body*<br>Source: The NSW DECC website now refers to this guideline as NSW EPA (2000), not 1997<br>Correct | Text revised. |
| 39 | 3.4 | *State government agencies*<br>7, 3rd dot point, Aerial and ground photographs , Suggest adding "(current and historical)" | Text revised. |
| 47 | | *Industry peak body*<br>Fig 1, Page 9, The way the information is presented is unclear. Add a column to the left with titles such as "site use", "goods stored", "surface condition". | Figure amended. |
| 5 | 3.5 | *Environmental consultant*<br>p10; Scope of desktop study; The desktop study does not need to investigate published data on soil density, porosity, CEC, pH, hydraulic head and gradients, conductivity and transmissivity. These should be investigated as part of a Detailed Site Investigation if required, not mandatory for a desktop study. | Text revised. |
| 33 | 3.6 | *Industry peak body*<br>p11; Items to be noted during site inspection, Should also include an inventory of | Text revised. |

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| | | chemicals stored/used at the site, MSDSs, dangerous good licences, operating licences, TWAs, notices, evidence of cut and fill, explicitly the presence of USTs and associated infrastructure. | |
| 47 | 3.6 | *Industry peak body*<br>2nd para—2nd sentence; "in tandem" is ambiguous, particularly as the previous sentence suggests that the site visit is better undertaken after the desktop review. Delete sentence. | Text revised. |
| | **4** | **Conceptual site models** | |
| 31 | 4 | *Environmental consultant*<br>p12; Conceptual Site Models, Considering the outmost importance of good CSMs for contaminated land assessment a more detailed and in depth discussion of CSM (as well as various types of CSMs) is thought to be warranted to include details on possible content and some examples (including graphical depictions of CSMs) | Text revised to include reference to both text and graphical formats and the importance of addressing data gaps in the conceptual site model. The extensive reference list includes more detailed discussion of CSMs. |
| 33 | S4 | *Industry peak body*<br>p12; Conceptual Site Models. Considering the outmost importance of good CSMs for contaminated land assessment a more detailed and in depth discussion of CSM (as well as various types of CSMs) is thought to be warranted to include details on possible content and some examples (including graphical depictions of CSMs) | Noted. The text has been amended to include reference to both text and graphical formats. The extensive reference list provides discussion on different types of CSMs and is more detailed than is appropriate to include in the NEPM. |
| 29 | S4.2 | *Industry*<br>p13; Should consider the ITRC LNAPL Tech Reg as well; Very useful for understanding potential source area issues | Noted. Reference has been added. |
| 47 | 4.1 and 5.1 | *Industry peak body*<br>12–14; Sampling programmes; It should be noted that sampling programmes should be designed:<br>- With the investigation objectives clearly articulated (who wants the information from the investigation and to what use will they put it? What kinds of decisions will hang from the investigation results? What are the constraints on objectives, if any?). I note that all reports have limitation statements in which the use of the report is constrained to the purposes for which the report was written. So | Noted. Section 4 on CSMs has been revised to place more emphasis on addressing data gaps which are critical to the assessment objectives.<br>Section 5 has been revised to emphasise that the SAQP must meet the assessment objectives. |

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| | | investigations have to be designed with these purposes in mind and clearly articulated up front.<br>- To focus on the issues of greatest materiality and greatest uncertainty that have been identified from:<br>- A conceptual model of the site stratigraphy, hydrogeology, contaminant sources and migration pathways – drawn from the existing information about site history and site conditions (it would be good if Sections 3.4 and 3.5 could outline how a conceptual model pulls together and makes sense of all the information gathered with the processes described there)<br>- The investigation objectives | |
| 39 | 4.1 | *State government agencies*<br>12, 2nd para, I would prefer the CSM to be presented graphically with a written explanation.<br>Consider | Text revised to include reference to both text and graphical formats. |
| 39 | 4.1 | *State government agencies*<br>12, 3rd para, I would add: and assessing the risk represented by a source of contamination.<br>Consider | Text revised. |
| 39 | 4. | *State government agencies*<br>The components required to be included in a CSM has become very prescriptive and detailed. A CSM should identify the known or potential contaminants, their location, pathways for their migration and receptors. The list of CSM components in Section 4.2 includes information which would be located within a Preliminary Site Investigation (PSI). I have concerns that the key issues at a site will get lost in the detail which will be required in the CSM. The increased detail required to be included in a CSM may also result in the CSM becoming un-realistic in terms of identification of the actual pathways and receptors at a site, which in turn will result in over-investigation of a site. | Noted. The essential elements of a CSM are bulleted to provide emphasis. The text indicates that the complexity of the CSM should correspond to the scale and complexity of the impacts. |
| 39 | 4 | *State government agencies*<br>The text refers to example Conceptual Site Models which can be found in other | Noted. The references contain significantly more detail on developing a CSM than is |

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| | | references, it would be useful to include an example in the text of this Schedule to reduce the need to look up multiple references. | appropriate to include in the NEPM. Multiple references have been included which are relevant to vapour intrusion as this is a rapidly developing field. |
| 47 | 4.2 | *Industry peak body*<br>2nd bullet point; Sediment missing; Add sediment | Text revised |
| 36 | 4 | *Environmental consultant*<br>P12, D1; Sources of contamination should include an assessment of the method of contamination, e.g. "top down" spills and leaks, placement of fill or wastes, releases from tanks or pipes, etc. | Text revised |
| | **5** | **Data quality objectives and sampling and analysis plans** | |
| 47 | 5 | *Industry peak body*<br>14, definition of purpose, It is important that all the information and data from an investigation be used in an holistic integrated manner (i.e. taking a weighted multiple lines of evidence approach) to:<br>- Update the conceptual model for the purposes of updating / confirming the issues of greatest materiality and uncertainty and of responding to the investigation objectives<br>- Assessing the degree of compliance with data quality objectives | Text revised to incorporate these points. |
| 39 | 5 | *State government agencies*<br>14, line 5, "determination of tolerable decision error rates" requires an explanation. Provide meaning or clarification | This section amended to provide more clarity. |
| 39 | 5 | *State government agencies*<br>14, para 4, Not clear, Change to: The CSM, which considers any data gaps, should guide the development of the DQOs. | Text revised. |
| 39 | 5 | *Stateg government agencies*<br>15, 1st dot point, Change to "sampling methods and procedures" and make "field screening methods" a separate dot point. Consider | Text revised. |

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| 39 | 5 | *State government agencies*<br>15, 5th line of 1st para, Suggest adding "or may represent a physical hazard" into bracketed text. Consider | Text revised. |
| 39 | 5 | *State government agencies*<br>General, I think this suggests that establishing the DQOs requires the development of the CSM. Hence the CSM should be included in the SAP., Add the CSM to what is generally included in the SAP | Text revised. |
| 36 | 5 | *Environmental consultant*<br>P14–15 and App. B; The DQOs process as described falls into the trap of being about the data quality instead of the project objectives and the quantity and quality of the data to achieve those objectives, e.g. see Crumbling D.M. 2002 as referenced in CRC CARE Report 13.<br>Far too many consultants perceive that DQOs are about the data usability issues alone, and as a consequence, the DQOs planning process' use as a transparent, documented and defensible planning process is squandered. In this regard, the DQOs planning process is comparable any iterative plan-do-check-act planning process, e.g. the ISO14000 series.<br>The DQOs planning process should be about clearly defining the project's agreed objectives and aligning all stakeholders to that objective, e.g. is it a dog house or a doll house we want built?<br>It is also useful to differentiate between a "project DQOs planning output" and smaller, "investigation DQOs planning outputs". The first seeks to answer large scale issues, e.g. is it appropriate to manage on site to conform with the waste hierarchy and sustainable remediation practices, whereas the second address more specific questions about appropriate sampling methodology, detection limits, and the quality control samples required.<br>Unfortunately, the increasing amount of information regarding DQOs, including NSW DEC 2006 and the draft NEPM, perpetuates the misunderstanding and contributes to the generally poor performance of the consulting practice. As originally conceived by the USEPA and DoE, it was all about developing a tool to | Noted. Section 5 has been revised to place more emphasis on project planning, project objectives and the SAQP required to meet those objectives. |

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| | | help scientist design their experiments. This, for the most part, has been lost as the majority of practitioners and the guidance gets bogged down in the minutiae. This NEPM represents a great opportunity to "get it right", and it appears to be being missed. See attached Cavvanba DQOs planning process and Data usability technical notes. | |
| 28 | 5/ ALL | *Environmental consultant*<br>DQO, Data quality objectives should be consistently reproduced or referenced from one section - QA/QC info is scattered at various schedules | Noted. The main text has been re-organised to provide greater clarity. Detailed information on the DQO process has been retained in the appendices so as not to break up the flow of the Schedule. |
| | **6** | **Soil Investigations** | |
| 39 | 6.1.2 | *State government agencies*<br>Refers to grid sampling being used "to cover the remainder of the site after judgemental sampling has been located". If a PSI has been done correctly and all known and potential sources of contamination identified, then judgemental sampling of these sources is all that is required. Why is grid sampling across areas where there is not thought to be any contamination required? The inclusion of this statement regarding grid sampling being used to investigate the remainder of a site will continue the practice of over-sampling of sites, and is not consistent with the site assessment process of sampling the areas of concern identified in the PSI. | The sampling section has been revised to improve clarity. Sampling is not required where there is no reason to suspect that contamination exists from the site history information or from the results of previous investigations. |
| 47 | 6.1.2 | *Industry peak body*<br>2 first sentences, It is illogical to discuss the advantages of "grid sampling" (1st sentence) before defining it (2nd sentence). Put 2nd sentence first. | The sampling section has been revised to improve clarity. |
| 47 | 6.1.4 | *Industry peak body*<br>Definition of transect sampling missing; Define transect sampling | Definition added. |
| 47 | 6.1 | *Industry peak body*<br>26; QC in groundwater; There is no recommendation on the requirements for QA/QC in groundwater | Position of text has been moved to clarify that QA/QC applies to all sampling media. |
| 36 | 6.10 | *Environmental consultant* | The DQO and Sampling Design sections have |

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| | | Additional information is considered necessary regarding QC within this schedule. It is somewhat contradictory that the included DQOs information seems almost entirely focused on data quality, yet the expectations within the site characterisation guidelines are barely mentioned. The inclusion of QC in the laboratory schedule suggests that this is an issue only for the laboratories. It is strongly recommended that more detail, including how to treat data based on QC results, is included with the site characterisation schedule.<br><br>See attached Cavvanba Data Usability technical notes.<br><br>See USEPA functional guidelines:<br><br>http://www.epa.gov/superfund/programs/clp/guidance.htm#som | been reorganised and more referencing to Appendix C included addressing this problem. |
| 4 | 6.11.1 | *Analytical laboratory services*<br><br>P28, Line 2; `kept on ice until arrival at lab '……<br><br>Please refer to my comments about ice in the B3 comments. Ice is inappropriate. This line should be changed to `kept cool, preferably with ice bricks or a refrigerated cooler, until arrival at the lab…'<br><br>There should also be a comment that cooling is not required if only metals are to be tested. | Text revised. |
| 33 | 6.11.2 | *Industry peak body*<br><br>p28, Chain of Costudy, May be important to mention that all parties in the chain (sampler, dispatcher, courier, lab) need to sign off on the CoC so that it gains the status of a valid record of sample transfer to the lab. | Text revised. |
| 39 | 6.2 | *State government agencies*<br><br>17, 1st para, 4th line, Suggest removing: "an appropriate level of". Sufficient to protect human health or the environment is an appropriate level. Consider | Noted. |
| 39 | 6.2 | *State government agencies*<br><br>17, last line, Change "and risk" to "and the risk they represent", Consider | Text revised. |

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| 47 | 6.2 | *Industry peak body*<br><br>14; Sampling strategy and density; Sampling plans, sampling densities, analytical schedules have to relate to how the resulting data will be interpreted and used for decision making, and the purpose of the decision making. It can be helpful to think in terms of "domains of interest" for decision making. A "domain of interest " is a matter of choice informed by professional judgement and could be for example:<br>- An area / volume of soil contaminated by one or more chemicals from a single source<br>- An area / volume of soil contaminated by a specific chemical from one or more sources<br>- An area / volume of heterogeneous fill<br>- A distinct stratigraphic layer in a natural soil profile<br>- A body of groundwater<br>- An area within which human or ecological exposure related to a pattern of land use could occur<br>- A volume of soil that has to be excavated and disposed off site.<br>- A cell in a landfill<br>- A volume of LNAPL or DNAPL<br>- A body of surface water | Section 6 has been revised to emphasise the importance of addressing the project objectives. Section 6.3 addresses selection of an appropriate sampling design, including splitting the assessment area into subareas. More information is provided on the use of judgemental sampling. |
| 31 | 6.2 | *Environmental consultant*<br><br>p16; Sampling density and depth of sampling. Because it is still common practice by many practitioners to default to the sampling density provided in AS4482.1 (Table E), often without much or any consideration of a CSM or site-specific issues, more detailed guidance on sampling density (including references) is needed and a stronger warning on the limitations of sampling density according to AS4482.1 is thought to be appropriate, to counteract any misuse. | Additional text has been added on alternatives to using the sampling density provided in AS4482.1 (Table E) including limitations of the various approaches. |
| 39 | 6.2 | *State government agencies*<br><br>Last dot point in list "potential remediation and management strategies" should be removed; the Sampling and Analysis Plan should be developed to address the elements of the CSM and characterise the site, decisions on remediation and management should come after the results of the investigations have been obtained. | Text revised. |

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| 39 | 6.2 | *State government agencies*<br>States that "development of sampling plans based on the CSM is the preferred method for determining requirements for sampling density....". Using the CSM to determine the sampling requirements should be the only accepted method, not "preferred" method—why else create a CSM? | Section has been revised to improve clarity. |
| 37 | 6.2 | *Environmental consultant*<br>In my experience proposed future use of the site does not have any impact on the sampling density required, only on the assessment criteria. Particularly if the site is the subject of an environmental audit there is a need to have sufficient sampling data regardless of the future site use. Similarly, depth of sampling should require at least sampling into natural soil and below any potential contaminant sources such as USTs, regardless of the future site use. | The point is included for completeness as in some cases the proposed site layout, particularly for more sensitive uses, may affect both sampling density and depth of sampling. |
| 39 | s6.3 and 6.6 | *State government agencies*<br>Both contain information on site investigation methods, these sections should be combined to reduce repetition. | Section 6 on soils has been revised to improve clarity. |
| 39 | 6.3 | *State government agencies*<br>18, 3rd para of 6.3, Seems to promote a rarely used method, | Noted. These tools have a role in assessment of complex sites and are therefore included. |
| 39 | 6.3.2 | *State government agencies*<br>19, 3rd para of 6.3.2, Not sure that dry ice is used. An "engel" or equivalent is more realistic. | Reference to dry ice removed and replaced with kept cool using 'ice bricks or refrigerated' |
| 27 | 6.3.4–6.3.5 | *Environmental consultant*<br>General, Laser Induced Flourescence and MIP's are all good tools but are rarely used in the Australian context.<br>Do not provide so much of a detail on techniques that are not readily available or applicable to many sites. | Comment noted. Information retained as these tools can play a valuable part in large or complex sites. |

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| 47 | 6.3 | *Industry peak body*<br>18; Geophysics—lack of detail about available techniques or guidance as to where to source relevant information is provided; Consult with the Australian Society of Exploration Geophysicists (a key stakeholder) to provide relevant guidance as to references and technologies. A prescriptive framework could easily be adopted, such as a screening flow chart to assist in determining the most effective tool for the job. | Noted. Inclusion of guidance on geophysical techniques is beyond the scope of the Amendment; however, additional references have been added. |
| 36 | 6.3 | *Environmental consultant*<br>P1–P2; Comment should be made regarding the danger of drawing conclusions about shallow fill from boreholes, particularly when mixed fills, including AC fragments, are detected. | Noted. Additional text added. |
| 29 | 6.36 | *Industry*<br>p21; GPR is usually not able to differentiate the presence of NAPL, especially in a heterogeneous setting;<br>Limitations in use | Noted. Text revised. |
| 31 | 6.4 | *Environmental consultant*<br>p21; Field description of soils, It would be highly desireable to recommend a single and uniform minimum standard for soil descriptions. The most preferable is the Australian Standard for Soil Descriptions for Geotechnical Purposes (AS1726). The groundwater assessment section (7) refers to AS1726 for soil logging for bore installation. One consistent method should be used and referenced in the NEPM. | Field description of soils - text has been amended to refer only to AS 1726-1993 (soils and groundwater sections). |
| 47 | 6.4 | *Industry peak body*<br>21; References provided for logging of soils are not consistent in the soil guidance (Section 6.4) and groundwater investigation guidance (7.2.1). The references quoted in Sections 6.4 for field descriptions of soils should be made consistent in sections 6.4 (field description of soils) and 7.2.1 (logging of groundwater monitoring bores). The soil classification system has particular relevance to the hydrocarbon HSLs so different systems will present a large risk to the community. | Field description of soils - text has been amended to refer only to AS 1726-1993 (soils and groundwater sections). |

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| 47 | 6.4 | *Industry peak body*<br>P21 L6–7; Soil classification references for field description of soils are inconsistent with US soil texture classification referenced in Schedule B1.2.2.3.2 for soil gas HSLs. Select one soil classification standard | Field description of soils - text has been amended to refer only to AS 1726-1993 (soils and groundwater sections). |
| 15 | 6.4 | *Environmental consultant*<br>p21; Soil texture triangle appears to be from USDA but there are references to the Australian System. This needs to be clarified and the Australian system used in preference (see comments on Schedule B(1) above). | Field description of soils - text has been amended to refer only to AS 1726-1993 (soils and groundwater sections). |
| 31 | 6.4 | *Environmental consultant*<br>p21; Field description of soils. Guideance on logging is currently inconsistent, refering to 3 different logging protocols (Australian soil classification, USCS vis AS1726 and US textural classification in HSLs). It would be highly desirable to recommend a single and uniform minimum standard for soil descriptions. The most preferable is the Australian Standard for Soil Descriptions for Geotechnical Purposes (AS1726). The groundwater assessment section (7) refers to AS1726 for soil logging for bore installation. One consistent method should be used and referenced in the NEPM. and include guidance on soil/fill/rock classification and log preparation. | Field description of soils - text has been amended to refer only to AS 1726-1993 (soils and groundwater sections). |
| 33 | 6.5 | *Industry peak body*<br>p21; Composite Samples, It should also be stated that sub-samples should be preferably composited by and in the analytical laboratory and individual sub-samples sampled similar like individual samples. | Additional text added (6.2.6). |
| 39 | 6.5 | *State government agencies*<br>Information of the assessment of composite samples against the investigation levels should be included i.e where composite samples have been used, the assessment level should be divided by the number of samples included in the composite. | Noted. Text can be found at the end of the composite sampling section (6.2.6). |
| 39 | 6.5 | *State government agencies*<br>The reference to the use of clustered samples maybe being acceptable to regulatory agencies is ambiguous. The purpose of the NEPM is to standardise the requirements | Noted. Reference has been deleted. |

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| | | of all jurisdictions, are clustered samples acceptable or not? If there is disagreement between jurisdictions, then they are not acceptable. | |
| 4 | 6.6.2 | *Analytical laboratory services*<br>Table 2: P23; Min number of samples for assessment of stockpiles seems low.<br>The number of samples recommended looks quite small when you consider that from a 250ml jar of soil the lab may only take 1g for metals for example.<br>Four x 1g sub samples from a 75 – 100 $m^3$ stockpile doesn't really seem representative. | Noted. The guidance provides recommendations for the minimum requirements which can be increased on a site-specific basis, for example where the material is very heterogeneous. |
| 47 | 6.6.2 | *Industry peak body*<br>23, Table 2 refers to minimum number of stockpile samples required and although section notes other jurisdictions may apply alternative frequency rates, it is not clear as to which one takes precedence?<br>Make clear statement on precedence of sampling rates, NEPM versus differing state guidelines. | Noted. The table provides minimum requirements; relevant jurisdictions should be consulted for information on whether additional requirements apply. |
| 18 | 6.6.2 | *Other*<br>P23, Table 2; The range '175 - <200' is missing from the table. Ensure the full range of stockpile volume is covered in the table without gaps. | Table amended. |
| 47 | 6.6.4 | *Industry peak body*<br>23, Statement "compositing may improve the reliability of samples". It should be noted here that some jurisdictions (e.g. SA EPA) do not recommend the use of composite sampling at all. Make clear statement on situations where composite sampling will be accepted. | Text clarified. Note SA EPA permits composite sampling in certain circumstances. |
| 31 | 6.7 | *Environmental consultant*<br>p24; Assessment of leachability. Provide guidance on sample selection for collection of leachability or bioavailability data. | Additional guidance added on selection of samples for leachability studies. |
| 33 | 6.8.1 | *Industry peak body*<br>Appendix A, 24, Choice of Analytes, The analytes list (based on EPA Vic 1998) | Noted. The list of analytes provided is an indicative list only. The choice of analytes should be informed by the PSI and the CSM. |

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| | | appears outdated and does definitely not take into account new and emerging contaminants, some of which have been found of major concern in other jurisdictions: e.g. 1–4 Dioxane and other solvent stabilisers, NDMA, perchlorate, N-S-O-Heterocyclic Compounds, asphaltenes, bromated and flourinated flame retardents, PFOA, PFOS, MTBE, pesticide degradation products, polybrominated diphenyl ether (PBDE), organotins, etc. It would be appropriate to update the list of analytes (which will be used by laboratories as the NEPM screen) to take new and emerging contaminant into account, so that appropriate analytes are selected where necessary. | |
| | **7** | **Groundwater investigations** | |
| 31 | 7 and 8 | *Environmental consultant*<br>QA/QC; Why is there specific guidance on QA measures and QC data for soil but not GW or soil gas? | QA/QC measures apply to all sample media, the text has been restructured to provide this clarity. |
| 47 | 7 | *Industry peak body*<br>Last para, "the collection and assessment…. qualified and experienced professionals" is inappropriate at this location. Shift to Schedule dealing with competencies. | Noted. A similar comment is included elsewhere in Schedule B2 where specific expertise is required. |
| 33 | 7 | *Industry peak body*<br>p29; Groundwater Investigations, Soil and groundwater contamination assessments are dealt with in isolation. Especially soil contamination is generally the source for groundwater contamination and the soil to groundwater transport and fate and the potential for groundwater contamination need to require stronger integration with soil investigations (e.g. through the CSM, fate and transport soil to groundwater, assessment criteria for the soil to groundwater pathway, predictive models for unsaturated to saturated zone transport). | Noted. Additional text has been added to improve cross-referencing between sections and schedules. |
| 15 | 7 | *Environmental consultant*<br>Well life-spans, old well reliability, and decommissioning<br>There is no information on the lifetime of a monitoring well, e.g., in relation to wells that are 10–15 years old and not possibly fit for use anymore. | Well lifespan will depend on the materials used, the standard of installation and whether aggressive ground conditions are present.<br>Guidance is provided in s. 8.2.1 to the effect that the monitoring network should be fit for |

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| | | | purpose. |
| 39 | 7.1.2 | *State government agencies*<br>30, After first para, Consider adding: The results of soil investigations completed as part of the detailed site investigation may also be used to update and refine the CSM and the GW investigation proposed. | Text revised to include reference to earlier investigations (soil and soil gas). |
| 39 | 7.1.2 | *State government agencies*<br>30, Dot points, I would add " the nature of the contaminant" to the dot points (even though this is addressed later in the section) | Text revised. |
| 29 | 7.1.3 | *Industry*<br>p30, Understanding the deposition environment provides an understanding of expected changes laterally and downgradient. Supported | Text revised. |
| | 7.1.4 | 31, Last dot point of second set of dot points, Remove "other forms of" | Text revised. |
| 47 | 7.2.1 | *Industry peak body*<br>P32 L2-3, Australian Standard AS 1726-1993 is referenced for describing soil and is inconsistent with previous soil references in Schedule B1.2.2.3.2 and Schedule B2.6.4. Borehole logs in Appendix D use Australian Standard AS 1726-1993? Apparent contradiction in which soil classification standard/method to use?<br>Select one soil classification standard | AS 1726-1993 adopted for borehole logging and soil description. |
| 47 | 7.2.1 | *Industry peak body*<br>P32 L4, EPHC website Field Check Lists. The ASC NEPM field check list for soil on the EPHC website uses the United Soil Classification System (USCS) rather than the US soil texture classification used in Schedule B1.2.2.3.2. Select one soil classification standard. | AS 1726-1993 adopted for borehole logging and soil description. |
| 33 | 7.2.1 | *Industry peak body*<br>p32; Logging of boreholes, Further more detailed discussion of surface and downhole geophysical methods for groundwater investigatons are warranted, as such methods should be used more frequently to determine aquifer characteristics in more detail and to supplement other methods (e.g. geological logging, core | Noted, however, detailed description of geophysical techniques is beyond the scope of the Amendment. Additional references have been inserted. |

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| | | analysis, aquifer tests, water sampling and analysis etc). | |
| 39 | 7.2.2 | *State government agencies*<br>33, 2nd line of 3rd para, Insert "surface water" before runoff | Text revised. |
| 33 | 7.2.2 | *Industry peak body*<br>p32; Well construction, This section is very general and unspecific and lacks any details expected from a guidance document. Particular emphasis should be placed on the construction beetween the bentonite seal and the surface cement seal. It appears still to be practice to fill borehole with drill cuttings in the cased section. The guidance should discourage such practices and suggest to use cement-bentonite slurry and the best suitable methods for placing the grout (and for that matter also the gravel pack and bentonite seal) - e.g. use of centralisers, tremie pipes, etc. Reference should also be provided to documents which discuss the suitability of various well screen/casing materials for a range of contaminants, to guide the choice of materials. | Noted, however, detailed description of drilling techniques and well construction is beyond the scope of the Amendment. The text has been edited to improve clarity and additional references have been inserted. |
| 33 | 7.2.2.1 | *Industry peak body*<br>p33; Screen Depth and Length, Slot size of the well screens is very important for the hydraulic connection and behaviour of the well. A discussion should be added (with references) on how to determine appropriate well slot sizes in various geological environments. This is an area which is generally overlooked an inappropriate slot sizes in monitoring wells are currently very common. | Noted, however, detailed description of drilling techniques and well construction is beyond the scope of the Amendment. The text has been edited to improve clarity and additional references have been inserted. |
| 28 | 7.2.2.1 | *Environmental consultant*<br>Page 34 Para 1 , The statement that plumes will dive and plunge is emotive and the mechanism does not work that way-groundwater recharge generally results in mounding and very rarely, if any time "plunges and dives."<br>This needs to be softened completely to state that under some circumstances , recharge may put pressure on an aquifer. | 'plunges and dives' has been removed and replaced by 'migrate downwards'. |
| 29 | 7.2.2.1 | *Industry*<br>p33, Well screens that are designed to monitor LNAPL on the water table need to consider potential water table fluctuations and typically need screens designed to | Noted. Table 5 provides guidance for LNAPLs and screen length. |

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| | | accommodate this. | |
| 15 | 7.2.2.2 | *Environmental consultant*<br>p34; In our opinion, filter socks (inert and woven) do not affect redox conditions or biological activity any more than PVC screens, and do not impact on LNAPL measurement.<br>The last paragraph on page 34 relating to filter socks should be removed. | Noted. Jurisdictions may accept the use of filter socks where the effects are proven to be negligible. |
| 33 | 7.2.2.3 | *Industry peak body*<br>p34; Well Development, Well development is another critial part of well installation, which is often performed very poorly (or even not at all). Further more detailed discussion and guidance on available and most suitable well develeopment methods should be included (with references), including the need for detailed well development records to be completed and provided as part of an ESA report. | Noted, however, detailed description of drilling techniques and well construction is beyond the scope of the Amendment. The text has been edited to improve clarity and additional references have been inserted. |
| 29 | 7.2.2 | *Industry*<br>p32; Biodegradable muds such as Revert (guar-based) can be considered but need to be carefully developed, suggestion | Noted, however, detailed description of drilling techniques and well development is beyond the scope of the Amendment. |
| 33 | 7.2.3 | *Industry peak body*<br>p35; Groundwater sampling, The references to groundwater sampling information are somewhat outdated and a number of new and at times better methods are available now. Hence should also include EPA Vic (2000), Groundwater Sampling Guidelines; and more recent and very relevant publications like Nielsen & Nielsen (2006) The Essential Handbook of Groundwater Sampling, and even more extensive is Nielsen (2005) The Practical Handbook of Environmental Site Characterisation and Ground-Water Monitoring, Second Edition | Noted. Updated references included. |
| 33 | 7.2.3 | *Industry peak body*<br>p36; Groundwater sampling, Some discussion may be warranted about sampling of low to very low yielding wells, which may be even purged dry when using low flow methods. In such cases the purging dry and sampling after recovery is now more and more discouraged and alternative sampling methods are available including minimal or no-purge sampling, use of devices like Hydrasleeves or snap | Section on groundwater sampling has been revised to place more emphasis on low flow sampling and the use of passive sampling devices. |

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| | | samplers. | |
| 28 | 7.2.3 | *Environmental consultant*<br>Page 36 , Bailers should be more strongly eliminated for any validation sampling- the document is not strong enough in eliminating them. More strongly advocate low flow. | Section on groundwater sampling has been revised to place more emphasis on low flow sampling and the use of passive sampling devices. |
| 31 | 7.2.3.4 | *Environmental consultant*<br>37, field filtering; In principle, ideal low flow techniques would not require filtering, however, given the range of application in the industry, and the likelihood that wells will not be tailored perfectly to the aquifer materials, the suggestion that field filtering is not required for low-flow will be misused. | Text deleted. |
| 27 | 7.2.3.4 | *Environmental consultant*<br>Page 37,line 25, "bore construction problem"-this needs to be more specific-it is a monitoring well design problem-the bore is the hole in the ground, Replace bore construction with "monitoring well design." | Text deleted. |
| 4 | 7.2.3.4 | *Analytical laboratory services*<br>P37; Metals filtration; Many Consultants still don't understand how to take metals samples – total or dissolved, nitric or unpreserved etc. The correct procedure needs to be spelled out because of this confusion amongst consultants. Suggest adding a clear explanation like the Envirolab fact sheet attached (App 2). | Text revised. |
| | 7.2.3.4 | Page 37 section 7.2.3.4 ; Lines 1 & 2; Firstly the section talks about dissolved metals in surface water implying that this is what is tested. Most surface waters are tested for total metals and this may be misleading. Modify / Insert comment "In surface water bodies, if testing for dissolved metals, a substantial amount of metals…. | Text revised to provide more clarity. |
| 5 | 7.2.3.4 | *Environmental consultant*<br>37; Field filtering; Highly suspended solids will occur in silty aquifers irrespective of the sampling methods. Please specify if the groundwater sample be field filtered or not. Also advise of whether the laboratory should undertake the filtering? | Field filtering for dissolved metals in groundwater is the recommended procedure.<br><br>Text revised to provide more clarity. |

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| 47 | 7.2.3.4 | *Industry peak body*<br>37; Statement "filtration should not be necessary is using a low-flow technique and the flow rate has been adjusted to the local hydrogeological conditions"—does this imply that where no filtration is conducted only total metals should be analysed for?<br>Expand statement to describe whether lab filtration is still appropriate. | Field filtering for dissolved metals in groundwater is the recommended procedure.<br>Text revised to provide more clarity. |
| 31 | 7.2.3.4 | *Environmental consultant*<br>p37; field filtering; In principle, ideal low flow techniques would not require filtering, however, given the range of application in the industry, and the likelihood that wells will not be tailored perfectly to the aquifer materials, the suggestion that field filtering is not required for low-flow will be misused. | Field filtering for dissolved metals in groundwater is the recommended procedure.<br>Text revised to provide more clarity. |
| 30 | 7.2.3.4 | *Environmental consultant*<br>Page 37, Line 26; States that the truly dissolved component of water is <0.45 micron. It is actually 0.1 micron. 0.45 micron filtering will suffice in many situations, however, sometimes it is necessary to filter to 0.1 micron to remove all particulates. Delete the words (that is, <0.45 um) and replace with 'Typically filtration with a 0.45 um filter will remove the majority of suspended particulates, however, it may be necessary to filter samples with a 0.1 um filter to remove all suspended particulates.' | Text revised. |
| 30 | 7.2.3 | *Environmental consultant*<br>Page 36, line 22; Makes references to appropriate guidelines for low-flow sampling.<br>Make reference to Vic EPA Publication 669, Groundwater Sampling Guidelines, April 2000 which is applicable in both Victoria and NSW. | Text revised. |
| 33 | 7.2.4 | *Industry peak body*<br>p38; Monitoring and profiling of groundwater parameters, If ferrous iron is one of the selected analytes it should be best analysed in the field as well. | Text revised. |
| 4 | 7.2.4 | *Analytical laboratory services*<br>P38; Says alkalinity and EC should be done in the field; Both these tests are OK to be done in the lab. EC has a 28 day holding time and alkalinity a 14 day holding time. | Noted. Reference to field measurement of alkalinity removed, reference to EC has been retained. Field monitoring of EC, in combination with other parameters, is |

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| | | | required during purging operations to determine when parameters have stabilised. |
| 47 | 7.2.4 | *Industry peak body*<br>38; Statement " parameters that should be measured in situ", noted change from "may" to "should", does this imply that in situ parameters should take precedence over laboratory measured parameters.<br>Expand statement to describe preference over laboratory parameters. | No change in preference is implied. Field measurement is required to establish when downhole conditions have stabilised during purging. Any difference between field and laboratory measurements (for stable parameters) may be informative if there are QC issues with the sample batch. |
| 27 | 7.2.5 | *Environmental consultant*<br>39, 2nd line, Suggest inserting sentence "Monitoring may be required to quantify the tidal effect" | Text revised. |
| 27 | 7.2.5 | *Environmental consultant*<br>Page 39 line 10, Sinking and diving plumes, This phenomenon is uncommon and likely to be very short term and I think too much importance has been placed on it . This paragraph should be removed. | Noted. Terminology revised. |
| 27 | 7.2.5 | *Environmental consultant*<br>Page 39, line 1, Water level Measurements should be taken on the same day-this is too far a time step., Should be replaced by "water levels should be measured in one concurrent event, well within the same day to ensure that external recharge or diurnal effects are minimised." | Noted. Text revised to provide greater clarity on this issue. |
| 47 | 7.2.5 | *Industry peak body*<br>39; Statement "saline and hot groundwater conditions also require that measured groundwater elevations are corrected for density effects"—is there a guideline that can be provided to assist with this correction factor?<br>Expand statement to provide reference to appropriate guidance. | Additional explanation and reference added. |
| 33 | 7.2.6 | *Industry peak body*<br>p40; Groundwater velocity and hydraulic conductivity, The treatment of fractured rock aquifers in one passing sentence and one reference is asthoningly brief, | Noted, however, a detailed discussion of fractured rock issues is beyond the scope of the amendment. |

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| | | considering that a number of densely populated and contaminated areas are situated on fractured rock aquifers (i.e. Melbourne). Some more detailed consideration and discussion on the specific issues faced during groundwater assessments in fractued rock should be provided with more extensive reference list and a warning that fractured rock aquifer sites may need specialised hydrogeological assessments (esp where NAPLs are present) by qualified contaminant hydrogeologists with experience in fractured rock aquifers. (Note: This statement is valid for all aspects of groundwater assessments - chapter 7 especially when NAPLs are found to be present) | The text has been removed from the sub-section on groundwater velocity and hydraulic conductivity and moved to the introduction to section 8 to provide more prominence. |
| 27 | 7.2.6 | *Environmental consultant*<br>Page 40,L 13, This paragraph is misleading since slug tests and grainsize analyses are inferior and if remediation is required, it is imperative to do pumping tests, to ensure effective, practical design., Paragraph should be removed. | Text has been revised to state that less obtrusive methods should be considered or that testing may be performed outside the impacted area. |
| 4 | 7.2 | *Analytical laboratory services*<br>P37 onward; Sediment/colloids in groundwater; The presence of sediment or colloids in groundwater samples is seen almost daily in laboratories. Currently there is not a consensus on how to deal with this. Some labs will shake or invert the bottle, others will decant off the supernatant. This will obviously lead to differences in lab results. We often see up to 50% colloids in ground waters.<br>ELIG has previously asked both the NSW EPA and NATA Technical Committee to make a ruling, however, as yet there is no consensus. The NEPM review is the ideal time to come up with a rule that all labs follow. Previous ELIG suggestions were:<br>let a water settle and carefully decant the supernatantinvert water, wait 30 seconds, anything still in suspension is extracted as part of the water<br>shake the water and extract anything suspended<br>extract the entire sample load – water/colloids<br>Vic EPA 669 document is good, however, does not adequately cover this aspect of what labs should do. | Noted. Samples with excessive sediment or colloids introduce significant uncertainty into the relevance of analytical results regardless of how the samples are treated in the laboratory. The recommendation to use low flow techniques and in-line filters should reduce the occurrence of this issue. |
| 15 | 7.3 | *Environmental consultant*<br>p41 last para; Vertical delineation of groundwater contamination; MIP and LIF technology has been considered to provide semi-quantitative information. I think it | Noted. Text moved to 8.3.1 and revised to refer to reducing uncertainty in lateral and vertical extent of contamination using in situ direct |

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| | | should be established that (like using a PID to gauge VOCs) MIP/LIF is used as a tool to gauge and thus plan. | push technologies. |
| 27 | 7.3.1 | *Environmental consultant*<br>Page 41 L2., "screened above the water table for DNAPLs." This text underplays the need to look for DNAPLs and the specific details of well construction required in that circumstance.<br>Needs expansion to cover the fate and transport of DNAPLs. | Noted. Text in 8.3.1 refers to initial investigations and LNAPLs. DNAPLs are addressed in 8.3.3 and references therein. |
| 5 | 7.3.1 | *Environmental consultant*<br>p40; Deeper groundwater levels, This section implies that an initial investigation must investigate both shallow and deeper levels in the aquifer(s). If the contaminant of concern is less dense than water why should the initial investigation assess deeper levels in the aquifer(s)? | Text deleted. |
| 27 | 7.3.2 | *Environmental consultant*<br>Page 41 ,para 1 and 2, Diving plumes, See previous comments | Noted. Text revised. |
| 27 | 7.3.3 | *Environmental consultant*<br>20, Last line, "values of 1% solubility"-what is the relevance of this statement? Explain or remove. | Text revised to clarify relevance of this statement. |
| 33 | 7.3.4 | *Industry peak body*<br>p43; Attenuation of groundwater contaminants, The term 'water washing' appears to be unusual and has not be encountered before in the relevant literature. The references used in relation to attenuation are few and quite outdated. | Noted. Term deleted and references updated. |
| 27 | 7.4 | *Environmental consultant*<br>UK Source-w should use Australian modelling text "Murray Darling Basin" reference is much more appropriate and contains much better text than quote here. | Noted. Although an excellent reference for groundwater flow modelling, the guidance does not address solute transport modelling in any detail. References to the MDBC (2000) report have been added. |
| 29 | 7.4.1 | *Industry*<br>p45; Transparency in model objectives and development is key, supportive | Noted. |

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| 4 | 7.4.2 | *Analytical laboratory services*<br>Table 4: P47; FOC—fractional organic carbon<br>This is a term causing confusion amongst consultants and labs. Please clarify definition and method. I think perhaps you mean Organic Carbon Fraction?—which would then just be a TOC. | Noted. Fraction of organic carbon (FOC) is a term often used in hydrogeological texts and journals. The text has been amended to TOC. |
| 5 | 7.4.2 | *Environmental consultant*<br>p46; Table 4 - Partition coefficient - column 2 shows tick ("for inorganics"—should that be "for organics"? Correction? | Text is correct. |
| 15 | 7.4.2 | *Environmental consultant*<br>46, Table 4; If Kd data is 'essential' then by default, CEC (for inorganics) and FOC (for organics) data also must be 'essential' rather than 'useful'. Change the CEC and FOC site-specific data requirement from 'useful' to 'essential'. | Noted. Literature values for $K_d$ are much more limited than for CEC or FOC, hence necessary to measure. |
| 39 | 7.4.3 | *State government agencies*<br>47, 1st line of 7.4.3, Change "a project" to "fate and transport modelling" | Text revised. |
| | **8** | **Vapour and soil gas investigations** | |
| 47 | 8 | *Industry peak body*<br>49 to 58, International approaches; There is a paucity of information on vapour investigations from UK, Europe and non-US jurisdictions. This should also be canvassed, particularly from RIVM. | The assessment of vapours is a rapidly evolving area which has produced a large number of publications over the last 5 years. The guidance in the NEPM is largely based on the recent review conducted by Davis et al (2009) in response to recommendation 16 of the Review Report. Reference to the latest UK approach (Baker et al, 2009) has also been included. |
| 31 | 8 | *Environmental consultant*<br>49+, VOCs. What is the purpose of specifying volatile organic compounds and not all volatile chemicals? Rework | Noted. Reference is made to volatile organic compounds to make it clear that the guidance is not targeted at ground gases associated with landfills or buried putrescibles wastes. |

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| 15 | 8 | *Environmental consultant*<br>Leak testing – initial QC check to see if installed vapour wells are reliable<br>There is no mention of leak testing for new 'active' vapour wells. Some NSW Auditors have based the integrity of the vapour investigation on this as it directly affects the reliability of the sample. Maybe at least a mention of 'leak testing', and if adventurous, suggest using, eg, helium or isoproponyl? | Noted. Refer Section 9.4.2.4 |
| 47 | 8.1 | *Industry peak body*<br>p49; Introduction—Vapour and soil gas investigations, Separate guidance on ground gases (from landfills and other sources) should be prepared and included in the NEPM, as this is now of major concern during many site assessments and a lack of Australian guidance on this issue is evident | Noted, however, the inclusion of specific guidance on ground gases (from landfills and other sources) was not included in the scope of the amendment. |
| 33 | 8.2 | *Industry peak body*<br>p49; Preliminary screening, Some more discussion would be beneficial to provide more clarity on the definition of the 30m screening zone. The inclusion of a vertical screening distance should be considered as well. | Noted. Additional text added to clarify when the screening step is not applicable. |
| 31 | 8.2.3 | *Environmental consultant*<br>p50; data for CSMs; Physical characteristics of soil/rock may be required, which are only relevant to vapour migration. | Text revised. |
| 18 | 8.3.2 | *Other*<br>P51, L19; Final sentence of first paragraph under 8.3.2—'less well oxygenated' could be rephrased. Would read better if simply 'less oxygenated'. | Text revised. |
| 29 | 8.3.2 | *Industry*<br>p51; Substantial differences between aerobically biodegradable petroleum and (recalcitrant) chlorinated solvent chemicals are widely acknowledged and supported (references below).<br>- ASTSWMO: Petroleum Vapor Intrusion Status Report, January 2010. Association of State and Territorial Solid Waste Management Officials, 444 North Capitol Street, N.W., Suite 315, Washington, D.C. 20001. | Noted. Although a shorter distance may be accepted in other jurisdictions for degradable substances, 30 m has been retained as a conservative measure. |

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| | | - USEPA: Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). November 29, 2002. United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. http://www.epa.gov/correctiveaction/eis/vapor.html<br>- USEPA, 2005, Review of recent research on Vapor intrusion, US Environmental Protection Agency, Washington DC, EPA/600/R-05/106.<br>- ITRC, 2007: Vapor Intrusion Pathway: A Practical Guideline (January 2007) Interstate Technology & Regulatory Council, Washington, DC, USA. www.itrcweb.org<br><br>Suggest separate exclusion distance criteria for biodegradable petroleum and (recalcitrant) chlorinated solvent chemicals. | |
| 33 | 8.4 | *Industry peak body*<br><br>p53; Soil gas sampling methods, Field screening methods using a PID, FID or LFG meter may not be sensitive enough to obtain necessary concentrations levels relevant for risk assessments. Best practice is not to directly connect field meters to sampling point, but to collect a sample via a vacuum pump and a "lung box" into a Tedlar bag or similar and connect the meter to this. | Text revised. |
| 33 | 8.4.1 | *Industry peak body*<br><br>p53; Temporary spear probing, These are prone to leakage through the outside of the drive rod. The quality my be improved by temporary sealing area around drive point using bentonite slurry and to conduct a leak test. However the absence of any positive soil gas measurements in temporary probes does not necessarily mean the absence of soil vapour. | Additional factors to consider when installing temporary probes are discussed in section 9.4.2.4, including the importance of sealing around the probe. Text revised to improve clarity. |
| 47 | 8.4.4 | *Industry peak body*<br><br>54, 2nd dot point makes reference to collection of shallow depths (<1.m) may be appropriate but requires justification. The guidance implies but does not clearly state that in most cases samples should be obtained >1m unless otherwise justified. A defined statement be provided that recommends in most cases sampling should be undertaken >1m unless otherwise justified. | Text revised. |

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| 31 | 8.4.4 | *Environmental consultant*<br>55, Factors for consideration in soil gas sampling; Equilibration times for soil gas sampling are highly dependent on drilling method. | Noted. Additional information provided. |
| 47 | 8.4.4 | *Industry peak body*<br>55, Tubing Type- can guidance be provided to a preferred reference or list of recommended tubing types. Add further detail or reference as required. | Noted. Published information is limited. Further information on material properties may be obtained from suppliers or manufacturers. |
| 29 | 8.4 | *Industry*<br>p53, Refer to API guidance on soil gas sampling; supplement | Additional references to the API guidance have been included. |
| 31 | 8.4 | *Environmental consultant*<br>p53; Soil gas sampling methods; Comment on correct sealing (and leak testing??) relates equally to temporary spears, sub-slab, multi level and single sampling points. | Noted. Factors to consider when sampling soil gas are discussed in section 9.4.2.4, including the importance of correct sealing. |
| 22 | 8.5–8.7.2 | *Industry*<br>Pages 55–58 inclusive;<br>Several methods for collection of soil gas samples are described in Schedule B2. This guidance does not, however, assist in defining which soil gas sampling methods are preferred and which methods actually provide the most reliable and accurate soil gas data.<br>It is requested that the soil gas sampling methods that are considered to provide the most reliable and accurate soil gas data be clearly documented in Schedule B2, in a manner consistent with the detail provided in the laboratory sampling methods and techniques in Schedule B3. This approach will provide a consistent method for the collection of soil gas samples across each of the various state jurisdictions, and enable laboratories, regulators and consultants to be able to invest in appropriate sampling equipment, and evaluate consistent data soil vapour data.<br>Update the vapour sampling guidance to detail a consistent and acceptable set of minimum protocols for the collection of soil gas samples. | The guidance provides a summary of commonly used acceptable methods for sampling and characterising soil gas at a site. The decision on which method(s) to use is a site-specific consideration which will be informed by consideration of the investigation objectives and analytical requirements as documented in the SAQP.<br>The information on the availability of international vapour intrusion guidance is noted. Updates may be accommodated by a process of making a minor variation to the NEPM. |

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| | | Methodologies for the testing of soil gas data are available in other jurisdictions and international references however sampling and analysis of vapour intrusion data in risk modelling is a rapidly evolving area. As a result, many of the key documents are under review, and continue to be published in a manner that allows for regular updates. We therefore request that the NEPM allow for an update of the vapour sampling methodologies as more accurate or updated Australian and international scientific data is produced on these techniques. This is particularly important where new information becomes available which may provide greater protection for human health or the environment. We note that the following key international documents are all important reference documents incorporating vapour intrusion guidance, and are all in various stages of revision:<br>1. County of San Diego Site Assessment and Mitigation Manual. Section 5, Site Investigation Techniques; Subsection IV Soil Vapor Sampling. Link: http://www.sdcounty.ca.gov/deh/water/sam_manual.html<br>2. California State Water Resources Control Board Draft for Public Comment Leaking Underground Fuel Tank Guidance Manual Version 1.0 – August 3, 2010. Link:http://www.sdcounty.ca.gov/deh/water/docs/sam_draft_california_swrcb_luft_manual_080310_v2.pdf<br>3. Guidance For The Evaluation And Mitigation Of Subsurface Vapor Intrusion To Indoor Air. Department of Toxic Substances Control California Environmental Protection Agency December 15, 2004: Link: http://www.dtsc.ca.gov/AssessingRisk/upload/HERD_POL_Eval_Subsurface_Vapor_Intrusion_interim_final.pdf | |
| 33 | 8.5 | *Industry peak body*<br>p55; Flux chamber methods, These methods are generally not used or considered a primary SVI assessment methods due to a number of limitations and distvantages. This should be discussed and emphasised that flux chamber methods are generally used for specific circumstances and as additional line of evidence with other methods. | Noted. Additional discussion added to the introduction to flux methods. |
| 31 | 8 | *Environmental consultant*<br>p49; VOCs. What is the purpose of specifying volatile organic compounds and not | Noted. Reference is made to volatile organic compounds to make it clear that the guidance is not targeted at ground gases associated with |

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| | | all volatile chemicals? Consider if the guidance is relevant (or should be provided) for all volatile chemicals. | landfills or buried putrescibles wastes. |
| 28 | 8.7.1.1 | *Environmental consultant*<br><br>p57; Sorbent tubes have a maximum capacity which may be exceeded in circumstances where the source concentrations are high and/or the sample volume is large. A control section of the tube analysed separately to the sample indicates whether breakthrough has ocurred, that is whether the capacity of the sample section has been exceeded. In this case, the mass of the target chemicals reported will under-represent the true concentrations to various degrees. Add some discussion on the limitations of sorbent tubes. | Noted. Additional text added. |
| 28 | 8.7.2 | *Environmental consultant*<br><br>p58, Passive Methods: Lack of discussion about the advantages and disadvantages of this method. Missing adequate referencing., Recommend a table that summarises the advantages and disadvantages of the various vapour sampling techniques or at least appropriate reference to where reviews have been undertaken. | Noted. Additional text and references added. |
| 41 | | *Environmental consultant*<br><br>Schedule B(2), Guideline on Site Characterisation, does not include the use of advanced technologies for screening sites for contamination in soil or groundwater, such as passive soil gas technologies. The objectives from the use of soil gas technologies are not limited to identifying vapor intruision pathways and identifying when contaminants in the vapor phase may pose a health risk. Both active and passive soil gas surveys are routinely performed to screen sites for source areas and delineate plumes of VOC and SVOC contamination. A high resolution passive soil gas survey is capable of defining the nature and extent of organic contamination with fewer data gaps than typically result when only sampling the soil and/or groundwater. | Noted. Additional text added to Sections 7.2.6, 8.3.1 and 9. |
| 41 | | *Environmental consultant*<br><br>Passive soil gas samplers are an easy-to-use, minimally invasive, and relatively inexpensive technique for identifying VOCs and SVOCs in the vadose zone. The inherent simplicity and low cost of passive samplers enables them to be applied in large numbers, facilitating detailed mapping of contamination across a site, for the | Noted. |

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| | | purpose of identifying source areas and release locations, focusing subsequent soil and groundwater sampling locations, focusing remediation plans, identifying vapor intrusion pathways, tracking groundwater plumes, and monitoring remediation progress. | |
| 41 | | *Environmental consultant*<br>Source Identification and Spatial Variability Assessment<br>Passive soil gas sampling is a cost effective and sensitive method to identify contaminant source areas in the vadose zone and delineate the extent of contamination. The simplicity, sensitivity, and low cost of the method allow for an increase in data density and, therefore, provide a high-resolution depiction of the nature and extent of contamination across the survey area. By comparing the results, as qualitative or quantitative, from one location to another, the relative distribution and spatial variability of the contaminants in the subsurface can be determined, thereby improving the conceptual site model. Areas of the site reporting non-detects can be removed from further investigation, while subsequent sampling and remediation are focused in areas determined from the PSG survey to be impacted. | Noted. |
| 41 | | *Environmental consultant*<br>Monitoring<br>Passive soil gas samplers are used to monitor changes in site conditions (e.g., new releases on-site, an increase in contaminant concentrations in groundwater from on-site or off-site sources, and effectiveness of remedial system performance) as reflected by the changes in soil gas results at fixed locations over time. An initial set of data is collected to establish a baseline and subsequent data sets are collected for comparison. The sampling and analytical procedures should remain as near to constant as possible so significant changes in soil gas results can be attributed to those changes in subsurface contaminant levels at the site that will then warrant further investigation to identify the cause. | Noted. |
| 41 | | *Environmental consultant*<br>Vapor Intrusion Evaluation | Noted. |

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| | | Passive soil gas sampling can be used to identify vapor migration and intrusion pathways, with the data providing a line of evidence on the presence or absence of the compounds in soil vapor, the nature and extent in relation to potential receptors, and whether a vapor pathway is complete. Sorbent samplers can be placed beneath the slab or in close proximity to buildings to collect time-integrated samples targeting VOCs and SVOCs at concentrations often lower than which can be achieved with active soil gas sampling methods. | |
| 41 | | *Environmental consultant*<br>Beacon Environmental recommends, as a minimum, adding subsections to Section 6.9 and 7.3.1 describing the use of passive soil gas technologies to define the nature and extent of VOCs and SVOCs. Following are a few resources for information on and the use of passive soil gas technologies. Beacon's staff would be glad to assist with development of language in Schedule B2, as well as elsewhere in the NEPM document, covering the use of passive soil gas technologies to provide high-resolution data sets to accurately characterize sites for VOCs and SVOCs. A passive soil gas survey is considered a valuable tool in the U.S. EPA's Triad Approach in the technology's ability to refine the conceptual site model and accurately identify source areas and define the lateral extent of groundwater plumes. | Noted. Additional text added to Sections 7.2.6, 8.3.1 and 9. |
| | **9.1** | **Asbestos** | Note bonded-ACM refers to bonded-asbestos containing material |
| 24 | 9.1 | *Environmental consultant*<br>The guideline does not include practical guidance on sampling density or sample size.<br>Include guidance on sampling density and sample size. | Additional information included in 11.3. |
| 23 | 9.1 | *State government agencies*<br>p59, 1st paragraph; Clarification is needed to specify that assessment is needed where risk of asbestos becoming airborne exists.<br>The introductory paragraph states that assessment only applies to sites that are being developed. | Text revised. |

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| | | Please add the following (new text in italics):<br>"…describing the nature quantity of asbestos present and its likelihood to give rise to elevated levels of airborne asbestos fibres in sufficient details…"<br>Clarify that the section applies to current land use as well as proposed or future land uses. | |
| 23 | 9.1 | *State government agencies*<br>p59, line 12; Reference is made to transmission electron microscopy as the favoured method of asbestos identification. Identification can be made, in some cases, using polarised light microscopy or phase contrast microscopy, although these have limitations as well. | Text revised. |
| 23 | 9.1 | *State government agencies*<br>p59, line 6; The reference to "a comprehensive detailed assessment will not be required in many cases" is inconsistent with the flow chart in Schedule A, page 10. Amend flow chart. | Schedule A shows the general process of site assessment, it is non-prescriptive and amendments are permissible with appropriate justification. |
| 23 | 9.1 | *State government agencies*<br>p59, line 8; Reference is made to "many cases" where a detailed assessment would not be required. Suggest being more specific and providing some examples of scenarios that would (or would not) require a detailed assessment. | Examples have been included in Schedule B1. |
| 31 | 9.1 | *Environmental consultant*<br>59, Asbestos assessment; Provide guidance on sample selection for asbestos data | Additional information added to 11.3. |
| 47 | 9.1.1 | *Industry peak body*<br>59, ACM definition provided is not recognised by industry. ACM is defined as asbestos cement material. It should be amended to reflect asbestos containing material. | Refer to revised text in Schedule B1 (table of equivalent terms (Table 6) s. 4.1.4). |
| 5 | 9.1.1 | *Environmental consultant*<br>59, Experience requirements, This section specifies the level of experience required to undertake asbestos work. Is this beyond the purpose of this schedule? | Text clarified. |

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| 47 | 9.1.1 | *Industry peak body*<br><br>59, Transmission electron microscopy is nominated as the favoured method to determine if asbestos is present in the cement matrix. Local OHS and environmental regulations require that the method adopted is NATA accredited. TEM is not NATA accredited. TEM is not suitable for broad screening of soil samples and is not the industry preferred method.<br><br>Reference should be made to AS4964 - Method for the qualitative identification of asbestos in bulk samples (2004) for the identification of asbestos. This reference should be made for the analysis of asbestos in building materials, soils and ores. The well established industry practice is for analysis to be conducted in accordance with AS4964. This is considered to be an equivalent or superior analytical method for environmental standards. | Text revised to include reference to 'transmission electron, phase contrast or polarised light microscopy or other methods, as appropriate'. |
| 47 | 9.1.1 | *Industry peak body*<br><br>P59 L11-12, '...ACM, identification by transmission electron microscopy is the favoured method...' Availability and cost with respect to analysis using transmission electron microscopes could be an issue. In addition a transmission electron microscope has a small field of view potentially missing other areas containing asbestos. It should only be used to determine mineralogy.<br><br>A screening step is recommended to enable appropriate use of SEM. Cost and availability preclude typical use. Suggest alternative, more realistically implementable methods. NATA accredited methods are available that are both more available and cost effective. Suggest that a NATA accredited approach is used rather than recommending SEM. | Text revised to refer to 'transmission electron, phase contrast or polarised light microscopy or other methods, as appropriate'. |
| 15 | 9.1.1.1 | *Environmental consultant*<br><br>p59; Condition of the asbestos materials, This section, as necessary as it is, should clearly and concisely summarise the definition of different forms of asbestos. Even if it actually included bullet-pointed definitions directly cut/pasted from the WA guidance, this would be good. The section is not easy to read. | Noted. The guidance in B2 should be read in conjunction with that in Schedule B1. |
| 23 | 9.1.1.1 | *State government agencies*<br><br>p59; Last sentence discusses products that may be considered friable. | Text revised. |

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| | | Please add that they are friable "if they can readily give rise to airborne asbestos fibres". | |
| 23 | 9.1.1.3 and 9.13 | *State government agencies*<br>60 & 61; Reference to detailed test pit and trenching program is a concern when no guidance is provided on the investigation, remediation and validation of asbestos below 30cm. In particular, guidance is insufficient for assessing deeper asbestos contamination and is difficult to define.<br>Provide guidance on asbestos investigation, remediation and clean up based on the future/proposed use of the land. For example, "asbestos investigation is not applicable to any asbestos buried below the deepest excavation during construction". | Refer revised text in Schedule B1 and B2. |
| 47 | 9.1.1.3 | *Industry peak body*<br>60, Definitions should include reference to respirable fibres; The omission of a reference to respirable fibres as analysed by trace analysis in AS4964 (2004) presents a potential issue in relating actual exposure risk for personnel involved in activities that disturb soils. | Noted. |
| 47 | 9.1.1.3 | *Industry peak body*<br>60, Detailed site investigation is only applicable to asbestos cement material. This statement ignores the significant health risks associated with AF and FA.<br>It is recommended that this section of the NEPM is redrafted to include provisions to assess AF and FA in conjunction with ACM. References to remediation and management techniques should be removed from Schedule B2 (site characterisation). | Refer revised text in Schedule B1 and B2 |
| 23 | 9.1.1.3 | *State government agencies*<br>p60; Fourth line—'concern' should be qualified.<br>Reference to "This more detailed assessment may also be carried out when ongoing management of the site under regulatory controls is a potential requirement" is not clear and could be misinterpreted. Does this imply regulation under planning and/or contaminated land legislation? | Text deleted. |

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| | | Please clarify "concern" (is it substantiated?).<br>Suggest deleting the sentence "This more detailed assessment may also be carried out when ongoing management of the site under regulatory controls is a potential requirement" as it does not make sense. | |
| 5 | 9.1.1 | *Environmental consultant*<br>p59; Experience requirements<br>This section specifies the level of experience required to undertake asbestos work. Is this beyond the purpose of this schedule? | Reference to specific level of experience deleted. |
| 23 | 9.1.1 | *State government agencies*<br>59, line 5; Reference is made to "appropriately qualified and experienced assessor"' when investigating asbestos contaminated sites. There are currently no merit-based accreditation schemes for asbestos specialists. This could be problematic as the responsibility for deciding the need for further assessment is highly dependent on such individuals. Please include additional guidance. | Text revised to refer to 'competent persons' and definition of competency included. |
| 1 | 9.1.2.1 | *State government agencies*<br>States "There should be no visible ACM fragments greater than 7mm x 7mm on the surface or in the top 10 cm of soil…"As stated earlier the requirement should be that all visible asbestos containing material (ACM) must be removed regardless of size.<br>Require the removal of all visible asbestos containing material, not just material greater than 7 mm x 7 mm. | Text revised - refer s.4.1.3 in Schedule B1 and Schedule B2 |
| 33 | 9.1.2.2 | *Industry peak body*<br>p60; Assessing Quantity and distribution - gravimetric approach, The guidance provided on density of investigation and frequency of sampling is very general and dows not provide any guidance in this regards. More details and specifics on this matter are warranted. | Additional information included. Further guidance can be found in the referenced WA guidelines. |
| 47 | 9.1.2.2 | *Industry peak body*<br>P61 L1–5, The method for the collection of soil asbestos samples relating to ACM should make reference to WA guidelines and reflect the use of sieving or inspection | Reference to WA Guidelines included. |

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| | | on a contrasting coloured background. Make reference to WA guidelines, sections 4.1.4, 4.1.5 and 4.1.6 | |
| 24 | 9.1.2.3 | *Environmental consultant*<br>".....irregular distribution of the ACM that will allow partial removal of material to achieve lower overall asbestos concentration in the soil"<br>Does this statement advocate hotspot removal of asbestos contaminated material?<br>This statement requires additional information to clarify when hotspot removal would be an appropriate management action.<br>Partial removal" of asbestos contamination should be for the purposes of remediating or managing the site, not to "lower the overall asbestos concentration". WA Guidelines do not support area averaging of asbestos contamination | Text revised. Partial removal of bonded-ACM hotspots may be considered for the purposes of remediating or managing the site. Whether hotspot removal or placing some form of clean cover/barrier layer over the contamination is preferred will be a site-specific decision. |
| 27 | 9.1.3 | *Environmental consultant*<br>Page 61 para 2, Covering with a 30cm layer-this is dangerous since the coverage may need to vary depending on nature of the soil(sandy vs clay) ,wind and other considerations., Provide amore rounded statement about the depth of cover-otherwise it will be universally accepted and will lead to many site issues. | Reference to 30 cm of cover deleted. |
| 24 | 9.1.3 | *Environmental consultant*<br>para 3; "In situations where no long term management is able to occur, high levels of buried ACM >0.1% are not acceptable<br>As there is not guarantee that the ACM will not be disturbed over time." This statement infers that levels less than 0.1% are acceptable without management, and contradicts limit set in B(1).<br>Consider rewording this statement to reflect limits set in B(1). | The reference to levels has been deleted and text revised to clarify that statutory management controls may be required. |
| 23 | 9.1.3 | *State government agencies*<br>Discussion of management options for asbestos. The NEPM should explicitly acknowledge that the recommended options for management reflect good practice but may not be required in all cases to mitigate risk. | Noted. |
| 39 | 9.1.3 | *State government agencies* | Reference to 30 cm of cover deleted. |

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| | | 61, 2nd line of 2nd para of 9.1.3, I would remove "(minimum of 30cm layer)" - otherwise it will be adopted as a default and is only appropriate where it can be justified. | |
| 47 | 9.1.3 | *Industry peak body*<br>61, Management strategies should be addressed on a site by site basis. One remediation strategy does not suite all possible scenarios. Remove section prescribing management techniques. Preamble points out the history of unnecessary remediation and many of the other proposed changes to the NEPM are to facilitate unnecessary over-remediation. Any prescribing of a single remediation strategy must, in many instances constitute over-remediation of some (less impacted) sites. | Noted.<br>Management techniques are not prescribed in the text. |
| 47 | 9.1.3 | *Industry peak body*<br>61, Reference to minimum 30cm layer is not consistent with existing practice and may not be appropriate for all sites. Recommend removing reference to 30cm and allowing for site-specific remediation plan. | Reference to 30 cm of cover deleted.<br>Management techniques are not prescribed in the text. |
| 47 | 9.1.3 | *Industry peak body*<br>P62 L2, '10 ACM fragments or less per $m^2$' is inconsistent with the WA guidelines which states 'less than $10cm^2$ per $m^2$'. Be consistent with the WA guidelines | Text deleted. |
| 47 | 9.1.3 | *Industry peak body*<br>P62 L4, 'more than 10 ACM fragments per $m^2$' is inconsistent with the WA guidelines which states 'more than 10 $cm^2$ per $m^2$'. Be consistent with the WA guidelines | Text deleted |
| 1 | 9.1.3 | *State government agencies*<br>Do not support covering visible ACM with uncontaminated fill (minimum 30 cm layer).<br>The visible ACM should be removed. In addition consideration must be given to any proposed trenching type works where ACM may be uncovered. | Reference to 30 cm of cover deleted.<br>Management techniques are not prescribed in the text. |
| 31 | 9.1 | *Environmental consultant*<br>p59; Asbestos assessment; Provide guidance on sample selection for asbestos data | Further guidance can be found in the referenced WA guidelines. |

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| 23 | | *State government agencies*<br>Either incorporate the information from the WA guidelines in the proposed NEPM documentation OR permit the use of WA guidelines as a process/procedure acceptable to NEPC. | Noted. The WA guidelines contain appropriate procedures and are extensively referenced. |
| 23 | 9.1 | *State government agencies*<br>The information on asbestos in soils included in Schedule A, B1 and B2 does not seem to be integrated, with various parts contradicting one another.<br>Please review the practices and processes described in Schedules A, B1 and B2 and ensure they are appropriately integrated and linked. Consider removing the assessment details in B1 and consolidating in B2. | Refer revised text in B1 and B2.<br>Schedule A shows the general process of site assessment, it is non-prescriptive and variations are permissible with appropriate justification. |
| 23 | | *State government agencies*<br>There should be minimal treatment required for sites with bonded asbestos in good condition. More focus on appropriate remediation/management strategies such as removal of contaminated top soil and/or containment of asbestos. | Refer revised text. |
| 23 | | *State government agencies*<br>It should be noted that electron microscopy can be very expensive and largely unavailable to consultants in Australia. Samples may have to be sent overseas for analysis, thereby increasing costs and delaying management/remedial action to await results. NEPM should clarify and minimise a need for analysis using electron microscopy. Also, consider changing "favoured" to "most reliable" (with regards to microscopy method). | Reference to appropriate methods revised to include phase contrast and polarised light microscopy. |
| 21 | | *Industry peak body*<br>By providing screening criteria and a methodology for determining the level of asbestos contamination of soil, the revised NEPM provides greater certainty for site owners and builders. Master Builders welcomes the fact that Schedules B(1) and B(2) of the NEPM emphasise that the assessment and management of asbestos contamination of soil should take into account the very low human health risk posed by most occurrences of soil contamination by bonded asbestos. | Noted. |

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| 21 | | *Industry peak body*<br><br>Master Builders also supports the management of asbestos contamination of soil in situ where possible. Soil removal is not only expensive, it also exposes the workers involved in the removal, transport and disposal of the soil to potential risks to their health and safety which would not occur if the contamination is able to be managed in situ. Master Builders acknowledges, however, that it is important to ensure that in situ management does not create risks to health and safety from future uses of the land. This aspect of the NEPM could be strengthened by providing additional information on the factors that need to be taken into account when determining whether in situ management of asbestos contamination of soil is appropriate. | The text in B1 and B2 has been revised to provide greater clarity. |
| 21 | | *Industry peak body*<br><br>Master Builders would also welcome greater clarity in the material regarding asbestos management and remediation. Currently, information about assessment, management and remediation is provided throughout the asbestos section of Schedule B(2) making it difficult for readers to determine what approaches are appropriate. For example, the information on page 60 on removing visible Asbestos Cement Material (ACM) fragments where there is surface distribution of asbestos is a management/remediation measure and would be better placed in this section of the guideline. | The text in B1 and B2 has been revised to provide greater clarity. |
| 21 | | *Industry peak body*<br><br>There are also apparent conflicts in the information provided. For example, on page 60 of Schedule B(2) the guideline notes that where cohesive soils or large surface areas are involved, it may be more practicable to skim the top 5-10cm for disposal. On page 61, on the other hand, management in situ is preferred, including covering the contamination with uncontaminated soil (minimum 30cm layer) and/or other protective or warning layers. There is insufficient information to determine whether, for example, protective layers are suitable for situations where surface distribution of asbestos occurs in cohesive soils or whether protective or warning layers are intended primarily where there is ACM through the soil profile. Master Builders therefore considers that there is still scope for uncertainty and different approaches to be taken in response to detection of asbestos in soil. Without clearer guidance on these matters, the potential benefits identified in the impact statement may not | The text in B1 and B2 has been revised to provide greater clarity. |

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| | | occur. | |
| 21 | | *Industry peak body*<br><br>Master Builders notes that on page 61 the NEPM refers to Western Australian guidelines which provide a simplified management approach for use by local government in dealing with single residential lots with ACM contamination. Master Builders does not believe that it is appropriate for the NEPM to refer to the guidelines of any particular jurisdiction given that the NEPM is intended to be a national measure. The status of the approach on page 62 is also unclear – whether this merely outlines the approach taken in the Western Australian guidelines or whether this is the recommended approach to managing asbestos contamination on single residential lots. | Noted.<br><br>Relevant text has been deleted. |
| 21 | | *Industry peak body*<br><br>Master Builders is concerned about the proposal in section 9.1.1 (page 59) that fragments of ACM must be inspected by an appropriately qualified and experienced assessor. Compulsory use of qualified assessors to identify asbestos is a different approach to that being adopted in the Model Work Health and Safety Regulations for managing asbestos in workplaces. The (draft) Model Regulations provide that a competent person is able to identify asbestos in a workplace. A competent person is a person who has, through training, qualification or experience, the knowledge and skills to carry out the task. There are segments of the construction industry that deal with ACMs on a regular basis that can, based on their experience and knowledge of the subject, readily identify asbestos without the need to engage an approved assessor. Master Builders therefore does not support compulsory use of qualified | Text on appropriately qualified and experienced assessor amended. |

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| | | assessors to inspect asbestos – it unnecessarily adds to costs for industry and the availability of suitable assessors, particularly in rural and remote locations, is poor. | |
| 21 | | *Industry peak body*<br><br>Master Builders notes that one of the objectives of amending the NEPM is to ensure that there is a basis to allow an effective and defensible regulatory framework for asbestos contamination of soil to be established. Master Builders supports this objective. An effective and defensible regulatory framework must establish clear and consistent responsibilities which appropriately protect public/worker health without placing unnecessary costs on industry. | Noted. |
| 21 | | *Industry peak body*<br><br>Key issues for achieving an effective and defensible regulatory framework include:<br>1. The need to have clear reporting obligations for asbestos contamination of soil.<br>2. Consistency between the approach taken in the NEPM/contaminated site regulations and occupational health and safety laws.<br><br>Reporting obligations for contaminated sites | Noted.<br><br>Reporting obligations for contaminated sites is a jurisdictional matter. |
| 21 | | *Industry peak body*<br><br>Currently reporting requirements for asbestos contamination of sites in a number of jurisdictions use the Health Investigation Levels (HIL) in the NEPM to determine whether or not a site is considered to be contaminated, triggering reporting and remediation obligations under State and Territory environmental legislation. The revised NEPM does not include a HIL for asbestos given the limitations of quantifiable assessment of asbestos in soil. There is therefore potential for ongoing | Health-based screening levels are included in the NEPM.<br><br>Reporting obligations for contaminated sites is a jurisdictional matter. |

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| | | uncertainty regarding reporting obligations for contaminated sites unless there are amendments to State and Territory environmental/contamination regulations and guidelines. | |
| 21 | | *Industry peak body*<br>Consistency of occupational health and safety laws<br>As part of the harmonisation of Australia's work health and safety laws, work on developing model work health and safety regulations is currently underway. The final shape of the regulations relating to asbestos has not been decided. However, the most recent version of the regulations is somewhat unclear about how asbestos contamination of soil should be dealt with by duty holders. It is also potentially at odds with the approach in the NEPM; it does not distinguish between the nature of the asbestos contamination (eg surface distribution or distribution through the soil profile) and it does not allow for remediation options that do not involve removal or reburial of asbestos. | Noted.<br>The technical working group has consulted with WorkSafe Australia to promote consistency between the OH&S regulations and the NEPM. |
| 21 | | *Industry peak body*<br>The approach in the draft model work health and safety regulations is the same as that currently adopted by a number of OH&S regulators. For example, recent guidance issued by WorkSafe Victoria (available from www.worksafe.vic.gov.au/asbestos) focuses exclusively on removal of all visible traces of asbestos from soil. It does not distinguish between types of asbestos nor different distribution of asbestos. | The technical working group has consulted with WorkSafe Australia to promote consistency between the OH&S regulations and the NEPM |
| 21 | 4.12 | *Industry peak body*<br>Master Builders understands that OHS regulators often favour the removal of asbestos contaminated soil over other remediation options such as those outlined in the NEPM. If there is not consistency in the approach adopted by OHS and environmental regulators on this issue, with that approach based on the NEPM, | The technical working group has consulted with WorkSafe Australia to promote consistency between the OH&S regulations and the NEPM. |

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| | | then the anticipated benefits identified in the Impact Statement will not eventuate. | |
| 23 | | *State government agencies*<br>P59; Given that the sampling approaches for asbestos in soils are mainly judgemental, video photography of the site would provide a more objective means for determining the appropriate sampling location. Suggest adding a statement about including video photography when characterising an asbestos-contaminated site. | Text revised. |
| 24 | | *Environmental consultant*<br>Page 61 paragraph 6—Not sure why 0.1% w/w has been used instead of the screening criteria levels in the following sentence and what about AF and FA? "In situations where no long-term management is able to occur, high levels of buried ACM >0.1% are not acceptable as there is no guarantee that the ACM will not be disturbed over time." | Text deleted |
| 44 | 9.1.1.3 | *State government agencies*<br>States that a detailed site assessment is only applicable to ACM—this should include a comment that schedule B1 addresses unbonded asbestos which is dealt with by management/remediation. And/or this may be better included in section 9.1 where B1 is mentioned but some more detail regarding the purpose of schedule B1 versus B2, in relation to asbestos, would be useful. | Text clarified. |
| 44 | 9.1.2.1 | *State government agencies*<br>It is stated that "there should be no visible ACM fragments greater than 7 x 7 mm"; it is unclear whether this just represents a first pass remediation of the site. Also, given that the previous sentence refers to "isolated fragments" this appears to imply the same situation as that described in B1 (option 1 above, in the comments on schedule B1) where handpicking of all "scattered" pieces of ACM is to occur. | Refer revised text. |
| 44 | 9.1.3 | *State government agencies* | Section deleted. |

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| | | References the WA guidelines on asbestos (May 2009).and refers to handpicking the ACM if there are "10 ACM fragments or less per $m^2$" or other actions if there are "more than 10 ACM fragments per m2". The WA guidelines in fact state that if ACM total sheet area <10$cm^2$ per $m^2$ then it is acceptable to just hand pick the fragments and if there are >10$cm^2$ per $m^2$ then other actions may be required. | |
| 23 | | *State government agencies*<br>Repeated reference is made to qualitative assessment of the contamination. This should be clarified with the term 'visual', (i.e. "qualitative visual assessment" | Text revised. |
| 23 | | *State government agencies*<br>Repeated reference to WA guidelines is not specific. Given the NEPM is a legal instrument, any relevant assessment guidance should be incorporated in the NEPM to make it standalone. | Noted. |
| | **10** | **Assessment of summary statistic data and data presentation and reporting** | |
| 5 | 10 | *Environmental consultant*<br>p63; Second dot point - delete the words "a failure to provide". Correction. | Text revised. |
| 47 | 10 | *Industry peak body*<br>Statistical programs, Understanding of data distribution is critical when determining end use of the data and site. Suitable guidance should be provided to ensure appropriate evaluation of the data - endorsement of a suitable software program (ProUCL?). Needs to allow for development in use of newer programs. B2 Section 10, pg 63 | Noted.<br>The scope of the amendment did not include revision of the statistical chapter; however, a section on reviewing data quality and increased emphasis on understanding the data distribution has been included. Key references have been updated including reference to ProUCL (US EPA, 2007). |
| 47 | 10 | *Industry peak body*<br>63 to 65, Statistical evaluation, This section is reproduced from much earlier work and needs to be substantially revised by an expert in environmetrics. | Noted.<br>The scope of the amendment did not include revision of the statistical section; however, a minor revision has been carried out. |

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| 47 | 10 | *Industry peak body*<br><br>63, Reporting—general<br><br>In reports, it has to be possible for the reader to follow and understand:<br>- The investigation objectives<br>- The logic and rationale for the scope and methodology for the investigation and for the DQO's<br>- The quality of the data *vis a vis* the DQO's<br>- The logic and rationale that underpin the selections and delineation of each domain of interest in the context of, and that also support, the features of the conceptual site model<br>- The logic and rationale that underpin the characterizations using the multiple lines of evidence of each domain of interest<br>- The uncertainties in such characterizations | Noted. The scope of the amendment did not include revision of the statistical and reporting section; however, a minor revision has been carried out including the addition of a section on reviewing data quality in the context of the DQOs. |
| 47 | 10.1.1 | *Industry peak body*<br><br>63, summary statistics, Statistics of chemical concentrations should only be computed for defined "domains of interest" in which there is confidence that homogenous (ie not bi or multi modal) populations of data exist and for which there is sufficient data for meaningful and robust statistical analysis. It must be remembered that statistics are to be an aid to decision making—so must be pertinent to the nature of the decisions required for the "domain of interest" and the purposes for which they are needed. Also statistics of chemical concentrations represent only one of multiple lines of evidence, albeit often the one given the most weight. Relying on statistics of chemical concentrations alone can be unwise. Relying on statistics of chemical concentrations alone, without recognizing and allowing for uncertainties in the base data (for which it is important to understand the limitations of the project specific DQO's and the degree of compliance with them) is even more unwise. | Noted. The scope of the amendment did not include revision of the statistical section; however, a minor revision has been carried out including the addition of a section on reviewing data quality in the context of the DQOs. |
| 31 | 10.1.1 | *Environmental consultant*<br><br>p63; Summary statistics; More thorough guidance should be provided or referenced on user of statistics, including appropriate data sets, potential tools and appropriate applications. | Noted. The scope of the amendment did not include revision of the statistical section; however, a minor revision has been carried out. |

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| 47 | 10.1.2 | *Industry peak body*<br>64, Statistical analysis and laboratory detection limits, What concentration is to be used when concentrations are below detection limits? B2 Section 10—biasing data | Noted. The scope of the amendment did not include revision of the statistical section; however, a minor revision has been carried out, including the use of censored data. |
| 31 | 10.1.2 | *Environmental consultant*<br>p64; Censored Data; Half the detection limit is commonly used for data points with results below LOR. For statistical analysis this causes similar issues to using the LOR. Further discussion and guidance on preferable alternative approached would be beneficial. | Noted. The scope of the amendment did not include revision of the statistical section; however, a minor revision has been carried out, including the use of censored data. |
| 33 | 10.2 | *Industry peak body*<br>p65; Data Presentation, The use of electronic publishing and utilisation of GIS should be discussed and its use encouraged, especially for more complex and larger sites. | Noted.<br>The scope of the amendment did not include revision of the data presentation section; however, a brief comment has been added. |
| 31 | 10.2 | *Environmental consultant*<br>p65; Data Presentation; The use of spatial information management techniques should be discussed and its use encouraged, especially for complex and large sites. | Noted.<br>The scope of the amendment did not include revision of the data presentation section; however, a brief comment has been added. |
| 39 | 10.2.5 | *State government agencies*<br>66, dot points, The dot points listed are too limited. Should be expanded or stated that this is a limited list. Should include lab certificates, historical photos etc etc. | Text revised.<br>Note photographs are listed earlier in this section. |
| 47 | 10.2.6 | *Industry peak body*<br>67, Data presentation; 3–D representation of data for complex sites should be recommended. | Noted.<br>The scope of the amendment did not include revision of the data presentation section; however, a brief comment has been added. |
| 29 | 10.2.6 | *Industry*<br>p67; Vertical exaggeration could be shown as well; suggestion | Text revised. |
| 36 | 10.2.7 | *Environmental consultant* | Text revised. |

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| | | A comment should be made regarding the minimum font size used in presenting data. Based on the "fit to page" function on spreadsheets, some ridiculous sized data tables are presented on single pages. A simple one line comment here, e.g. min. 8 or 9 font size, would save a lot of grief. | |
| 11 | 10.2.8 | *Analytical laboratory services*<br>75 10.2.8 entire paragraph<br>See ALS comment 1<br>It is recommended that this be updated to include "All field splits" | Text revised. |
| | **11** | **Protection of the environment during site assessment** | |
| 29 | 11 | *Industry*<br>p80; There is a need to discuss site safety considerations while conducting an investigation. Considerations such as traffic, etc are important issues and are part of a sustainability analysis.<br>Suggestion | Noted. Consideration of site safety conditions is an occupational health and safety issue which is outside the scope of the NEPM. |
| | **13** | **Appendices** | |
| 47 | 13.2 | *Industry peak body*<br>94, DQO; What is the purpose of the DQO. The DQO objectives are excessive and not necessary for some investigations (small sites) and push the industry down excessive documentation with little merit. In complicated sites it may be necessary. Recommend a systematic process in accordance with industry standard procedures rather than use the DQO process. | Text revised to improve clarity and additional text added to incorporate reference to screening situations where the full DQO process may not be required. |
| 47 | 13.2 | *Industry peak body*<br>94; suggested rewording; The DQO objectives are excessive and are sometimes appropriately limited for some investigations (small sites) and may warrant development of a two tier process. 1—standardised DQO process (close to current "industry standard procedures") where the standardised DQO and their limitations are spelt out. 2—as proposed. Also provide guidance on adoption of detailed DQO (eg where a known or perceived site characteristic requires, or working beyond a | Text revised to improve clarity and additional text added to incorporate reference to screening situations where the full DQO process may not be required. |

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| | | screening level investigation) | |
| 22 | 13.2 | *Industry*<br>Page 94; Appendix B: Data quality objectives (DQO) process. This DQO section is based on NSW EPA (2006) guidance, which was based on US EPA guidance from 2000. The US EPA (2006) Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4 is considered to be the latest and most preferred methodology for documentation of DQOs. This is a view shared by a number of environmental auditors and consultants within Australia.<br>Update the DQO section within Schedule B2 so that the wording is consistent with the more recent US EPA DQO guidance: US EPA (2006) Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4. | Text has been revised to be consistent with US EPA 2006 |
| 4 | 13.3.1.5 | *Analytical laboratory services*<br>P102; Lab considerations—matrix spike duplicates; Matrix spike duplicates are not required—remove. | Text revised. |
| 5 | 13.3.1.5 | *Environmental consultant*<br>101—Last sentence; Laboratory duplicates only measure laboratory precision when samples are entirely homogenous. This causes a lot of confusion among some industry professionals when writing reports.<br>It is suggested the following wording as more appropriate—"Laboratory duplicates measure analytical precision when the sample is totally homogenous. When sample heterogeneity exists, laboratory duplicates (and intra laboratory splits) measure the sum of laboratory precision plus sample heterogeneity. High sample heterogeneity impact confidence in data and may warrant additional sampling to increase confidence or detect hotspots " | Text revised. |
| | 13.6 | Page 121, Dioxin-seems not to belong –why list dioxon when a large number of other chemicals(CCO) could also be listed., | Section retained as it provides useful background on when site assessment may be |

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| | | Remove it. | required for dioxins and dioxin-like compounds and is provided in specific response to a recommendation of the Review Report. |
| 47 | 13.6.1 | *Industry peak body*<br>Whilst it indicates that in 2005 WHO98 TEQ was updated to WHO2005 TEQ (Van den berg et al 2006), a note should be included that emphasizes the very large change in TEF for some congeners (notably OCDD and OCDF that changed from 0.0001 to 0.0003 – a factor of 3). This change had a profound effect on dioxin concentrations TEQ calculated before and after the change due to the large preponderance in the environment of these congeners, so that comparison of concentrations must include indication of whether the TEQs were calculated with WHO98 or WHO2005. Suggest inclusion of a note emphasising the changes in TEF for some congeners between the WHO98 and WHO2005 TEQs. | Text revised to acknowledge this change. |
| 47 | 13.6.3 | *Industry peak body*<br>As the National Dioxins Program, particularly Technical Report No 5 - Dioxins in Soil in Australia, from which the NEPM extensively quotes, dates from May 2004, it clearly quotes figures as WHO98. Therefore all the quotes in the NEPM must either be corrected to WHO2005 figures—or—clearly indicate that it is based on WHO98. At the same time, (May 2004) should also be included in the title of this section.<br>The change in the WHO advice can have a profound effect when comparing concentrations assessed subsequent to 2005 (using WHO2005) with the National Dioxins Program and therefore also the figures quoted in the NEPM.In undertaking review of both background and imported pollution by dioxins at DTP in Victoria, where over 6000 dioxin analyses have been undertaken. TCDD was rarely responsible for more than 10% of the TEQ calculated, and in the background samples often significantly less.<br>Whilst the Technical Report No 5 published concentrations of individual congeners in Appendix D, the conclusion that "on average, more than 80% of the toxic equivalency across soil samples could be attributed to 2,3,7,8 – PCDD/Fs." could be questioned.<br>As health risk based site criteria are assessed only on the total TEQ (the summed | Text revised to acknowledge this change. |

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| | | TEQs for each congener compared to the toxicity of TCDD) the RBSCs would not be anticipated to change. This would include published criteria such as the German derived target value of <5pg TEQ g-1 dwt. For comparison, the target criteria derived for residential use at DTP was 64 pg TEQ g-1 dwt (or 64 ng/kg TEQ).<br>All the quotes in the NEPM must either be corrected to WHO2005 figures—or—clearly indicate that it is based on WHO98. At the same time, (May 2004) should also be included in the title of this section of the NEPM. | |
| 5 | 13 | *Environmental consultant*<br>p93; Reference given as "EPA Victoria 1998"—reference not given in Bibliography<br>Include reference in Bibliography | Noted. Reference to EPA Victoria 1998 has been deleted as the source information is not available. |
| 36 | | *Environmental consultant*<br>App D6; p1 Should be sampling, analysis and quality plan (SAQP). | Text revised. |
| 47 | | *Industry peak body*<br>App D, Fig 2—p 107, North missing on figure, Add north | North arrow added. |
| 15 | | *Environmental consultant*<br>App. D; Borehole log examples are for geotechnical descriptions as oppose to soil descriptions.<br>Provide examples based on the Australian System (see comments on Schedule B(1) above). | Borehole logs provided in Appendix D use Australian Standard AS 1726-1993 which has been retained as the reference for soil classification. References to other systems have been deleted from Schedule B2. |
| 47 | | *Industry peak body*<br>Appendix D, P117-120, Borehole logs provided in Appendix D appear to use the Soil Classification in Australian Standard AS 1726-1993. Schedule B1.2.2.3.2 uses the US Soil Texture Classification. Apparent contradiction in which method to use?<br>Select one soil classification standard and revise Appendix D borehole logs accordingly | Borehole logs provided in Appendix D use Australian Standard AS 1726-1993 which has been retained as the reference for soil classification. References to other systems have been deleted from Schedule B2. |
| | **14** | **Shortened forms** | |

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| 9 | | *Local government*<br>14: p126; ACM is listed in section 14 (Shortened Forms) of Schedule B2 as 'asbestos cement materials' but the terms FA and AF are not listed. All these terms are used in section 9. | |
| | | **General comments** | |
| 34 | | (and B1)<br>*Industry peak body*<br>PACIA questions the practicality of these schedules in relation to Asbestos in soil. While noting that this is based largely on the only available guidelines from WA, PACIA would support further work being undertaken in this area. | Noted. |
| 47 | | *Industry peak body*<br>ALL, DQO, Data quality objectives should be consistently reproduced or referenced from one section - QA/QC info is scattered at various schedules | Noted. The main text has been re-organised to provide greater clarity. Detailed information on the DQO process has been retained in the appendices so as not to break up the flow of the Schedule. |
| 47 | | *Industry peak body*<br>General, It is illogical to have only one sub-section in a section. Every section should have several subsections, or none. | Noted. Text revised. |
| 47 | | *Industry peak body*<br>General, When a section has subsections, it is illogical to not include part of the text of the section into one of these subsections. All text of the section should be part of subsections, with headings. | Noted. Text revised. |
| 20 | | *Industry peak body*<br>Nationally harmonised approach to the assessment of petroleum hydrocarbon impacted sites<br>Guidance on comprehensive site characterisation of petroleum hydrocarbon impacted sites was lacking in the previous editions of the NEPM. While a number | Noted. |

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| | | of guidance documents related to hydrocarbon contaminated site characterisation were available in Australia, these were typically regional, and were not specific to petroleum hydrocarbon impacts.<br><br>Characterisation and monitoring of petroleum-impacted sites can be very costly. Poor characterisation can result in uncertain mapping of the magnitude and distribution of petroleum hydrocarbons in subsurface environments. This in turn can lead to conservative decision making and increased costs where remediation is prolonged, misapplied or not well targeted due to lack of appropriate data.<br><br>Currently several guidance documents exist at state and national levels (e.g. the 1999 NEPM; NSW EPA Guidelines for Assessing Service Station Sites - first published in 1994) as well as within industry and these indicate the types of investigation activities to be carried out at sites where hydrocarbon releases have occurred or are suspected. However, a more comprehensive approach to site characterisation was required to:<br>- unify current guidance across Australian jurisdictions;<br>- provide support for innovative technologies and approaches to be adopted by the industry;<br>- present a systematic framework to inform and educate industry, consultants and regulators about the issues and factors to be considered in the assessment and characterisation of sites in Australia impacted by petroleum hydrocarbons;<br>- move characterisation further toward the holistic development of robust and dynamic conceptual site models (CSMs); and<br>- be credible and acceptable to all stakeholders, including industry leaders, regulators and community groups. | |
| 20 | | *Industry peak body*<br><br>The revised NEPM Schedule B2 now addresses the extent of data requirements for 'adequate' characterisation of contaminated sites, which balance the uncertainties in risk assessments, and the cost-effectiveness of remediation strategies, given a set or limited quantum of data. Schedule B2 incorporates acceptable and reliable techniques and technologies to quantify the risk associated with contamination, and provide information on the conceptual framework for linking total contaminants at a site with soil and individual contaminant properties. | Noted. |

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| 20 | | *Industry peak body*<br>Schedule B2 will be of considerable value to the Australian petroleum industry as well as to environmental authorities. It provides scope for significant benefits to be realised by industry, regulators and the community in terms of effective environmental policy, public health, safety, cost and environmental amenity and can be expected to remove current obstacles to cost-effective assessment and remediation of contaminated sites for site owners and developers. | Noted. |
| 20 | | *Industry peak body*<br>From an AIP perspective, the most essential ingredient to achieving better assessment outcomes is a harmonised national approach to the assessment of contaminated sites. The NEPM Schedule B2 addresses this, and its tiered approach will significantly reduce the cost of site characterisation project delays, and the over-remediation or understatement of risks on individual sites. Schedule B2 provides important information on the properties of petroleum hydrocarbons and their potential environmental and human health effects. It recommends strategies for site management, methods for conducting site investigation, data presentation and reporting. | Noted. |
| 20 | | *Industry peak body*<br>Health screening levels (HSLs) for petroleum hydrocarbons<br>In Australia the normal approach for triggering further investigation is to determine whether Health Investigation Levels (HILs) or Ecological Investigation Levels (EILs) are exceeded. These levels can also form the basis for clean-up criteria. In the case of petroleum hydrocarbons, a number of screening levels already exist, however, these are very limited and do not extend to the full range of soil types and aquifer situations encountered, or to the assessment of volatile hydrocarbons. There is guidance on how the assessment of risk associated with such contaminants should be carried out, and it is common practice to undertake a health risk assessment to determine whether the concentrations might pose a health risk. As such, there is a need to develop a set of health-based screening levels for petroleum hydrocarbons and the variation has begun to address this issue<br>The development of a set of health screening levels for petroleum hydrocarbons | Noted. |

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| | | involved a staged program of work, carried out under the guidance of the PAG involving various Australian industry representatives and regulatory agencies. CRC CARE conducted a detailed literature study, which identified the complex technical and policy issues that needed to be addressed. It also suggested approaches that might be adopted.<br><br>In parallel with this work, a set of screening criteria were developed for particular land use settings, and these screening criteria and their documentation were made available to the PAG for consideration. Through a series of workshops, the PAG then reached a consensus on the overall approach and on how most of the issues should be addressed.<br><br>The HSLs for petroleum hydrocarbon vapours developed by CRC CARE were based on the use of the Johnson and Ettinger vapour intrusion pathway model. This work and research was driven by a national review of the ASC NEPM (ASC) by the NEPC and was strongly supported by State regulatory and health agencies and various industry and consulting companies. CSIRO Land and Water assisted with the development of the HSLs and especially the incorporation of biodegradation into HSL estimates based on vapour migration of petroleum hydrocarbons. CSIRO Land and Water reviewed current models of vapour migration and the Johnson and Ettinger model for development of the HSLs estimates.<br><br>The overall approach in deriving the HSLs was extensive and included reviews of previously agreed assumptions and approaches/methodologies for deriving screening levels for petroleum hydrocarbons. Vapour emission models were established for the various land uses, soil types, depths to source, and different chemicals of interest, based on the Johnson and Ettinger model. Detailed risk calculations were conducted to determine the health screening levels for these various land uses, soil types, depths and chemicals. The PAG and its technical working groups closely monitored the progress of this. The work was peer-reviewed by international experts at various stages of the project.<br><br>The HSLs for petroleum hydrocarbons for soil, soil vapour and groundwater now provide adequate guidance on the assessment of Tier 1 health-based screening levels for petroleum hydrocarbon contaminated sites. The new guidance will not only avoid unnecessary costs in site assessment and remediation, but it also takes account of the latest science and places Australia at the forefront of guidance in this | |

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| | | area. One of the most notable features of the HSLs is comprehensive screening levels for soil and groundwater contamination for various soil types, depths below surface and a range of land uses. This novel approach also includes screening levels for sub-surface soil vapour to deal with health risks from toxic hydrocarbon vapours including benzene as a carcinogen of concern in site assessment. Although additional assessment for soil vapour testing in some sites may mean additional costs, the benefits of clear and comprehensive screening levels to progress site development without delay, while being protective of human health, will outweigh any additional costs. The HSLs will not only help in minimising the cost of remediation, but also avoid unnecessary remediation, without compromising human health. | |
| 20 | | *Industry peak body*<br><br>Guidance and models on the assessment of impacts and risks from volatiles.<br><br>The 2005 review of the ASC NEPM, and other industry and regulatory feedback, has driven the need to generate national guidance on the field assessment of vapours in soils/groundwater at contaminated sites, and to achieve a consensus on the modeling of the potential for vapour ingress to buildings built on impacted land.<br><br>AIP recognises that more guidance and models on the assessment of impacts, risks from volatiles, and their field assessments was required to support the risk assessment of hydrocarbon impacted sites and has been completely supportive of the work undertaken by CRC CARE in this area.<br><br>Exposure to vapours can often be the dominant health risk at a site contaminated by volatile compounds. However, quantifying vapour exposure is highly uncertain, through lack of understanding, poorly validated vapour models, and inadequate field assessment protocols and techniques. Because of these uncertainties and other factors vapour exposure assessments are (not unreasonably) generally overly conservative, with the result that significant cleanup may be implemented unnecessarily at impacted sites.<br><br>Vapour assessments need to be protective of human health, but should not drive unnecessary expenditure to cleanup sites to unrealistically low concentrations in soils/groundwater. | Noted. |

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| | | The revised NEPM now provides adequate guidance on the field assessment of vapours and identifies various accepted methods and models to be used for vapour assessment at potentially contaminated sites.<br><br>The work conducted by CRC CARE took into account recent developments and knowledge as well as yet to be released technical papers relating to this area, including field sampling and measurement methods. It also provided a comparison and review of overseas approaches and recent progress, but with an orientation to Australia-specific circumstances.<br><br>In particular Schedule 2 will assist in delivery of more easily applied, reliable and acceptable techniques and monitoring tools for assessing the risk (e.g. bioavailability and toxicity) from contamination in soil and groundwater, in surface water and air, where the contamination may migrate into these media.<br><br>This schedule also provides better techniques for quantifying the extent of exposure that can be expected to occur and the fate of contaminants over the period that is relevant (e.g. a lifetime or a shorter period, depending on the contaminant).<br><br>Uncertainty around the potential ingress to built structures can drive substantial cleanup expenditure by contaminated site owners where it may not be warranted. The scale of this issue is enormous – potentially affecting all cases of volatile chemical spillage (petroleum, solvent and other) around the world, with a particular focus in USA, Australia, and parts of Europe. So there is a ready and needy market and the outcomes of this work by CRC CARE have the potential to result in substantial cost savings and better targeted remediation efforts.<br><br>Establishing greater certainty and better quantifying the potential ingress of vapours to built structures has enabled the development of more reliable HSLs for volatile substances and hence reduced cleanup and field assessment costs. The savings are potentially significant – both for regulators and industry, who both need greater certainty in relation to the assessment of vapour risks so as to allow appropriate prioritisation of expenditures. | |
| 20 | | *Industry peak body*<br><br>Conclusion | Noted |

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| | | AIP continues to support the CRC CARE research program, which is much valued by the petroleum companies and by regulators and provides significant benefits to the community at large.<br><br>This is also acknowledged in the Impact Statement for the Variation to the National Environment Protection (Assessment of Site Contamination) Measure, that stated:<br><br>"The adoption of [CRC CARE outputs] is expected to deliver significant cost benefits to assessment and development of affected sites."<br><br>AIP concurs with NEPC in its assessment of the financial implication of these changes to the ASC NEPM. AIP considers there will also be significant spill-over benefits to the wider public as a result of the changes to the NEPMs, through more harmonised policy and governance, better protection of public health, and improved economic and environmental outcomes.<br><br>AIP also commends the comprehensive efforts of the ASCNEPM (ASC) variation team and looks forward to the finalisation and implementation of this variation to the NEPM. | |
| 37 | | *Environmental consultant*<br><br>This schedule is well written and provides a good description of a thorough site investigation program. | Noted |
| 47 | | *Industry peak body*<br><br>ALL, Objective should be clear, The generation of data for the purposes of human health or ecological risk assessment needs to be clearly expressed. This is the prime objective - impact assessment. Risk assessment is at the forefront of this process. | Noted |
| 18 | | *Other*<br><br>Inconsistencies throughout document:<br>- 'subsample' vs 'sub-sample'<br>- 'soil gas' vs soil-gas'<br>- 'photoionisation' vs 'photo-ionisation' | Text revised. |

## APPENDIX E – Issues and responses – Schedule B3

| Submitter number | Section | SCHEDULE B3 - Issue | Response |
|---|---|---|---|
| | 1 | **Introduction** | |
| 11 | 1.1 | *Analytical laboratory services*<br>Line 3, The preface states "It aims to ensure consistency in analytical results…". These could be consistently incorrect.<br>Recommend wording be updated "It aims to ensure accuracy and precision in analytical results…" | Text amended |
| 15 | 1.1 | *Environmental consultant*<br>Paragraphs 1 and 2, Line 1; Leading sentences in these two paragraphs are not complete sentences that link to the dot points.<br>Add: "The Schedule will provide the following guidelines on ....." | Text amended |
| 15 | 1.2 | *Environmental consultant*<br>Dot pt 2; Environmental professionals of private companies and academic institutions ie non –consultants, may also use this document. Other parts of this guideline (eg Section 3.4) refer to "site assessor". Use same terminology, for consistency.<br>Replace: "... environmental consultants assessors " | Text amended |
| | 2 | **Laboratory analysis of potentially contaminated soils** | |
| 17 | 2.1 | *Other*<br>The last sentence specifies that 'Accreditation from the National Association of Testing Authority (NATA) should be obtained for all analytical procedures wherever possible'.<br>The accreditation shall not only cover the method but must also ensure the method is accredited for the matrix the laboratory is going to analysed, eg. | Text amended to include reference to other ILAC accreditation body. |

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| | | soils, sediments or solid wastes.<br><br>Suggested wording: 'Accreditation from the National Association of Testing Authorities (NATA) should be obtained for all analytical procedures and matrix for the analytes of concern whenever possible.' | |
| 4 | 2.1 | *Analytical laboratory services*<br>Line 11; NEPM currently states : ` Accreditation from NATA…'<br>Australian labs need to have a choice as NATA currently has a monopoly. At the moment NATA has internal management issues and is struggling to accredit laboratories in a timely fashion. Several Australian labs are actively looking for better service from IANZ (NZ), A2LA (USA) or UKAS (UK) with the aim of leaving NATA.<br>NATA are a member of ILAC (International Laboratory Accreditation Cooperation), along with these other accreditation bodies around the world.<br>I would like this NEPM statement to say `Accreditation from NATA or other ILAC accreditation body to ISO 17025'. (Refer www.ILAC.org) | Text amended to include reference to other ILAC accreditation body. |
| 11 | 2.2 | *Analytical laboratory services*<br>point 6; L9;<br>"…have a limit of reporting no greater than 20% of the relevant maximum contaminant obtained in a similar matrix…". What does this actually mean? It is very confusing and uor people do not understand this.<br>Re-phrase or remove. | Noted |
| 47 | 2.2 | *Industry peak body*<br>Terminology: …to measure non -residual contaminants in soil Residue chemistry is a term traditionally used to describes extraction and analysis of soil contaminants. Suggest changing 'non residual contaminants in soil' to .. potentially mobile and/or biologically available or other | Text amended |
| | 2.2 | *Industry peak body* | Text amended |

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| | | Terminology: Appropriate LOR The requirement 'no greater than 20% of the relevant maximum contaminant obtained in a similar matrix' is misleading. Suggest rewording ….no greater than 20% of the adopted site-specific screening concentrations | |
| 11 | 2.2 | *Analytical laboratory services*<br>L14; "…measure non-residual…". This term is vague and contrasts with analytical terminology such as "pesticide residues" which are most definitely not naturally occurring.<br>It is recommended that NEPM Substitutes the word non-residual for "…..available……" | Text amended |
| | 2.2 | *Industry peak body*<br>Alternative methods Add requirement…The laboratory will document the method performance verification and make the data available for audit. | Text amended |
| 4 | 2.2 | *Analytical laboratory services*<br>Line 20; NEPM currently states: `NATA Accredited'….<br>Australian labs need to have a choice as NATA currently has a monopoly. At the moment NATA has internal management issues and is struggling to accredit laboratories in a timely fashion. Several Australian labs are actively looking for better service from IANZ (NZ), A2LA (USA) or UKAS (UK) with the aim of leaving NATA.<br>NATA are a member of ILAC (International Laboratory Accreditation Cooperation), along with these other accreditation bodies around the world.<br>I would like this NEPM statement to say `Accreditation from NATA or other ILAC accreditation body to ISO 17025'. (Refer www.ILAC.org) | Text amended to include reference to other ILAC accreditation body. |
| 15 | 2.2 | *Environmental consultant*<br>Last paragraph , Line 6; The analytical method should also be validated to suit the appropriate concentration range for a range of soil types<br>Add: '....Validation should be performed on the range of soil types and | Text amended |

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| | | concentrations most likely to be analysed." | |
| | 3 | **Determinative methods** | |
| 47 | 3 | *Industry peak body*<br>Section Title: Determinative Methods: Title appears misplaced. Section 3 discuss more than the limitations with respect to determinative methods. Suggest rename section 3 and discuss Determinative Methods as section 3.1 | Noted |
| 15 | 3 | *Environmental consultant*<br>Paragraph 1, Line 2 "each" sounds too specific.<br>*Replace: "...determinative procedures for each every analyte is outside...."* | Text amended |
| 4 | 3 | *Analytical laboratory services*<br>Terminology: reference compound, standard component Change all three dot point relating to mass spectral requirements to '..of the reference calibration check standard'. | Text amended |
| 4 | 3 | *Analytical laboratory services*<br>Line 4 (NATA 2007)<br>This document is now 2010. Please update without dates. | Noted<br>Dates required for referencing |
| 17 | 3 | *Other*<br>Document reference to NATA field application document (NATA 2007). This document is outdated. NATA documents are continuously being reviewed and updated as required. It is recommended that the document shall remove the year reference.<br>*Recommend to remove the year the document is issued from the NEPM.* | Noted<br>Dates required for referencing |
| 47 | 3.1 | *Industry peak body*<br>Terminology: Screening methods<br>Change '...identification'… to appropriate analyte specificity…. | Text amended |
| 31 | 3.1 | *Environmental consultant* | Text revised. |

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| | | Screening tests<br>The criteria included at the end of this section for sufficiency of a screening test, tacitly assume that the correlation of the screening results to related laboratory results is both linear and has a 1:1 regression. The reviewer has demonstrated that this assumption does not necessarily apply and refers to Ecoforum 2009 paper e9047, where results for field screening for lead using XRF were compared with laboratory analyses for the same soils. In this instance, the proposed criteria are likely to have not been met, however, the adopted correlation was sufficient for project needs. Based on his wide experience of field screening methods, the reviewer suggests that the tacit assumptions are unnecessarily restrictive.<br>The reviewer suggests that the criteria for assessment of sufficiency of a field screening test should be based on reliability of correlation between screening measurements and associated laboratory results. The onus should be placed on the consultant, or person responsible for assessing measurements, to demonstrate the sufficiency of screening tests. | |
| 11 | 3.2.1 | *Analytical laboratory services*<br>Line 14, HPLC/MS does not provide standard searchable spectra<br>Delete reference to HPLC/MS in this context. | Noted |
| 17 | 3.2 | *Other*<br>The last paragraph specifies that 'Validation should be performed on the range types most likely to be analysed. This might not be appropriate as there some soil type is more difficult to analysis than other others.<br>Suggestion: Change the sentence to 'Validation should be performed, preferably using a more difficult soil sample type that likely to be analysed, eg. use clay instead of sand.' | Text added |
| 15 | 3.3 | *Environmental consultant*<br>Paragraph 3, Line 2<br>Leachability methods for assessing organic compounds are also provided in | Text amended |

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| | | Section 11, as well as methods for assessing common metals. It is unclear why organics is not mentioned in this paragraph.<br>Mention leachability methods for organics in this section. Since this section is specific to Leachability, why not direct the reader to this section as well (Section 11) by including this information in the text. | |
| 15 | 3.4 | *Environmental consultant*<br>Paragraph 1, dot pt 3; Timing of relevant communication is important, for appropriate actions to be taken eg alarmingly dubious results for analytes with short holding times<br>Add: "....the analyst communicates all relevant information to the site assessor in a timely manner" | Text amended |
| | 4 | **Quality assurance** | |
| 4 | 4.1 | *Analytical laboratory services*<br>Line 25 (NATA 2007)<br>This document is now 2008. Please update without dates. | Noted<br>Dates required for referencing |
| 47 | 4.2.1 | *Industry peak body*<br>Process Batch *Insert ….QC requireemts, and QC monitoring interval,...* | Text amended |
| 47 | 4.2.1 | *Industry peak body*<br>Process Batch *Replace ….'should be considered' with ..is considered as more than one batch for the purpose of determining QC monitoring interval.* | Noted |
| 11 | 4.2.1 | *Analytical laboratory services*<br>Defining process batch : "…similar in terms of sampling…". The lab is not necessarily aware of sampling procedures so this is difficult to achieve<br>*It is recommended that NEPM substitute "…similar in terms of matrix…"* | Text amended |
| 47 | 4.2.1 | *Industry peak body*<br>Process Batch As above the NEPM should be more specific with respect to | Noted |

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| | | QC interval. Suggest replacing all 'should be at least' with a more definitive ..'At least one … per process batch is required and reported with the primary sample data'. | |
| 17 | 4.2 | *Other*<br>Field blank is not listed in the QC/QA requirement. The field blank can monitor contamination during the sampling and/or while transporting the sample from the sample site back to the laboratory. This is especially the case for VOC types of analysis.<br>Recommend to add field blank to the QC section. | Noted<br>Field procedures are discussed in Schedule B2 |
| 47 | 4.2.2 | *Industry peak body*<br>Analysis Blank Replace ….'where laboratories are required to report analysis blanks' with ..when laboratories report analysis blanks...' | Text amended |
| 47 | 4.2.3 | *Industry peak body*<br>Duplicate Analysis Add ….samples with obvious high concentrations of interferents which most likely require subsequent dilution of sample extracts and raised LORs, should not be used for duplicate analysis | Text amended |
| 11 | 4.2.3 | *Analytical laboratory services*<br>Duplicates: "…provide an estimate of lab precision…". True, but also of sample heterogeneity.<br>It is recommended that NEPM substitute "…an estimate of method precision and, in some cases, Laboratory precision plus sample heterogeneity. | Text amended |
| 47 | 4.2.4 | *Industry peak body*<br>LCS Analysis Insert ..control matrix spiked with all analytes... | Text amended |
| 47 | 4.2.4 | *Industry peak body*<br>LCS Analysis Insert ..spiked at concentrations equivalent to the mid -point of the preceeding linear calibration or continiung calibration check, upon which sample quantitation will be based.. | Text amended |

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| 47 | 4.2.4 | *Industry peak body*<br>LCS Analysis LCS recovery data are generaly used for internal laboratory quality control measure, however, because labs rarely spike all analytes (organic compounds) into matrix spikes, the LCS recovery data should be reported with primary sample data, thus enabling the site assessor to assess method accuracy for the relevant analytes | Text amended |
| 4 | 4.2.4 | *Analytical laboratory services*<br>Line 1; …`a standard reference material, ……..'<br>Sometimes you cannot buy or spike a sample as an LCS. Eg for a SPOCAS LCS you are best using an old sample and assigning your own reference value.<br>Please change this line to ` a standard reference material, a matrix of proven known concentration, or a control matrix spiked….' | Text amended |
| 4 | 4.2.4 | *Analytical laboratory services*<br>Line 4; LCS's – some labs use their calibration standard as their LCS, this is not ideal. The LCS should ideally be from an independent source, however, it is also acceptable to run an ICV from an independent source as a calibration check. If this occurs then the LCS can be from the same source as the calibration std.<br>Please add the line `The LCS must be from an independent source to the calibration standard, alternatively an ICV (independent calibration verification) must be used to confirm the validity of the primary calibration .' | Text amended |
| 47 | 4.2.4 | *Industry peak body*<br>Matrix Spike Analysis Spiking at the 'regulatory level' is not practical due to the wide range of guideline levels of contaminants of interest adopted for site ivestigations ..suggest spiked at concentrations equivalent to the mid -point of the preceeding linear calibration or continuing calibration check, upon which sample quantitation will be based... | Noted |
| 4 | 4.2.5 | *Analytical laboratory services* | Text amended |

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| | | Line 10; `to the corresponding regulatory level….'<br><br>This is not always practical as regulatory limits vary and may be very low. Spiking where MU is highest is not sensible. Remove the word `equivalent '. Suggest you add `close too the corresponding … ' or `level that is appropriate for the matrix ' | |
| 4 | 4.2.5 | *Analytical laboratory services*<br><br>Line 8; Poor matrix spike recoveries may well be valid and the client should know these eg low PAH spikes in soil with charcoal. Too many consultants think failed QC is bad – they need to realise that failed QC tells a story and should be reported.<br><br>Please add this line: `If after investigation the matrix spike is still below acceptance then this failed recovery should be reported to the client with an explanation to show the limitations of the method to that particular matrix . The acceptable LCS will prove that it is the matrix, not the method, that may be the issue.' | Text amended |
| 11 | 4.2.5 | *Analytical laboratory services*<br><br>L30; "…added at a concentration equivalent to regulatory level…". This is impractical for multicomponent analyses and also where regulatory levels are very high. Also, in order to provide clients with timely analytical results and to have relevance as part of a "process batch" matrix spiking is performed without foreknowledge of actual concentrations in sample.<br><br>It is recommended that NEPM substitute with "at a concentration no greater than twenty times the reporting limit" | Noted |
| 11 | 4.2.5 | *Analytical laboratory services*<br><br>L34; "…one matrix spike per soil type per process batch…". The laboratory is not in a position to make the judgement on "soil type"<br><br>It is recommended that NEPM substitute with "…one matrix spike per process batch…". | Noted |
| 11 | 4.2.6 | *Analytical laboratory services* | Text amended |

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| | | Section heading<br>Surrogate use is restricted and should be reflected in the title per 4.2.7 Internal Standards<br>It is recommended that NEPM add "(where appropriate)" to the title. | |
| 47 | 4.2.6 | *Industry peak body*<br>Surrogate spikes To address the variable method performance of different compounds (example phenols and methyl phenols being acidic and water soluble) suggest adding a requirement as follows...Several surrogates appropriate for monitoring the variable method performance and potential bias regularly observed across the target analyte list (eg phenols) should be spiked into the sample matrices. | Noted |
| 47 | 4.2.7 | *Industry peak body*<br>Internal Standards -results of QC procedures This should be under a separate subsection. Add ...Results should be reported (in a supplementary report) with the primary sample data | Text amended |
| 15 | 4.3 | *Environmental consultant*<br>; Paragraph 1, Line 3; Each lab needs to conduct its own Method Validation.<br>Replace: "..Method validation needs to be performed for by each laboratory....." | Text amended |
| 47 | 4.3 | *Industry peak body*<br>Method Validation Compared to a more rigorous method such as Soxhlet extraction is redundant. Laboratories have not used soxhlet extractions for many years (in contrast to 2.2 the method is expensive and time consuming). Suggest remove tgis reference. Validation against one or more CRMs, representative of the varied sample matrices to be analysed should suffice. | Noted, reference deleted. |
| 47 | 4.3 | *Industry peak body*<br>Method Validation minimum validation – "percent recovery" is widely | Noted |

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| | | understood to be a means of assessing accuracy. Suggest moving to 4.3.1 | |
| 17 | 4.3 | *Other*<br>The minimum validation data required shall also include linearity and uncertainty of measurement.<br>Recommend to include linearity and uncertainty of measurement (MU) to dot point listed. | Text amended |
| 47 | 4.3.4.2 | *Industry peak body*<br>PQL Australian laboratories assignment of LORs is currently somewhat arbitrary. The laboratories should be able to statistically prove the LOR in terms of acceptable precision and accuracy. This can be readily achieved by analysing the MDL data where samples are analysed at 5 times expected MDL. Suggest adding this requirement | Noted<br>Document states the option of terms |
| 47 | 4.3.4.2 | *Industry peak body*<br>PQL Australian laboratories universally use the term LOR. Suggest changing subsection heading to LOR. | Noted<br>LOR is stated as an optional term |
| 29 | 4.3.4.2 | *Industry*<br>PQL is defined as 5 times MDL. This does not address the need for the PQL to be at or below the HIL or HSL or the need for the laboratory to simplify data reporting.<br>Set range for PQL and require it to be lowest calibration standard. Chapter 1 in SW-846 | Text amended |
| 15 | 4.4 | *Environmental consultant*<br>It is important that the sample is analysed/ extracted within the appropriate holding time.<br>Add, under "Other valuable information...", extra dot points on:<br>i) whether the sample was received within a reasonable time for the analysis to be conducted within the appropriate holding time; and | Noted |

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| | | ii) whether the sample was analysed/ extract within the appropriate holding time | |
| 17 | 4.6 | *Other*<br>Requirement of NATA-endorsed documents – recently NATA has introduced the concept of delegated signatory. NATA accredited laboratories can now issue NATA endorsed report signed by delegated signatory. This shall be added to dot point.<br>Recommend to change the dot point 'the signature of an approved NATA signatory' to 'the signature of an approved NATA signatory or delegated signatory.' | Text amended |
| 29 | 4.6 | *Industry*<br>Analytical Report should also include information on the lab that performs the analysis in case the analysis is sub contracted.<br>Subcontracted samples should be clearly identified. | Text amended |
| 4 | 4.6 | *Analytical laboratory services*<br>Line 16; Approved NATA signatory<br>Change to `Approved NATA or equivalent ISO 17025 signatory ' | Text amended |
| 47 | 4.4 | *Industry peak body*<br>Sample Control Could this sub section be more appropriately placed in Section 5 - Preparation and Storage | Note |
| 47 | 4.4 | *Industry peak body*<br>Sample Control Sample integrity should be maintained through storage in controlled refrigeration for no less than 2 weeks after issue of the analytical data, so that repeat analysis may be performed to investigate anomalous results observed by the site assessor. Could this section be more appropriately placed in Section 5 Preparation and Storage | Noted |
| 47 | 4.6 | *Industry peak body* | Text amended |

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| | | Analytical Report This is a different subject to Quality Assurance, and of key importance with respect to reliable contaminated land investigations. Several laboratories have performed poorly with respect to the formatting and completeness of laboratory reports. The subject should be documented in a separate section. | |
| 47 | 4.6 | *Industry peak body*<br>Analytical Report All laboratories must be required to issue a Sample Receipt Report detailing the condition of samples, sample preservation status and Chain of Custody, immediately after receipt by the laboratory. This provides for a stop check moment for both laboratory and site investigator. Sample temperature upon receipt should be reported. | Noted<br>Temperature already included in the list. |
| 47 | 4.6 | *Industry peak body*<br>Analytical Report Other valuable information - implies reporting is optional and far to soft, particularly for contaminated sites investigation and remediation under Statutory Audit. Strongly suggest making the deliverables as listed compulsory. All can be readily reported in a supplementary QAQC report. Reporting whether or not a sample has been homogenised and sieved should be specifically included. | Text amended |
| 11 | 4.6 | *Analytical laboratory services*<br>L13<br>"date on which sample analysis commenced". In some cases, analysis needs to be completed within a specified time.<br>It is recommended that NEPM substitute "dates on which sample analysis commenced and was analysed" | Text amended |
| 47 | 4.7 | *Industry peak body*<br>Split samples Suggest adding ..split samples provide a check on the reproducibility of primary laboratory data. | Text amended |
| 4 | 4.7 | *Analytical laboratory services* | Noted |

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| | | Line 11; 30% acceptance is too tight<br>Even though the NEPM says higher variations can be accepted, the environmental consultants only look at the 30% figure. This is too tight – suggest at least 50%. | Current generalised comment in the NEPM is considered appropriate. |
| 4 | 4.7 | *Analytical laboratory services*<br>Line 14; `with low analyte concentrations'.<br>Differences also occur with non homogenous samples. Please add `with low analyte concentrations or non homogenous samples '. | Text amended |
| 11 | 4.7 | *Analytical laboratory services*<br>L23; "…split samples should be homogenised…" – not appropriate for volatiles analysis.<br>Exclude volatile organics from this process and add an additional procedure for volatiles samples as follows:<br>"For the analysis of volatile organic compounds rapidly create split samples attempting to minimize losses by halving the sample and placing half in each container compacting and topping up to achieve zero headspace" | Text amended |
| 11 | 4.7 | *Analytical laboratory services*<br>L24; "…(an independent laboratory run by a different organisation or company)…" This is a non-technical definition and does not, in itself, assure independence. NATA provides separate audits on separate sites and site accreditations is independent. It is suggested that this comment undermines or casts doubt on the NATA process<br>It is recommended that NEPM substitute the wording to "an independently NATA accredited laboratory with samples submitted totally independently and coded to avoid identity as per duplicate samples". | Text amended |
| 29 | 4.7 | *Industry*<br>Split Samples; p13; Guidance does not state what happens if split sample results are greater than 30% difference. No corrective action is | Text amended |

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| | | recommended.<br>An investigation should be triggered if results are greater than 30% difference. A review should be conducted of both laboratories and of the appropriateness of the method being used. | |
| | 4.8 | *Industry peak body*<br>Blind replicate samples Suggest adding a QC limit RPD of < 30% | Noted |
| 11 | 4.8 | *Analytical laboratory services*<br>L35; "Blind replicate samples provide a check of the repeatability of a laboratory's analysis….". Repeatability is only relevant to the particular sample or sample matrix as submitted. It may also reflect the heterogeneity of the sample submitted. In particular, where there are restrictions to the degree of homogenisation that can be done (volatile organics).<br>It is recommended that NEPM substitute this to " Blind replicates provide an estimate of Laboratory precision and, in some cases, laboratory precision plus sample heterogeneity. | Noted |
| 29 | 4.8 | *Industry*<br>Blind replicate samples; p13, No acceptance criteria or corrective action is given for the use of blind replicate samples.<br>The acceptance criteria of 30% difference should also be used for the blind replicate. Failure of the acceptance criteria should trigger an investigation of cause. | Text amended |
| | **5** | **Sample preparation and storage** | |
| 15 | 5 | *Environmental consultant*<br>The focus of this section needs some re-work. It is currently structured according to preparing a field-moist or dry sample, with the secondary consideration of the analyte group (volatile, semi-volatile, non-volatile). It should be the other way round ie the analyte group determines which preparatory method is required. | Noted |

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| | | Sub-heading "5.1 Sample preparation" seems undefined as Sections 5.2 and 5.3 also pertain to Sample preparation.<br>i) Combine Sections 5.1.1, 5.1.3 and 5.2.2, as they relate to semi-volatiles and non-volatiles, with appropriate sub-sections/ clarification to suit<br>ii) Combine Sections 5.2.1 and 5.1.4, as they relate to non-volatiles, or add after the combined paragraph above.<br>iii) Suggested Section structure:<br>5.1 Sample preparation considerations<br>5.2 Field-moist vs dry analysis portions<br>(Add reference to Table 1 which provides guidance on sample condition for the various analytes)<br>5.3 Homogenising<br>5.4 Semi-volatiles and non-volatiles<br>5.4.1 Separation and removal of extraneous components<br>5.4.2 Semi-volatiles<br>5.4.2.1 Field-moist analysis portions<br>5.4.3 Non-volatiles<br>5.4.3.1 Preparation of dry analysis portions(drying and partitioning)<br>5.5 Volatiles<br>5.6 Sample collection for volatile analytes<br>5.7 Preliminary screening analysis<br>5.8 Sample storage | |
| 11 | 5.1 | *Analytical laboratory services*<br>This entire protocol is onerous and could add significantly to consultant costs. | Noted |

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| | | Application of techniques specified in 5.1, in particular the first and second dot points should be sufficient in most cases. Otherwise, the laboratory should act under the instructions of the consultant. It is recommended that the words – "Where appropriate" be added | |
| | 5.1 | *Industry peak body*<br>This section should state that it excludes soil asbestos sample preparation and storage. | Text amended |
| 4 | 5.1.1 | *Analytical laboratory services*<br>Line 12; Mixing the samples<br>The mixing procedure documented is not practical. It is time consuming and may contribute to cross contamination or airborne OHS issues to staff. Suggest saying `to mix in the jar for sands and soils and for clays take a representative core with a spatula '. | Text amended |
| 4 | 5.1.2 | *Analytical laboratory services*<br>Line 10; At least 25% by weight or 200g<br>This is too much to take. Suggest getting rid of this and just saying `an appropriate well mixed portion '. No lab can practically take this much. | Text amended |
| 15 | 5.1.2 | *Environmental consultant*<br>Paragraph 4, Line 4; Need to be clear that no other test is required.<br>Add: "...The entire sample may be homogenised but only if no other test requiring the original, untreated sample..." | Text amended |
| 11 | 5.1.2 | *Analytical laboratory services*<br>"…mixed by hand, in a mortar and pestle…". Use of mortar and pestle for homogenisation – this can be a considerable source of cross-contamination.<br>Substitute with "…homogenised and mixed using appropriate techniques and ensuring that equipment is thoroughly cleaned between samples or systems are in place to ensure no cross contamination of samples". | Text amended |

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| 4 | 5.1.3 | *Analytical laboratory services*<br>Line 13; Passing through a 2mm sieve<br>Again this is time consuming and may contribute to cross contamination and may generate unnecessary dust. Suggest saying to use ` sample that is visually approximately <2mm or choose the fines where possible'. | Noted<br>Need some determination other than visible |
| 11 | 5.1.4.2 | *Analytical laboratory services*<br>L20; Grinding Dry Sample. This contradicts 2.2 as this procedure may extract or digest more than "available" contaminants.<br>It is recommended that NEPM delete section. It is not practiced due to contradiction with 'available' contaminants. | Text amended |
| 15 | 5.1.4.2 | *Environmental consultant*<br>Paragraph 2; This paragraph discusses decontamination of equipment for sample preparation and sub-sampling. It should be a separate sub-section on its own.<br>Remove this paragraph to a separate sub-section under "Equipment decontamination" | Text amended |
| 47 | 5.1.4.4 | *Industry peak body*<br>L1 'The analysis portion of the dry sample must be a representative sample'. Please provide guidance making reference to a code or Australian standard. | See above to the same comment. |
| 11 | 5.1.4.4 | *Analytical laboratory services*<br>L1;<br>Partitioning of dry samples – this procedure is not practical given sample sizes usually collected.<br>It is recommended that NEPM remove this requirement as it is mining focused, not representing practices in Australia and riffle splitters in particular are not appropriate for such sample sizes. | Noted |

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| 47 | 5.2.1 | *Industry peak body*<br>'Partition the fraction <2mm diameter by hand, with sample divider or alternate comparable method' *Please provide guidance making reference to a code or Australian standard.* | Noted |
| 15 | 5.2.1 | *Environmental consultant*<br>Item No.8, dot pts; The first part of Item 8 refers to the procedure to obtain a representative amount of sample. The second half of this sentence refers to "size reduction". Is this particle size or quantity size reduction? It is unclear how using a mechanical sample divider or following the manufacturer's instruction will provide further "size reduction".<br>*Perhaps have a separate paragraph for "further size reduction", for whichever meaning is intended.* | Text amended |
| 15 | 5.2.1 | *Environmental consultant*<br>Item No.8, Line 1; Add the previous step no., for greater clarity<br>*Add: "Repeat steps 7 (a) to (c)....* | Text amended |
| 47 | 5.2.1 | *Industry peak body*<br>Preparation of dried samples Appears to be replication with respect to air drying verses oven drying at 40C. Further clarification required, Note laboratories will require use of oven in order to meet typical data turnaround expectations. Ambient air drying is probably redundant | Noted |
| 47 | 5.3 | *Industry peak body*<br>Section title '5.3 Volatile analytes – sample collection and preparation' should note that this section excludes acid sulphate soil or soil asbestos. Insert excluded sample material comment at the beginning of the section | Noted<br>Comments in text state when this may be appropriate |
| 31 | 5.3.2 | *Environmental consultant*<br>Preliminary screening analysis<br>The reviewer is concerned about the tacit assumption that cored samples can | Noted |

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| | | be relied upon to produce replicate samples placed in two 40mL vials. The reviewer's experience is that each 40mL vial is approximately 100mm long, which means that, for two 40mL vials, a single cored interval of at least 200mm would be required. Where contamination may vary substantially in the vertical dimension (for example, petroleum hydrocarbons in the capillary fringe), such samples are unlikely to be replicates.<br><br>The reviewer suggests that the placement of a soil sample into a 40 mL VOA vial is impractical and unsafe for the large majority of soil and soil-like materials generally sampled during contaminated site assessment and remediation. | |
| 31 | 5 | *Environmental consultant*<br><br>; The text at the end of paragraph 2 tacitly assumes that a person using this Schedule would be able to select "the most conservative approach" regarding type of sampling container and holding time. The reviewer considers that this assumption is unreasonable, especially regarding the type of container. Despite this concern, the reviewer considers that the requirements of the relevant authority in the jurisdiction (generally the State or Territory) should take precedence over a person's opinion of "the most conservative approach". Thus, the reviewer suggests that the last sentence in paragraph two of this section be deleted. | Text amended |
| 4 | Table 1 | *Analytical laboratory services*<br><br>Table 1, Bottom of table – f: washing containers……<br><br>*Washing containers may potentially add contamination. All labs use food grade containers so this should say `use food grade containers and conduct regular blank checks '.* | Noted.<br><br>Option added for use of food grade containers, and that containers must be free from contamination. |
| 4 | Table 1 | *Analytical laboratory services*<br><br>Table 1, EC, TOC, CEC, B<br><br>These do not necessarily have to be air dried. They should be listed as air dried or field moist. The majority of commercial labs analyse on the field moist. And then moisture correct. | Text amended |

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| 4 | Table 1 | *Analytical laboratory services*<br>Metals data – Glass Jars Leaching<br>NEPM recommends that soil samples for Hex Cr and Mercury analysis be collected in a plastic container instead of glass. This is not practical and ELIG requests this be changed.<br>ELIG have organized a glass jar leaching experiment to prove that the metals that leach from glass jars are insignificant. There are slight increases with time for Ca, Na and Si, however, soils are rarely required to be tested for these analytes and these levels are considered insignificant. It is recommended that soils for metals analysis be collected in either glass or plastic.<br>Fluoride Glass Leaching Experiment<br>A leaching study was conducted by Envirolab several years ago (11/7/07) using DI water in 250ml glass soil jars. Results are below. This shows that on average over 30 days there was no leaching of F from glass jars. Further more a PQL of 50mg/kg for Total F or 0.5mg/kg for soluble F means that any slight leaching that may occur from glass would be insignificant to overall value of F in a soil.<br>Need to see hard copy of submission for table. | Noted<br>It is understood that either glass or plastic is appropriate unless one or the other is required by the method. |
| 4 | Table 1 | *Analytical laboratory services*<br>Table 1, Fluoride and Mercury and Chromium VI and CEC<br>NEPM Specifies plastic. This is impractical and consultants will not be prepared to take a separate container just for these analytes. It is also very wasteful and environmentally irresponsible to expect a second container just for these. Please find attached Envirolab in house study (app 1) that shows insignificant leaching of fluoride from Glass and an ELIG study (app 3) that shows insignificant leaching of metals from glass.<br>This table needs to allow both plastic and glass as suitable containers. | Noted<br>Limitation is noted. |
| 4 | Table 1 | *Analytical laboratory services* | Noted |

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| | | Table 1, General statement about holding times.<br><br>Too many consultants rely too heavily on published holding times as gospel. Many (most) still think that at midnight on the last day of holding time the analyte will be gone. NEPM needs to have a general statement about holding times. The NZ Ministry of the Environment has a very sensible statement that may be worth adding to NEPM:<br><br>`Holding times are not standards and are useful for reference only, as times may vary depending on the particular sample matrix. Once a sample has been collected, the nature of the analytes present may change as the result of:<br><br>- loss by volatilisation<br><br>- degradation by exposure to light<br><br>- degradation be exposure to oxygen or other chemicals<br><br>- degradation by living organisms.<br><br>The rate of sample degradation or loss will depend on the analyte, matrix and other factors present (eg, oxygen, light, soil microbes, moisture, temperature), and the site conditions. These changes can be minimised by collecting samples in appropriate containers, using preservatives (if appropriate), keeping samples chilled, cold or frozen and undertaking analysis as soon as possible. Sample preservation methods should be documented.<br><br>Example: The recommended holding time before extraction of polycyclic aromatic hydrocarbons (PAHs) is 14 days, although there is unlikely to be any significant change in PAH concentrations after sampling where contamination occurred several years ago, even over a period of several months. However, PAHs collected from a deep excavation, where the environment was anoxic, may undergo rapid changes on exposure to light and oxygen.<br><br>Guideline holding times before analysis should be taken into consideration when setting the DQOs, and should take account of:<br><br>- required turnaround | |

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| | | - regulatory (legal) requirements<br>- location and transport considerations<br>- number of samples and laboratory capacity. '<br>ELIG is also currently co-ordinating a holding time study. The plan will be to have this study published. | |
| 11 | Table 1 | *Analytical laboratory services*<br>Table 1, Comments E and F; All sample containers should be validated to be free of contamination for the analytes of interest. This may be the case using fresh, food grade glassware in the absence of washing. What is important is that the containers must be shown to be free of contamination.<br>*Amend notes E and F to reflect the need for using demonstrably clean containers rather than specifying a cleaning procedure.* | Text amended |
| 11 | Table 1 | *Analytical laboratory services*<br>Table 1- SVOCs; Holding times. It is recommended that current ability to hold extracts for 40 days be added. This is current practices and USEPA approved.<br>OCs, PCBs, PBDEs and Dioxins are POPs as listed under the Stockholm convention. It is recommended that longer holding times be adopted to reflect this.<br>CRMS for these compounds have extremely long shelf lives supporting this change<br>It is recommended that SVOC holding times" include a 40 day extract holding time".<br>If is recommended that OC/PCB and PBDE holding times all move to 28 days and dioxins move to one year as per industry standard | Text amended |
| 11 | Table 1 | *Analytical laboratory services*<br>Table 1, row 14; Sulfur – holding time can extend to almost indefinitely with | Noted |

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| | | drying and pulverising.<br>It is recommended that the NEPM review committee provide an option for 180 days commencing after drying and pulverising which must be done within the "wet" holding time. Refer to CANMET MP-1b reference material (includes sulfur) that has 20 year shelf life. | |
| 11 | Table 1 | *Analytical laboratory services*<br>Table 1, row 17; Volatiles – most, if not all, Australian laboratories use methanolic extractions which provide preservation of volatiles. US EPA method 5035B allows 14 days for methanol preserved samples.<br>*Allow 14 days for all volatiles if samples are extracted into methanol within 7 days.* | Noted |
| 11 | Table 1 | *Analytical laboratory services*<br>Table 1, row 7;<br>Why is there a requirement for a plastic container. US EPA methods 3060A (Cr6) and 7417A (Hg) permit the use of glass or plastic containers. The extra container places an additional burden on field collection and generates additional and un-necessary waste to be disposed of to landfill plus increases greenhouse gas emissions.<br>*It is strongly recommended that NEPM review committee permit the use of glass containers.* | Noted |
| | 7 | **Physicochemical analyses** | |
| 11 | 7.1.1 | *Analytical laboratory services*<br>Moisture determination on "field moist or air-dried" samples "…to then express chemical concentrations on a dry weight basis". All specified methods must be clear as to the application of moisture correction for reporting. For example, typical agricultural soil methods such as CEC are performed on an air dried sample and then reported without correction for moisture loss at 105 to 110 degrees.<br>Relevant methods must clearly state the requirement for dry weight correction. Alternatively, this should be noted in the preamble to analytical | Noted |

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| | | methods, Section 6, and then noted in specific methods by exception, if necessary. | |
| 4 | 7.2.2 | *Analytical laboratory services*<br>Line 1; `at 25 deg….'<br>25 deg is too accurate and not always possible. Realistically this should say `approx 25 deg with temp compensation probe'. | Noted<br>Temperatures are stated without approx throughout the text |
| 15 | 7.4 | *Environmental consultant*<br>CEC analysis is recommended using NH4Cl method only.<br>Consideration to mentioning the Barium Chloride (BaCl2) and Silver Thiourea (AgTU+) methods as being (more) appropriate. | Noted |
| 15 | 7.6.1 | *Environmental consultant*<br>Paragraph 4; It is unclear whether this paragraph refers to a method for analysing Organic carbon in acid sulfate soils or the analysis of acid sulfate soils.<br>International standard for spelling of sulfate is with an "f", not "ph". (Note: "Sulfur" is spelt correctly in sub-sections 10, except for the actual heading of Section 10).<br>If the reference is for the analysis of acid sulfate soils, insert this paragraph in a new sub-section.<br>Replace all spelling of "sulphate" in this guideline to "sulfate" | Text amended |
| | 8 | **Metals** | |
| 15 | 8 | *Environmental consultant*<br>Four digestion methods are provided in these sections. It would be useful to have some guidance on how the various digestion methods compare and what metallic components are extracted by each method eg aqua regia is likely to be more aggressive and hence, a higher metal concentration can be expected compared to the other digests (?). This is an important guidance, as assessors will have different requirements of the metal analysis, and should | Noted |

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| | | be encouraged to seek clarification with the laboratory for guidance on the appropriate digestion/ analytical method.<br>Add some discussion on how the various digestion methods compare and what metallic components are extracted by each method ie under what conditions or requirements would each digestion and determinative method should be most appropriate. | |
| 15 | 8 | *Environmental consultant*<br>Various determinative methods are provided eg FAAS, GFAAS, ICP-AES, ICP-MS. As a guidance document, it would be good to provide some comments on how each method is more appropriate for some analytes over the other methods, or how the results compare.<br>Add some discussion on appropriateness/ suitability of each of the determinative methods listed in 8.2.2. | Noted. Refer to text in Section 3 on Determinative methods |
| 15 | 8 | *Environmental consultant*<br>There are ACLs for Cr(III) but no analytical method provided for this metal species. This should be included.<br>Add analytical method for Cr(III) in soil in Section 8. | Methods are presented in sections 8.2 and 8.3 which are generally applicable to analysis of CrIII in soils |
| 15 | 8.1.1 | *Environmental consultant*<br>Paragraph 2, Comments on interferences from organic matter and other organics are already mentioned in section 11.13. | Noted |
| 11 | 8.2.1 | *Analytical laboratory services*<br>Table, US EPA method references.<br>It is recommended that the NEPM review committee reference latest versions of US EPA SW846 methods. | Agree, text changed |
| | **9** | **Halides** | |
| 4 | 9.1.2 | *Analytical laboratory services*<br>Line 2; Bromide - `with a suitable soil : water ratio'…. This statement needs | Noted |

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| | | tightening.<br>Everywhere else in the NEPM states a 1:5 soil water ratio. Bromide should be no exception. | |
| | **10** | **Non-metals (cyanide and sulfur)** | |
| 4 | 10.2 | *Analytical laboratory services*<br>Total S<br>Total (recoverable) S should also be allowed after an HN03/HCl digest and ICP as per other metals. Though this method won't include elemental S, we don't think this would be an issue as we would be reporting Recoverable S. | Noted |
| | **11** | **Organics** | |
| 47 | 11.2 | *Industry peak body*<br>MAH<br>*Move note regarding FID to 11.2.1 Preliminary screening* | Text amended |
| 47 | 11.3 | *Industry peak body*<br>Volatile halogenated compounds Add VHC to title | Text amended |
| 47 | 11.3 | *Industry peak body*<br>Volatile halogenated compounds Although water soluble and very volatile suggest adding oxygenate compounds specific to petroleum sites: methyl tertiary butylether (MTBE) and ethyl tertiary butylether (ETBE) | Noted |
| 37 | 11.5 | *Environmental consultant*<br>In many cases we will need to deal with volatile hydrocarbons retrospectively (for example, when including historical sampling results) and therefore both the old and new TPH/TRH fractions will need to be reported by the laboratories and considered. Alternatively, is there any acceptable method of converting the old TPH fractions to new TRH fractions?<br>Include additional guidance on how it might be acceptable to deal with historical results which have different fractions reported. | Noted |

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| 15 | 11.6 | *Environmental consultant*<br>Paragraph 3; Emphasise relevance to analysis of volatiles<br>Add: "...not limited to analysis of volatile hydrocarbons which … | Text amended |
| 11 | 11.8.1 | *Analytical laboratory services*<br>Table note; US EPA method 3550C uses an ultrasonic probe, not a bath. While the cooling of samples being extracted is appropriate, the reference to an ultrasonic bath is not. This provides endorsement for a method that uses much lower ultrasonic energy which is insufficient for the extraction of semivolatile organics.<br>It is recommended that the NEPM review committee delete any reference to "ultrasonic bath"on page 38, 40, 42, 44, 46, 48 and 51 | Text amended |
| 47 | 11.9 | *Industry peak body*<br>PAHs Suggest adding tetraethyl lead as an SVOC add on - most obvious is an add on to the PAH list (readily detectable by GCMS in full scan or SIM method) | Noted |
| 4 | 11.9.1 | *Analytical laboratory services*<br>Line 1; `ensure samples don't overheat, consider putting ice packs into ultrasonic bath '.<br>Ultrasonic baths are not considered appropriate for any organics. USEPA 3550c is for Ultrasonic extraction but only covers a horn probe, not a bath.<br>This applies to each organic method of NEPM that allows water sonication bath. | Text amended |
| 4 | 11.9.2 | *Analytical laboratory services*<br>`must be concentrated using a kuderna danish….'<br>This should say `or equivalent '. The NEPM shouldn't be so prescriptive when there are other recognised techniques available. | Text amended |
| 31 | 11 | *Environmental consultant* | Text amended where appropriate |

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|---|---|---|---|
| | | The reviewer's experience is that organic compounds may be identified by different names in different regions (for example, perchloroethylene and tetrachloroethene). The reviewer considers that this aspect has the potential to confuse readers regarding identification of guideline values for such compounds.<br>*Reviewer suggests that organic compounds in this section be identified by the appropriate CAS number as well as the compound name.* | (Eg CAS No 127-18-4) |
| 4 | 11.12.3 | *Analytical laboratory services*<br>Sample analysis section for OP's does not include ECD.<br>GC-ECD should also be a recognised technique in NEPM.<br>NEPM already references USEPA 8141 for OP's. Section 4.5 of USEPA 8141 states that `many of the OP pesticides may also be detected by the electron capture detector (ECD), however, the ECD is not as specific as the NPD or FPD. The ECD should only be used when previous analyses have demonstrated that interferences will not adversely effect quantitation, and that the detector sensitivity is sufficient to meet project requirements '.<br>As per discussions at the NEPM/Lab meeting in Melbourne 2009, the NEPM needs to be more performance based and less prescriptive. If a lab can prove a technique based on recognised performance such as proficiency testing then there should not be a problem.<br>In our case we follow strict QC procedures with OP's – OP's are confirmed by a second column, the retention times must match that of the standard in both columns and the concentration of the compounds should be approximately the same on both columns. If these criteria are met then we can confirm a result as positive. | See: Referenced methods and use of alternative methods |
| 15 | 11.13.1 | *Environmental consultant*<br>Re-emphasise that where silica-gel clean up is performed, the analysis should be referred to as TRH-silica, for consistency in the description of this extra step. | Text amended |

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| | | Add reference to "TRH-silica" method of analysis in or after this sentence, where silica-gel clean up is performed. | |
| 15 | 11.13.1 | *Environmental consultant*<br><br>Paragraph 2, Line 3; This sentence states that "...inspection of the chromatogram may reveal that the silica-gel clean up was not sufficient to remove the non-petroleum based hydrocarbons..." and recommends that "... GC-MS – or other appropriate analytical method....- is applied to the extract or silica gel cleaned sample to improve accuracy. It is important that a report and interpretation of the result is prepared by the analyst".<br><br>This paragraph infers that TRH with silica-gel clean up is conducted. Need to clearly state this.<br><br>Commercial labs conduct hundreds of TRH analysis daily. How many analysts actually take the time to review each chromatogram for the possibility that the extract has not been cleaned up adequately or that the sample may have high biogenic HC content? The lab only take instructions from the assessor. Hence, it is up to the assessor to provide clear instructions to the lab of the possibility of the false positive. Notwithstanding any instructions from the assessor, a good analyst who picks up any unusual profile should take it up immediately with the assessor, to seek some answers, so that immediate actions/ decisions can be taken to avoid unnecessary delay or re-work.<br><br>Also, aren't all lab reports signed off by an analyst? This sentence seems superfluous or the intent is unclear.<br><br>Add: "...inspection of the TRH-silica chromatogram may reveal that the silica-gel clean up was not sufficient to remove the non-petroleum based hydrocarbons..."<br><br>Emphasise in this paragraph, the need for:<br><br>- the analyst to be on the constant look out for unusual profiles/ results | Noted |

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|---|---|---|---|
| | | - the analyst to discuss unusual profiles/ results immediately with the assessor (preferably before the report is issued)<br>- the assessor to point out to the lab the possible interference/ false positives due to high biogenic HC content<br>Re-word this sentence to reflect the comments mentioned above. | |
| 15 | 11.13 | *Environmental consultant*<br>Paragraph 3, The definition of TRH is being related to its detection by "GC/FID in specified ranges". The detection method should not be relevant, rather the extraction and an appropriate detection method within the relevant HC range, as described in Section 15.1.1.<br>*Reword TRH definition in this section to be consistent with Section 15.1.1* | Text amended |
| 11 | 11.13.1.4 | *Analytical laboratory services*<br>Table; 8270D is an inappropriate reference in the bottom right-hand cell.<br>It is recommended that the NEPM review committee delete "8270D" from cell. | Removed |
| 47 | 11.14 | *Industry peak body*<br>Phenols Suggest adding xylenols (dimethylphenols) to target list | Noted |
| 47 | 11.15 | *Industry peak body*<br>Chlorinated herbicides Remove bentazon from target list | Text amended |
| 47 | 11.15 | *Industry peak body*<br>Chlorinated herbicides Remove nitrophenol from target list | Text amended |
| | **12** | **Leachable contaminants** | |

| Submitter number | Section | SCHEDULE B3 - Issue | Response |
|---|---|---|---|
| 15 | 12.1 | *Environmental consultant*<br>Paragraph 2, Line 5; Leachability results are usually evaluated against other parameters and site conditions, not just compared against other leachability results or criteria.<br>Replace: ".. to ensure that leachability test results can be (compared) evaluated accordingly" | Text amended |
| | **13** | **Bibliography** | |
| 17 | 13 | *Other*<br>As been pointed out under comment #3 above, NATA documents are being review and modified as required. The year of the documents being release changed all the time. Recommend to remove the issuing year from the reference.<br>*Remove year reference fo NATA Field application Document, Technical Note #23, Technical Note #17 and the GLP document.* | Noted and dates removed |
| 17 | 13 | *Other*<br>The name of the NATA GLP document is incorrect. The website address for NATA is also incorrect.<br>The name of the GLP document is 'What is GLP?' instead of 'What is this thing called GLP?'.<br>The website address for NATA shall be www.nata.com.au. | Text amended |
| 17 | 13 | *Other*<br>The USEPA method 1613B is not from the Office of Solid Waste but from the Office of Waters. Hence the it shall be label as SW846.<br>*Remove SW846 from the name.* | Text amended |
| 17 | 13 | *Other*<br>The method US EPA SW-846 Method 8015B is not up to date. The most up to date method is US EPA SW-846 Method 8015C. | Text amended |

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|---|---|---|---|
| | | *Change name to 8015C.* | |
| | **14** | **Appendix 1 CRC Care Technical Report 10 – Health Screening Levels for petroleum hydrocarbons in soil and groundwater (Summary Report)** | |
| 18 | 14 | *Other*<br>L20-24; L25-27; L32-34; L35-38; P62L3 & L15; P63 L41; P65 L12, L20, L24-26, L47-48<br>Appendix 1 refers to the CRC CARE summary report developed for the NEPM. The majority of the text has been copied and pasted. However, some elements of the text have been modified to refer to earlier Schedules and tables. This is confusing to the reader and detracts from the intent of Appendix 1.<br>It is proposed that the full text, including references and tables, of the CRC summary report (Friebel, E & Nadebaum, P 2010, Health screening levels for petroleum hydrocarbons in soil and groundwater. Summary for NEPC (DRAFT), CRC CARE Technical Report no. 10, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.) be placed into the Appendix 1 and not modified. | Noted – Section Removed |
| 47 | 14 | *Industry peak body*<br>L27-30 Consistency with schedule B1 is required with the soil categories. | Noted – Section Removed |
| 31 | 14 | *Environmental consultant*<br>; In the sub-section "Appropriate soil type" (page 63), reference is made to "loam". The reviewer notes that this soil type is not included in the Unified Soil Classification System (USCS), which is the industry standard for classification of soils. The reviewer suggests that references to soil types in this sub-section be made consistent with those of the USCS. | Noted – Section Removed |
| 15 | 14 | *Environmental consultant*<br>Section 14 is on HSLs and do not contain any component related to laboratory analysis of soil. | Noted – Section Removed |

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| | | *Remove this section.* | |
| 47 | 14 | *Industry peak body*<br>The HSLs have significant limitations and although specified as such there is no clarity on HSL limitations associated with analytical protocols | Noted – Section Removed |
| 47 | 14 | *Industry peak body*<br>The inclusion of the summary report for derivation and application of HILs for TRH (Appendix 1) seems somewhat redundant, and it could be asked why the TRH method is listed in detail in this schedule while no other methods are elaborated? | Noted – Section |
| | **15** | **Appendix 2 Determination of total recoverable hydrocarbons (TRH) in soil** | |
| 15 | 15 | *Environmental consultant*<br>Procedure No. 3; Need to maintain sample in a cool environment at all times. Some heat may be generated during this step, especially from the ultrasonicater.<br>Add a comments that the sample should be maintained in a cool environment during sampling and extraction. | Text amended |
| 4 | 15 | *Analytical laboratory services*<br>L21, "ultrasonic bath" is not acceptable as it provides insufficient energy to disaggregate samples.<br>It is recommended that the NEPM review committee replace with "ultrasonic horn type device" per US EPA 3550. These provide much more concentrated energy which is delivered as pulses. | Text amended |
| | | **General** | |
| 47 | | *Industry peak body*<br>Consistency of analytical procedures. All methods of analysis should be consistent with the analytical procedures used in the toxicity data on which the HILs are based, e.g. Not the case for Total cyanides and Free Cyanide vs | Noted. Where possible, the method of analysis is consistent with the toxicity data |

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| | | complexed cyanides (lower toxicity) | |
| 15 | | *Environmental consultant*<br>Good to see that a few more analytes are added to the list, and with TRH/TPH clarifications included.<br>With the maturing of contamination assessment, assessors are paying closer attention to the meaningfulness of the results (as they should be doing) and are likely to query laboratory analysts more often on the interpretation and integrity of the results, especially for "outliers". While there have been improving communication and expectations between assessors and laboratories, it would be useful to have some guidance or "ground rules" on what information or communication needs to happen for the requested results to be provided in a useful manner. This will add to the quality the results. | Addressed in Section 4.6, Analytical Report information |
| 4 | | *Analytical laboratory services*<br>How to sample Metals<br>There are two types of metals analysis offered by most Environmental Laboratories - Dissolved Metals and Total Recoverable Metals. In theory Dissolved Metals should be less than Total, however if the correct sampling technique is not employed then problems may arise. The correct preservation technique is vital, particularly for mining waters or other waters that are very high in elements like Iron and Aluminium.<br>Dissolved (Soluble) Metals - This is generally done for Ground Water and involves filtering the water sample through a 0.45µm filter.<br>Correct Technique - Client filters water through a 0.45µm filter on site into a Nitric Acid (HN03) preserved bottle. The client marks on the bottle that they have field filtered. The lab then runs this sample directly on receipt for Dissolved metals.<br>Alternate technique - If you have filters but don't have preserved bottle then filter directly into unpreserved bottle. You must mark on bottle and COC that you have done this. Staff at lab can then directly preserve this bottle, and let | Comment not applicable to Schedule B3 as it refers to sampling water not soil. Refer to section 8.2.4.4 Field filtration in Schedule B2 |

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| | | sit overnight. This is valid technique.<br><br>Total Recoverable (Acid Recoverable) Metals – This is generally done for Surface Waters, Drinking Waters, Trade Wastes and Industrial Waters.<br><br>Correct Technique – Client samples water directly into a Nitric Acid (HN03) preserved bottle. The client marks on the bottle this is for Total Metals. On receipt at the lab, staff will digest this preserved sample prior to analysis.<br><br>Alternate technique – If you do not have an acid preserved bottle then sample directly into an unpreserved bottle. Staff at the lab can then directly preserve this bottle, and let sit over-night. This is a valid technique. | |
| 4 | | *Analytical laboratory services*<br><br>The problem with ice - samples floating in a pool of contaminated ice water. This is a serious problem and ice should be banned. Only ice bricks should be used to minimize contamination and safety issues with transport. As long as consultants have gone to the effort of adding ice bricks then the samples are starting on the cool down cycle and so should be acceptable. | Preference for ice block or refrigerated cooler noted in text. |
| 31 | | *Environmental consultant*<br><br>References to NATA accredited laboratories/methods are not technically correct. NATA is an accrediting body which part of its scope is to issue ISO17025 accreditation for the laboratory management system and individual methods.<br><br>*Replace "NATA accredited" (and the like) with "ISO17025 accredited" throughout document.* | Text amended, accredited to ISO17025 (ie, by NATA or equivalent accrediting body) |
| 31 | | *Environmental consultant*<br><br>Schedule B3 appears to have been revised to allow for advances in laboratory analysis of petroleum hydrocarbons and associated fractionation of hydrocarbons, including distinction between petrogenic and non-petrogenic sources. This reviewer has no other general comment to make and agrees with the proposed structure of Schedule B3. | Noted |
| 47 | | *Industry peak body* | Noted. |

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| | | The Schedule B(3) while relevant to our business, is, we think, more critically addressed by laboratories that are performing these analyses on a day to day basis. I am aware that there has been a meeting with EPA and Victorian based laboratories, for example, to discuss the changes and presumably this is also occurring in other states.<br><br>A review of the proposed schedule suggests there is very little change to the overall approach and content of the schedule. The main changes appear to be the removal of method summaries, which is considered appropriate (it is not the purpose of the NEPM to produce a how to guide on sample analysis) and the addition of some methods, notably for TRH, dioxins &furans, hex chromium among others. There are numerous changes of minor import, such as sample storage temperature being increased to a recommended <6oC, up from 4oC, and some amendments to holding times (mostly, although not all, extending the acceptable times), which recognise industry sampling limitations and reality of obtaining representative samples. | |
| 23 | | *Stage government agencies*<br><br>Use of silica gel when analysing petroleum hydrocarbons: if the use of silica gel is optional, the reporting values will not be consistent among laboratories, and results could be interpreted as a false positive. So if one lab reports a TPH/TRH result with their method and the other lab reports the result by silica gel method, how can they be compared? Most likely, a request would be made to conduct silica gel clean-up so the two results can be comparable.<br><br>The NEPM should emphasise a need to consult the laboratory on the use of silica gel when analysing TPH/TRH in "dirty" samples to enable inter-laboratory comparisons and avoid unnecessary delays. | Noted, this should be clearly stated on the instructions to the laboratory and stated in the analytical report. |
| 15 | 14 | *Environmental consultant*<br><br>While it is recognised that this section is from the CRC publication, there should be clear guidance on the most appropriate methodologies for TRH/ TRH-silica analysis. There are a lot of common statements between this section and Sections 11.5 and 11.13. Section 15 is more complete and detailed in the analysis guidance. | Noted<br><br>Changes made as appropriate |

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| | | Incorporate Section 15 details into Sections 11.5 and 11.13, or combine all these into a separate section, or combine all these into a separate sub-section of Section 11. | |

## APPENDIX F – Issues and responses – Schedule B4

| Submitter number | Section | SCHEDULE B4 - ISSUES | RESPONSE |
|---|---|---|---|
| | 1 | **INTRODUCTION** | |
| 25 | 1.1 | *Environmental consultant*<br>First dot point would read better as 'establish the fundamental principles of risk assessment as they relate to contaminated land decision making in Australia to ensure the protection of human health'.<br>Third dot point—insert 'the' after 'deriving' | Addressed |
| 47 | 1.2 | *Industry peak body*<br>1—Providing guidance on the development of response levels should be within the scope of the schedule …at a site given the proposed land use ***and to aid in decision making with regard to the end-point for remedial works*** | Addressed |
| 47 | 1.3 | *Industry peak body*<br>1—No observable impact relates only to threshold compounds<br>...considered to result in no ***significant*** observable impact to health | No change |
| 47 | 1.3 | *Industry peak body*<br>2—If there is an "obvious" problem risk assessment is still useful in providing criteria for clean-up<br>a complex assessment is not required ***although methodologies proposed herein may be useful in determining the extent of remedial works required in such cases.*** | Addressed in text already |
| 47 | 1.3 | *Industry peak body*<br>2—It is not the whole QRA process that is reversed (issues identification is not the last step of estimating "tolerable" concentrations). A clearer statement of response level derivation is required. | Text has been changed to include that suggested |

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| | | In a forward assessment, the risks associated with a measured contaminant concentration are estimated by comparing a modelled dose that a receptor may receive with a dose considered to result in no significant observable impact to health. It is possible to undertake the modelling in reverse, starting with the dose considered to result in no significant observable impact to health, and back-calculating "tolerable" contaminant concentrations at the site. These concentrations can then be used... | |
| 47 | 1.3 | *Industry peak body*<br>2—More detailed discussion of how a reverse assessment is performed is not included in the schedule. Could such a discussion be included? | Noted. Refer to Schedule B7 for guidance |
| 25 | 1.3 | *Environmental consultant*<br>Terminology<br>The use of the term 'precision' is not ideal. As uncertainty decreases, confidence in the risk assessment is increased (not reduced). | Addressed |
| 31 | 1.4.1 | *Environmental consultant*<br>p2; Level of detail about sub-populations who may have pica, seems out of place. Delete from here. Possibly include in glossary. Formatting: missing close bracket. reformat sentence | Noted |
| 47 | 1.4.1 | *Industry peak body*<br>2—More detail is required regarding the limitations of the HILs<br>After 1st para:<br>***They are defined for specific land uses and will not necessarily be protective for other land uses.***<br>***There are a number of assumptions (for example relating to site geology or the nature of exposure) built into the HILs, and careful review should be undertaken to determine whether these assumptions are appliacable on a given site.*** | Addressed |

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| | | ***The absence of an HIL for a specific COPC does not indicate that no potential risk is posed; site-specific risk assessment may be required.*** | |
| 47 | 1.4.1 | *Industry peak body*<br>2—Make mention of the HSLs for petroleum hydrocarbons?<br>presented in B7. ***Health screening levels (HSLs) have been separately developed for petroleum hydrocarbons by CRCCare.*** | Addressed |
| 31 | 1.4.1 | *Environmental consultant*<br>2—Level of detail about sub-populations who may have pica, seems out of place. | Addressed |
| 47 | 1.4.1 | *Industry peak body*<br>2—2nd para indicated that "Levels marginally in excess of the HILs do not imply unacceptability or that a significant health risk is likely to be present. Similarly, levels less than the HILs may not imply acceptability or that a significant health risk does not exist for a sensitive sub-population..". Comments: The statement creates ambiguity in term of the applicability of the HILs.<br>Include a discussion and guidance in how the "sensitive sub-populations" are addressed using the HILs based on the land use categories. | Noted—no change |
| 47 | 1.4.2 | *Industry peak body*<br>3—Site geology is part of the conceptual site model, even at an early tier<br>Extra bullet after bullet 3:<br>**** The physical properties associated with the geology and hydrogeology underlying the site*** | Addressed |
| 31 | 1.4.3 | *Environmental consultant*<br>p3; "In turn, the precision of the RA process may be reduced"—Sentence is unclear. Provide clarification of reduced precision and where/why it may occur. | Addressed—reference to precision removed as not relevant |

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|---|---|---|---|
| 25 | 1.4.3 | *Environmental consultant*<br>p3; Use of term 'precision' not ideal<br>As uncertainty decreases, confidence in the risk assessment is increased (not reduced). | Addressed |
| | 2 | **THE AUSTRALIAN RISK ASSESSMENT FRAMEWORK** | |
| 28 | 2.1 | *Environmental consultant*<br>There is little context provided regarding how the enHealth documents inform the NEPM with respect to contaminated land assessments. Further, the new Draft enHealth 2010 Environmental health risk assessment document was not available so it cannot be reviewed against B4 content | Noted—the enHealth revisions were considered in conjunction with the B4 revision |
| 28 | 2.1 | *Environmental consultant*<br>Additional text should be included regarding whether the NEPM takes precedence over the enHealth guidance with respect to contaminated land. | Noted - not relevant in NEPM document |
| 28 | 2.1 | *Environmental consultant*<br>Reliance on US EPA.<br>There is a strong influence of US EPA approaches—previous NEPM (Australian) work should be used and extended. | Noted |
| 47 | 2.1 | *Industry peak body*<br>4—"environmental health" is confusing wording in this context. Implies health of the evironment. Suggested wording:<br>...a national approach to undertaking h***uman health risk assessments associated with environmental hazards,*** reprinting… | Addressed |
| 47 | 2.1 | *Industry peak body*<br>4—Note that this is superseded by the NEPM of which this schedule forms a part | Addressed |
| 47 | 2.1 | *Industry peak body* | Noted - document is not referenced in B4 |

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|---|---|---|---|
| | | 4—enHealth draws heavily on NHMRC, 1999 for carcinogenic assessment.<br>c.f. Toolbox doc Schedule B4 Cancer Methodology. This doc states that NHMRC, 1999 is rescinded, but it is indicated as current on NHMRC website. What is the current status of this doc, and are there any schedules or associated docs superseding this? It's status should be clarified, given the extent to which it is referenced in enHealth. Extra bullet: ***NHMRC, 1999. Toxicity Assessment for Carcinogenic Soil Contaminants*** | |
| 47 | 2.1 | *Industry peak body*<br>5—It is not clear from section 2.1 why the enHealth framework is being discussed.<br>Suggest tying this section into the next by finishing 2.1 with:<br>***As discussed in Section 2.2, the framework presented in enHealth forms the basis for the risk assessment framework adopted in this schedule.*** | Addressed |
| 47 | 2.2 | *Industry peak body*<br>Terminology<br>The text would be better phrased as to enable the comparison of potential health 'benefits' of various remedial technologies. While both impacts and benefits of different remediation technologies can be assessed and compared, better to highlight the aim of remediation as beneficial. i.e. rephrase so that the primary decision drivers for remediation are on the remedial outcomes, rather than secondary items. | Addressed |
| 25 | 2.2 | *Environmental consultant*<br>p5; Dot point 4—Better phrased as to enable the comparison of potential health 'benefits' of various remedial technologies.<br>While both impacts and benefits of different remediation technologies can be assessed and compared, better to highlight the aim of remediation as beneficial. | Addressed |
| 47 | 2.2 | *Industry peak body* | Addressed |

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|---|---|---|---|
| | | 5—The derivation of tolerable concentrations is not required on all sites, and is done when required after the assessment of baseline risks. Move to be the third bullet, and add "***if required***". | |
| 47 | 2.2 | *Industry peak body*<br>5—More context is needed with regards to the relative status of the NEPM and enHealth with regard to contaminated sites<br>Here or at the end of 2.1: ***This schedule is intended to provide guidance specific to a contaminated land context. Therefore, in the assessment of contaminated sites, it is the intent of this schedule to take precedence over the enHealth framework, and documents referenced therein, where there are contradictions; it is noted that the enHealth framework has a wider remit than the assessment of contaminated sites only, and elements of the guidance will not be relevant to a contaminated sites context.*** | Addressed |
| 31 | 2.2 | *Environmental consultant*<br>5—What is the onus on consultants to reveiw and revise risk assessments, based on new information, where HRA have already been issued? Are we to recind all previous assessments when a new tox value is developed?? | Addressed |
| 47 | 2.2 | *Industry peak body*<br>5 1st para, 3rd dot point indicated that "The risk assessment process for contaminated land is intended to ….to establish the baseline risks and determine whether site remediation is required.". Comments: there were no further discussion of the baseline risks in the schedule. Include a discussion or guidance of the establishment of the baseline risks in relation to the "forward" and "backward" risk assessment process (including the application of the HILs), as discussed in Section 2.4.3.. | Noted |
| 31 | 2.2 | *Environmental consultant*<br>p5; What is the onus on consultants to review and revise risk assessments, based on new information, where HRA have already been issued? Are we to rescind all previous assessments when a new tox value is developed?? | Addressed |

| Submitter number | Section | SCHEDULE B4 - ISSUES | RESPONSE |
|---|---|---|---|
| 28 | 2.2 | *Environmental consultant*<br>p5, The first objective listed in the risk assessment process for contaminated land is "to determine tolerable levels of contaminants...". The derivation of 'tolerable levels of contaminants;' (i.e. risk-based criteria) is not required on all sites, and is generally undertaken after the assessment of baseline risks if required. | |
| 28 | 2.2 | *Environmental consultant*<br>This may be one objective of the risk assessment process. Could change the preceding wording to say the that the "typical objectives of the risk assessment process for contaminated land include….". Or, could move the first bullet point to third and add "...if required". | Addressed |
| 28 | 2 | *Environmental consultant*<br>p6, Figure 1, Risk communication based on previous enHealth guidance commences at the beginning and is involved throughout the HRA process. | Addressed |
| 27 | 2.2 | *Environmental consultant*<br>Figure 1, We note the incorporation of a preliminary step to establish the contextual framework of the assessment and to drive the inclusion and revision of a conceptual site model throughout the risk assessment process. We consider this to be an appropriate inclusion as all such reports need to be considered in context and in the light of an appropriate conceptual model. | Noted |
| 31 | 2.3 | *Environmental consultant*<br>9, Figure 2. Example does not make sense, Check diagram for consistency in regards to potential sources, transport mechanism, pathways and receptors. (e.g. Wind erosion is marked as a potential transport mechanism with source. Receptors are inconsistent.) | Both Figures 2 and 3 are examples only |
| 25 | 2.3 | *Environmental consultant*<br>Fig 2; p9; Purpose of the reverse arrow—For example, how is potable water use connected to leaching and groundwater transport. Clarify | Addressed |

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|---|---|---|---|
| 47 | 2.3.1.1 | *Industry peak body*<br>List of stakeholders<br>Include "land developer". | Addressed |
| 47 | 2.3.1.1 | *Industry peak body*<br>Terminology<br>The term 'telecommunication' more relevant currently and in the future than 'telephone'. | Addressed |
| 31 | 2.3.1.2 | *Environmental consultant*<br>8, "managers" needs clarification | Addressed |
| 15 | 2.3.1.2 | *Environmental consultant*<br>p8; The title "Problem formulation" seems pretentious and is not particularly clear.<br>Perhaps renaming it "defining the objectives" or "defining the scope" would be better. | The terminology 'problem formulation' is consistent with that used in enHealth and has not been changed |
| 15 | 2.3.1.2 | *Environmental consultant*<br>p8; This section does not seem to fit well into the flow diagram Figure 1.<br>Consider incorporating this step clearly into figure 1 or rename the section so it is more aligned with the "Data Evaluation" step in the flow diagram. | Addressed |
| 15 | 2.3.3 | *Environmental consultant*<br>p10<br>Very busy diagram that is difficult to understand and adds little to understanding the process.<br>Either remove the figure or provide a simplified diagram. Some text in the NEPM that refers to the scoping step should be provided and that could potentially refer to this figure. As it is, the only reference to figure 3 is a footnote on figure 2. | Figure 3 is for example only and the text above the Figures has been updated for improved referencing. |

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| 15 | 2.3.3 | *Environmental consultant*<br>p8; First point—the contaminants should also consider the physical and chemical nature of the contaminant and its potential to partition in the environment and the bioavailability of the contaminant | Addressed |
| 47 | 2.3.3 | *Industry peak body*<br>8—Above-ground site characteristics missing<br>After bullet 2:<br>***Physical characteristics above-ground: sizes and locations and structures of current or furture buildings (if known); nature, size and location of outdoor spaces on and off-site as relevant*** | Addressed |
| 47 | 2.4 | *Industry peak body*<br>11—Discussion of tiered approach.<br>Provide clarity in relation to adopting the "forward" and "backward" risk assessment process (as discussed in Section 2.4.3) in the tiered approach. Both approaches can be employed in the tiered approach to risk assessment. | Addressed where relevant |
| 47 | 2.4 | *Industry peak body*<br>11, the word "significant" is used throughout schedules but no clarification is given as to what this actually means. Interpretations of what is 'significant' will vary greatly!, Clearly define | Addressed in the document where possible |
| 47 | 2.4 | *Industry peak body*<br>11, Only HILs are mentioned. Are other levels also relevant here? i.e. HSLs?, clarify or define | Addressed |
| 15 | 2.4.1 | *Environmental consultant*<br>p11; Explanations are very generic (to be expected).<br>Perhaps a figure would help explain what is in words. | Noted |
| 18 | 2.4.1.1 | *Other* | Addressed |

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| | | P11 L6 & L7; HSLs are not included alongside HILs. Alter sentences to 'HILs and HSLs' in both instances. | |
| 47 | 2.4.1.1 | *Industry peak body*<br>11—Should expand on "that should be understood" to indicate what needs to be understood.<br>a variety of circumstances. ***The assumptions on which the HILs are based (including site conditions and the exposure scenarios) should be understood in order to determine whether the HILs are applicable for a given site.*** Exceedances... | Addressed |
| 47 | 2.4.1.1 | *Industry peak body*<br>11—More detail would be beneficial<br>…including HILs)***, for example if:***<br>**** there are no risk based guidance levels for a particular contaminant identified at the site; or***<br>**** the land use applicable to the site is not covered by the risk-based guidance levels***<br>**** the physical characteristics (e.g. geology, hydrogeology) of the site are such that the risk-based guidance levels may not be sufficiently conservative.*** | Addressed |
| 47 | 2.4.1.2 & 2.4.3 | *Industry peak body*<br>11 & 13—Development of site-specific target level (SSTL). Comments: SSTL implies a "target" value for remediation which generally take into consideration risks to receptors other than humans at the site. The term SSTL does not appear to be fully consistent with the purpose of Schedule B4, which focused on assessment of human health risks and the intent of HIL development (as discussed in Section 1.4.1, 2nd para). Comments: The HIL is similar to regional screening levels (USEPA) and soil guideline value (MfE New Zealand and UK's DEFRA). The process for developing the site-specific value should be consistent with the process adopted in the development of HIL which "may be used for further assessment or to provide a basis for clean | Addressed |

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| | | up (as indicated in Section 2.4.3).<br><br>Consider replacing site-specific target level (SSTL) with other terminology such as site-specific risk based levels, site-specific HILs (to differentiate from NEPM HILs) etc. | |
| 31 | 2.4.2 | *Environmental consultant*<br><br>12, Averaging groundwater concentrations would be inappropriate when determining whether groundwater extraction was suitable at a site. This should probably be mentioned at other sections of the schedule, state in text | Addressed in section 3.4.4 |
| 28 | B4–7, 2.4.3, 5.9 | *Environmental consultant*<br><br>13, 57–59, Although it is listed as an objective of risk assessment for contaminated land, no detailed guidance is given for derivation of clean-up levels or threshold concentrations in this schedule. This is particularly significant with respect to the adoption of an ILCR of 1x10-5 for derivation of a criterion, which therefore allows the presence of only one threshold chemical at the site. Further guidance and discussion on the derivation of site-specific criteria should be provided. | Noted |
| 47 | 2.4.3 | *Industry peak body*<br><br>13—No detailed guidance given for clean-up target derivation in this schedule | Noted—the methodology included in Schedule B7 for the derivation of HILs should be considered. |
| | 3 | **DATA COLLECTION AND EVALUATION** | |
| 47 | 3 | *Industry peak body*<br><br>7—It is not the whole QRA process that is reversed (hazard identification is not the last step of deriving HSLs). The arrows on the figure are misleading, and it would be more helpful to present a separate figure / separate wording detailing the process.<br><br>In a forward assessment, the risks associated with a measured contaminant concentration are estimated by comparing a modelled dose that a receptor may receive with a dose considered to result in no significant observable impact to health. It is possible to undertake the modelling in reverse, starting with the dose considered to result in no significant observable impact to | Addressed |

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| | | health, and back-calculating "tolerable" contaminant concentrations at the site. | |
| 25 | 3.2 | *Environmental consultant*<br>p14; Descriptions of site-specific variables is helpful. A description of other common site-specific variables such as soil moisture would also be beneficial. | Noted and extra dot point included for moisture content |
| 15 | 3.2.1 | *Environmental consultant*<br>p14; In the case of PAHs the source of the PAHs has a significant bearing on its availability. Eg coal tar sources may be 100% bioavailable but PAHs in ash may be several orders of magnitude less available.<br>Mulvey, P J and McKay, C (2006) "Source characterization and identification as a means of assessing the type of bonding in the soil and its subsequent impact on bioavailability". Land Contamination & Remediation 14(2): 412-425. | Generally addressed |
| 47 | 3.2.1 | *Industry peak body*<br>14—Toxicity data are not strictly only available for specific substances.<br>Toxcity data are ***generally*** only available | Addressed |
| 47 | 3.2.1 | *Industry peak body*<br>14—Assessing specific substances for complex mixtures isn't possible in practice, and would result in portions of the contamination remaining unassessed.<br>Suggest rewording final lines of para.<br>...only for specific substances. ***For certain complex mixtures commonly found on contaminated sites (e.g. petroleum hydrocarbons as discussed in Section 4.8.3, PAHs and PCBs as discussed in Schedule B7, Appendix A2) there are established ways of mitigating this problem, which provide the preferred way of assessing these mixtures. On sites where the contamination can be fully defined by reference to individual specific substances (for which toxicity data is available), it is preferable to assess these specific substances.*** | Addressed |
| 47 | 3.2.1 | *Industry peak body* | Addressed |

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| | | 15—This para implies substance specific breakdown of TPH, father than fractionation.<br><br>Chemical analyses providing detailed ***breakdowns for groups of organic compounds into individual sustances (e.g. PAH), or a limited range of individual "indicator" compounds plus fractions containing groups of compounds with similar physicochemical properties (e.g. TPH) are commercially available. It is commonly necessary to undertake such analyses of mixtures in order to understand the mixture sufficiently to assess risk, because*** individual compounds within these groups have very different physiochemical | |
| 47 | 3.2.1.1 | *Industry peak body*<br><br>15—Speciation is not the only factor contributing to toxicity, and this won't apply for all metals/species<br><br>heavy metals ***can be highly*** dependant | Addressed |
| 47 | 3.2.1.1 | *Industry peak body*<br><br>15—Should leachability of metals be discussed here or in a separate para?<br><br>For a particular metal, partitioning between soil and porewater is dependant upon various geochemical parameters of the soil and porewater, and the form in which the meal is present within the soil. As such, the use of leachate parameters to assess this pathway has its limitations. Where it is necessary to model the partitioning of metals into porewater as part of a risk assessment, there can be value in undertaking leachate testing in the laboratory to achieve a site-specific estimate of the partition coefficient. EPA/600/R-05/074 2005 presents a range of literature values and provides a discussion of the issues and uncertainties | Noted |
| 31 | 3.2.1.1 | *Environmental consultant*<br><br>15, 'heavy' metals is an outdated expression.<br><br>Delete 'heavy' throughout the document in reference to metals | Addressed |
| 31 | 3.2.1.2 | *Environmental consultant* | Addressed |

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| | | 15—Unclear on applicability of relationship to iron for all geologies and regions. | |
| 47 | 3.2.1.3 | *Industry peak body*<br>15—Should highlight that :<br>a) ambient air measurements will include background sources<br>b) ambient air guidelines are not necessarily developed in accordance with the guidelines for toxicity assessment presented in this schedule, and should not be used as toxicity data defining an acceptable exposure concentration in a contaminated sites risk assessment | No change—addressed elsewhere |
| 31 | 3.2.2.1 | *Environmental consultant*<br>16, "sufficient" is not defined or a reference given to help user do this, define or provide reference | Addressed |
| 47 | 3.2.2.1 | *Industry peak body*<br>16—Not true for all contaminants<br>...adsorb to soil particles. ***For organic compounds, which sorb most readily to organic carbon within soils, the*** partition coefficient… | Addressed |
| 47 | 3.2.2.1 | *Industry peak body*<br>16—Not true for all contaminants<br>…water in soil. ***For organic compounds, the*** relationship… | Addressed |
| 47 | 3.2.2.1 | *Industry peak body*<br>16—The source zone is the crucial soil type to be characterised, as this is generally where partitioning from the soil is modelled. It may also be necessary to characterise the aquifer if pathways of groundwater flow are to be modelled.<br>…each soil type being characterised, ***with particular focus on characterising soils representative of the source zone (but not using impacted samples taken*** | Noted |

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| | | ***from the source itself), and the aquifer (if pathways of groundwater flow are to be modelled).*** | |
| 31 | 3.2.2.2 | *Environmental consultant*<br>16, Listed key parameters are not always required / available.<br>Change "are required" to "may be required" | Addressed |
| 15 | 3.2.2.2 | *Environmental consultant*<br>p16; The presence of physical barriers or conduits should be considered | Addressed |
| 15 | 3.2.2.2 | *Environmental consultant*<br>16—Should the guideline specify preference for site-specific measurement of both groundwater elevations (in order to calculate flow-direction and hydraulic gradient) and hydralic conductivity (used together with hydraulic gradient and effective porosity to calculate groundwater velocity)? These parameters can be highly site-specific, and the potential for off-site migration can be highly dependant on them. | Noted |
| | 3.2.2.2 | *Industry peak body*<br>16—Does schedule B2 specify permeability testing (e.g. RHT)? Should it? | Noted |
| 31 | 3.3.1.1 | *Environmental consultant*<br>17, Silica gel removes polar compounds which includes natural organics, but also includes some weathered petroleum hydrocarbons.<br>Change "removes natural" to "removes polar" | Addressed |
| 47 | 3.3.1.3 | *Industry peak body*<br>17—HIL not necessarily available<br>...Tier 1 screening level***, if one is available***. | Noted |
| 47 | 3.3.1.4 | *Industry peak body*<br>17—Does this imply that off-site measurement is usually required?<br>exposed to it. ***If potential receptors are present off-site, it may be more*** | Addressed |

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| | | ***appropriate to determine whether a potential pathway to these receptors exists by assessment of on-site data prior to collecting data at the point of exposure for off-site receptors.*** | |
| 47 | 3.3.4 | *Industry peak body*<br>18—Applicability dependant on land use scenarios / site conditions<br>...the HILs ***(where available and appropriate)*** will be used... | Addressed |
| 47 | 3.3.4 | *Industry peak body*<br>19—6th para, 2nd dot point. Justifications for 'no further assessment' based on Tier 1 screening criteria which include 1) 95%UCL of arithmetic mean not exceeding Tier 1 criteria, 2) standard deviation not exceeding 50% of the Tier 1 criteria, and 3) no single vale exceeds 250% of the Tier 1 criteria. Comments: The combination of the above three conditions may be too conservative given 1) the current NEPM applies arithmetic means and not the 95% of the arithmetic mean in combination of the other assessment criteria; 2) Example on how the UCL 95% of the arithmetic mean for comparison to screening criteria is provided in the NSW sampling design guidelines (NSW DEC 1995), where the standard deviation was used in the calculation of the UCL95% of the arithmetic mean, but not used as a criterion for comparison with the screening criteria.<br>Options, in the absence of statistical justification, include: 1) use of the three conditions stipulated in the current NEPM document where the arithmetic mean and not the 95% UCL of the arithmetic mean is used; or 2) calculate and apply the UCL95% of the arithmetic mean concentration based on the NSW sampling design guidelines with the condition that any value exceed 250% of the screening criteria is considered as a "hot-spot" that required further assessment.<br>Further guidance is required to clarify if these assessment criteria is also applicable to the Tier 2 value (i.e.. site-specific risk-based value) developed for a particular site. | Addressed—section has been made consistent with Schedules B1 and B2 |
| 27 | 3.3.4 | *Environmental consultant* | Addressed by better defining what are used in Australia as Tier 1 values |

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| | | p.19 Lines 14 to 45, There is discussion that "marginal" exceedences of generic HILs may not require quantitative Tier 2 assessments and there is reference to the statistical assessment of site data relative to HILs. In Schedule B1, there are now interim HILs for volatile compounds in air (Table 1A(2)). It is my understanding that the statistical approach described ("hotspot assessment") is relevant to soil samples for which the HIL guidelines presented in Schedule 1, Table 1A(1) are presented due to the assumptions inherent in the derivation of these criteria and would not necessarily apply to vapour measurements. Similarly, total petroleum hydrocarbons are not listed in Table 1A(1).<br><br>There is a risk that application of this method by people who have not familiarised themselves with the assumptions behind the development of particular HILs may result in the misapplication of this strategy.<br><br>Clarification of the application of the "no further assessment" criteria the HILs derived for volatile compounds and total petroleum hydrocarbons and in media other than soil. | |
| 47 | 3.3.4 | *Industry peak body*<br><br>P19 L5—'This should be undertaken by suitably qualified professionals'<br><br>Please provide more guidance as to who is considered as suitably qualified professionals. | Noted - refer Schedule B8 |
| 6 | 3.3.4 | *Environmental consultant*<br><br>Hotspots<br><br>More explanation and justification is required why 'hotspots' are to be removed from the data set as stated in page 20. It should be noted that 'hotspots' should not be construed as an 'outlier' without careful evaluation of the data quality and variability as it would affect the outcome of the risk assessment. As defined by the USEPA's "Guidance for Data Quality Assessment. Practical Methods for Data Analysis. EPA QA/G-9 QA00 UPDATE" (2000), outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Outliers may result from | Addressed—and included suggested reference |

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| | | transcription errors, data-coding errors, or measurement system problems such as instrument breakdown. However, outliers may also represent true extreme values of a distribution (for instance, hotspots) and indicate more variability in the population than was expected. Not removing true outliers and removing false outliers both lead to a distortion of estimates of population parameters.<br><br>In view of the above, risk assessors should justify and document in the risk assessment if 'outliers' are to be remove or not from the data set. The USEPA (2000) recommends the following five steps in treating extreme values or outliers:<br><br>1. Identify extreme values that may be potential outliers;<br><br>2. Apply statistical test;<br><br>3. Scientifically review statistical outliers and decide on their disposition;<br><br>4. Conduct data analyses with and without statistical outliers; and<br><br>5. Document the entire process.<br><br>The USEPA 2000 can be downloaded from http://www.clu-in.org/conf/tio/pasi_121603/g9-final.pdf | |
| 25 | 3.3.4 | *Environmental consultant*<br><br>p19; If it is necessary to create HIL equivalent screening criteria it is noted the work should be conducted by a 'suitably qualified professional'. Is a 'suitably qualified professional' a toxicologist as mentioned in other sections of Schedule B4? Reference to a 'suitably qualified scientist' is also made in Section 5.4.1 however no definition is provided. Clarify. | Addressed where relevant |
| 25 | 3.3.4 | *Environmental consultant*<br><br>p19; Statement 'marginal exceedances may not require quantitative Tier 2 risk assessment to conclude that further assessment is not necessary' is helpful and could potentially save significant effort and cost. Endorse. | Noted |
| 47 | 3.3.4 | *Industry peak body* | Addressed |

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| | | 20—should "toxicity reference values" be replaced by "risk-based screening criteria"? | |
| | 4 | **EXPOSURE ASSESSMENT** | |
| 47 | 4 | *Industry peak body*<br>21, No mention has been made of the possibility that impact in the subsurface may be brought to the surface doing redevelopment of a site, Include comment/limitation | Addressed |
| 47 | 4.1 | *Industry peak body*<br>21—Physicochemical properties not included in list Insert as 2nd bullet:<br>* ***determine physicochemical properties for contaminants*** | Addressed |
| 47 | 4.2.2 | *Industry peak body*<br>23—This should be worded differently. Suggests HIL input parameters are "primary". More emphasis should be placed on the selection of input values appropriate to the site. c.f. Section 2.4.2 and following paragraph. | Text revised |
| 47 | 4.2.3 | *Industry peak body*<br>24—Comment that background exposure must be accounted for where it may contribute towards exposure to threshold contaminants. For carcinogenic contaminants, incremental risks above background are assessed and there is no need to account for background exposure in the assessment of risks?<br>Reference Section 5 for further dicussion. | Addressed with some revisions. Note also the information provided on a chemical-specific basis in the appendices to Schedule B7. |
| 47 | 4.3 | *Industry peak body*<br>24—There should not be a preference for indoor air measurements where these may be affected by background sources. | Addressed |
| 15 | 4.3 | *Environmental consultant*<br>p25; Point 5 should also include eggs | Addressed |
| 28 | 4.3 | *Environmental consultant* | Addressed in Section 4.4.2 |

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| | | p24, Although indoor air samples may provide an indication of the exposure concentration for a person in that environment, it may not be the preferred method and exposure assessment in risk assessment for contaminated land. The information should be used in conjunction with other measurements such as sub slab and soil gas, as indoor air measurements may be affected by background sources. It must be recognised that indoor air concentrations are point in time values and hence considerable repeat sampling under a variety of ambient atmospheric conditions may be need to adequately characterise the exposure concentration using this approach.<br><br>The consideration of background is particularly important with respect to indoor air samples and should be discussed further in section 4.4.2. The consideration of differences in ambient atmospheric conditions on indoor air samples and the need for multiple event sampling to accommodate for this should also be considered. | |
| 28 | 4.4 | *Environmental consultant*<br><br>25—Vinyl chloride<br><br>Vinyl chloride in soil vapour has been found at Australian sites - what review for Australian conditions has been undertaken? | Noted - no change necessary as the text is to just identify that VC behaves differently than other chlorinated compounds |
| 15 | 4.4.1 | *Environmental consultant*<br><br>p25; Point 2: if comment 12 was adopted with an equation, then this point should also have an equation describing the relationship.<br><br>Insert equation 2 of United States Environmental Protection Agency (US EPA), February 2004, Users guide for evaluating subsurface vapour intrusion into buildings. | Noted - not required |
| 44 | 4.4.1 | *State government agencies*<br><br>The principle of applying soil saturation concentration to the movement of molecules through the soil is recognised. However in the wet-dry tropics with approximate 2 metres of rainfall over an average wet season it would be impossible to achieve an accurate and consistent assessment of total recoverable hydrocarbons (TRH) in soil gas. This poses challenges for the NT | Noted. Discussion on the affects of environmental factor is provided in Schedule B2 Section 9.3.5. Dry season sampling results are likely to be more reliable for consideration of vapour risks. |

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| | | given that most of the contaminated sites tagged for redevelopment are historically associated with the petroleum industry.<br><br>Regional Case studies to be developed prior to finalisation so to assist in the development of region specific fate and transport model in the differing climatic regions of Australia | |
| 15 | 4.4.1 | *Environmental consultant*<br><br>p25; Point 1: This point should be supported by a reference. It appears too simplistic. My understanding is that the Kd relates to partitioning between soil and water and therefore is strictly speaking irrelevant to air/soil partitioning (though it probably is somewhat similar).<br><br>Removal of the phrase "described by ….." to the end of the sentence and replacement with "described by a function of soil concentrations, Henry's law coefficient, soil/water portioning coefficient (Kd) soil bulk density, soil water filled porosity and soil air filled porosity"<br><br>You could consider inserting equation 1 of United States Environmental Protection Agency (US EPA), February 2004, Users guide for evaluating subsurface vapour intrusion into buildings. | Addressed |
| 47 | 4.4.1 | *Industry peak body*<br><br>25—Disagree with this definition. Agreed that these are good determinands, but the criteria for VP rules out volatile contaminants (including naphthalene).<br><br>Propose:<br><br>a. Henry's Law Constant of >10-5 atm $m^{-3}$ $mol^{-1}$<br>b. Vapour Pressure of >0.05 mmHg<br>For a detailed disussion please refer to separate word doc "Definition of volatility". | No change to the fundamental criteria but added in the requirement to also consider toxicity—which then brings in naphthalene and some other compounds. |
| 47 | 4.4.1 | *Industry peak body*<br><br>25—There should not be a preference for indoor air measurements where these may be affected by background sources. | Addressed |
| 47 | 4.4.1 | *Industry peak body* | Addressed |

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| | | 25—It is indicated that "the most appropriate approach to quantification of these exposures (exposure to volatiles) is to utilise direct measurements of indoor or ambient air."<br><br>Comments: the most appropriate approach should be determined on a site-specific basis.<br><br>Replace the "most appropriate" approach by the "most direct" approach. | |
| 47 | 4.4.1 | *Industry peak body*<br><br>26—This is the right conclusion. Earlier paragraphs are confusing/contradictory. Suggest start with conclusion that soil vapour is the preferred route, and then reference a good methodology.<br><br>Reference should also be made to the fact that an assessment of soil gas data is only as good as the data. Assessment from soil/groundwater is not necessarily "more uncertain" if the soil and groundwater data gives better coverage of the source/site or if soil gas data does not meet DQOs. Soil vapour data is only better if it is representative of soil vapour concs applicable to the exposure scenario. If it isn't (e.g. wrong depths, insufficient samples, trend/seasonal variation not assessed, soil vapour measured in open ground to assess future below slab concentrations), soil and groundwater data may be better to use. This issue with soil vapour data is discussed well in CRCCare Petroleum HSL docs. | Addressed |
| 47 | 4.4.2 | *Industry peak body*<br><br>26—As discussed above, indoor air measurements are rarely the most practicable method in contaminated sites assessment. | Addressed |
| 29 | 4.4.2 | *Industry*<br><br>p26; Comment #1 is supported by modelled results using the API BioVapor model (as cited, section 4.4.2). Both the BioVapor model and the exclusion distance concept are in consideration for revised petroleum vapour intrusion guidance in preparation by USEPA Office of Underground Storage Tanks.<br><br>Suggested USEPA Contact (Petroleum Vapor Intrusion Guide Project | Noted and addressed generally in the petroleum section |

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| | | Manager):<br>Matt Young, USEPA, Young.Matthew@epamail.epa.gov<br>+1 (703) 603-7143<br>For updates of USEPA Guidance progress. | |
| 47 | 4.4.4 | *Industry peak body*<br>27—Agree that modelling of finite conditions should be allowed for where appropriate | Noted |
| 28 | 4.4.4 | *Environmental consultant*<br>p27, Model validation, It should be stated that the JEM is not a completely field validated vapour intrusion model and predictions are highly variable. The development of HSLs has used a vapour intrusion model (JEM) that is not validated ensuring significant uncertainty in the establishment of screening numbers that are designed to be protective of human health and the author of the model in peer review has indicated not to use the model for criteria development. | Noted. The methodology to derive the HSLS was refined in response to the peer review comments. |
| 25 | 4.4.4 | *Environmental consultant*<br>p27; The sentence 'Assessments should consider whether sufficient source exists to support the volatilisation modelled for the time period under consideration' is vague. A definition of sufficient source would be beneficial as would further descriptions of field evidence that could be use to justify when a finite source could be applied. | Addressed |
| 29 | 4.4.5 | *Industry*<br>p26; For low petroleum vapour concentrations and sufficient separation distance between a persistent vapour source and a building foundation (exclusion distance) attenuation of biodegrading petroleum chemicals is essentially complete. Davis (2009) presents such an exclusion distance based on extensive empirical field data. That is, for benzene concentrations in water less than 1 mg/L, and total petroleum in water of less than 10 mg/L, a five foot (1.5 m) separation distance in soil is sufficient to attenuate benzene vapors | Noted, however this aspect has not been sufficiently discussed for inclusion at present—a more general comment has been included. |

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| | | to non-detectable levels.<br>Suggested text at left; reference below.<br>Davis, R.V.; Update on Recent Studies and Proposed Screening Criteria for the Vapor Intrusion Pathway, LUSTLine, Bulletin 61, 2009, New England Interstate Water Pollution Control Commission, Lowell, Massachusetts. May. www.neiwpcc.org/lustline/ | |
| 31 | 4.4.5 | *Environmental consultant*<br>28, Point 3 needs clarification.<br>Clarify area where biodegradation may occur is where slab area is less than 7.5m radius | Addressed |
| 47 | 4.4.5 | *Industry peak body*<br>P28 L11—'exclusions 2) and 3) do not apply' don't 2) and 3) apply?<br>Change 'exclusions 2) and 3) do not apply' to 'exclusions 2) and 3) do apply' | Addressed |
| 47 | 4.4.5 | *Industry peak body*<br>28—Should stress that utilisation of models such as BioVapor need not require that all of the Davis conditions are met. Biovapor takes into account building size / measured oxygen concs already. | Addressed |
| 47 | 4.4.6 | *Industry peak body*<br>38-40; Clarification on the application of Raoult's law to the Johnston and Ettinger model- it is unclear how a mole fraction can be accurately calculated from a sample of a separate phase liquid (with the well recognised interferences in its analysis) and where other partitioning factors and the toxicity of mixtures are either not considered or not applied.<br>Review of this schedules to ensure clear linkages in interpretation | Noted. Laboratory analysis of the separate phase liquid is required. |
| 47 | 4.4.6 | *Industry peak body*<br>29—It is noted that this section references SSTLs, though no earlier discussion of forward risk assessment has been made. Suggest this talks about forward | Noted and addressed where relevant |

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| | | assessment of risks only unless more detail regarding forward assessment is to be presented.<br><br>The guidance seems to confuse to separate issues on this point:<br><br>1. how potential vapour risks from NAPL should be assessed<br><br>2. the general "unacceptability" of NAPL, irrespective of risk assessment of different pathways (i.e. saying SSTLs should be set equal to Csat to eliminate the possibility of NAPL which could migrate to groundwater)<br><br>Risks from vapour pathways are proportional to the soil concentration up to Csat as stated. When concentrations are measured above Csat, there is the potential for NAPL to be present. If NAPL can be identified (e.g. on groundwater) and characterised, then the risk associated with the vapour pathway can be calculated by applying Raoult's law. It is not uncommon, however, for concentrations above Csat to be measured in limited samples, but for no free phase to be identified. This makes assessing the risks using Raoult's law impossible, as the nature of the LNAPL (in terms of mole fraction of different constituents) will not be known. What is the recommended methodology for assessing risk in these circumstances? The guidance, in stating that SSTLs should be limited to Csat unless Raoult's Law is applied, suggests that concentrations in excess of Csat, where NAPL cannot be characterised are unacceptable (although it states that this is because of the risks to groundwater and not from vapour intrusion).<br><br>NB For direct contact pathways, the assessment of risk holds regardless of the phase in which the contaminant is present in soil, and risks should be calculated without reference to Csat. Calculating an overall SSTL when both vapour and direct contact pathways are active is complex and would be dependant on how concentrations above Csat should be assessed. Is this something that should be included?) | |
| 31 | 4.4.6 | *Environmental consultant*<br><br>29, "NAPL-SCREEN and NAPL-ADV models, which should be..." Is this implying that these particular models MUST be used?<br><br>Change "should be" to "can be" | Addressed |

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| 31 | 4.4.6 | *Environmental consultant*<br>29, Last paragraph. This approach is flawed as concentrations <Csat can still leach to groundwater and concentrations >Csat may be stable (not free flowing).<br>Rethink the value or reword the reasoning. | Paragraph deleted |
| 47 | 4.5 | *Industry peak body*<br>30—This section should emphasise that dust concentrations in air need to be estimated in order to assess pathways of dust inhalation indoors and outdoors only where there are impacts to shallow, uncovered soils. Direct contact pathways with dust are effectively assessed through assessment of pathways of direct contact with soils.<br>Can the guidance comment on the significance of this pathway compared to the others assessed? | Addressed<br>This needs to be a site-specific comparison. |
| 28 | 4.5 | *Environmental consultant*<br>30—The use of the US EPA particulate emission factor approach to estimate dust exposures may not be appropriate for Australian conditions. The US EPA equation requires an input of Q/C (inverse of mean conc. at centre of square source (g/m2-s per kg/m3)). The value of Q/C is site-specific and dependant upon the site's size and meteorologic condition. Default values have been provided in the Technical Background Document to the soil screening guidance these are based upon air quality modelling at 29 locations in the United States. The default values may not be applicable to Australian conditions.<br>Include some discussions about the limitations of using the PEF equations from the US EPA soil screening guidance. For sites where dust may be an issue, it may be more apporpriate to recommend air quality monitoring. | Addressed |
| 47 | 4.6.1 | *Industry peak body*<br>31—Mention the inapplicability of the HILs when home-grown produce is significant. | Noted—refer Schedule B7 |

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| | | cf hydrocarbon HSLs the significance of this pathway is noted here; but is excluded from HSLs. | |
| 47 | 4.7 | *Industry peak body*<br>33—Exposure equations<br>Previous exposure equations from the National Workshops (prior to the NEPM 1999) should be used and extended | Noted |
| 47 | 4.7.1 | *Industry peak body*<br>33—The wording is slightly unclear, and a quick reading implies that risks may not be additive across different pathways (when the purpose is stressing the use of appropriate TRVs for each pathway.<br>Specify that risks may be additive across different pathways, but as the TRV may be different, the intake values are not summed at this stage. Instead, it may be appropriate to sum the levels of risk corresponding the the different exposure pathways at the risk characterisation stage (5.5.3). | Addressed |
| 47 | 4.7.1 | *Industry peak body*<br>33—It is not precisely correct to say "a single high dose" as these are chronic reference doses.<br>remove:<br>"***a low dose over a long period causes equivalent effects to a single high dose, that is, that it is***" | Addressed |
| 47 | 4.7.1 | *Industry peak body*<br>33—It is indicated that "..for non-threshold chemicals, intake are estimated on a daily basis,…."<br>Comments: for carcinogen that is considered as non-threshold chemical, generally genotoxic carcinogens, the intake dose is based on a lifetime average exposure, which is also expressed as mg/kg/day. | Addressed |
| 47 | 4.7.2 | *Industry peak body* | No change |

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| | | 34—Clarify ingestion rate is per exposure, not an average per day<br>Soil ingestion rate ***per exposure*** | |
| 31 | 4.7.3 | *Environmental consultant*<br>34, Equation for DAevent is for soil and does not apply for water, yet adsorption from water is listed as a potential pathway. Define DAevent separately for soil and water. | Included approach from USEPA RAGS |
| 47 | 4.7.4 | *Industry peak body*<br>35—NB Bioavailbility for inhalation exposures will generally be accounted for in tox data, as discussed in 4.8.2 | No change |
| 47 | 4.7.4 | *Industry peak body*<br>35—Section 4.7.4 presented two equations for quantification of intakes or exposure via inhalation. Comments: Both methods lead to a different results. It appears that the exposure concentration (EC) method was adopted for the development of HSL for BTEX and TPH , while the inhalation intake dose method was adopted for the development of HIL for TCE/PCE and products.<br>An unified methodology should be discussed and adopted in the Schedule B4 for the assessment of volatile chemicals. | Noted |
| 47 | 4.7.4 | *Industry peak body*<br>36—NB Bioavailbility for inhalation exposures will generally be accounted for in tox data, as discussed in 4.8.3 | Noted |
| 6 | 4.7.4 | *Environmental consultant*<br>Inhalation Intakes<br>Section 4.7.4 states "The quantification of intakes or exposures via inhalation can be undertaken on the basis of an intake (USEPA 1989) or an exposure concentration (USEPA 2009)". There is no recommendation as to what dosimetric equation to use or what equation is more appropriate (i.e. USEPA 2009 or 1989). | Addressed |

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| | | The approach outlined in the USEPA 1989 (hereinafter referred to as RAGS Part A) was developed before the USEPA issued the Inhalation Dosimetry Methodology (USEPA 1994). In this regard, the USEPA 2009 (hereinafter referred to as RAGS Part F) has updated their inhalation dosimetric approach to be compatible with the Inhalation Dosimetry Methodology, which represents the USEPA's current methodology for inhalation dosimetry and the derivation of inhalation toxicity values.<br><br>RAGS Part F recommends that when estimating risk via inhalation, risk assessors should use the concentration of the chemical in air as the exposure metric (e.g., $mg/m^3$), rather than inhalation intake of a contaminant in air based on Inhalation Rate (IR) and Body weight (BW) (e.g., mg/kg-day). Hence, if NEPM will default to the USEPA's equation for inhalation dosimetry, reference to RAGS Part F should be used rather than the RAGS Part A equation. Section 3.1 of RAGS Part F also states "EPA recommends that the intake equation presented in RAGS, Part A (USEPA, 1989, Exhibit 6-16) should no longer be used when evaluating risk from the inhalation pathway".<br><br>It is also noted that the equations and methods used in the assessment of health risk from vapour inhalation by Friebel and Nadebaum are based on the inhalation dosimetry outlined in RAGS Part F. | |
| 28 | 4.8 | *Environmental consultant*<br><br>39—TPH fractions<br><br>The TPHCWG fractional ranges as used by ATSDR and RIVM should be included with the analysis of aliphatic and aromatic components. This approach is consistent with existing values in the NEPM 1999 and would be consistent with the NEPM Review Report Recommendations (2006). The use of the complete TPHCWG fractions and their separation into aliphatic and aromatic components provides the most accurate measure of fate and transport and health risk during site assessment. This work should be extended. This is an important factor in industry assessment of TPHs. The development of HSLs has used a vapour intrusion model (JEM) that is not validated ensuring significant uncertainty in the establishment of screening numbers that are designed to be protective of human health and the author of | Noted.<br><br>The methodology for derivation of the HSLs was revised in response to peer review comments including the model coding. |

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| | | the model in peer review has indicated not to use the model for criteria development | |
| 18 | 4.8.2 | *Other*<br>P37, para 1, L7; Both bioavailability and relative bioavailability need to be defined. The document needs to be precise when defining these terms (there is a difference).<br>Absolute bioavailability is the fraction or percentage of a compound which is ingested, inhaled or applied to the skin that actually is absorbed and reaches systemic circulation.<br>Relative bioavailability is referred to the comparative bioavailability of different forms of a chemical or for different exposure media containing the chemical and is expressed as a fractional relative absorption factor. In the context of environmental risk assessment, relative bioavailability is the ratio of the absorbed fraction from the exposure medium in the risk assessment (e.g., soil) to the absorbed fraction from the dosing medium used in the critical toxicity study. | Addressed |
| 18 | 4.8.2 | *Other*<br>P37, para 1, L8; Bioavailability does not refer to the rate at which the substance is absorbed into the body.<br>Remove this statement. | Text revised |
| 18 | 4.8.2 | *Other*<br>General comments;<br>The information presented in section 4.8.2 is confusing. It is unclear, poorly structured and may tend to cause confusion due to the misuse of terminology. Due to the misuse of terminology, inappropriate methodologies may be recommended for the determination of contaminant bioaccessibility.<br>It would be easier to re-write section 4.8.2. | Addressed |
| 18 | 4.8.2 | *Other* | Text revised |

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| | | P37, para 2, L1-2; In the previous paragraph, bioavailability has been defined, but the second paragraph states that literature definitions of bioavailability are variable! Why not say this upfront but then define the term bioavailability specifically for the NEPM. | |
| 18 | 4.8.2 | *Other*<br>P37, para 2, dot points 1 and 2; Bioavailability is not divided into two distinct elements. Bioavailability processes may, however, be divided into distinct elements such as contaminant interactions between phases (i.e. association, dissociation), transport of contaminants to organisms and passage across physiological membranes. The first dot point is NOT bioaccessibility—it is simply the processes of ingestion and inhalation. Bioaccessibility is the fraction of a compound that is soluble following gastrointestinal extraction and is therefore available for absorption, which is specifically referred to when in vitro assessment models are used. It is unclear why the text in parenthesis is included—again, there is the need to stress the importance of precise and consistent definitions. Clarify definitions especially if introducing a new term (bioaccessibility) | Addressed |
| 18 | 4.8.2 | *Other*<br>P37, para 4; Confusion in the statements regarding TDIs. Relative bioavailability is rarely accounted for, not bioaccessibility. Relative bioavailability is referred to the comparative bioavailability of different forms of a chemical or for different exposure media containing the chemical and is expressed as a fractional relative absorption factor. In the context of environmental risk assessment, relative bioavailability is the ratio of the absorbed fraction from the exposure medium in the risk assessment (e.g. soil) to the absorbed fraction from the dosing medium used in the critical toxicity study. | Addressed |
| 18 | 4.8.2 | *Other*<br>P37, para 5; Is this paragraph necessary? | Addressed |
| 18 | 4.8.2 | *Other* | Text modified and a new section on dermal absorption added |

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| | | P37, para 6/P38, para 1<br>Dermal pathway—the description of how bioavailability is estimated is confusing. For soil bound contaminant, there is little data on the influence of matrix on absorption. This should be simply stated. | |
| 18 | 4.8.2 | *Other*<br>P38, para 2, L2; Use correct terminology: 'relative bioavailability'. | Addressed |
| 18 | 4.8.2 | *Other*<br>P38, para 2, L3-5; Generic relative bioavailability values are not presently available for As and Pb. A value of 60% relative bioavailability was previously utilised for Pb, however, the USEPA has moved to site-specific analysis. | Addressed |
| 18 | 4.8.2 | *Other*<br>P38, para 3, L1; Why predict contaminant bioaccessibility when it can be measured? Of course it's going to be variable depending on soil and contaminant properties in addition to soil-contaminant residence time and environmental factors. | Addressed |
| 18 | 4.8.2 | *Other*<br>P38, para 3, L4; HILs are not derived using 100% bioaccessibility—they may be derived using 100% relative bioavailability. If bioaccessibility / bioavailability is variable and not readily predicted on a generic basis, why are As and Pb the exception? | Addressed |
| 18 | 4.8.2 | *Other*<br>P38, para 4; The UK has never validated the PBET against a suitable animal model. The supporting references are not included in the bibliography. The UK has moved away from using the PBET and is now using the Unified BARGE (BioAccessibility Research Group of Europe) Method (UBM). Some effort has been made to validate the UBM; however, this is yet to be published in the peer-reviewed literature.<br>The USEPA do not use the PBET for Pb bioaccessibility assessment; they utilise | Text clarified |

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| | | the Relative Bioavailability Leaching Procedure (RBALP), which has different operating parameters and chyme constituents to the PBET. The RBALP is the same as the gastric phase of the SBRC assay. The reference outline the validation of Pb bioaccessibility and Pb relative bioavailability is incorrect – the validation report was not published until 2007. Assessing Pb bioaccessibility using the PBET will produce a completely different result to the RBALP . 'It is generally accepted that the PBET test has limitations' – what are these limitations? Explain. Is it limited because the methodology was only validated for mine impacted soils? Is it limited because its not recommended for use with phosphate stabilised soils?<br>'and that the results are prone to be very variable between sites' —naturally because of the reasons outlined in point no. 10. That is the reason why these tests are performed on a site-specific basis. | |
| 18 | 4.8.2 | *Other*<br>P38, para 5; This paragraph is repetition of poorly-worded statements. | Removed paragraph |
| 18 | 4.8.2 | *Other*<br>P38, para 6; Avoid confusion with the generic use of PBET. Consider using the term 'in vitro assay' instead of 'physiologically based extraction procedures'. | Addressed |
| 18 | 4.8.2 | *Other*<br>P38, para 7; Why are in vivo methods likely to be less conservative than in vitro methods? Where is the supporting information? | Addressed |
| 18 | 4.8.2 | *Other*<br>P38, para 8; The PBET in vitro method of Ruby et al. (1996) should not be recommended for the assessment of either As or Pb bioaccessibility. For Pb bioaccessibility, it is recommended to use the RBALP as outlined by the USEPA (2007). | Addressed |
| 18 | 4.8.2 | *Other*<br>P38, para 9; The final paragraph states that there does not appear to be any validated methods for estimating inhalation bioaccessibility. This is true but | Addressed |

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| | | why limit the statement to just vapours—what about $PM_{10}$? 'Assuming 100% bioaccessibility is probably appropriate' should read 'assuming 100% relative bioavailability is appropriate'. | |
| 47 | 4.8.2 | *Industry peak body*<br>38—In line with RAGS E, would this be limited to a 50% cutoff, or no?<br>cf different approach for petroleum hydrocarbons | No change |
| 47 | 4.8.2 | *Industry peak body*<br>38—Without the testing, assessment can be undertaken but will be conservative. Stress that this testing is most useful when assessment without it has shown there to be unacceptable levels of risk. | Noted |
| 47 | 4.8.2 | *Industry peak body*<br>38—Para 14 refer to recommended in-vitro bioaccessibility/bioavailability methods as Kelly *et al* 2002 and Ruby et al. 1996. Comments: No reference was made to the bioaccessibility/bioavailability methodology that was developed by the CRC CARE in Adelaide. | Revised section |
| 47 | 4.8.3 | *Industry peak body*<br>39—Indicator compounds should be assessed in addition to the TPH fractions<br>the recommended approach. ***The risks associated with indicator substances (such as benzene and benzo(a)pyrene) should be assessed in addition to the TPH fractions.*** | Addressed |
| 47 | 4.8.3 | *Industry peak body*<br>39—Add comment to indicate that TPH >C16 are also not volatile according to the definition in 4.4.1 (both the one currently there and the suggested amendment) | Addressed |
| 47 | 4.8.3 | *Industry peak body*<br>p39, TPH fractions, The TPHCWG fractional ranges as used by ATSDR and RIVM should be included with the analysis of aliphatic and aromatic components. This approach is consistent with existing values in the NEPM | Noted Minor change to text |

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| | | 1999 and would be consistent with the NEPM Review Report Recommendations (2006). The use of the complete TPHCWG fractions and their separation into aliphatic and aromatic components provides the most accurate measure of fate and transport and health risk during site assessment. This work should be extended. This is an important factor in industry assessment of TPHs. | |
| 47 | 4.8.3 | *Industry peak body*<br>39, Inhalation of dust for TPH C16–36 is ignored. Guidance for inhalation of dusts containing TPH C16–36 should be provided. | Addressed |
| 47 | 4.8.3 | *Industry peak body*<br>40—Should it be noted that there are differences between the methodology used to calculate petroleum hydrocarbon HSLs, and the risk assessment methodology adopted for HILs and presented here? Differences include:<br>* the dermal pathway approach<br>* assumed physical properties different than for HILs | Noted |
| | 5 | **TOXICITY ASSESSMENT** | |
| 47 | 5.1.1 | *Industry peak body*<br>42–43—Table 4 presents the order of the data sources should be used in risk assessment. Comments: It is considered that the Australian sources should be given the highest priority and listed above the WHO or IARC. There are many instances where the toxicity assessment by the Australian authority have been deviated from other international bodies. Also toxicity assessment by the Canadian Authorities has not been included in the list, even though Health Canada has been mentioned in various sections in the Schedule. | Text revised and Health Canada included but no change to order |
| 25 | 5.1.2 | *Environmental consultant*<br>p43; Quoting sources in order that should be used to source physical and chemical data is very helpful and should help bring about consistency and transparency as mentioned. Endorse. | Noted |
| 25 | B5.2.2/ | *Environmental consultant* | Noted |

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| | B4.5.2.3 | Some repetitiveness in discussion—metal fumes used as an example in both sections. | |
| 47 | 5.2.3 | *Industry peak body*<br>46—This differs from NHMRC (1999) guidance. See comment on para 2.1 regarding NHMRC guidance; is it superceded and by what? | Addressed |
| 47 | 5.3.3 | *Industry peak body*<br>49—Is the recommended approach to use unit risk factors, or slope factors, or either? If either, may be helpful to say that eiter apprach is acceptable, for clarity. | No change |
| 47 | 5.3.3 | *Industry peak body*<br>50—This should clarify whether it applies to both genotoxic and non-genotxic carcinogens.<br>Is the use of threshold TRVs not related to cancer end-points acceptable only for non-genotoxic carcinogens (this is suggested here by "in the event that the threshold TRV does not consider carcinogenic effects", as threshold TRVs could only consider carcinogenic effects for non-genotoxic carcinogens, and threshold TRVs are only discussed in relation to non-genotxics in the above bullet)?<br>Or can non-cancer end-point toxicity data be used for genotxic carcinogens in the absence of other data (this is suggested in 5.2.3 p46 penultimate para)?<br>In the event that the threshold ***TRV*** does not consider... | Addressed |
| 47 | 5.3.3 | *Industry peak body*<br>50—This should reference Figure 6.1, not Figure 4.<br>Figure 6.1 does not distinguish between cancer and non-cancer endpoints for threshold TRVs for non-genotoxic carcinogens.<br>Figure 6.1 does not suggest that threshold data could be used in the absence of BMD/slope factors for genotoxic carcinogens. cf comment above (5.3.3, p50, bullet 4) | Addressed |

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| 47 | 5.4.2 | *Industry peak body*<br>51—Last sentence is confusing: is it recommended to adopt this process for individual contaminants where there is clear evidence of a mutagenic mode of action? I feel this is the way that e.g. carcinogenic PAH and TCE should be assessed. | Addressed—revised wording is consistent with enHealth |
| 47 | 5.4.3 | *Industry peak body*<br>51—Overall comment:<br>Is separate tox data available for different species? If not, speciating (through laboratory analysis or modelling) will not allow better assessment. For different valencies (e.g. Cr(III) / Cr(VI)) the data is very relevant.However, for the different species presented in e.g. Table 7, is separate tox data available?<br>Is this topic (with the exception of valency) more relevant in a Section discussing boiavailability/bioaccessibility? As discussed, the species affects the toxicokinetics (absorption, distribution, biotransformation and elimination). For which of these processes are there species specific data? Where is this data?<br>The final para on p52 is certainly sensible. | Noted |
| 47 | 5.4.3 | *Industry peak body*<br>52—How can we derive the worst-case assumption from this information? What guidance tells us which is the worst-case assumption? Which references allow you to predict which species may be available from this data? | Noted |
| 47 | 5.4.3 | *Industry peak body*<br>53—Is this helpful? Do we have toxicity/bioavailability/bioaccesibility to distinguish between the species predicted in this modelling? Or is this data only available for different valencies? Does the modelling predict valency distribution, or do these need to be analysed for? | Noted |
| 47 | 5.4.3 | *Industry peak body*<br>P52 L11—'Some typical elemental species in soil are summarised in Table 7' | Examples only—minor change |

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| | | Table 7 presents the compounds that the elemental species relate too.<br>Provide the table with compounds, elemental species and parent Please provide clarification on what this table is meant to convey. | |
| 6 | 5 | *Environmental consultant*<br>Risk Characterisation<br>A major section should be inserted before Section 5.5 as a "Risk Characterisation" section.<br>Aggregating risk across multiple exposure pathways<br>Adding a separate section after "s5.9 Risk Evaluation of Mixtures" which talks about a clear guideline on aggregating risk across multiple exposure pathways should be considered. This issue, however, has been pointed out in s5.7.1 under the last bullet which states "All exposure pathways should be summed unless information is available that indicates the same individual or subpopulation cannot be exposed by a particular pathway(s)" and in s5.7.2 in the second to the last bullet which states "ILCR estimates should only be summed where they relate to an exposed population that could plausibly be exposed to all of contaminants/pathways that are added".<br>Based on the above, one may conclude that for non-threshold risk, multiple exposure pathways would automatically be summed unless information is available that indicates the same individual or subpopulation cannot be exposed by a particular pathway(s) whilst for threshold risk, multiple exposure pathways would not be automatically summed unless the individual or subpopulation are exposed to all of contaminants/pathways.<br>The draft guideline should take into consideration the approach mentioned in RAGS Part A under s8.3 which states "One should not automatically sum risks from all exposure pathways evaluated for a site,..". RAGS Part A describes how to identify exposure pathways that should be combined and how to sum cancer risks (see s.8.3.1) and non-cancer hazard indices (see s.8.3.2) across multiple exposure pathways.<br>It is noted that automatically summing the risk across multiple pathways | Addressed<br>Addressed by making each section clearer- the additional comments are noted |

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| | | appears to be a conservative approach; however it may overestimate the actual risk and consequently the likely remedial action mainly because for real world situations in which contaminant concentrations vary over time and space, the same individual or subpopulation may or may not experience the reasonable maximum exposure (RME) for more than one pathway over the same period of time. A receptor might face the RME through one pathway, and a different individual face the RME through a different pathway. Hence, only if the risk assessor can explain why the key RME assumptions for more than one pathway apply to the same individual or subpopulation should the RME risks for more than one pathway be combined (USEPA 1989). | |
| 15 | 5.5 | *Environmental consultant*<br>p53; "Introduction" seems a very strange title to the fifth subsection of section 5.<br>Consider calling it "Introduction to Risk Characterisation" | Addressed |
| 47 | 5.5-5.10.2 | *Industry peak body*<br>53-61—Comments: Sections 5.5 to 5.10.2 provide discussions of risk characterisation. Risk characterisation is generally not part of the toxicity assessment (Section 4).<br>Consider having 5.5 to 5.10.2 as a separate section of Schedule B4. This is consistent with the framework provided in Section 2.1. | Addressed |
| 47 | 5.5-5.9 | *Industry peak body*<br>53-59—Comments: These sections provide discussions on the conduct of a "forward" risk assessment with no discussion on how the approach relates to the development of HIL, which is based on a "reverse" risk assessment. | Noted |
| 47 | 5.7.1 | *Industry peak body*<br>55—This is correct, and should be emphasised at 4.7.1 p33 para 1. | Noted |
| 47 | 5.7.1 | *Industry peak body*<br>55—This needs a clearer explanation in line with 5.3.3. Are they separated only if BMD data is available for genotxic carcinogens? Or are they always | Noted |

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| | | separated along these lines (say if there's a slope factor for a genotxic carcinogen).<br>Clarify whether non-genotoxic carcinogens should be combined with non-carcinogens.<br>Is the distinction between assessing as threshold and non-threshold? This might be clearest, as for any contaminant, there is a process (determined both by its MoA and data availability) for assigning tox information. | |
| 47 | 5.7.2 | *Industry peak body*<br>56—It would be sufficient for either of these conditions to be true...modes of action of the contaminant are clearly different for different pathways ***OR*** that the same person cannot be exposed... | Addressed |
| 47 | 5.8 | *Industry peak body*<br>56—Further explanation/example useful<br>…of the effect occurring (USEPA 1989)***, just as a hazard quotient of 1 doesn't imply the certainty of an effect.*** | Noted—no change |
| 47 | 5.8 | *Industry peak body*<br>56–57—Comments: A discussion of acceptable cancer risks when conducting a forward risk assessment was provided in Section 5.8.2. It is also stated in this section that 1) the recommended acceptable incremental lifetime risk of cancer from exposure to carcinogens in soil is 1 x 10–5 and 2) the HILs for non-threshold chemicals were developed using 1 x 10–5 as an acceptable risk value. However, the acceptable hazard index (HI) or that applied in the development of HILs for thresholds chemicals was not stated in this section. It appears that a HI of 1 was adopted. | Addressed |
| 47 | 5.8.2 | *Industry peak body*<br>56—This is not fully consistent with the cancer risk assessment document (which doesn't conclude). Can this conclusion go in the cancer risk document too for clarity? Is that document part of the NEPM? Understand that the determination of the acceptable risk is a policy rather than science decision | Noted |

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| | | which may explain the difference. | |
| 47 | 5.8.2 | *Industry peak body*<br>56—Suggest this discussion is removed but left in the cancer risk assessment document. A recommendation has (rightly) been made in the NEPM, and therefore this discussion has minimal bearing on the way we will do QRA, and may cause confusion. Maybe just a note that the concept of acceptable risk is subjective and variable, and a full discussion is provided in the cancer risk assessment document. | Noted |
| 10 | 5.8.2 | *Stage government agencies*<br>Page 69—The use of an ACLR of 1 x 10–5 is not adequately justified. Simply listing a number of national and international practices including 10–6 does not provide justification. Other relevant regulatory examples should have been looked at such as contaminated site practices in Australia jurisdictions (DOHWA for instance uses 10–6) and in other environmental settings such as air quality. Also a figure should be based on argument rather than pure mimicry.<br>Part of the argument may the great conservatism built into the models used to derive contaminated site investigation thresholds. | Noted |
| 47 | 5.9 | *Industry peak body*<br>57–59—The hazard quotient approach and the summation of non-threshold risk estimates for evaluation of multiple chemical exposure were discussed in Section 5.9. It appears that the conservative approach is to conduct a summation of the HI or ILCR for each components of the mixture. The total HI or risk was evaluated against the acceptable threshold, i.e.. HI of and ILCR of 1 x 10–5. Comments: The acceptable risk thresholds (i.e. HI of 1 and ILCR of 1 x 10–5) is consistent with the current industry practice for a forward risk assessment. The adopted of these threshold values for the development of HIL creates the following issues: 1) For chemicals with similar toxicity end points, the total risks for residual concentrations allowed on the site (assuming the residual concentrations is the HIL) will exceed the acceptable risk thresholds (i.e. HI of 1 and ILCR of 1 x 10–5). The acceptable risk thresholds | Noted |

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| | | are applicable for scenarios with single chemical exposure, both in a forward or backward risk assessment, but become ambiguous when backward risk assessment (i.e.. development of site-specific risk-based levels) is to be conducted for a multi-chemical exposure scenario at a site.<br><br>Options for consideration: 1) allow an acceptable cumulative HI greater than 1 (i.e.. HI of 5 or 10) for multiple chemical exposure with no HI greater the 1 for individual chemicals. Similarly, allow the cumulative ILCR greater than 1 x 10–5 (i.e. 1 x 10–4) for multiple chemical exposure with no individual chemicals exceed the ILCR of 1 x 10–5. 2) Revised the HILs based on a lower risk thresholds to account for potential cumulative risks.<br><br>Suggest moving this discussion to 5.5.3.3 as it has a bearing on previous discussions. Note that this just discusses in more detail what is already presented in "Threshold risk estimation" and "Non-threshold risk estimation".<br><br>This section is really about risk estimation rather than risk evaluation, with the exceptionof p 58, para 3 (threshold) and para 6 (non-threshold). These paras (or similar) should be appended to the relevant sections in "Risk Evaluation".<br><br>Should be 5.5.3.3, or if retained in it's current location, 5.6.3. | |
| 47 | 5.10.1 | *Industry peak body*<br><br>60—This contradicts the final bullet on the page<br><br>* Uncertainty and variability should be kept conceptually separate<br><br>Suggest this concept of separating uncertainty and variability is brought up-front, together with a clear discussion of what is meant by variability. Variability should be removed from this bullet. | No change |
| 47 | 5.10.1 | *Industry peak body*<br><br>Access to enHealth 2010 is required to fully assess this section.<br><br>should be 5.7.1 | Noted |
| 47 | 5.10.2 | *Industry peak body*<br><br>Should be 5.7.2 | Addressed |

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| | | Further clarification is required. This states that this is "a type of uncertainty analysis" and "should be undertaken in addition to uncertainty analysis".<br><br>This doesn't provide a quantitative estimate of uncertainty in input variables (as stated), it provides a quantitative estimate of the effect of uncertainty and/or variability in the input parameters on the results of the risk assessment.<br><br>Suggest providing an explanation along the lines of the following:<br><br>Sensitivity analysis provides a quantitative estimate of the effect of uncertainty and/or variability in the input parameters on the results of the risk assessment.<br><br>Sensitivity analysis should be undertaken when a risk assessment is conducted using a deterministic exposure model. While a single value must be entered for each parameter in a deterministic model, it is unlikely that reasonable inputs for each parameter can be limited to a single value. This may be due to uncertainty (based on an absence of site-specific data, or site measurements, we may not know where the "true" value lies) and/or variability (the "true" value may vary across the site or over time due to variations in site geology laterally or with depth, or due to changes in site conditions over time). As such, a range of reasonable values will be defined as appropriate for a given input parameter.<br><br>Sensitivity analysis is the process of changing one variable ***within the defined range*** while leave the others... | |
| 47 | 5.10.2 | *Industry peak body*<br><br>—Continued from above comment<br><br>..Sensitivity analysis can be used to identify important input variables (or groups of variables) and develop bounds on the distribution of exposure or risk. ***Effort may then be directed to the collection of additional data for these imporatant variables; as additional data is collected, the uncertainty in the "true" value is reduced, and it may be possible to define a smaller range for a given parameter. The uncertainty in the results of the risk assessment may*** | Addressed |

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| | | ***therefore be reduced.*** | |
| | 8.1 | **APPENDIX 1: STRUCTURE OF A RISK ASSESSMENT REPORT** | |
| | 10 | **GLOSSARY** | |
| 31 | 10 | *Environmental consultant*<br>79, Definition of Bioavailability is slightly inconsistent with text,<br>84, Definitions of Cancer slope factor and Unit Risk are incorrect (or possibly just very unclear), | Addressed—made consistent with enHealth |
| 31 | 10 | *Environmental consultant*<br>79—Definition of Bioavailability is inconsistent with text<br>84—Definitions of Cancer slope factor and Unit Risk are incorrect (or possibly just very unclear) | Addressed |
| | | **GENERAL** | |
| 25 | Contents | *Environmental consultant*<br>The numbering for Section 5 (Toxicity Assessment) includes that for Risk Characterisation which should be a new section (Section 6), with subheading 6.1 'Introduction' which is currently numbered as Section 5.5. Follow on numbering is therefore also incorrect. | Addressed |
| 28 | | *Environmental consultant*<br>Toxicology and Epidemiology.<br>There is either limited or negligible discussion on the role of toxicology and epidemiology in the HRA process and how information from these sources should be used. The NEPM should be explicit on this matter and provide guidance in terms of the preferred hierarchy of sources to ensure pragmatic and efficient derivation of values for risk assessment purposes. | Noted |
| 28 | | *Environmental consultant*<br>Public Health. | |

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| | | There is limited discussion of the role of site contamination in health risk assessment as a preventative public health measure, It is important to recognise this contribution and that it is designed in the long term to mitigate population health impacts | Noted |
| 10 | | *State government agencies*<br>This is probably the most polished of the three Guidelines reviewed but as mentioned elsewhere it needs to better integrate with other Guidelines in regard to the new health criteria being used rather than just on the HIL methodology and past more narrow NEPM practices. | Noted |
| 47 | ALL | *Industry peak body*<br>enHealth consistency<br>The proposed risk assessment process is based on the revised enHealth which hasn't been provided for comment. Therefore meaningful comments on the NEPM risk assessment process can not be provided and it is recommended that a further period of public consultation be undertaken. | Noted |
| 47 | ALL | *Industry peak body*<br>Reliance on US EPA<br>There is a strong influence of US EPA approaches - previous NEPM (Australian) work should be used and extended. There should also be presentation of UK, RIVM and other jurisdictional information. | Noted |
| 47 | General | *Industry peak body*<br>General comments—a great effort in the attempt to complete a robust and difficult task. | Noted |
| 47 | General | *Industry peak body*<br>Reference enHealth 2010 and enHealth 2011. The new HILs are developed with risk parameters are adopted from enHealth 2010 and 2011. However, these references have not been finalised and published yet. If any changes made to enHealth 2010 and 2011, new NEPM HILs will not be accurate. | Noted—enHealth reference is changed to 2012 Only minor changes have occurred to the version released in 2010. |

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| | | The NEPM will be finalised prior to enHealth 2010 and 2011 based on the time limit given for the public review of the NEPM. If this is to occur and enHealth 2010 or 2011 change, can industry rely on the finalised NEPM? | |
| 48 | General | *State government agencies*<br>NRETAS considers that there are major inconsistencies between the assessment of vapours relating to Health Screening levels in Schedule B1 sections 2.2.3, the detail provided in the Johnston and Ettinger model in Schedule B4 and the Laboratory assessment methodology for total recoverable hydrocarbons in Schedule B3 ,the soil vapour analytical techniques as well as the field assessment sections in Schedule 6<br>Major review of these schedules to ensure clear linkages between assessment, laboratory analysis and interpretation and that the methodology in the laboratory analysis allows for the accurate calculation of HSLs. | Noted but there are reasons for the differences— petroleum hydrocarbons are not the same as chlorinated compounds and there are a number of ways that criteria can be derived that are equally acceptable. Text clarified where relevant. |
| 45 | | *Environmental consultant*<br>We concur with the stated problems being the overstatement of risks for carcinogenic and bioavailability and asbestos due to lack of guidance, absence of methodology for mixtures, and minimal consideration in current NEPM of asbestos.<br>Incorporation of best international practice for bioavailability, carcinogenic substances, and mixtures is welcomed.<br>Also adoption of the WA Dept of Heath asbestos guidance is welcomed.<br>The impacts of the changes, being less conservative assessment and remediation and cost savings for reduced need for remediation and timescales for assessment with clearer guidance are welcomed.<br>The industry will need to embrace more quantitative risk assessments and guidance on standard models that NEPM see as best international practice would be useful. Auditors need to be able to resource delegation of the assessment of such risk assessments to specialists as part of their SAS process.<br>Could be a bottleneck in getting Quantitative Risk Assessments produced and | Noted |

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| | | reviewed.<br><br>Recommendations by NEPM or regulators of acceptable models that could be used based on best international and current Australian practice could be useful, e.g. BP RISC, RBCA. In the UK—Environment Agency have this consideration. This would be useful for auditors as well. | |

## APPENDIX G – Issues and responses – Schedule B5

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|---|---|---|---|
| | 2 | **Introduction** | |
| 18 | 2 | *Other*<br>P2; The approach of providing EILs that account for soil-specific properties and aging is an attempt to account for bioavailability in the risk assessment. However, as a result, EILs for only eight compounds could be derived. Although it is possible to use assessment levels from other jurisdictions (where EILs do not exist), this lack of data for the EILs will likely result in repetitious risk assessment and literature reviews. | Noted |
| 14 | 2 | *Environmental consultant*<br>Section 2, p2<br>Fifth or last paragraph states "....aim towards protecting the VAST MAJORITY of, BUT NOT ALL, species from the harmful effect of contaminants." THIS IS in contradiction of the 2nd bullet point on the same page, "...all aspects of the environment are interdependent and cannot be considered in isolation....." and the fourth paragraph which states: "risk based process.....principals of ecologically SUSTAINABLE development (ESD). ESD aims to protect biodiversity and maintain ecological processes and functions.....".<br>Please recognize that sustainability is unattainable. Plus, if you are stating that one of your principles is to recognize everything is interconnected do not contradict it on the same page. | Noted. EIL methodology protects varying percentages of species depending on land use. |
| 14 | 2 | *Environmental consultant*<br>Section 2, p2, Fifth or last paragraph "Human health risk assessment uses.....but the vast majority (for example, acceptable cancer risk are one to ten in 100,000 over a lifetime)"<br>Just a generic comment concerning this: What about 1 in 1,000,000? This is can be considered acceptable as well. | Noted. Sentence deleted as not relevant to the EIL methodology. |

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| | 3 | **The ecological risk framework** | |
| 18 | 3 | *Other*<br>P3, para 4;<br>CHANGE 'The toxicity of *some* contaminants is affected by ....'<br>TO 'The toxicity of *many* contaminants is affected by...' | Amended. |
| 15 | 3 | *Environmental consultant*<br>Section 3; Page 3, 4th bullet point; The use of bioavailability data should be discussed in a bit more detail.<br>In order to allow to derive site-specific Tier 2/3 EILs the use of site-specific leach data (test are discussed in schedule B3) to address bioavailability (what percentage of each component is actually bioavailable) of components is a legitimate approach. | Refer to Section 3.1 of Schedule B5b for further information. |
| 27 | 3 | *Environmental consultant*<br>P4 L11, Statement that EIL only applies to a depth of 2 metres below current surface<br>Further explanation of why this depth has been adopted may provide information to the assessor to help develop remedial strategies that are in keeping with intent of the guideline depth of 2 metres. | Refer to Schedule B1 for application of EILs. In addition, an explanation has been added to the text. |
| 18 | 3 | *Other*<br>Perhaps consideration needs to be added regarding soils naturally containing high levels of 'contaminant'. | Noted. Refer Schedule B1 for application of EILs including consideration of background. |
| 5 | 3 | *Environmental consultant*<br>: p4; Depth dependence of EILs<br>Just above Figure 1 is a comment stating that EILs only apply to soil down to a depth of 2 metres:<br>– This is an important comment, and should be highlighted alongside the tabulated results (i.e. the Appendix in 9.1, and elsewhere where EILs are presented in other Schedules). | Refer to Schedule B1 for application of EILs. In addition, an explanation has been added to the text. |

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| | | – The process for deriving EILs is discussed in Schedule B5b, but no comment is made on how this 2m depth determination was made. Some discussion and support from literature is recommended, and is probably suited to Schedule B5b. | |
| 18 | 3 | *Other*<br>3<br>P4; The EIL values are stated to apply to soil down to a depth of two metres below the current soil surface. It is not stated how this depth of two metres has been selected or why it is appropriate. Also, soil properties (such as pH, organic matter, and CEC) will vary widely over this two metres depth, yet it is not clear which of these soil properties are to be used when calculating the soil-specific ACL values (for example, Table 9 of 5c).<br>The depth of two metres would appear to be quite arbitrary. If there is not a specific reason as to why this depth has been selected, then perhaps a more meaningful depth could be selected. For example, given that the primary purpose is to protect biota, then perhaps a depth of 30cm would be more appropriate. | Refer to Schedule B1 for application of EILs. In addition, an explanation has been added to the text. |
| 47 | 3 | *Industry peak body*<br>3 Quote "EILs only apply to soil down to a depth of two meters below the current soil surface"—indicates exceedance of EILs below this depth is a non-issue.<br>Clarification regarding assessment of risk to groundwater etc required, possibly via cross-reference. | Refer to Schedule B1 for application of EILs. In addition, an explanation has been added to the text. |
| 47 | 3 | *Industry peak body*<br>3 Para 4 Briefly addresses soil-specific quality guidelines (SQGs) and generic and soil specific EILs. This is the first mentioning in the document of these guidelines and levels and it is somewhat unclear and confusing.<br>Brief explanation on SQGs (or reference to Schedule B5b Section 3.2) and soil-specific and generic EILs with reference to Appendix 1 would improve reading flow. | Definition of SQG added to glossary. |
| 47 | 3 | *Industry peak body* | Amended. |

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| | | 3, 3 Third dot-point—read 'accounting for background concentrations of contaminants', rather than 'accounting of background concentrations of contaminants' | |
| 47 | 3 | *Industry peak body*<br>3, 3, Fourth Paragraph. "In addition, most of the available toxicity data for contaminants in soil were obtained in laboratories where the contaminant is added to the soil immediately prior to commencing the test. However, it is known that contaminants become less bioavailable in the field and over time (they age). Thus, laboratory-based experiments may overestimate toxicity in the field."<br>Not all contaminants degrade within the timeframes that are considered in most ERAs (for example, dioxins and furans are extremely persistent). Perhaps this sentence could be changed to say "…it is known that some contaminants become less bioavailable in the field over time". | Amended. |
| 28 | 3 | *Environmental consultant*<br>3, p4, "the EILs only apply to soil down to a depth of 2m". Is it intended that soils above current EILs below depths of 2 m can remain in situ? It is anticipated that only deep rooted plants (e.g. trees) may be exposed to contamination below 2 m, but that these may warrant protection on a site-specific basis. Provide clarity. | Refer to Schedule B1 for application of EILs. In addition, an explanation has been added to the text. |
| 5 | 3 | *Environmental consultant*<br>3: General comment; This is an idealised process and in practice it is rarely achieved.<br>It is recommended to include some discussion about 'real world' application. This could include the alternative outcomes imposed by land owners/funding agencies considering the economic circumstances or development timeframes etc. and acknowledge and provide guidance on incorporating ERA into simple site assessments where the formalised process is not normally completed, but inherently adhered to via the application of published EIL values. | Refer to Schedule B1 for application. |
| 5 | 3 | *Environmental consultant*<br>Figure 1: p4; Clarity of figure | Amended |

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| | | This figure could be improved to enhance clarity:<br>– There is no feed back arrow from site management/remediation. In practice, the outcomes of site management and remediation will need to be assessed under the context of the ERA to determine suitability.<br>– There is inconsistency in the line weight of the arrows adopted. | |
| 5 | 3 | *Environmental consultant*<br>3: p3; Contamination in excess of background<br>Discussion of the concept of added contamination and ambient background concentrations should be provided. Methods for determining added contamination should be noted. | Amended. Refer to Section 2.4, Schedule B5b for further information. |
| 5 | 3.3 | *Environmental consultant*<br>3.3: p5; Steps of an ERA - Many of the steps described are inherently completed during the assessment of basic sites when applying published EILs. Under these circumstances, the process noted over-complicates the assessment process.<br>It is recommended that the 'real world' nature of many assessments is acknowledged here and recommendations on how to apply this process in a simplified manner be provided. | The steps of the ERA in this document have to be generic to cover all scenarios. They may as stated sometimes not apply in all situations. Examples of how the ERA framework would apply are provided in Schedule B1 on the application of EILs. |
| 14 | 3.3 | *Environmental consultant*<br>Section 3.3; p5, 2nd basic component, Receptor Identification: "This requires the identification of local species, ....."<br>No Mention of Species At Risk i.e. threatened or endangered species. This is an extremely important aspect of the Receptor Identification and it should be emphasised! Also emphasis on species at risk should be mentioned throughout the guideline especially when making risk management decisions. Note that in the EPBC Section 18 states that: actions with significant impact on listed threatened species are prohibited without approval. This should be made clear to people conducting ecological risk assessments! | Noted.<br>It is important to undertake problem and receptor identification prior to applying the EILs. |
| 14 | 3.4.2 | *Environmental consultant*<br>3.4.2; p7, First sentence "uncertainty". Should also mention the identification of | Amended. |

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| | | "data gaps".<br>Identification of uncertainty is similar to data gaps but data gaps clearly identify gaps in the field investigation that need to be fully addressed either qualitatively or quantitatively | |
| 14 | 3.4.2 | *Environmental consultant*<br>Section 3.4.2, p 7 Monitoring—no mention of determining background concentrations. This may be of particular importance in national parks or areas that border national parks (terrestrial or marine parks). Sampling for background concentrations may help determine site-specific values. This can also relate to biological monitoring (i.e. population numbers, number of off-spring, biomass). For example population numbers on-site may look ok but there are no reference areas to determine if these numbers are normal or relevant. Therefore background information in that area may be relevant. Another example for biological monitoring is determining and/or comparing bioaccumulation factors on-site vs. background. Again population numbers may be healthy but accumulation of chemicals on-site compared to background or normal is higher and potentially affecting physiological functions that are not showing up in acute instances.<br>Add some text concerning background biological and chemical monitoring. | Methods for determining background concentrations are provided in Schedule B5b. Definitive ERAs, where warranted, will give more specific consideration of biological and chemical monitoring. |
| 47 | 3.5.1 | *Industry peak body*<br>3.5.1 Needs further detail regarding assessment of biomagnification or clear reference to Schedule B5b section 2.3.2 for further information.<br>Further detail | Amended |
| 47 | 3.5.1 | *Industry peak body*<br>3.5.1 Explanatory note A to Table 1 should also direct reader to the reference information relating to logarithm of the octanol-water partition coefficient.<br>Direct to reference information | Definitions of $K_{ow}$ and biomagnification added to the glossary |
| 14 | 3.5.1 | *Environmental consultant*<br>3.5.1, p 8; First sentence and bullet list of section – NO mention of species at risk! | Noted. Refer to B1 for application of EILs which considers threatened or endangered species. |

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| | | Please make specific mention of threatened or endangered species as well as ecosystems/vegetation communities!!!! | |
| 31 | 3.5.1 | *Environmental consultant*<br>3.5.1, P8, The difference between the generic ecological values of 'native flora and fauna', 'introduced flora and fauna' and 'transitory or permanent wildlife' is not clear. Provide definition or reference. | Noted. The EILs aim to protect all the types of organisms listed in the dot points. Separate EILs are not derived for each of these types of organisms. |
| 14 | 3.5.1 | *Environmental consultant*<br>3.5.1; p8; Last paragraph and sentence of page: " .....it is assumed that not every individual organism or species can be or needs to be protected". THIS IS IN CONTRADICTION TO introduction and "sustainability goal"!<br>Please reword as appropriate so as not to be in contradiction. | Noted. EIL methodology (Schedule B5b) provides information on the concept. |
| 14 | 3.5.1 | *Environmental consultant*<br>3.5.1; p9; Table 1: "national parks and areas with high ecological value"<br>Please state that "high ecological value" pertains to "species at risk" and "ecosystems/communities at risk"—i.e. threatened, endangered, vulnerable". The statement "high ecological value" is very ambiguous and can be interpreted differently! It is best to just state the obvious! | Refer to s.2.2.1 of Schedule B5b for information.<br>Renamed 'area of ecological significance' and definition added to the glossary |
| 47 | 3.5.1 | *Industry peak body*<br>Table 1—Explanatory notes B and C to Table 1 warrant some further explanation as to their basis - are these standard areas or do they relate to an already published reference?<br>Further explanation | Reference to Schedules 5b & 5c added. Refer to these schedules for derivation of the EILs. |
| 14 | 3.5.2 | *Environmental consultant*<br>3.5.2; p10, Site-specific ecological values can be identified in a preliminary ERA. This can easily be done through a desktop exercise. Identifying species should be done even in an preliminary ERA because it sets the tone for any potential work down the line. | Noted. Development of the conceptual site model will assist in determining the species requiring attention. |

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| | | Please add text stating that at least a desktop exercise in identifying species, ecosystem communities, and species and ecosystems at risk should be undertaken. This exercise does not need to be detailed but it will help in identifying any receptors of concern also lead to identifying uncertainty or rather data gaps with any associated investigations | |
| 27 | 3.5.2 | *Environmental consultant*<br>P10 L20, What constitutes "appropriate community engagement"<br>Some parameters around the expectation of the extent of community consultation is understood prior to committing to the process so that scopes budgets, time lines etc can be estimated. | Noted. Refer to Schedule B8 for further information. |
| | 4 | **Preliminary risk assessment** | |
| 27 | 4 | *Environmental consultant*<br>P11 L, What is meant "scale of concern", Clarification is needed here if this is a serious requirement when setting objectives. | Changed to "issue of concern". |
| 14 | 4 | *Environmental consultant*<br>Section 4, p13; Table 2: In either the Problem identification/Formulation or Receptor Identification—there should be mention of identifying the "Exposure Setting". i.e. the habitat/ecosystem at the site and surrounding areas. This is important in identifying receptors in the "Receptor Identification".<br>Exposure setting should outline:<br>– Current and Anticipated Land Use<br>– Physical site description<br>– Habitat description<br>The Receptor Identification should also mention:<br>- Site biological observations (easily done for either preliminary ERA because someone does go on-site; does not have to be detailed for prelim ERA)<br>- Listed species are risk or communities/ ecosystems | These issues should be addressed with the conceptual site model. |
| 14 | 4 | *Environmental consultant* | Refer to Schedule B5b for more information regarding background. |

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| | | Section 4, p11; First bullet in first vertical list: ".....background values". What are Australian background values? If these are "ranges" that is unacceptable because one would automatically pick the highest background value as relevant. These values need to be definitive and they should be based on regions.<br><br>One good example of an appropriate background value guidance document is Protocol 4: Determining background soil quality by the BC Ministry of Environment (http://www.env.gov.bc.ca/epd/remediation/policy_procedure_protocol/index.htm)<br><br>Another good reference for assisting investigations in determining background concentrations is the BC Ministry of Environment's Technical guidance 16: Soil sampling guide for local background reference sites (http://www.env.gov.bc.ca/epd/remediation/guidance/index.htm) | |
| 31 | 4 | *Environmental consultant*<br><br>3, Table 2, P13, Selection of the most appropriate EILs is included in the problem identification section, however the receptor identification and exposure assessment would need to be completed prior to section EILs. Reconsider process | Amended. |
| 47 | 4.1 | *Industry peak body*<br><br>4.1 final para—Refers to soil-specific EILs. Again further clarification and example using Appendix 1 would be useful | Amended and refer to the glossary where the term is defined. |
| 14 | 4.1 | *Environmental consultant*<br><br>4.1; p14; "background concentrations"<br><br>Exposure setting should outline:<br>- Current and Anticipated Land Use<br>- Physical site description<br>- Habitat description<br><br>The Receptor Identification should also mention:<br>- Site biological observations (easily done for either preliminary ERA because someone does go on-site; does not have to be detailed for prelim ERA) | These issues should be addressed within the conceptual site model. Methods for determining background concentration are available in Schedule B1 and B5b. |

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| | | - Listed species are risk or communities/ecosystems | |
| 47 | 4.2 | *Industry peak body*<br>4.2 14—Fourth Paragraph—This paragraph may need some re-wording, as currently it can potentially be interpreted as "if there is something of high ecological value at or near the site, you will need to discuss this in the Preliminary ERA (without doing any further work)".<br>Identification of a keystone species or some element of the ecosystem that has an elevated 'value' at or near a site of interest should, in almost all cases, trigger a Definitive ERA, and sound justification for the lack of follow-up should be required in the Preliminary ERA in cases where a Definitive ERA is not undertaken. | The wording is sufficiently clear. A definitive ERA should be considered where an EIL may not provide adequate protection for a particular species or a type of organism. |
| 28 | 4.2 | *Environmental consultant*<br>4.2, p14, Where a species or organism of ecological value at a site is not protected by the EILs a Definitive ERA is to be undertaken. Establishing if the EIL protects a particular species requires detailed knowledge of each EIL. This will be challenging for some practitioners to assess. Proceeding to a Definitive ERA may not always be justified on this basis if it is accepted that international best practice risk assessment methods for deriving guidelines/standards/ objectives have limitations. For example, they are based on available ecotoxicological data and available methods, some which have little scientific basis (e.g. the assessment of uncertainty factor approach). The basis of the EILs is SSDs which have a sound scientific basis but will not protect 100% of species. Where exceedances occur, it may simply mean that the soil has limitations in terms of its capacity to support the full range of species. The soil may still provide adequate support to a sustainable ecosystem given the site setting and realistic expectations of use versus a "pristine" situation.<br>Provide dialogue around pragmatic application of exceedances of the criteria before launching into risk assessment. | Noted. Refer to Schedule B1 for guidance on application of EIL.<br>The basis for the decision of whether or not to proceed to a Definitive ERA should be clearly presented in the Preliminary ERA report. |
| 28 | 4.3 | *Environmental consultant*<br>B5a—8, 4.3, 14, Based on the above comments re: Definitive ERA, it is considered possible that many sites may proceed to Definitive ERA which will result in | Noted. Refer to Schedule B1 for guidance on application of EIL. |

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| | | increased cost for assessment, remediation and management and in cases where this may not be justified. It may also lead to soil excavation and disposal for unsustainable reasons.<br><br>Provide dialogue around pragmatic application of exceedances of the criteria before launching into risk assessment. | |
| 28 | 4.3 | *Environmental consultant*<br><br>B5a—6, 4.3, 14, 3rd sentence, n-octanol/water partition coefficient is incorrectly abbreviated as Koc. The abbreviation is Kow. Koc is the abbreviation for the organic carbon adsorption coefficient. Change to Kow | Amended. |
| 47 | 4.3 | *Industry peak body*<br><br>4.3 14—Final Paragraph. When assessing exposure to a COPC, you note that "all exposure pathways considered in the derivation of the EILs are applicable", and go on to discuss the importance of the physical setting of the site and by physical and chemical properties of the contaminants (for example, solubility in water, n- octanol/water partition coefficient (Koc), soil/water partition coefficient and volatility).<br><br>Rework | Amended. |
| 28 | 4.3 | *Environmental consultant*<br><br>4.3, p14, The requirement to assess physical-chemical factors such as: solubility in water; Kow; Kd; volatility; the impact these have on pathways of exposure; identifying significant pathways of exposure; and identifying the pathways not protected by the EILs requires detailed knowledge of the EILs. Where these requirements are not met, the practitioner is expected to proceed to Definitive ERA. If it is accepted that guidelines/standards/objectives do not protect all species or pathways, but provide adequate protection for most species and communities in an ecosystem, this should suffice in assessment of ecological risk.<br><br>Provide dialogue around pragmatic application of exceedances of the criteria before launching into risk assessment. | Refer to Schedule B5c and EIL calculation spreadsheet for derivation of EILs where certain physicochemical factors are considered.<br><br>Amended |
| 47 | 4.4 | *Industry peak body* | Amended. |

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| | | 4.4 15—First Paragraph. In this paragraph you discuss that the toxicity data and methods used to calculate the endorsed EILs are sufficiently protective of the biota at the site. However the ERA process is designed to protect not only biota, but also the systems (such as soil structure) that these biota depend upon.<br><br>To ensure that the EILs are protective of all ecological processes, an additional section could be included titled "Ecological processes assessment" | |
| 14 | 4.4 | *Environmental consultant*<br><br>4.4; p15<br><br>6th paragraph on page: "....combined effects of the contaminants should be assessed using the methods set out in Appendix 2....". This should be done, as stated in Appendix 2, with only a select number of chemicals. These include certain metals, PCBs, and where necessary chemicals with the same target organ!<br><br>This "addition" of effects should not be encouraged because it if fraught with error, especially if the risk assessor does not understand what they are doing. Please refer to:<br><br>P. Allard et al. 2009. Recommendations for the Development and Application of Wildlife Toxicity Reference Values. Integrated Environmental Assessment and Management 6(1): 28-37. SETAC | Noted.<br><br>Definitive ERA may address the issues of mixtures where warranted.<br><br>Refer to Appendix 2 of Schedule B5a for information. |
| 27 | 4.6 | *Environmental consultant*<br><br>P16 L8, Further clarity on the determination of "ecological significance of the values identified". The ERA process is robust but can get compromised by insufficient guidance where an independent "judgment decision" is required.<br><br>Provide more examples than the ones given. May be use a rank table of high to low to show clearly the intent of the document and what is considered or constitutes "ecological significance" | Noted. Refer to definition of "areas of high ecological value" in Schedule B1 and consult relevant jurisdictional regulator. |
| 14 | 4.6 | *Environmental consultant*<br><br>First bullet point on page: "….cost of remediation." This is just to point out that the costing of remediation should only be presented as side note in prelim ERA. All costing and associated calculations should be part of an investigation report! | Noted. |

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| 14 | 4.6 | *Environmental consultant*<br>4.6; p16; 3rd bullet point on page it is mentioned "....low ecological significance, e.g. a rabbit)". Again this is in contradiction with the principals what is stated in this ERA guidance document! | Noted. EIL considers ecosystem protection, not specific species. |
| 14 | 4.6 | *Environmental consultant*<br>4.6; p16; Second paragraph after first vertical list "Where the risk assessor has identified a high level of uncertainty.....(for example, because there was limited data.....)". What about SAMPLING BIAS? Investigations on contaminated sites are biased, i.e. they are looking for contamination and a lot of samples tend to be clustered around contamination!<br>Please mention that sampling bias is important to note in any ERA because a lot of the data we use and obtain comes from a highly biased investigation. | Appropriate conceptual site model and DQOs will inform relevant sampling approach. |
| 14 | 4.6 | *Environmental consultant*<br>S4.6, p17, First paragraph of page "The decision should be based on a multiple-lines-of-evidence approach".<br>Just a note that some Prelim ERAs have extremely limited lines-of-evidence with extremely high uncertainty therefore a risk manager should really be very careful in assessing the data in a prelim ERA. A risk assessor should also be cognoscente of this and make sure it is highlighted in the report. I have seen reports where uncertainty and data gaps were not fully identified and bad decisions where mad that ultimately resulted in major costs after it was picked up later down the road. In some instances this resulted in legal action being taken by the government. | Noted. Appropriate CSM will assist with improved decision making. |
| | 5 | **Definitive risk assessment** | |
| 5 | 5.3 | *Environmental consultant*<br>5.3: p20; It is stated that "Advanced quantitative models may be used' without giving examples or types.<br>Can examples or types be listed? | Amended.<br>It is not appropriate to provide examples as the appropriateness of models will change over time and new models be developed. Therefore any examples would quickly become outdated and may be used to infer |

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| | | | that only the listed models were appropriate. |
| 5 | 5.3 | *Environmental consultant*<br>5.3-5.4: A number of approaches which 'may' be used or carried out are listed. Whilst these are informative, it is potentially under-prescriptive.<br>Can the wording be tightened up to list minimum requirements in respect of exposure assessments and toxicity assessments? | Noted. See suggested response above. |
| 47 | 5.4 | *Industry peak body*<br>5.4 21—First Paragraph: "A detailed review of the literature since the EILs were derived should be conducted to update the toxicological profile of each contaminant of concern and mixtures of the contaminants." Will this be a requirement for every Detailed ERA? Perhaps this requirement could be tempered by considering the length of time that has passed since the previous review, as well as considering any recent findings and research that may make numbers that are currently in-use obsolete. Also, the last sentence in this paragraph appears to be incomplete. | Amended. The EILs should be reviewed and updated where warranted. |
| 5 | 5.4 | *Environmental consultant*<br>5.4: p21; 1st para: The last sentence does not specify the method for deriving new EILs<br>Insert method or reference | Amended. |
| 5 | 5.4 | *Environmental consultant*<br>5.4: p21; Last para. Toxicity testing on species that occur or should occur on the site are the most relevant, however it would be inappropriate to carry out exposure assessments on threatened or endangered species.<br>Suggest inserting "(excluding threatened or endangered species)" after "…expose species that occur (or should occur) at the site or surrounding areas" | Amended. |
| 14 | 5.4 | *Environmental consultant*<br>S5.4, p21; 4th paragraph: "....rather than just biochemical changes which may or may not be adverse". Biochem changes can be chronically adverse and ultimately | Noted. Where warranted, more specific site assessment should be conducted. |

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| | | have a significant effect on populations. Importance should also be given to these effects. | |
| | 6 | **Uncertainty** | |
| 9 | 6 | *Local government*<br>6: p24<br>The Precautionary Principle should be introduced / enforced in this section; ie: if there is a potential for risk of harm to health or the environment, then action to minimise and /or eliminate the risk should be taken. | Noted. |
| | 7 | **Reporting** | |
| 14 | 7 | *Environmental consultant*<br>S7, 25-27; Uncertainty should be presented in one section only! There is no need to provide an explanation of uncertainty in each section, especially when you have an Uncertainty section!<br>As for Executive Summary, this should precede everything, including the table of contents. It should be after the title page. | Noted. |
| 47 | 7 | *Industry peak body*<br>7 Addresses reporting requirements and outlines information to be included. Sections 7.2 and 7.3 outline need for conceptual site model (CSM) considerations. It may be reasonably presumed that findings of Sections 7.2 to 7.5 feed into the development of a CSM, from which risk characterisation can be determined.<br>Therefore it is considered suitable to include "Development of Conceptual Site Model" as one of the main components listed in Section 7.0, as opposed to consideration within Sections 7.2 and 7.3. | Noted. Refer to tables 2 & 3 and note that CSM is part of problem identification. |
| 47 | 7.3 | *Industry peak body*<br>7.3 26—Given that these receptors often end up driving final ERA outcomes, consideration of the methods used to identify 'key' receptors is warranted.<br>The final report should also include justification for the choice of key receptors/drivers (e.g. endangered species, sensitive organisms, potential for | Noted. |

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| | | dryland salinity if significant numbers of deep-rooted trees are killed, etc). | |
| 47 | 7.3 | *Industry peak body*<br>7.3 26—The previous Section (Page 21, Final Paragraph) references the need to undertake an assessment not only of species that are present, but also that 'should occur'; "The most environmentally relevant toxicity tests are those that expose species that occur (or should occur) at the site or surrounding areas to the contaminants of concern in soil from the site." Despite this, there is no discussion in the Receptor Identification Section regarding the need to assess not only species that are present, but those that have the potential to be present in the future. In addition to this, what is the definition of a species that 'could occur'? Are species that 'could occur' those that would be present if the contamination was not? Transitory species? Species that could re-colonise the site if land was changed from industrial to, say, open parkland?<br>Clarification on how to assess species that 'should occur' is required. | Amended. |
| 47 | 7.3 | *Industry peak body*<br>7.3 26—What is the definition of a 'key receptor'?<br>The definition of a key receptor should be included in the glossary | Noted. |
| 27 | 7.7 | *Environmental consultant*<br>P27, Section 7.7. The uncertainty assessment of the ERA is another area where I feel that ERA authors too easily write of some uncertainties as insignificant. | Noted |
| | 9 | **Appendices** | |
| 14 | 9 | *Environmental consultant*<br>S9, p32<br>EILs are given in ranges, which is not good! Most people will use the highest value. If these EILs are to be used please provide appropriate information as to how they are to used. Only a single value should be carried forward for use as a screening level value for assessing risk | The table is provided as a summary only. An explanation of the ranges and a suitable cross-reference to the full tables has been provided. Refer to Schedule B5c, Schedule B1 and the EIL calculation spreadsheet in the Toolbox for further information. |
| 5 | 9.1 | *Environmental consultant* | Noted. |

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| | | 9.1: p31; In Appendix 1, the table lists EILs for contaminants which, although calculated to be ecologically protective, are potentially harmful to human health — e.g. naphthalene and lead.<br><br>It is suggested that a footnote be added to the table stating that HILs and HSLs should be cross referenced to ensure that human health is adequately protected, particularly for the urban residential scenario. | |
| 47 | 9.1 | *Industry peak body*<br><br>Appendix 1 — As a means of explaining the use of the developed generic and soil specific EILs (i.e. concentrations outlined in Appendix 1), cross reference to the fully worked derivations in Schedule B5c using the ERA approach and EILs would be beneficial in assisting readability<br><br>Include cross references | The table is provided as a summary only. Refer to Schedule B5c, Schedule B1 and the EIL calculation spreadsheet in the Toolbox for further information. |
| 47 | 9.1 | *Industry peak body*<br><br>Appendix 1 — Summarises EILs for fresh and aged contamination in soil with various land uses.<br><br>Include cross reference here to explanations of these classifications in B5c. A brief explanation of "added contaminant limits" (ACLs) is also considered necessary, or reference to Schedule B5 b or c for further details. | The table is provided as a summary only. Refer to Schedule B5c, Schedule B1 and the EIL calculation spreadsheet in the Toolbox for further information. |
| 28 | 9.1 | *Environmental consultant*<br><br>Appendix 1, 31, Table 9.1, it would be useful to have footnotes for the EIL/SQG to indicate the reliability of the EIL/SQG i.e. high, moderate or low. Add appropriate footnotes. | The table is provided as a summary only. Reference is made to Schedule B5c for further information on reliability. |
| 5 | 9.1 | *Environmental consultant*<br><br>Appendix 1: p31; Tabulated EILs - The EILs are not supported by much in the way of description.<br><br>It would be beneficial to direct the reader to the relevant Schedule where information on the application can be found. It would also be beneficial to include some basic supporting information. for example: | The table is provided as a summary only. Refer to Schedule B5c, Schedule B1 and the EIL calculation spreadsheet in the Toolbox for further information. |

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| | | – It is not mentioned that these EILs are ACL (added contaminant limits), to be added to the ambient background concentrations (ABC);<br>– Data is presented as a range. Guidance should be provided on how to apply the EILs as the range presented is large for some contaminants;<br>A note should be included mentioning that the EILs apply to the top 2 m of the soil profile | Amended. |
| 27 | 9.1 | *Environmental consultant*<br>P31 App 1, Aged soils are those that contain a contaminant that are greater that 2 years old. How do you tell or justify the use of this guideline. In most industrial cases it is more than likely to be judged to be greater than 2 years old. I can also foresee strategies being developed that require land banking for two years rather than taking action<br>May be the use of the 2 year data can be further justified by direct measurements of organic carbon and clay content etc. | The period of two years is based on review of ecotoxicology data that is available for the effects of ageing. |
| | | **General** | |
| 47 | | *Industry peak body*<br>Although general content is clear and the new approach to application of EILs is considered more appropriate, some effort to make the document more reader friendly would be helpful.<br>The detail provided within Schedules B5b and c should be cross-referenced to assist readability of Schedule B5a. For example, brief summaries of these Schedules should be included in Schedule B5a and vice-versa. | Noted and reference to Schedules 5b & 5c added. |
| 18 | | *Other*<br>Although the rationale for the proposed methodology is reasonably clear, there is concern that the approach is overly-complicated. This raises several potential difficulties. Perhaps foremost is the issue of uncertainty with regards to the multiple steps required to derive both the EILs and the soil-specific ACL values.<br>A sensitivity analysis should be performed to determine the influence of the various steps / conversion factors. The results of this analysis should be discussed. | Noted. This is largely addressed by having the EIL calculation spreadsheet.<br>Noted |

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| | | In regard to the first point above relating to the complexity of the approach, many of the proposed factors appear to be largely arbitrary or empirical. For example, Table 8 (5b) lists conversion factors to convert chronic measures of toxicity to chronic NOECs. These values appear to be largely empirical and yet have a substantial influence on the final calculations. | The conversion factor approach is consistent with international practice. |
| 31 | | *Environmental consultant*<br>EILs are commonly used for screening purposes in documents other than ERAs, such as site assessments, where exposure and toxicity assessments are not conducted.<br>It would be valuable to include some discussion regarding the application of EILs in site assessment reports. | Such a scenario is covered by the Problem identification component of Preliminary ERA's—specifically by the Conceptual Site Model and selection of appropriate screening criteria. |
| 5 | | *Environmental consultant*<br>General comment: EILs largely ignore the potential effects of soil contamination on aquatic ecosystems. Two notable exposure pathways exist—erosion and sediment transport into waterways; and leaching into groundwater and discharge into aquatic environments.<br>The limitation of the process to address these issues should be clearly stated, and furthermore, it is recommended that greater import is given to quantifying these exposure routes. The groundwater exposure pathway is given a brief overview in the Appendix of B5b, however this is quite light treatment. It should at least be referenced, and preferably enhanced. Ideally, a set of soil screening values for leaching to groundwater would be beneficial. | Amended. |
| 5 | | *Environmental consultant*<br>General comment: Guidance should be provided in this Schedule on how to interpret site investigation values.<br>For example, should EILs be compared against maximum concentrations, average concentrations, or upper confidence concentrations (i.e. 95% UCL)? | Refer to Schedule B1 for information. |
| 5 | | *Environmental consultant*<br>General comment: The land use scenarios don't appear to adequately address a | This is issue is addressed in Schedule B1 for consideration of offsite impacts. |

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| | | situation where a contaminated site is directly adjacent to an area of high ecological value. Sensitive species are not necessarily confined to the site of higher ecological value, or fulfil the criterion of 'transitory wildlife' | |
| 5 | | *Environmental consultant*<br>General comment: There are a number of references to the protection of introduced species (compared to native flora and fauna). Introduced species are frequently undesirable; is there a risk that sites may require remediation on the basis of risks to introduced species and not native flora and fauna, and would this be justified?<br>It could be stated that the desirability of introduced species should be assessed on a site-specific basis before deriving site-specific EILs which take undesirable introduced species into account. | Where warranted, site-specific consideration of such issues may be considered in Definitive ERAs.<br>This issue is covered by point 3 of Section 5.1 which states that a Definitive ERA should determine site-specific EILs that take into account the ecological values at the site. |
| 47 | | *Industry peak body*<br>General—Interchanges between the use of 'biota' and 'ecosystem processes' when describing what is to be protected.<br>The use of 'biota' is incorrect when discussing what is to be protected; we should be looking at (and protecting) the ecosystem as a whole, not just the 'living things' within it. | Noted. |
| 47 | | *Industry peak body*<br>General—tabulated EILS, this has been split between Schedule 1b and Schedule 5a.<br>Appendix 1 would be better included in Schedule 1B where the effects of aging are discussed. | The table is provided as a summary only. Reference has been included to Schedule B5c, Schedule B1 and the EIL calculation spreadsheet in the Toolbox for further information. |
| 28 | | *Environmental consultant*<br>General—Two terms are used to describe the guidelines: EIL and SQG. It is unclear why although it appears these terms are interchangeable.<br>Provide clarity on terms EIL and SQG. If the term SQG is included, and is different to EIL, a definition of SQG, including the distinction between EIL and SQG should be included in the glossary. Note, definitions in Schedule 5a should be the same as | Amended. SQG is a generic term for soil criteria, while EIL has been adopted based on SQG using EC30/LOEC data. Definition of SQGs has been added to the Glossary. |

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| | | in Schedule 5b. | |
| 5 | | *Environmental consultant*<br>General: B5a,b,c; This application of CSIRO's tox work on different types of soils to determine the EILs will save a lot of time for ecotoxicologists who have to date been undertaking the calculation process for each site to get site-specific EILs. It is noted however that TOC is not considered in their calculations. | Refer to Schedules B5b and B5c and the EIL calculation spreadsheet for information on physicochemical factors required to derive the EILs. Please note that TOC is one of the physicochemical properties of soils that is considered – but only where appropriate. |
| 28 | | *Environmental consultant*<br>Guidance for statistical data used in screening in a Preliminary ERA (i.e. whether use of maxima, 95% upper confidence limit of the mean, or mean concentrations are preferred/acceptable) is not provided.<br>A cross-reference to where this guidance is presented (if provided) would be helpful. | Refer to Schedule B1 for application of EILs. |
| 27 | | *Environmental consultant*<br>I would like the addition of an empirical approach to this while also including the existing suggestions of an uncertainty analysis. Maybe a Score system like the one suggested to assess the quality of toxicological data that is proposed to be used in Table 7 of B5b. Such a table may also be helpful in the preliminary stages of and ERA or the development of the scope of an ERA to quickly assess if you are able to achieve an acceptable level certainty with the data/scope you have or propose to collect/undertake. | Noted. Section 6 of B5a is to highlight the importance of uncertainty consideration. |
| 18 | | *Other*<br>The EILs are based upon the amount of contaminant added to the soil, rather than the background + added. Whilst this approach is satisfactory in the majority of cases, it fails in instances where the background concentration is already high and at toxic (or near-toxic) values. Such examples do exist, such as in the case of excess Ni in soils formed from ultramafic minerals. In these cases, it is permissible to add the same amount of contaminant (with detrimental effects) as can be added to a soil with very low background levels (to which adding the contaminant would have no observable detrimental effect) whilst remaining below the EIL. | Noted. Refer Schedule B1 for further information regarding naturally elevated background concentrations. |

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| 31 | | *Environmental consultant*<br>The NEPM ERA guideline only assesses the risk to terrestrial ecosystems, however in practice ERAs often assess risks to both the terrestrial and aquatic environments. Although alternative guidance, such as ANZECC/ARMCANZ (2000) is available, discussion on the process for incorporating the assessment of aquatic ecosystems into ERAs would be beneficial. | Noted. Reference to the ANECC Water Quality guidelines added. |
| 28 | | *Environmental consultant*<br>There are a number of exclusions included in the ERA section in regard to the EILs derivation (eg. ecological values and exposure pathways that were not considered), and other requirements, such as the assessment of mixtures. Need to check these have been clearly outlined where the EILs are presented. | Noted |

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| | 2 | **EIL Deriviation Methodology** | |
| 5 | 2.1 | *Environmental consultant*<br>2.1: p1; In the first para there is a reference to "long term targets for contamination". This is ambiguous. In the contaminated land industry, target values and clean up criteria are often used interchangeably.<br>Suggest revised wording to explain concept of long term targets for contamination. | Amended |
| 28 | 2.2 | *Environmental consultant*<br>2.2, p3, The last paragraph states that the EILs are based on LOEC and EC30 data. It may be worth clarifying at this point that the screening and selection of toxicity data (described later in the Schedule) entails conversion of the following acceptable endpoints: LC10, EC50, NOEC, LOEC or MATC, to LOEC and EC30 equivalent, in standardisation of the toxicity data. Alternatively, a cross-reference to the subsequent section may suffice. Add clarification or cross-reference. | Amended |
| 47 | 2.2.1 | *Industry peak body* | Noted |

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| | | 2.2.1 Four ecological receptors are listed. | |
| 47 | 2.2.1 | *Industry peak body*<br>2.2.1 The reason for the four designations is not made clear, and they are never really used again. | The four types of organisms and processes are mentioned to indicate what the EILs aim to cover |
| 47 | 2.2.1.2 | *Industry peak body*<br>2.2.1.2 States "...it would be reasonable to expect that such land uses should sustain plant growth of both introduced (ornamental) and native species...". Does this correctly presume food crops grown in residential settings constitute introduced (ornamentals) ?<br>One might presume that these are largely dealt with in the human health measures (Schedules B4 and B7).<br>Cross references here to relevant part(s) of the human health measures (B4 and B7) would e helpful for clarity.<br>This revision to include the concepts (with fully worked derivations) of ambient background contaminant concentrations (ABCs), added contaminant levels (ACLs), and soil quality guidelines (SGCs) for the selection of contaminants is a significant improvement and an enhancement to the encouragement of competent ecological risk screening and assessment by contaminated site practitioners.<br>The previous version of this schedule was very much conceptual and the inclusion here of the fundamental soil physico-chemical and ecotoxicological concepts is sure to raise the technical standard and defensibility of practice in the various state and territory jurisdictions (if adopted). | Urban residential includes normal backyard garden species.<br>The EILs only consider growth and survival aspects of plants—they do not consider human health aspects of human consumption of plants. Refer to Schedule B1 for applications of investigations and screening levels.<br>Noted.<br>Noted. |
| 5 | 2.2.1 | *Environmental consultant*<br>2.2.1: p4; The first bullet point states that the contaminant must meet the criteria for biomagnification. It would be useful if contaminants which are known to biomagnify could be tabulated (it need not be a definitive list, but examples would be informative). | Noted. Such information is presented in Table 5 of Schedule B5b. |
| 14 | 2.2.1 | *Environmental consultant* | Threatened & endangered species are captured |

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| | | 2.2.1; p3; Vertical list. In the bullet points there is no mention of species or communities/ecosystems at risk (threatened, endangered)<br><br>Make reference to species at risk | under flora and fauna category. |
| 14 | 2.2.1 | *Environmental consultant*<br><br>2.2.1; p4; First paragraph after Table 1. "This Measure focuses on the first three groups". WHAT measure? Please explain as this seems to come out of nowhere. | Noted, Measure has been added to the list of shortened forms. |
| 28 | 2.3 | *Environmental consultant*<br><br>2.3, p8, Box 2, the bullet list of physical and chemical properties should be numbered 1 to 13 to cross-reference with the routes of exposure illustrated in the graphic.<br><br>Amend list for clarity | Amended. |
| 5 | 2.3 | *Environmental consultant*<br><br>Box 2: p8, Bullet points below diagram<br>- The bullet points under the diagram are not well linked to the diagram. Some commentary linking the bullet points to the exposure pathways in the diagram would be beneficial.<br>- The eighth bullet point lists Henry's gas law. KH is not inserted in parenthesis in keeping with the other abbreviations that follow their long title | Amended. |
| 5 | 2.3.1.3 | *Environmental consultant*<br><br>2.3.1.3, 10,<br>- What is 'the low guideline value for protecting aquatic ecosystems (ANZECC & ARMCANZ 2000)'? This description is not consistent with the terminology used in ANZECC & ARMCANZ 2000. Recommended to revise this reference. | Amended. |
| 28 | 2.3.1.3 | *Environmental consultant*<br><br>2.3.1.3, p10, Section header "Octanol-water partition and organic carbon-water coefficient". Kow is discussed but Koc (organic carbon-water coefficient) is not., Change heading or add discussion on Koc | Amended |
| 5 | 2.3.1.3 | *Environmental consultant* | Amended. |

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| | | 2.3.1.3: p10; To assist in interpretation, it is recommended to:<br>- Insert a paragraph break between 'This effect is known as secondary poisoning.' and 'Contaminants with low log Kow…..'<br>- Insert '(high log KOW)' after …'while highly fat soluble, lipophilic contaminants are most likely to biomagnify' | This is defined as log $K_{ow}$≥4 |
| 5 | 2.3.1.2 | *Environmental consultant*<br>p10: Henry's Law<br>The first paragraph discusses the dimensionless version of KH, and states that this is based upon molar concentration in the gas phase to the molar concentration in the liquid phase.<br>Comment—it is equally valid for concentrations to be mass concentrations (i.e. mg/L). As most environmental analysis is based in mass terms rather than molar terms this is an important clarification to make.<br>There appears to be some confusion between the use of KH and H in the first paragraph with the two terms being used interchangeably.<br>Table 3—Henry's constant is listed as cm3 solution/cm3 air. This appears to be the wrong way around as Henry's constant is the gas phase over the dissolved phase.<br>An alternative would be: gas concentration/dissolved phase (i.e. mg L-1air/ mg L-1water) | Amended |
| 28 | 2.4 | *Environmental consultant*<br>2.4, p13, Final paragraph, the following references are not included in the bibliography: Posthuma (1997); Mann & Ritchie (1994); (Díaz-Raviña & Bååth (1996), Bååth et al. (1998); Rutgers et al. (1998); McLaughlin & Smolders (2001); Rusk et al. (2004); Fait et al (2006)., Add reference to the bibliography | Amended |
| 18 | 2.4 | *Other*<br>2.4.1.5; Table 7; Although these criteria have been previously published, the weightings for some are somewhat surprising. For example, even if a study does not include an appropriate control, it can still be included in the dataset. This will create a problem, for example, when a toxicant has been applied with a carrier | This method is based on the USEPA data assessment method and is consistent with the method used to assess the quality of all data used to derive the Australian and New Zealand water quality guidelines. |

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| | | which could be itself toxic (i.e. a solvent).<br><br>Some criteria should be considered essential, such as inclusion of a control, growth media, and concentration-response relationship observable. | |
| 15 | 2.4 | *Environmental consultant*<br><br>Section 2.4; p13; There is a lack of supporting evidence regarding the incorporation of the added contaminant limits (ACL). We concur with the statement that in areas with naturally elevated concentrations ecosystems may actually need these conditions for their survival and maintenance. However, it is not made clear how any added concentration on top of background levels would not pose any detrimental effect on local biota. Moreover, the ACL could not be accurately determined given the lack of Australian specific data (see point below) and thus leading to false conclusions.<br><br>The background levels should be compared to the allowable levels rather than added. Allowable levels should reflect allowable levels. | Refer to Schedule B5c. |
| 15 | 2.4.1.1 | *Environmental consultant*<br><br>Section 2.4.1.1; p14; ECOTOX and ECETOC databases may not account for species relevant to a particular Australian ecosystem. Even though Australian toxicity database exists, this primarily accounts for aquatic biota. Serious data gaps exist at the moment, for example the lack of data for reptiles and marsupials.<br><br>Set up a working group to undertake ecotoxicological studies using native Australian species. | Noted. An update to the Australasian database has been written and has now been cited. In addition, a footnote stating that the database will be placed on the CSIRO web-site has been added. |
| 47 | 2.4.1.1 | *Industry peak body*<br><br>Figure 2, 8 The incidental ingestion of soil by herbivores appears to have been omitted from this figure.<br><br>Also, do the numbers in the diagram correspond with the bullet points listed below the diagram?<br><br>Address pathway. Fix cross-referencing | Amended |
| 5 | 2.4.1.4 | *Environmental consultant* | Noted. |

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| | | Equation 4: p17; notation adopted for RHO<br>The terminology RHOsoil is used for the dry bulk density of soil. Commonly the Greek lowercase symbol for rho (ρ) is used rather than the long hand description. The symbol is used elsewhere in the document | |
| 5 | 2.4.2.1 | *Environmental consultant*<br>2.4.2.1 20, In the third paragraph, it discusses that toxicity data causing >65% effect should not be used, however in this section it categorises the use of toxicity data up to 60%. There is therefore no guidance on how to address toxicity data causing an effect level of 60% to ≥65% | Amended so that data causing > 60% effect are not to be used. |
| 5 | 2.4.2.1 | *Environmental consultant*<br>2.4.2.1: p 20; Toxicity cut off levels—In the third paragraph, it discusses that toxicity data causing >65% effect should not be used, however in this section it categorises the use of toxicity data up to 60%. There is therefore no guidance on how to address toxicity data causing an effect level of 60% to ≥65% | Amended so that data causing > 60% effect are not to be used. |
| 14 | 2.4.2.1 | *Environmental consultant*<br>2.4.2.1; p20-21; Table 8—Conversion factors.<br>Only concerned that this will introduce a large amount of uncertainty! | Noted. |
| 5 | 2.4.2.2 | *Environmental consultant*<br>2.4.2.2: p21; Definition of Added Background Concentration<br>Definition of Added Background Concentration varies slightly from that provided in the glossary. | Amended |
| 28 | 2.4.4 | *Environmental consultant*<br>2.4.4, p24, 1st paragraph, cross-reference to Table 11 (p. 26) would be useful in defining "nutrient groups"., Add cross-reference | Amended. |
| 28 | 2.4.4 | *Environmental consultant*<br>2.4.4, p25, 3rd paragraph, a cross-reference to section 2.4.11 would be useful in clarifying the 'reliability' classifications and data requirements. However, it is | Amended |

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| | | noted that nomination of reliability classifications following use of modelled data is not provided. , It is suggested that further discussion is included, and / or an example SQG, on use of modelled data. | |
| 5 | 2.4.4 | *Environmental consultant*<br>Table 9, 24, Protection levels for other land use settings<br>Questions: Is there value in adding protection levels for other land uses, rather than just residential? | Amended. |
| 28 | 2.4.4 | *Environmental consultant*<br>2.4.4, p25, Table 10, birds (particularly predatory birds, which are sensitive to secondary poisoning from biomagnifying chemicals) are notably missing as a receptor group from the last line in this table (Chordata) albeit that there may be few available ecotoxicological data. | Amended |
| 15 | 2.4.4 | *Environmental consultant*<br>Section 2.4.4; p25; The approach of "a minimum of three taxonomic groups and five species" may not consider key and/or endangered species of a particular ecosystem.<br>Considerations should always be made in a risk assessment for key, endangered and/or protected species. If data is not available the risk assessment should consider potential species soil ingestion factors (based on feeding and behavioural habits) and derive EILs based on toxicity and exposure as it is undertaken for Human Health Risk Assessment. | This comment is correct. But this schedule outlines the method for deriving EILs, not for conducting the ERA. Toxicity data for key or endangered species should be included if it is available – but generally it is not. Schedule B5a states how this issue can be addressed in both Preliminary and Definitive ERAs. |
| 28 | 2.4.6 | *Environmental consultant*<br>2.4.6, p27, Numbered bullet points at bottom of page (numbered 1, 2, and 3). The use of 'merge' in this context may need clarification; 'compilation' may be a better term. | Amended |
| 18 | 2.4.6 | *Other*<br>2.4.6; Table 12<br>It is not clear how it is possible to define a 'typical' soil for Australia, given the | The term should be reference soil and all references to 'standard soil' have been removed. The reference soil could include any property which is included in a normalisation |

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| | | diversity from tropical to temperate, and humid to arid landscapes. It is also surprising that the typical soil does not include consideration of the iron oxide content, given the importance of this parameter for controlling the bioavailability of some contaminants (e.g. arsenic) as is stated in the final paragraph on Page 38.<br><br>If the proposed approach is to be used, then it is suggested that iron oxides be included. | relationship used to derive EILs. As iron oxides were not included in any used normalisation relationships they were not included in the reference soil. The reference to iron oxide has been removed from p. 38 to remove this apparent discrepancy. |
| 5 | 2.4.8 | *Environmental consultant*<br><br>Table 14: p31; Title of table states it is for organic and inorganic substances. Guidance on the previous page states that KOW should not be used as an indicator for BMF for inorganic substances. | Amended. |
| | 3 | **Technical notes on methods used in the EIL derivation methodology** | |
| 18 | 3.1.1 | *Other*<br><br>3.1.1; P37;<br><br>In the section titled "Chemical estimates of bioavailability" a number of statements are made, including:<br>– "A number of soil extraction methods have been developed with the aim of providing a better estimate of the bioavailable fraction than total concentrations"<br>– "There is considerable evidence both from overseas and Australia that, at least for metals, extractable concentrations in soil are not better measures of bioavailability than total concentrations"<br><br>There is general agreement that EILs should be based largely upon total concentrations (for a number of reasons). However, the following comments are relevant:<br>- There is also evidence in the literature that chemical extractants are indeed better than total concentrations (see large meta-analysis of: Menzies N W, Donn M J and Kopittke P M 2007 Evaluation of extractants for estimation of the phytoavailable trace metals in soils. Environ Pollut 145, 121-130).<br><br>Therefore, statements made in this document need to be more cautious and balanced. | Amended. |

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| 15 | 3.1.1 | *Environmental consultant*<br>3.1.1; p37; Different contaminant forms are not considered and nor is bioavailability. It is noted that provisions are made for "aging processes "however, the vastly differing risk posed by for example lead sulfate (low bioavailability) versus lead carbonate (high bioavailability) is not considered. It is understood that a conservative approach is recommended by the guidelines and thus 100% bioavailability is assumed (which is rarely the case). Nevertheless, this may lead to unnecessary remediation by overprotective measures and the consequent waste of resources, CO2 emissions, etc.<br>The use of specific reagents should provide a measure of bioavailability. There are several studies conducted using different reagents that have shown good correlations between in-vivo and in-vitro studies (such as PBET and EDTA). | Noted. Differences in availability are recognised and this is why in Schedule B5c it states the forms of the metals that are specifically covered in the derivation of the EILs. Also Appendix C addresses this issue. |
| 2 | 3.3 | *Environmental consultant*<br>Section 3.3 / Section 3.5; Page 5<br>The integration of receptor identification and exposure assessment into the method of applying and developing EILs using the nominal percent protection has not been described and does not seem consistent with the method used to develop the proposed EILs. | Noted. This is a policy position which aims to be consistent with the ANZECC Water Quality Guidelines. |
| 47 | 3.3.2 | *Industry peak body*<br>3.3.2, 54, Inconsistent use of the term risk assessment/assessment in first two sentences of last paragraph. Use of the term risk assessment is inappropriate. Delete the word 'risk' from the first sentence. | Amended. |
| 2 | 3.5.1 | *Environmental consultant*<br>3.5.1<br>Table 1. The percentage of species and soil process to be protected is for biomagnifying and non-biomagnifying chemicals. The derivation of these percent protection values does not appear to be based on scientific judgement and as such cannot ensure that the ecological values described will be protected.<br>The surface area coverage which has significant impact on exposure is influence by | Noted but there is a different view about not being based on scientific judgement. The percent values are similar (but not identical) to those used by other jurisdictions.<br>Noted. |

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| | | animal home range in biomagnification processes. The scientific justification for surface areas should be discussed.<br><br>Increasing the theoretical number of species to be protected for the purpose of protecting animals that may be affected by biomagnification process's does not appear to be based on any scientific basis. The nominal increase in percent protection on the hope that it will protect higher order animals from the effects of biomagnification, simply can not be supported.<br><br>It is of interest as to the relevance of including toxicity data into a statistical distribution for unrelated toxicological impacts. (eg the impact of DDT on some invertebrates is completely unrelated to the toxicological impact on plants as well as impact on mammals). Any statistical distribution must be a measure of a specific and related event for related toxicological impacts.<br><br>The inclusion of a mixture of unrelated endpoints, unrelated biological process and unrelated toxicological processes into a database can not be used to validly claim that an extrapolation from the distribution can be used to protect a percentage of all species.<br><br>Suggested change:<br><br>There appears little scientific foundation for the approach used to address biomagnification.<br><br>The development of EILs accounting for biomagnification can not be supported.<br><br>It is recommended that the use of any statistical distribution model be used to model the toxicological sensitivities of like groups. Example all plants together ect. Then following the derivation of a suitable level for the protection for that group EILplant, EILgroup 1, EILgroup 2 ect, the lowest EIL for a relevant group becomes the level that will suitably protect all other relevant groups. | This methodology was adopted so that the terrestrial and aquatic guidelines deal with biomagnifying chemicals in the same manner.<br><br>Noted. Data can be combined providing the distribution is unimodal. This is standard international practice. For example the Australian and New Zealand water quality guidelines are derived by combining species of different taxonomic groups. |
| | 5 | **Appendices** | |
| 47 | 5.2 | *Industry peak body*<br><br>General—The inclusion of methodology (Appendix B) for deriving EIL/SQG protective of aquatic ecosystems is valuable. | Noted and reference to this section added to introduction |

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| 45 | 5.2 | *Environmental consultant*<br>The use of the DAF to calculate the SQG for protection of groundwater is not practical and too subject to bias. | Noted. |
| 18 | 5.3 | *Other*<br>On Page 37, in Section 5.3 (Appendix C, Page 74), the reader is told that "further chemical investigation of the bioavailability of the contaminants (can) be undertaken prior to direct toxicity assessment".<br>On page 75, the reader is referred to McLaughlin et al. 2000, who states "In many countries, assessment of metal hazard is still inappropriately based on the total soil metal concentration".<br>Thus, the reader is initially told that: (i) total concentrations are used in the current EILs because they provide equally good measurements of bioavailability, (ii) that risk assessments systems based upon the total metal concentrations are "inappropriate", and (iii) that it is possible to use chemical extractants to estimate bioavailability.<br>It is suggested that the statements need to be clarified. For example, "For the purposes of developing EILs (which are used across soils with a wide range of properties), there is some evidence from both overseas and Australia that, at least for metals, extractable concentrations in soil may not necessarily be better measures of bioavailability than total concentrations. However, for the purposes of examining bioavailability within a risk assessment (where the variation in soil properties is limited), chemical extractants may still be used to provide an estimate of bioavailability". | Amended<br>The first sentence has been adopted. The second has not because extractable concentrations are only useful to compare against EILs and there are no extractable based EILs. |
| | | **General** | |
| 15 | | *Environmental consultant*<br>Actual EILs were derived for a total of 8 components and a methodology is presented to do it for other components. However it is desirable (and would save the industry a lot of money) if Tier 1 EILs were derived for more chemicals. This should be funded by the Government or by the industry itself. | Noted. |

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| | | Setup a task force between consultants and CSIRO in order to derive Tier 1 EIL's for all components as listed in Table 1A(1) in Schedule B1. | |
| 30 | | *Environmental consultant*<br>The new EIL derivation approach is rigorous and commendable. However, this approach seems does not address the need for generic guidelines for initial screening purposes (for example in PSIs). It is not commercially realistic to apply this methodology at all times as it requires specialist skills to derive EILs for each site. This will have major cost implications for the assessment of low risk sites in particular. | Noted. Refer to Schedule B1 and EIL Spreadsheet (toolbox on website) which provide information on deriving/applying EILs for Tier 1 site assessment. |
| 30 | | *Environmental consultant*<br>In view of this, it is suggested that the EILs from the existing NEPM be re-produced as initial screening criteria (ecological screening levels). These would be particularly useful for organic substances, which mostly do not have natural background levels. Should these be exceeded, site-specific EILs should be derived as per the new NEPM. | 1999 NEPM will be superseded. |
| 2 | | *Environmental consultant*<br>It is unclear how a derived EIL is integrated with the description provided for conducting preliminary ecological risk assessment e.g. receptor identification require the assessor to ensure that all relevant receptors and exposure pathways were included in the derivation of the EIL.<br>Clarity should be provided | Refer to Schedule B5a for information. |
| 28 | | *Environmental consultant*<br>Overall the approach and methodology presented is thorough, clear, easy to read, and has adopted state of the art methodology for deriving SQG.<br>Furthermore, it uses the available Australian data and research in designing an approach that is relevant to Australia. The technical competency and expertise required to derive SQG is high. Consequently, it remains to be seen how readily development of site-specific SQG will be undertaken by practitioners and organisations other than CSIRO. Nevertheless, CSIRO should be commended for | Refer to B5c for derivation of criteria protective |

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| | | the comprehensive methodology they have prepared.<br>The inclusion of methodology (Appendix B) for deriving EIL/SQG protective of aquatic ecosystems is valuable.<br>Cross-referencing throughout the Schedule would be helpful e.g., where discussion is illustrated or clarified in a later section – some specific examples are listed in the comments below., Include cross-references where appropriate | |
| 2 | | *Environmental consultant*<br>Page 8 and generally<br>It is agreed that not all land uses require the same level of protection. However, the levels of protection should be on the basis that at some sites there are very few ecological values.<br>The SSD methods with nominal percentiles for each land use scenario do not ensure the protection of ecological values and in some cases may be un-necessarily too restrictive as they do not exclude specific biota that is not relevant to a land use. In other cases they may not protect the very species that we want protected.<br>The use of the SSD to develop EILs in this form is not supported. | Where warranted, definitive ERA should be undertaken to consider protection of specific species that are relevant to the site being considered. This is specifically addressed in Schedule B5a. |
| 2 | | *Environmental consultant*<br>Section 2,3 and generally<br>2. two final paragraphs<br>1) The policy decision to protect only a percentage of species is not similar to that used in human health risk assessment. Threshold contaminant toxicity values are based on NOECs and the uncertainty factors for extrapolation from laboratory animal to human include an UF that accounts for the protection of our most sensitive individuals.<br>For non-threshold and non threshold contaminants the policy decision for human health is to protect our most vulnerable (eg children and those who have a behaviour that leads to a higher level of exposure eg the few who live in a house for 70 years all of life). | |

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| | | The setting of acceptable risk for non-threshold contaminants of 1 in 100,000 (not 1 in 10,000 as stated in text) is based on every person exposed to a particular level sharing the same level of risk. This is totally different to deciding that there are some people or species that we decide not to protect.<br><br>Reference to the human health policy is incorrect and should be deleted.<br><br>2) The assumption that protecting the majority of species will result in the protection of ecosystem function, is totally unfounded. There are numerous cases where a group or individual species are critical to maintaining ecosystem function and the lack of their protection has massive implications for the majority of other ecosystem species.<br><br>The development of EILs or site-specific EILs on the stated assumption (final paragraph) will not ensure the protection of ecosystems and species that we identify as being valuable to each land use environment.<br><br>The development of EILs should be based on the identification of species and or biological functions that are of value to specific land use environments.<br><br>The simplistic view that we can allow some species to be impacted by contamination even though they are the very species that are of value to a particular land use environment is not commensurate with the idea of protecting the ecological values and beneficial use(s) that are associated with a land use environment.<br><br>A fundamental principle on which to base an EIL is that we must identify what it is that we want to protect in a landuse environment. Once we have decided that a group requires protection in a particular land use environment it is important that protection is ensured and not maintained by a particular chance that their toxicological vulnerability falls within the nominal % of biota that will be protected.<br><br>The fundamental aspect to an ecological risk assessment must be that firstly we need to identify what it is we want to protect in a specific land use environment.<br><br>The simple notion that by protecting a nominal % of biota we will provide sufficient protection to all ecological values of a land use environment should not | In B5a—sentence has been removed.<br><br>Noted. The methodology used (species sensitivity distributions) is used extensively to derive limits for contaminants in all environmental compartments. The only case where this method is not used is to use the Assessment Factor method which is even worse. The limitations that are mentioned are known and there are ways of addressing these which are set out in Schedule B5a. |

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| | | be the fundamental principle upon which to base EILs.<br><br>It is acknowledged that the application of statistical distributions to select toxicity reference values for species and groups that we have identified as requiring protection may have application. However, once we have decided that a group requires protection in a particular land use environment it is important that protection is ensured and not maintained by a particular chance that their toxicological vulnerability falls within the nominal percentage of biota % protected.<br><br>In the current form the proposed method of having an EIL equalling a nominal percentile concentration derived from a number of toxicity tests and endpoints is not supported. | |

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| | 1 | **Introduction** | |
| 28 | 1 | *Environmental consultant*<br><br>SQG for zinc (Zn) , arsenic (As), naphthalene, DDT and copper (Cu) were reviewed by us and to which the below 'specific comments' relate. SQG for lead (Pb), nickel (Ni) and trivalent chromium (Cr III) have not been reviewed by us and may contain similar typographic errors to those identified below. | Noted. |
| | 2 | **Overview of the method for deriving soil quality guidelines** | |
| 28 | 2 | *Environmental consultant*<br><br>Check lead (Pb), nickel (Ni) and trivalent chromium (Cr III) SQG for similar errors highlighted in following points.<br><br>2, p9, It is apparent that the National Biosolids Research Program (NBRP) has generated much ecotoxicological data and opportunities to understand relationships between soil parameters and chemical bioavailability and toxicity in Australian soils that has been used in derivation of the EIL/SQG. Will this data be published such that it may be used where practitioners are to derive site-specific SQG for chemicals not listed in the NEPM? Publish the data source. | These data are publicly available. A list of references for NBRP is included in the toolbox.<br><br>Appropriate editorial adjustments made. |

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| 28 | 2 | *Environmental consultant*<br>Figure 1, Suggest for clarity the penultimate box identifies the different ACL that may be calculated (where data are available), namely: (i) ACL (NOEC & EC10), (ii) ACL (LOEC & EC30), (iii) ACL (EC50), (iv) ACL (BM). | Refer to text above figure 1. |
| 28 | 2 | *Environmental consultant*<br>2, p9, Statement and bullet list below Figure 1—the steps 1 to 10 are relevant to all the SQG and not just to Cr III, Cu, Pb, and Zn. Amend text as appropriate | Amended |
| 28 | 2 | *Environmental consultant*<br>2, p12, Figure 2, Level 5 box in flow diagram, typo: the symbol '≥' should replace '?' in relation to no. of species and taxonomic groups. Amend text as appropriate | Amended |
| 2 | 2 | *Environmental consultant*<br>1) The inclusion of EC10 in the NOEC distribution should be discussed.<br>Proper justification for the inclusion of EC10 over a NOEC should be presented | EC30 and LOEC have been adopted for deriving EILs. EC10 and NOEC information included in B5c as illustration only. |
| 2 | 2 | *Environmental consultant*<br>2) The inclusion of mammal and bird data into distributions and grouping of other unrelated toxicity data is not scientifically justifiable.<br>Additionally, there was no discussion as to the relevance and exposure pathways considered in ascertaining a toxicity value for mammals and birds.<br>Develop EIL for each group. Select relevant groups and apply lowest EIL as the EIL for the relevant land use. | This issue has been raised and addressed previously in Schedule B5b. Combining toxicity data for different types of organisms in one SSD is a widely used practice in deriving environmental quality guidelines. In addition, there is insufficient data to derive limits for each type of organism. |
| 2 | 2 | *Environmental consultant*<br>3) The toxicological data applied is not referenced or freely available and cannot be scrutinised. | All the toxicity data that were used to derive the EILs can be found in the appendices (source document provided in tables). |
| | 3 | **Zinc** | |
| 28 | 3.7.2.3 | *Environmental consultant*<br>3.7.2.3 / 7.7.3.3, 29 / p68, The relevance of including the iron (Fe) content of soils | Refer to Section 7.6.1.2 - the ABC concentration was calculated using the method of Hamon et |

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| | | when presenting example calculations of SQG for aged soils in the 'soil descriptors' summary is unclear. Provide further information on the inclusion of iron. | al. (2004) which is related to the soil Fe content. |
| | 4 | **Arsenic** | |
| 15 | 4.2 | *Environmental consultant*<br>Section 4.2; Page 34 last paragraph; In Section 4.2 it is mentioned that Arsenic is not known to biomagnify. This comment does not match with Table 5 in Schedule B5b<br>Adjust Table 5 in Schedule B5b | Amended. |
| | 6 | **DDT** | |
| 28 | 6.8 | *Environmental consultant*<br>6.8, p51, The reliability of the EIL/SQG derived is termed 'medium reliability'. , Suggest the terminology is consistent with the other EIL/SQG i.e. 'moderate reliability'. | Amended. |
| | 7 | **Copper** | |
| 28 | 7.7.3.3 | *Environmental consultant*<br>7.7.3.3, p68, Example 2, the aged SQG(NOEC & EC30) of 350 mg/kg is outside of the range quoted for commercial/industrial land use in Table 9.1, Appendix 1, p. 31 of Schedule B5a. Amend text as appropriate | Refer to the footnotes of Table 9.1 of Schedule B5a and note the EIL is the addition of ACL and ABC. |
| | 8 | **Lead** | |
| 15 | 8.2 | *Environmental consultant*<br>Section 8.2; Page 72, first paragraph; In Section 8.2 it is mentioned that Lead does not pose a biomagnification risk. This comment does not match with Table 5 in Schedule B5b<br>Adjust Table 5 in Schedule B5b | Amended. |
| | 10 | **Chromium III** | |
| 7 | 10 | *Industry*<br>Problems with Schedule B5c for Chromium | |

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| | | Cr III is of very low toxicity to microorganisms, fish, plants and humans and it is not bioaccumulated in the food chain. The US EPA introduced limits for the land application of sewage sludge which included a level of 3,000 mg Cr/kg dry sludge solids. However, in 1994 the United States Court of Appeals for the District of Colombia invalidated the US EPA limitations for chromium in land-applied sewage sludge because they were not risk-based. The US EPA revised their limit for total chromium in sludge applied to agricultural land to 100,000 mg/kg of dried solids. Chromium in biosolids is not regulated in the UK or by the EU but the US considered there should be some limit. Many years of studies of sludges and chrome containing fertilizers applied to agricultural land have been undertaken. In Italy, leather wastes have been used as fertilizers for nearly 100 years: the soils have remained fertile without Cr VI in groundwater. Silva et al, 1996, found that no Cr III toxicity values for agricultural crops have been reported in the literature.<br><br>Schedule B5c is unjustifiably stringent for chromium.<br><br>Raw Toxicity Data<br><br>Consider Section 13.9 Appendix I: Table I1, p166, Schedule B5c: The raw toxicity data for trivalent chromium and the ageing leaching factor that were used in the derivation of the soil quality guidelines derived in this project and the source of the toxicity data.<br><br>Sykes et al 1981 is quoted 6 times in Table I1 as a source. Only 9 papers on a total of 12 plants were used and 8 of the papers were from 1971 to 1985. Data for 4 plants was from the Sykes greenhouse pot trials using soil to which Cr III in various forms was added. However, Sykes found no toxicity of Cr III at 1000 mg/kg. At 1000 mg chrome/kg in the soil there was marked beneficial effect on all the crops when either a leather-waste fertiliser or dried sewage sludge were the source of chrome. This increased growth was concluded to be due to nitrogen added with the chrome. Tannery sludge was used as another source of chrome and at 1000 mg/kg there was a significant reduction in the growth of lettuce. In 1981, tannery sludge contained high levels of sodium chloride and other salts which would have affected growth. It is likely that high salinity or unsuitable pH in the tannery sludge affected the growth of the lettuce. A second series of trials with soil chromium content of 500 mg/kg and nitrogen contents equalised showed | EILs are intended for screening purpose to determine whether or not further assessment is required. The application of the Tier 1 EIL does not exclude industry from developing EIL specific to industry using the methodology. For example Cr III and other contaminants in tanning waste which have the potential for soil contamination should be subject to a definitive ERA or development of EILs specific to the industrial wastes. |

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| | | chromium hydroxide addition could be beneficial. No chromium levels higher than 1000 mg/kg were used. Table I1 does not reflect the findings of the study.<br><br>These were not rigorous, well controlled trials: there was no pH monitoring or adjustment and no account was taken of components other than nitrogen in the source of chrome. Such studies undertaken over 25 years ago should not be used to derive current soil quality guidelines. Sykes would have disagreed with the low Soil Quality levels for Cr III in Schedule B5c (Sykes, 1994).<br><br>Schedule B5c quotes a number of greenhouse studies but the real environmental situation of chromium in soils in agriculture has been overlooked. Green house pot trials often do not simulate field and agricultural conditions.<br><br>Lack of Toxicity Data<br><br>Toxicity data, p 96: it is stated "Unlike the preceding elements, there is a lack of ecotoxicity data for Cr (III). This is reflected by the fact that the US EPA (US EPA 2008) could not derive Eco-SSL values (which require toxicity data for species belonging to three different types of organisms) for Cr (either as III or VI) for soil invertebrates and plants."<br><br>In spite of this, the Draft NEPM has stringent Soil Quality levels for Cr III.<br><br>Minimal Risk Data<br><br>Another example of questionable data is in Table 89. Soil quality guidelines (mg/kg) for total chromium, trivalent chromium (Cr (III)) and hexavalent chromium (Cr (VI)) from international jurisdictions, p106. The values given for minimal risk are 34 -130 mg/kg. The reference for the EU risk values is Carlon, 2007, Derivation Methods of Soil Screening Values in Europe. A review and evaluation of national procedures towards harmonisation.<br><br>In Carlon's Table 4.2, Screening values for negligible risk for metals and metalloids (mg/kg d.w.), Cr values for Belgium, Czech Republic, Netherlands, Slovakia are 34, 130, 100, 130.<br><br>It was noted: "In the comparison of negligible risk values for metals and metalloids it should be stressed that they are usually related to national background concentrations. In some countries they are only based on statistics on average | |

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| | | background concentrations." Therefore the values given in Table 89 do not represent minimal risk: they are low numbers because many European soils are low in chromium.<br><br>Chromium in Australian Soils<br><br>Cr III occurs naturally in soils at levels over 4,000 mg/kg (ppm). Chromium rich soils of geological origin cover large areas in Western Australia, Queensland and South Australia. At Port Macquarie in NSW the topsoil chromium concentration is up to 4540 mg/kg (Lottermoser, 1997, 2002). Thirty-nine composite topsoil samples (0–10 cm depth) had mean values of 1020 mg Cr/kg. Lottermoser was concerned that the soil quality guidelines established by ANZECC and NH&MRC (1992) gave maximum natural concentrations of chromium as 110 mg/kg because they were largely based on Canadian and Dutch soil quality standards and were not appropriate for Australia. The Draft NEPM is also not appropriate.<br><br>Chromium and Environmental Issues<br><br>Because Cr III is rendered insoluble, immobile and unreactive in soils it does accumulate in the top layers of the soil when land is irrigated with Cr III containing effluent, or when wastes or biosolids are applied. This is not a risk to the environment or to health as explained in Chaney et al (1996) and many other references. Until the 1970s, chrome containing wastes were not treated by industry in Melbourne and high levels of Cr III accumulated in the soils of the Werribee Sewage Farm (now the Western Treatment Plant). It is not a problem.<br><br>Most soils and rocks contain small amounts of chromium oxide, and weathering, oxidation and bacterial action convert this insoluble compound into soluble Cr III salts. Cr III exists naturally in river sediments. North Queensland river sediments which have not been subject to significant human influence contain chromium at levels up to 235 mg/kg (Moss and Bennett).<br><br>The US Department of Agriculture is interested in increasing chromium in diets and studied the uptake of chromium by plants in various soils, some of which naturally contain up to 11,000 ppm chromium. Cary and Kubota, 1990, found that the concentration of Cr in a wide variety of plants was very low in both high-Cr and low-Cr soils. Contamination of plants with soils has often led to erroneous results in other studies. | It is acknowledged that some Australian soils have high background concentrations of Cr (III) as pointed out by the submission. However, this is not a problem because the EILs that apply to a site are the ACL values plus the ambient background concentrations. |

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| | | Cr III is not oxidised to Cr VI in the natural soil environment (Rutland 1991 and 1995). Organic material, Mn2+, Fe2+, Iron (Fe), etc. reduce Cr VI to Cr III and some of these materials are being used to remediate Cr VI contaminated sites (Hug et al, James, and Powell and Puls).<br><br>Sass and Rai showed that Cr III and iron compounds form an amorphous Cr III - Iron III hydroxide solid solution with a solubility several orders of magnitude lower than pure chromium hydroxide. This very insoluble compound will limit Cr III leaching in acid environments. This work gives an explanation for the evidence that Cr III does not percolate through soils.<br><br>Work by Scheidegger et al on the formation of mixed cation hydroxide compounds demonstrated that other metal cations, including aluminium, could be involved in the immobilisation of Cr III in soils. Other workers state that Cr III is benign and that iron filings mixed with quartz sand completely reduce Cr VI and the Cr III is incorporated into sparingly soluble species (Pratt et al, 1997).<br><br>Important Considerations<br><br>1. The 1999 Australian NEPM for Assessment of Site Contamination adopted Health Guidelines based on risk. The Health Investigation Levels for Cr III varied from 12% (120,000 mg/kg) for Standard residential use with garden/accessible soil (including day-care centres etc) to 60% for Commercial/Industrial use. These levels are not usually encountered. The Levels for Cr VI varied from 100 to 500 mg/kg. The Ecological Investigation Levels (EILs) were not based on risk and the Interim Urban EILs were 400 mg/kg for Cr III and 1mg/kg for Cr VI. Unfortunately the current Draft NEPM values are still not based on risk.<br><br>2. US EPA<br><br>The US EPA introduced limits for the land application of sewage sludge which included a level of 3,000 mg Cr/kg dry sludge solids. However, in 1994 the United States Court of Appeals for the District of Colombia invalidated the US EPA limitations for chromium in land-applied sewage sludge because they were not risk-based. The US EPA revised their limit for total chromium in sludge applied to agricultural land to 100,000 mg/kg (ie 10%) of dried solids. (US Federal Register Standards for the Use or Disposal of Sewage Sludge, 40 CFR, parts 403 and 503, | |

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| | | pages 42563-42565.)<br>3. European Union<br>In 1988, the European Commission proposed a limit for chromium in sewage sludge and its application to land. However, this proposal was withdrawn in 1993 (Notice 93/C 228/04, OJ No C228, 24 August 1993).<br>4. Sludge (Use in Agriculture) Regulations 1989 (as amended), UK<br>The UK implemented Council Directive 86/278/EEC on the application of sewage sludge in agriculture through the Sludge (Use in Agriculture) Regulations 1989 (as amended). These regulations specify requirements for sewage sludge which is applied to land, including certain concentrations for certain heavy metals (lead, cadmium, mercury, copper, zinc, and nickel). No limits are specified for chromium.<br>Beneficial Utilisation of Chromium Containing Wastes on Land<br>The Australian tanning industry is using a range of methods to maximise the utilisation of Cr III and consequently to minimise its waste. Any tannery waste being applied to land in Australia now has only low Cr content. However, in the past higher Cr levels were applied. Different wastes have different Cr III levels. Even hair collected from the unhairing of hides contains some Cr III which has been absorbed by the wooden tanning drum during the previous tanning cycle. A number of tannery wastes containing low Cr III levels are being beneficially used on land in Australia (Money, 2010).<br>Chaney et al (1996) have written a comprehensive paper with 180 references: Development of the USA-EPA Limits for Chromium in Land-Applied Biosolids and Applicability of these Limits to Tannery By-Product Derived Fertilizers and Other Cr-Rich Soil Amendments. The authors found that limits on Cr in biosolids and tannery by-products are not needed to protect human health or the environment. This paper was published in a book, Chromium Environmental Issues; the proceedings of an EU scientific meeting held in Italy. Another paper showed that chromium-containing fertilizers give considerable economic benefits without risk to the environment (Silva 1996). | |
| 7 | 10 | *Industry* | Retained - conceptual site model should give consideration to the development of |

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| | | The Soil Quality levels for Chromium III (Cr III) in Schedule B5c of the Draft NEPM should be removed. Data used in Schedule B5c, 10, Trivalent chromium, is not sufficiently rigorous and the conclusions are flawed and are not risk based. The Guideline levels for industrial land are very low, typically 300–660 mg Cr III/kg. It is widely recognised that in soils, Cr III is rendered insoluble, immobile and unreactive. Disposal on land and leaching into groundwaters are not problems, even in acid soils. | appropriate EIL for the form of the contaminant. |
| 40 | 10.1 | *Environmental consultant*<br>10.1; Page 96, Line 4; "Many publications which contained toxicity data for Cr(III) did not state the chemical which supplied the Cr(III)." If the highly toxic Cr(VI) was present at even low levels, then it could have been contributed to the negative effect on the species being investigated. This would produce false results on Cr(III) investigations.<br>Ensure that all experimental data relied upon as basis for EIL measured both Cr(III) and Cr(VI) concentrations. | Reworded. |
| 40 | 10.2 | *Environmental consultant*<br>10.2; Page 96, Line 10, Line 21, Line 24<br>The choice of Cr(III) as one of the eight chemicals that have EIL imposed by the Assessment of Site Contamination NEPM is perplexing. Cr(III) is abundant in nature. Extensive research shows that it has very little effect on the environment. Cr(III) is the only chemical of the eight chosen that does not have a HIL guideline indicating its benign impact on mammalian fauna.<br>There seems to be no argument for its inclusion other than being one of a group of heavy metals to which a standardised risk process was applied by risk modellers with little demonstrated, peer reviewed skill in chromium environmental science. This is in clear contrast to their work on the other metals included.<br>Remove Cr(III) EIL from the Assessment of Site Contamination NEPM for all land use categories. | Noted. The EILs are intended for screening purposes. Where warranted, a Definitive ERA or EILs specific to the waste should be conducted. |
| 40 | 10.3 | *Environmental consultant* | EILs are intended for screening purpose to determine whether or not further assessment is |

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| | | 10.3; Page 96; Line 29<br>10.5; Page 98; Line 17<br>The inadequate scope and quality of the Cr(III) toxicity data used as input into the SSD modelling lacks the scientific rigour to justify a Cr(III) EIL in any land use category.<br>The statement in the document that there is a "lack of ecotoxicity data for Cr(III)"(NEPM Schedule B5c, Section 10.3, p 96, Line 29) is of particular concern. Compared to the other seven highlighted chemicals the raw data set for Cr(III) is small AND the diversity of taxonomic groups is small. Only arsenic and naphthalene have smaller data sets but both contain research on vertebrates. Vertebrates are unaffected by trivalent chromium below exceptionally high concentrations (Langard, S. 1982 "Biological and environmental aspects of chromium" New York: Elsevier Biomedical Press).<br>The risk modelling attempted to use Cr(III) toxicity data for 3 taxonomic groups — considered the minimum requirement to apply risk modelling (See Fig 2, p15 of Sch B5b). For Cr(III) the 3 groups were invertebrates, microbial soil processes and plants.<br>Validity of Plant data<br>The validity of the Cr(III) phytotoxicity data is extremely questionable. The Leather Industries of America, Incorporated versus Environmental Protection Agency case tried in the United States Court of Appeals, District of Columbia Circuit (1994) successfully demonstrated two major inadequacies in Cr(III) phytotoxicity research;<br>a) laboratory studies inadequately model plant uptake, and<br>b) field studies indicate little plant uptake.<br>On account of the data inadequacies, the United States Court of Appeals decreed that "the EPA failed to provide evidentiary support for its Table 2 cumulative pollutant limit on chromium" and ordered that they withdraw all limits on chromium for land disposal. This remains the case. | required.<br>The application of the Tier 1 EIL does not exclude industry from developing an EIL specific to a particular industry using the methodology. For example Cr III and other contaminants in tanning waste which have the potential for soil contamination should be subject to a definitive ERA or development of EILs specific to the industrial wastes. |

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| | | Phytotoxicity research involves two steps.<br><br>1) Determining the concentration of the toxicant in the plant tissue that reduces the plant growth by a set amount.<br><br>2) Determining the concentration of the toxicant in the soil that creates the toxicant concentration in the plant determined in step 1.<br><br>Concentrations of Cr(III) that negatively affected plants (Step 1) is well researched and cannot be disputed. However, Cr(III) uptake by plants (Step 2) was not adequately researched.<br><br>Most research into plant uptake of trivalent chromium was conducted in "pot" studies. However, "laboratory-based experiments may overestimate toxicity in the field" (p3 draft variation to the NEPM Schedule B5a). Flaws with "pot" studies are two-fold.<br><br>1. As opposed to Cr(III) in the field, chromium salts are not bound to an organic matrix and are therefore more freely available for plant uptake.<br><br>2. The "pots" restrict the area of root growth and therefore concentrate salts around the plant roots.<br><br>The US EPA (1994) acknowledged that "pot" studies were inadequate to model plant uptake.<br><br>A US EPA study of field grown corn indicated no risk of Cr(III) phytotoxicity in soils up to 3000kg/ha. In fact, "an inverse relation between soil concentration and plant concentration of chromium: the higher the soil concentration of chromium, the lower the plant concentration" (US EPA Court ruling (1994)). The Cr(III) soil to plant pathway is limited as Cr(III) is almost insoluble in water and immobile in soil and does not cross most cells (draft NEPM Schedule B5c). The US EPA tried to pass the 3000kg/ha as the limit for Cr(III) land application as this was "the upper boundary of the range for which the EPA had data for". The US Court ordered the US EPA to withdraw the limit.<br><br>Trivalent chromium phytotoxicity data should not be used to substantiate the EIL values in the proposed Variation. | |

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| | | Validity of Microbial Soil Processes data<br><br>The Cr(III) toxicity data assembled for this taxonomic group is presented in Table 83, p97 of Sch B5c. It compares poorly with that for the other metals. Most of the data is for enzymes (catalase, urease, etc) rather than living organisms.<br><br>Microbial populations are extremely adaptive to the environment through the genetic diversity of their population. Enzymes are non-adaptive chemicals. Consequently the use of enzyme inhibition data to assess soil microbial toxicity is scientifically unsound and unrepresentative of the underlying microbial populations which exhibit extraordinary capacity to adapt and evolve. Toxicity studies of microbial populations are themselves challenging, since the population will exhibit adaptive behaviour.<br><br>Eliminating the enzyme data set from Table 83 leaves 4 microbial process data sets which fails the Sch B5c test for use of SSD methodology.<br><br>Conclusion<br><br>We do not believe that the science supports the assertion of reliability contained in Section 10.8 (p105) for Cr(III). The questionable validity of the Cr(III) phytotoxicity and microbial soil process data means that the underlying risk modelling of Cr(III) ecotoxicity is scientifically dubious and fails the Variation's own test (See Fig 2, p15 of Sch B5b). In our opinion, this small and narrow focused data set does not provide a rigorous basis for a valid EIL. We recommend that trivalent chromium EIL be withdrawn from the National Environment Protection (Assessment of Site Contamination) Measure for all land use categories. | |
| 40 | 10.7.1 | *Environmental consultant*<br><br>10.7.1; Page 102, Line 19<br><br>"There are no ALFs available for Cr(III) nor data available to derive ALFs." The ALF was determined "2.5" which is a mean of ALF values for other cations. This is a huge approximation because the ageing and leaching factor (ALF) values ranged from 1 for nickel to 43 for lead. This is likely to be an important factor in the environment for Cr(III) and could radically changed the EIL for areas where Cr(III) has been applied over many years. | EILs are intended as a screening tool to determine whether or not further assessment is required. The application of the Tier 1 EIL does not exclude industry from developing EIL specific to industry using the methodology or from deriving a ALF. For example Cr III and other contaminants present in tanning waste which have the potential for soil contamination should be subject to a definitive |

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| | | Remove Cr(III) EIL from the proposed Assessment of Site Contamination NEPM Variation for all land categories. | ERA or development of EILs specific to the industrial wastes. |
| 28 | 10.8 | *Environmental consultant*<br>10.8, p105, Should the reliability of the Cr (III) SQG be high, rather than moderate? It meets the high reliability classification defined in Schedule B5b, section 2.4.11, p. 33, 1st bullet point. If not, is it the case that one normalisation relationship for one species (as stated for Cr III) is inadequate to achieve 'high reliability' status?, Provide further clarification on the reliability classification. | The reliability of Cr is considered moderately reliable. Refer to s.2.4.11 of Schedule B5b for information on the classification. |
| | | **General** | |
| 15 | | *Environmental consultant*<br>It is noted that the proposed methodology for the derivation of the EILs has been based on the ANZECC Water Quality Guidelines methodology. While this approach may be appropriate for the determination of EILs for soil processes and invertebrates, it is believed that it does not take into account that t he main pathway soil contaminant uptake for animals is ingestion.<br>Considering that all monogastric animals have basically the same gastric system, wildlife soil ingestion factors should be taken into consideration. Wildlife soil ingestion factors have been derived (see USEPA and Canadian guidelines) and could be adapted to Australian fauna as they relate to the feeding and behavioural habits and body mass rather than being species specific. | The EILs have been developed for screening purposes. Where warranted, specific uptake pathways may be considered in definitive risk assessment. |
| 2 | | *Environmental consultant*<br>4) The use of CEC tables for relevant soil types is a good advance but is only relevant to plants and perhaps soil invertebrate process and is in error when applied to data that includes mammals, birds or any other biota (some plants and invertebrates) that change the chemical environment of the soil particles (eg within the stomach). | This may be correct but for none of the contaminants where normalisation relationships were used were there toxicity for higher organisms (non-soil dwelling organisms)—so this criticism does not apply. In addition, the EILs have been developed based on physicochemical properties such as CEC. Where warranted, bioavailability may be considered in a definitive risk assessment. |
| 2 | | *Environmental consultant* | This may be correct but for none of the |

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| | | The use of the CEC tables in conjunction with distributions that include mammal and bird toxicity data has no relevance. Similarly the inclusion unrelated toxicological data (mammal and bird data with plant data for example) into the SSD distribution is not scientifically justifiable | contaminants where normalisation relationships were used were there toxicity for higher organisms (non-soil dwelling organisms)—so this criticism does not apply. In addition, the EILs have been developed based on physicochemical properties such as CEC. Where warranted, bioavailability may be considered in a definitive risk assessment. |
| 2 | | *Environmental consultant*<br>5) The lack of clarity in what ecological values are protected, the lack of scientific rigor the lack of transparency in the application and derivation of EILs means that they can not be confidently applied to assess ecological risk at a contaminated site.<br>However, the application of CEC tables to estimate the effect of soil type on bioavailablity will be a useful tool.<br>It is recommended that some of the previously described fundamental principles of ecological risk and methodologies for the derivation of EILs be given consideration.<br>Walker a,b,c in Langley etal 1998, The health Risk assessment and Management of Contaminated Sites – Proceedings of the fourth National workshop on the Health Risk Assessment and Management of contaminated sites.<br>Also reproduced in ANZECC/NHMRC 1997. National Framework for Ecological Risk Assessment of Contaminated sites, Parts A, B, and C<br>For comments on the ANZECC/NHMRC draft documents refer to the international peer review which involved more than 15 internationally recognised experts from the US, Cannada, The Netherlands, Australia and New Zealand.<br>Examples of the application of these ANZECC/NHMRC methodologies to landuse environments is applied in:<br>Walker P. McConnell S. Gibson E. Williams N. 1999. A pilot study on developing risk based ecological investigation levels for contaminated sites in Victoria. Published in the proceedings of Contaminated Site Remediation conference: | Noted and refer to B5a and B5b for information and references with regard to the methodology. |

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| | | Challenges Posed by Urban and Industrial Contaminants. Perth 1998.<br><br>Walker P. Hall A. 2000. Using source to ecosystem modelling in risk assessment to avoid an ecological restoration becoming an ecological disaster. Contaminated Site and Remediation conference: Source to ecosystem modelling. Melbourne 2000. | |
| 34 | | *Industry peak body*<br><br>The reference to contamination that has been in place for at least two years and the different treatment of sites with metal contamination less than two years is seen to be potentially confusing. Most contaminated sites would be greater than two years therefore this district ion should be removed. PACIA believes there is a lack of clarity on how the EILs should be applied and this will be especially problematic for industrial sites with large amounts of mixed fill which probably has fairly high metals levels in random distribution. In many cases this would be under hard cover and probably without exposure pathway for ecological receptors. PACIA believes that EILs should not apply to such material if it isn't exposed at the surface. The guidance is not clear on this issue. | Refer to Schedule B1, paying particular attention to the case studies which demonstrate application of the EILs |
| 34 | | *Industry peak body*<br><br>PACIA believes there is also an absence of guidance on what to do about elemental mercury vapours. | No EIL has been developed at this time for mercury. HIL has been developed for inorganic mercury as described in Schedule B7. Elemental mercury vapours are a site-specific consideration. |
| 47 | | *Industry peak body*<br><br>As indicated in comments on the preceding parts to this schedule (B5a and B5b), some cross-referencing of this schedule with the others to aid reading clarity of the material is advisable. The rationale for selection of the contaminants for schedule B5c is not explained particularly in the introductory sections. The selection is clearly a cross-section of common contaminants identified during contaminated site assessment, however are they priority contaminants, those with good (technically supported) data or otherwise selected?<br><br>Cross referencing to B5a and B5b<br><br>Some explanation would be helpful. | Noted. |

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| 45 | | *Environmental consultant*<br>The rounding of numbers throughout the document will make implementation very difficult in the industry. If for example the calculated guideline is 740mg/kg, the document advises rounding down to 700mg/kg. What if all samples are between 700mg/kg and 740mg/kg—the client will want a non-rounded number. | Noted. Refer to EIL Spreadsheet for calculating site-specific EILs which automatically does the rounding-off. |
| 45 | | *Environmental consultant*<br>The requirement to analyse for pH, CEC and Fe% will increase the cost of each sample by up to $67 (based on current prices). | Noted. It should not be necessary to analyse these parameters for every sample. Sufficient samples for analysis should be selected to provide a representative result for each soil unit of interest. |
| 45 | | *Environmental consultant*<br>The requirement to analyse samples for clay content will increase the cost of each sample by up to $150. This analysis would also require an additional sample as most contaminant laboratories will not undertake this analysis. This sample would have to be a bulk sample – up to 6kg depending on the largest particle size – and would therefore impact on the use of a drill rig to sample or would be collected over a large depth profile, which may not be appropriate for contaminant testing of specific layers. | Noted. It should not be necessary to analyse clay content for every sample. Sufficient samples for analysis should be selected to provide a representative result for each soil unit of interest. |
| 45 | | *Environmental consultant*<br>There are numerous errors throughout the document—some may be due to the use of rounding before/after the calculation, but these make it impossible to work through the examples: | Noted. Numerous typographical and rounding errors corrected. |

## APPENDIX H – Issues and responses – Schedule B6

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| | 1 | **Purpose** | |
| 31 | 1 | *Environmental consultant*<br>1 & 2, Sentence flow and structure makes readability difficult, and reduces clarity.<br>In particular:<br>Section 1.2 paras 1 & 2 | Sections 1 and 2 have been edited to improve clarity and provide better linkage with Schedule B2. |
| 47 | 1.1-1.3 | *Industry peak body*<br>1.1, 1.2 & 1.3—It is illogical to put these three subsections under the heading 1 "Purpose" as these are unrelated to "Purpose".<br>Renumber adequately. | Sections 1 and 2 have been edited to improve clarity and provide better linkage with Schedule B2 |
| 39 | 1.2 | *State government agencies*<br>1.2 Initiation of an assessment of groundwater contamination (pages 1 & 2), perhaps the term 'Beneficial Use', could be introduced. As such point on page 2 to read<br>Identification of potential receptors and beneficial uses | The term 'beneficial use' has been replaced by the term 'environmental value' in National Water Quality Management Strategy guidelines and the NEPM. |
| 47 | 1.2 | *Industry peak body*<br>1.2 Last para—last sentence<br>Inappropriate at this location Shift to Schedule on competencies | Noted. The text is included to emphasise where specialist advice is required. |
| 31 | 1 | *Environmental consultant*<br>Page 1 Should add the following as triggers for groundwater assessment: 1. Adjacent sites that may be contaminated and, 2. Water Supply Protection Areas | Sections 1 and 2 have been edited to improve clarity and provide better linkage with Schedule B2. The suggested improvements are covered in Schedule B2 section 8. |
| 31 | 1.2 | *Environmental consultant*<br>1.2, Page 2 first paragraph, Mentions the permeability of the site strata, Should | Sections 1 and 2 have been edited to improve clarity and provide better linkage with |

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| | | mention aquifer parameters | Schedule B2.<br>Suggested information has been added to B2. |
| 5 | 1.2 | *Environmental consultant*<br>1.2: p2; Section 1.2 provides a list of issues which should be considered during an initial appraisal of groundwater issues.<br>Suggest amendment of the 7th bullet point to provide clarification, as below:<br>"quantity of the contaminant, its mobility characteristics (e.g.: solubility, volatility) and toxicity. | Sections 1 and 2 have been edited to improve clarity and provide better linkage with Schedule B2.<br>Additional information has been added to B2 Section 8. |
| 36 | 1.2 | *Environmental consultant*<br>1.2; P2; Should include:<br>- direction of groundwater flow (known or estimated), and<br>- hydrogeological information such as gradient, porosity and hydraulic conductivity (known or estimated). | Sections 1 and 2 have been edited to improve clarity and provide better linkage with Schedule B2.<br>Additional information has been added to B2 Section 8. |
| | 1.2 | 1.2, Page 1, Should add the following as triggers for groundwater assessment:<br>- Adjacent sites that may be contaminated Water Supply Protection Areas, | Sections 1 and 2 have been edited to improve clarity and provide better linkage with Schedule B2.<br>Suggested information is incorporated in B2. |
| 31 | 1.3.2 | *Environmental consultant*<br>1.3, 2, bullet point 4 does not influence whether we place the focus on future uses.,<br>Delete bullet point 4 | Text amended. |
| 31 | 1.3.3 | *Environmental consultant*<br>1.3, 3, "the risk assessment process must consider…"<br>This sentence seems to contradict Section 3 para 1.<br>Revise and clarify text | Sections 1 and 2 have been edited to improve clarity and provide better linkage with Schedule B2. |
| 31 | 1.3 | *Environmental consultant*<br>1.3, P2, Lines 16, 19, 23, and in a number of places in this section , Please provide a | Noted. The realistic future uses of groundwater is a site-specific issue, however, |

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| | | definition or explanation of the words "realistic future use" of the groundwater since this is one of the basic for selecting an appropriate GIL., Auditors all have a different idea of what "Realistic" future use is.<br>This notion should be clarified. | additional clarification has been added. |
| 5 | 1.3 | *Environmental consultant*<br>1.3: p3; 2nd paragraph on this page refers to consideration of impacts which may cause groundwater parameters to differ from "ambient quality". This infers the need for an assessment of "background" conditions.<br>Suggest amendment of this paragraph to incorporate use of "background" terminology, as 'ambient' is not a concept or word used in the hydrogeology/contaminated land industry. | Noted. Additional guidance added on determining background and definitions of natural background, ambient background and background. |
| 31 | 1.3 | *Environmental consultant*<br>Section 1.3 paras 1 & 2 , Suggest rewrite | Sections 1 and 2 have been edited to improve clarity and provide better linkage with Schedule B2. |
| | 2 | **Framework for the application of the Australian Water Quality Guidelines for fresh and marine waters and the Guidelines for managing risk in recreational waters** | |
| 31 | 2.1 | *Environmental consultant*<br>2.1, 4, "The process involves…"<br>Sentence is unclear. What process? How does it respond?, Suggest delete sentence, or rewrite as follows if appropriate:<br>The framework allows a risk assessment to build on existing guidelines, yet remain adaptable as site-specific knowledge is gained. | Text clarified. |
| 31 | 2.1 | *Environmental consultant*<br>2.1, 4, "This section provides a methodology…"<br>A methodology? Or a framework?,<br>Suggest change 'methodology' to 'framework'. | Text amended. |

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| 15 | 2.2 | *Environmental consultant*<br><br>2.2; p4; For the six environmental values, maybe item 3 (agricultural water) could be further subdivided into 'stock watering' and 'irrigation' as these are vastly different from a hydrochemistry (including contamination) perspective. This also follows the demarcations of the Victorian State Environment Protection Policy (SEPP) Groundwaters of Victoria (1997).<br>- Agricultural water<br>- Irrigation<br>- Stock-watering | Text amended. |
| 39 | 2.2 | *State government agencies*<br><br>2.2 Framework—Does not appear to clearly provide environmental values for Domestic Scenario Groundwater Use (i.e. irrigation of Lawn and Gardens). WA DEC is currently using DoH 09 (for non-volatile and pesticides/herbicides apply 10 x DWG) for guidance values for domestic use of groundwater | Noted. |
| 5 | 2.2 | *Environmental consultant*<br><br>2.2 5—The final paragraph on this page discusses two levels of assessment, the first being comparison against relevant GILs, the second being a site-specific assessment potentially involving modelling and consideration of site-specific factors.<br><br>This paragraph appears to introduce inconsistent terminology with regards to preliminary site investigation and follow up assessments. Please either remove or re-write. | Terminology revised to be consistent with Schedule A and other Schedules to this Measure i.e. PSI, DSI and Tiers for risk assessment. |
| 31 | 2.2 | *Environmental consultant*<br><br>2.2, 5, Two levels of assessment are referred to – preliminary assessments and detailed assessments.<br><br>The text in this and following paragraphs lacks structure and reads in an essay-like format.<br><br>Detailed assessments are also confusingly referred to as detailed investigations. Improve structure with a rewrite. | Terminology revised to be consistent with Schedule A and other Schedules to this Measure i.e. PSI, DSI and Tier 1 and Tier 2 risk assessment. |

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| | | Include sub-headings, bullets or other structure to improve clarity. | |
| 31 | 2.2 | *Environmental consultant*<br>2.2, Page 3 and 5, No real framework for determining background or "ambient" conditions. | Additional guidance on determining background and relevant definitions has been added. |
| 5 | 2.2 | *Environmental consultant*<br>2.2: p5; The final paragraph on this page discusses two levels of assessment, the first being comparison against relevant GILs, the second being a site-specific assessment potentially involving modelling and consideration of site-specific factors.<br>Suggest this paragraph is amended to incorporate the terminology used for preliminary and detailed investigations in the other NEPM schedules. | Terminology revised to be consistent with Schedule A and other Schedules to this Measure i.e. PSI, DSI and Tier 1 and Tier 2 risk assessment. |
| 39 | 2.2 | *State government agencies*<br>'Detailed Investigation' is described at the end of page 5 and 'Preliminary Investigation' discussed at the beginning of page 7. Both are describe comparing against GILs and differ by the point of sampling, i.e. point of use v point of sampling.<br>The glossary could perhaps include definitions for 'Point of Extraction', 'Point of Use' for immediate clarity. | The Schedule has been edited to improve clarity and provide improved consistency with Schedule A and Schedule B2.<br>The changes include clarification of the application of the ADWG as GILs. |
| 31 | 2.2 | *Environmental consultant*<br>2.2, 6, Needs further reference of GDEs. Confusion in industry.<br>Need to reference Nation Water Commission GDE map | Noted. Additional information on groundwater dependent ecosystems has been added.<br>It is understood that the National Water Commission National Water Atlas of GDEs is work in progress |
| 31 | 2.2 | *Environmental consultant*<br>2.2, 7, No mention of the practicability of assessment (i.e. installing wells in roadways), Need to reference State and local jurisdiction and regulations. | Noted. The practicalities of installing wells in roadways etc would be a planning consideration in the Sampling and Analysis Quality Plan - see Schedule B2. |

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| 39 | 2.2 | *State government agencies*<br>Page 8—A Management Plan for unacceptable levels of contamination may include one or more of the following: perhaps could include a point referring to providing replacement water source to affected groundwater users (such as where service station hydrocarbons affect residential groundwater users – A Contaminated Site at times provides residents with additional mains water for irrigating lawn and gardens, at the cost of the Contaminated Site) | Text amended. |
| | 4 | **Glossary** | |
| 31 | 4 | *Environmental consultant*<br>4, 10, Groundwater also refers to artesian waters not just water below the ground surface. | Noted. The definition is consistent with that in *Guidelines for Groundwater Protection in Australia* (ARMCANZ and ANZECC 1995). |
| 15 | | *Environmental consultant*<br>s4; p10; The term 'aquifer' should be modified and the terms 'aquitard' and 'aquiclude' added.<br><br>An aquifer is defined as a saturated permeable geological unit that is permeable enough to yield economic quantities of water to wells.<br>- An aquitard is a geological unit that is permeable enough to transmit water in significant quantities when viewed over large areas and long periods, but its permeability is not sufficient to justify production wells being placed in it. Clays, loams and shales are typical aquitards.<br>- An aquiclude is an impermeable geological unit that does not transmit water at all. Dense unfractured igneous or metamorphic rocks are typical aquicludes. In nature, truly impermeable geological units seldom occur; all of them leak to some extent, and must therefore be classified as aquitards. In practice, however, geological units can be classified as aquicludes when their permeability is several orders of magnitude lower than that of an overlying or underlying aquifer.<br>Reference: Kruseman, G P and de Ridder, N A (2000) Analysis and evaluation of pumping test data. Second Edition. International Institute for Land Reclamation | Noted, however the terms 'aquitard' and 'aquiclude' are not used in this Schedule.<br><br>The definition of 'aquifer' is consistent with *The Guidelines for Groundwater Protection in Australia* (ARMCANZ and ANZECC 1995). This definition for aquifer is preferred as some domestic wells produce small quantities of water which, though fit for purpose, would not be considered economic for a commercial operator. |

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| | | and Improvement. | |
| 47 | 4 | *Industry peak body*<br>Text cites GDE and Bioaccessibility as new terms<br>These should be included in the Glossary | Noted. Definitions of GDE and bioavailable (bioavailable has replaced bioaccessible) have been added. |
| | | **General** | |
| 47 | | *Industry peak body*<br>ALL Limited scope This section is quite limited in scope and does not address site-specific human health and ecotoxicological assessment in cases where guidelines are not available or are in themselves limited. There is no consistency here on volatile emissions and impacts from groundwater which are not discussed. The information provided is quite generic. | Noted. The National Water Quality Management Strategy source documents should be consulted for information where generic guidelines are not available. |
| 47 | | *Industry peak body*<br>An opportunity seems to have been lost here in providing more comprehensive guidance on good practice and procedures<br>Inclusion of case study examples, including publicly available groundwater contamination assessments. | Noted. Additional guidance on the characterisation of groundwater contamination is included in Schedule B2. |
| 39 | | *Environmental consultant*<br>Apart from several typographical problems in the documents, I noted that there was not a strong emphasis in the papers on the managing contaminated sites so they don't harm water supply sources. Scenarios I have in mind are toxic substances that can leach down under the influence of rainfall or irrigation into the water table then move laterally posing a contamination threat to water supply bores. This is a significant issue in WA particularly in sedimentary basins (e.g. Perth coastal plain) where groundwater is used as a source of community drinking water supplies as well as garden, cropland and municipal irrigation). There are also circumstances where leached contaminants may move through shallow sandy topsoil over clay weathering zones and into surface waterways and water supply impoundments. The Health investigation level scenarios A,B, C & D don't appear to deal with direct ingestion of contaminated water, or uptake in food crops or | Noted. Additional guidance on the assessment of soil sources which may leach to groundwater is included in Schedule B2 and Schedule B5b.<br>The Australian Drinking Water Guidelines and the Australian and New Zealand Guidelines for Freshwater and Marine Water Quality are adopted as Groundwater Investigation Levels and address direct exposure to groundwater. |

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| | | animals supplied with contaminated water. | |
| 39 | | *Environmental consultant*<br>Case studies (say using a pesticide or fuel spill impact on groundwater used as a water supply source) would serve as useful tool to explain acceptable investigation methodology. | Noted. |
| 28 | | *Environmental consultant*<br>Figure 1, 6, The receptor group "Groundwater Dependent Ecosystems" (GDE) is listed, yet no information on how to assess or investigate risks to this receptor is provided.<br>Provide guidance on how to assess GDE, or remove this receptor group from Figure 1 and provide discussion on GDE in the document text. | Figure 1 has been deleted and additional information has been added to the text. |
| 39 | | *State government agencies*<br>Flow Chart – Figure 1 Assessment process for groundwater contamination<br>Box 3 reads Select relevant guidelines and compare with point of extraction concentrations, and provides a list of ecological and recreational, health and agricultural guidelines. Perhaps the term 'Point of Extraction' could be included within the Glossary as the point of extraction could also include point of groundwater discharge or even groundwater monitoring point, if assessing groundwater contamination | Figure 1 has been deleted and additional information has been added to the text. |
| 39 | | *State government agencies*<br>Flow Chart – Figure 1 Assessment process for groundwater contamination<br>At the point where the flow chart extends to the left where 'NO' relevant guideline is exceeded to an end point of No apparent Problem, If in the event the water quality criteria was equalled, and/or, monitoring was indicating a trend towards poorer water quality, if following the chart literally, no guideline is exceeded, therefore no problem is apparent. Perhaps the inclusion of another box asking if further indication of groundwater impacts are apparent would capture this for the purpose of Assessment of Groundwater Contamination. | Figure 1 has been deleted and additional information has been added to the text. |
| 47 | | *Industry peak body* | Noted and addressed. |

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| | | References variously to Schedules, Measures and Guidelines<br>References should be tightened up to ensure consistency | |
| 47 | | *Industry peak body*<br>Should bioaccessibility be changed to bioavailability for consistency with ANZECC 2000?<br>Use consistent language with contemporaneous standard (ANZECC/ARMCANZ 2000) | Text amended |
| 31 | | *Environmental consultant*<br>Structure is confusing. B6 contains 2 sections: one entitled 'Purpose' and one entitled 'Framework for the application…'. These titles do not fully fit the material presented.<br>For example. The Purpose section contains text describing purpose, aims, scope, assessment triggers, and risk assessment basis. Would be better split into 2 sections covering 1) an introduction and 2) assessments. The existing section 2 will then become section 3.<br>A reorganised structure and titles would improve clarity.<br>Suggest the following Structure:<br>1 Introduction<br>1.1 Purpose and Aims<br>1.2 Scope<br>2 Assessments<br>2.1 Initiation of Assessment of G/w Contamination<br>2.2 The Approach for Risk Assessment<br>3 Framework for Applying Water Quality Guidelines to Manage Contaminated Groundwater Risk<br>3.1 Introduction | Sections 1 and 2 have been edited to improve clarity and provide better linkage with other Schedules, particularly Schedule B2. |

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| | | 3.2 Framework | |
| 47 | | *Industry peak body*<br>Text is generalised, lacking in specific guidance and too brief to qualify as 'A Guideline'<br>Include references to contemporaneous standards (e.g. Murray-Darling Scheme) | Noted. The Schedule has been edited to improve clarity and provide improved consistency with Schedule A and other Schedules, particularly Schedule B2. Additional information on assessment of groundwater contamination is included in Schedule B2. |
| 47 | | *Industry peak body*<br>This Schedule has not been substantively revised or updated | Noted. The Schedule has been edited to improve clarity and provide improved consistency with Schedule A and other Schedules, particularly Schedule B2. |
| 28 | | *Environmental consultant*<br>This section is quite limited in scope and does not address site-specific human health and ecotoxicological assessment in cases where guidelines are not available or are in themselves limited. There is no consistency here on volatile emissions and impacts from groundwater which are not discussed. The information provided is quite generic. | Noted. The Schedule has been edited to improve clarity and provide improved consistency with Schedule A and Schedules B2 and B4. Additional information on assessment of groundwater contamination is included in Schedule B2. |
| 28 | | *Environmental consultant*<br>Three sources of water quality criteria are identified, addressing drinking water (ADWG 2004), environment (ANZECC 2000) and recreational use (NHMRC 2008).<br>The schedule states the following with regard to the application of the criteria:<br>"The criteria defined within the AWQG, ADWG and GMRRW define acceptable water quality at the point of use. In this Schedule, they are used as investigation levels at the point of extraction and as response levels at the point of use (unless a site-specific risk assessment has been carried out and an alternative, more appropriate response level has been determined)."<br>This comment could generate some confusion with respect to the application of the ANZECC 2000 guidelines, which are essentially surface water guidelines despite having been adopted for groundwater assessment (with the rationale that | Generally, the Australian water quality guidelines for fresh and marine water (AWQG) also apply to the quality of groundwater since the environmental values that they protect relate to above-ground uses (e.g. irrigation, drinking water, animal or fish production and maintenance of aquatic ecosystems).<br>The Schedule has been edited to improve clarity and provide improved consistency with Schedule A and Schedule B2. The reference to response levels has been removed and the text clarified to state that GILS are investigation |

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| | | groundwater eventually discharges to surface water). However, even at the point of discharge to surface water bodies the ANZECC trigger values are still just trigger values, which, if exceeded, prompt further site-specific consideration of potential risk. This would suggest to me that they are more akin to investigation levels rather than response levels.<br><br>For clarity, a definition of investigation and response levels could be provided in the glossary, with consideration to how these definitions relate to the adopted guideline documents. | levels except for when the Australian Drinking Water Guidelines are applied at the point of use (and if exceeded, a management response should be considered). |
| 39 | | *State government agencies*<br><br>We recognise that investigation protocols also need to consider probable travel for contaminant particles prior to impact on a receptor. If the travel duration is very long (maybe centuries) it would be realistic to define a duration beyond which the risk of impact on a receptor is likely to be insignificant due to dispersion, biochemical or geotechnical factors influencing the final contaminant concentration. | Noted. These issues should be considered in tier 2 or tier 3 risk assessments. Depending on site-specific circumstances, this may be a qualitative or quantitative assessment. |
| 39 | | *State government agencies*<br><br>Document references could also acknowledge national water quality management strategy series on water recycling (health and environmental risks) 2006 to 2009 (which include advice on toxicological matters). | Noted. |

## APPENDIX I - Issues and responses – Schedule B7

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|---|---|---|---|
| | 1 | **Introduction** | |
| 28 | 1.1 | *Environmental consultant*<br>p1, Recommendation 6—what are considered priority chemicals and how were they chosen, A summary table providing justification for the COI list presented and reasoning for those disregarded would be useful | Noted—no change—note paragraph below the recommendations. Refer to the Review report for additional information. |
| 28 | 1.1 | *Environmental consultant*<br>p1, Recommendation 8—what are considered priority carcinogenic chemicals and how were they chosen? (e.g. why is 1,3 butadiene not considered as it is classed Group 1 by IARC as carcinogenic by inhalation). , A summary table providing justification for the COI list presented and reasoning for those disregarded would be useful. | Noted—no change—note paragraph below the recommendations Refer to the Review report for additional information. |
| 25 | 1.1 | *Environmental consultant*<br>p1; The term 'more accurate numbers' is not ideal. The HILs are not in essence 'accurate' but should be representative of concentrations that are considered protective of human health under the relevant scenario. | Addressed |
| 25 | 1.2 | *Environmental consultant*<br>p2; Final sentence (and elsewhere in document - It is not clear what is meant by the use of the term 'durability' in reference to risk assessment. Clarify. | Addressed |
| 28 | 1.2 | *Environmental consultant*<br>p2, How are HILs to be applied to child care centres and low density residential if pica behaviour is not considered?, Provide guidance. | Minor revision (site-specific issue). |
| 2 | 1.2 | *Environmental consultant*<br>Equation 1<br>Equation 1: HIL=acceptable intake / intake from contamination = … does not | No change—the first half is a generalisation |

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| | | appear correct. The second half of the equation is correct<br>Delete first part of Equation 1. | with the second half being more specific to the ingestion of soil example provided |
| 5 | 1.3.1 | *Environmental consultant*<br>4, Eq 5. Error in units. Intake_o mg/kg/day instead of kg/kg/d Correct units | Units have been checked and are correct—no change |
| 28 | 1.3.1 | *Environmental consultant*<br>p2, The dot point list is described as providing other potential risks from "soil" contamination that are not covered by the HILs. However, not all dot points relate to soil (e.g. groundwater contamination arising from elsewhere, alternate sources of contamination).<br>Change the word "soil" to "site". | Addressed |
| 47 | 1.3.2 | *Industry peak body*<br>3—The statistical test for HIL's includes a requirement to compute a 95% UCL for the arithmetic mean, which is not consistent with Schedule B1 which simply requires comparison with the arithmetic mean. Check if this requirement is consistent with Schedule B1 and amend if necessary. | Addressed – revised to ensure consistency with Schedules B1, B2 and B4 |
| 47 | 1.3.2 | *Industry peak body*<br>4— "Exceedance of the HILs does not automatically imply that quantitative modelling at Tier 2 is warranted". Is this realistic e.g. for Auditors who often sign off on numbers?<br>Remove from NEPM. | No change—the wording is an important consideration of how the HILs may be used |
| 5 | 1.3.2 | *Environmental consultant*<br>5, Eq 7. Error in units. Intake_D mg/kg/day instead of kg/kg/d Correct units | Units checked and are correct—no change |
| 15 | 1.3.2 | *Environmental consultant*<br>p3 & 11—There is little information on the reasoning behind the requirement for the specified statistical tests within the NEPM.<br>Whilst there is guidance on how to calculate 95% UCL and standard deviation in reference documents, there appears to be little justification for how the statistical | Addressed—revised to ensure consistency with Schedules B1, B2 and B4 |

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| | | tests were determined and why we must apply these statistical tests:<br>- >250% HIL criteria for hotspots; and<br>- 50% HIL criteria for the standard deviation.<br>In addition, there does not appear to be a consistent approach regarding statistical tests between the NEPM and state documents. Specifically referring to the NSW DEC (2008) waste guidelines which only required the 95% UCL to be undertaken.<br>A better explanation on how the 250%hotspot and 50% standard deviation statistical criteria was derived and why it applies to the NEPM. | |
| 28 | 1.3.2<br><br><br><br><br><br><br><br><br><br>1.4 | *Environmental consultant*<br>p4, The dermal contact equation does not differentiate between residential and recreational sites. The exposure time on a recreational site is 2 hrs/day compared with 24 hrs/day on a residential site (Table 5 of Schedule B7). It is reasonable to assume that the dermal dose from soil on a recreational site would be less than that on a residential site. USEPA RAGS E (2004) provides allowance to adjust for event frequency where the exposure time per event is less than 24 hours (section 3.2.2.4 and equation 3.11 in RAGS E)., Include guidance to allow adjustment of the dermal dose for time (in hours) on a recreational site<br>p4, Reference is made to enHealth 2011, which has not yet been released. The revised enHealth framework is still in draft form and has not yet been endorsed. If changes are made, how will this influence the HILs that have been developed?, Presume this is the same reference as in Schedule B1, section 2.2.3, although they are cited differently. Extend the period of time for feedback comments on the NEPM to allow review of the Guidance (enHealth) documentation. | RAGS E (2004) explicitly states that the ABS value should not be adjusted for exposure times shorter than 24 hours, but that the EF and ED should reflect site-specific values. This has been conducted where possible in the derivation of the HILs—no change |
| 31 | 1.3.2 | *Environmental consultant*<br>Page 3<br>Lines 11 to 23, Items 2 and 3 are not statistical tests as stated. They present significant limitations on how test data can be utilised and interpreted. Site assessment data frequently reveals contaminant concentrations spanning several orders of magnitude reflecting the heterogeneity of soil conditions. Statistical analysis of data sets with a wide distribution can be undertaken to establish if the | Addressed |

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| | | true mean concentration is likely to be less than a HIL if undertaken appropriately following reputable guidance. , Change "should" to "can" in line 12 as statistical analysis is not always appropriate for every data set.<br><br>Delete items 2 and 3 (lines 16 to 18). | |
| 5 | 1.3.2 | *Environmental consultant*<br><br>p3; Bullet "standard deviation exceeding 50% of T1 criterion" is incorrect. This was applied in the 1999 NEPM to check that distribution was normal and mean concentration was used to compare against criterion. Use of 95%UCL supercedes this requirement.<br><br>Remove this bullet and include "95% UCL must be based on the appropriate distribution, whether it is normal, lognormal, or other" | Addressed |
| 5 | 1.3.2 | *Environmental consultant*<br><br>p3; last para, hotspots removed from dataset before applying statistics. This method will be abused to fudge datasets.<br><br>Either remove the suggestion that hotspots be removed from the dataset, or include paragraph that emphasises that any local hotspot removed from the dataset must be treated separately and care must be taken that the hotspot is indeed representative of a separate part of the data population, rather than an occurrence which is representative of any part of the population to which the statistics are being applied (e.g. in fill). | Addressed |
| 5 | 1.3.4 | *Environmental consultant*<br><br>7 & 8, These equations only consider the RAGS-A method. Should also include equations for RAGS-F inhalation method | Equations and approach changed to adopted RAGS F method only |
| 2 | 1.6<br><br>1.6.1 | *Environmental consultant*<br><br>Calculation of Volatilisation Factors<br><br>The document states that, On the basis of the above an indoor air volatilisation factor has been calculated for use if the derivation of HILs. This is incorrect and the modelling referred to was not applied. | Some additional words of explanation included to be more clear on which approach has been used in the derivation of the HILs and which equations are included for more site-specific assessments |

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| | | Equations stated as being used for the derivation of an HIL should accurately reflect the method of calculation of a reported HIL.<br>Correction required | |
| 5 | 1.6.1 & 1.6.2 | *Environmental consultant*<br>16—No discussion on soil saturation concentration (Csat) Include section on Csat (similar to Section 4.4.6 of schedule B4) | Addressed |
| 5 | 1.6.1 | *Environmental consultant*<br>14, Qsoil. The basis of Qsoil selection is different to that in the CRCCARE HSLs which uses the sub-slab to indoor air attenuation factor to set Qsoil/Qbuilding.<br>Should include a note that Qsoil/Qbuilding method can also be used. | Addressed |
| 2 | 1.6.2 | *Environmental consultant*<br>This section suggests that HILs associated with outdoor air exposure were modelled on the equations described in this section. However, this does not appear to be the case<br>Equations stated as being used for the derivation of an HIL should accurately reflect the method of calculation of a reported HIL.<br>Correction required | Additional note included<br>They are exactly the same |
| 5 | 1.6.2 | *Environmental consultant*<br>16—Eq 42. Conversion factor 1000 does not appear in equation.<br>Correct equation 42. | The factor was missing from the equation—included and equation checked with ASTM (2000) source |
| | 2 | **Presentation of the Health-based Investigation Levels** | |
| 15 | 2.0 | *Environmental consultant*<br>p6 & 9—Whilst "sizeable garden" is explained within the document, it does not seem appropriate in its use. The word sizeable really only refers to the size as opposed to the potential/actual soil exposure.<br>Suggestions could include garden with soil access, or garden without hardstand. | Text revised and now refers to garden/accessible soil. Addressed in Section 3.2.1 |

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| 47 | 2 | *Industry peak body*<br>6—Where does medium density residential use fit into the broad land use categories? Guidance should be provided for consistency. | Addressed at the start of Section 2 |
| 47 | 2 | *Industry peak body*<br>10—Table 2 refers to an HIL for a benzo(a)pyrene TEF, which is not consistent with Schedule B1 which uses the term carcinogenic PAHs in its tables.<br>Check if this is consistent with Schedule B1 and amend if necessary. | It is included in the footnote that this refers to carcinogenic PAHs—no change |
| 47 | 2 | *Industry peak body*<br>Table 3/ Appendix A4<br>***Comments:*** *the HIL for volatile chlorinated compounds, particularly for the vapour inhalation route, appears to be developed on different basis to those adopted for the development of HSL (BTEX and TPHs).*<br>Consider an unified approach in the assessment of risk associated with exposure to vapours from volatile chemicals. | The approach differs because chlorinated compounds and petroleum compounds differ in their behaviour as vapours—no one method addressed both well—no change |
| 31 | 2 | *Environmental consultant*<br>10—Include a footnote that Commercial setting does not include child care or other sensitive commercial scenario | Addressed |
| 31 | 2 | *Environmental consultant*<br>10–11—include exclusions/limitations where ever possible i.e. mercury HIL not applicable for elemental mercury. Etc, Include a reference to the appropriate section | Addressed and additional footnote included in Table 2 |
| 31 | 2 | *Environmental consultant*<br>11—Include a comment regarding depth to soil vapour measurement i.e. basements or if referring to subslab concentration, Include a comment regarding depth to soil vapour measurement i.e. basements or if referring to subslab concentration | Addressed |
| 29 | 2.1 | *Environmental consultant* | Thi is correct as PCBs are listed in both Annex |

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| | | p4—PCBs are listed in both Annex A and Annex C. This may be correct if different PCB congeners are relevant to each Annex but, if so, this should be defined. | A and Annex C of the convention |
| 15 | 2.0 | *Environmental consultant*<br>Table 2; PAHs have been referred to in this Table as Total PAHs, is it worth applying that same approach to the other identified summed chemical groups.<br>For example change PCBs stated in the table to Total PCBs. Keeping a consistent approach throughout the Table.<br>Possibly also referring to the specific analytes within each of these chemical groups | Noted but the document is sufficiently clear that these others refer to various mixtures |
| 15 | 2.0 | *Environmental consultant*<br>Table 2—There is some confusion relating to the comparison of carcinogenic PAHs and the use of the benzo(a)pyrene HIL and TEF application.<br>It may be better to actually refer to the sum of carcinogenic PAHs (specifically in table notes or refer back to Table 1 within this Schedule), as opposed to just listing benzo(a)pyrene in Table 2 with some very general table notes. | Addressed |
| 15 | 2.2.2 | *Environmental consultant*<br>p7 & 15—Within this section and the following, there is discussion on the additive affects of PAHs and similar chemical groups such as PCBs, but there is no direct discussion on what approach to take when there are non detects within those groups.<br>A discussion on whether the limit of reporting concentration should be applied where there are non detects within these summed chemical groups. Some guidance on this would reduce the uncertainty. | Addressed in Section 4.7 using the same approach as presented in B4 |
| 28 | 2.2.4 | *Environmental consultant*<br>p8—Inhalation is likely a predominant pathway of concern for elemental mercury—how does this effect the relevancy of the HIL derived for soil? | Elemental mercury has to be addressed using a site-specific assessment—the HIL for inorganic Hg is not relevant—as stated in Section 2.2.4—no change |
| 28 | 2.2.4 | *Environmental consultant*<br>p8—The absence of consideration of mercury vapours as an exposure pathway in | Footnote included in Table 2 B7 and equivalent table in Schedule B1 |

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| | | the derivation of the mercury HIL., The note regarding the HIL value for mercury should be added to the footnotes to table 1A(1) in Schedule B1 to reduce the possibility of misuse of the mercury HIL. | |
| 28 | 2.2.5 | *Environmental consultant*<br>8—Interim HILs are relevant for soil gas collected at 0 to 1m for a slab-on-grade scenario. A large proportion of Australian houses are built on crawl space foundations which may include a bare earth floor. Given that there may be little ventilation within the crawl space and stack effects may overide any dilution of vapours, this may result in higher concentrations of vapours inside houses than the interim HIL attenuation factor predicts.<br>The interim HILs may have little relevance for many sites across Australia with this limitation—what information regarding vapour intrusion into crawl-space housing has been reviewed? | The approach adopted is likely to be adequately protective of crawl-space homes as well given the mixing of vapours in the crawl-space and indoor air—however an additional note has been included to address these homes on a site-specific basis. |
| 28 | 2.2.5 | *Environmental consultant*<br>p8—Interim HILs are relevant for soil gas collected at 0 to 1m for a slab-on-grade scenario. A large proportion of Australian houses are built on crawl space foundations which may include a bare earth floor. In this scenario, the assumptions and inputs in the development of the vapour intrusion guidelines (interim HILs or HSLs) are not valid, and the guidelines may be overly conservative, or not sufficiently conservative.<br>The interim HILs may have little relevance for many sites across Australia with this limitation—what information regarding vapour intrusion into crawl-space housing has been reviewed? | Noted and addressed |
| 28 | 2.2.5 | *Environmental consultant*<br>p8—Interim HILs have been developed assuming that groundwater, "if present … [is] deeper than the soil source." It is assumed that the derivation of the interim HILs has not included protection of groundwater (via leaching from soil). Explicit mention that interim HILs are not necessarily protective of groundwater is needed. | This is relevant to all the HILs—not just the interim values—additional dot point included in Section 1.3.1 |
| 28 | 2.2.5 | *Environmental consultant*<br>p8—Interim HILs have been developed for some volatile chlorinated solvents. The | Noted |

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| | | NEPM acknowledges that "there are limitations and uncertainties associated with the assessment of volatile contaminants on the basis of soil concentrations. As these limitations are significant, interim HILs for soil have not been derived." In contradiction with these statements, HSLs on the basis of soil concentrations have been included in Schedule B1., Re-consideration of the HSLs for soil is required and consistency in the approach and language used to derive the HSLs and interim HILs is needed. The use of interim HILs for soil gas is appropriate and supported, provided the limitations and exclusions of these interim HILs (other pathways, aesthetic issues, etc) are explicit. | |
| 28 | 2.2.6 | *Environmental consultant*<br>p8—It is difficult to obtain accurate analysis of free cyanide in environmental media, Inclusion or direction to some guidance regarding sampling methods would be beneficial | Noted but not included as it is complex and likely to change with evolving methods |
| 28 | 2.2.6 | *Environmental consultant*<br>p8—Missing word: "the ability of standard vapour models to estimate the concentration….", Revise wording | Addressed |
| 28 | 2.2.7 | *Environmental consultant*<br>p8—Consumption of home grown eggs and poultry meat is increasingly popular. , If the NEPM will not consider this exposure pathway then should it provide guidance or direction to an appropriate methodology | Noted. A site-specific risk assessment would be required. |
| | 3 | **Generic land use scenarios** | |
| 31 | 3 | *Environmental consultant*<br>12-27, Subsurface workers not included in any of the scenarios or as a separate scenario. It is inconsistent with HSLs to exclude this receptor population. Important as many drive risk in some instances, Include as a separate scenario. | Occupational exposure scenarios are not included in the NEPM. |
| 28 | 3.1 | *Environmental consultant*<br>p12—Clarification on the land use settings for schools (as outlined above) is required.<br>List preschools, primary schools and child care centres under the HIL A dot point, | Refer detailed discussion on land uses presented in section 3.2<br>Table 2 footnotes have been revised to be consistent with Schedule B1 |

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| | | and/or reference the wording in section 2.2.1 on page 5 of Schedule B1. | |
| 28 | 3.1 | *Environmental consultant*<br>p12—Conceptual site models (CSMs) are first introduced in section 1.3.1 (page 2) of this Schedule. The CSM acronym should be introduced on page 2 and used thereafter (e.g. on page 12).<br>Revise text to use the acronym "CSM" | Addressed |
| 15 | 3.2 | *Environmental consultant*<br>p12-16; These sections indicate that basements do not form part of the application of these generic scenarios.<br>Should there be something directly relating sites with basements to HSLs within this section or, to the section within the NEPM that is applicable. | Noted. The HIL generic scenarios do not include consideration of basements. |
| 28 | 3.2.1 | *Environmental consultant*<br>12, As per section 1.2 regarding pica behaviour | Addressed |
| 28 | 3.2.1, 3.2.2, 3.2.3, 3.2.4 | *Environmental consultant*<br>pp 13–16, Vapour intrusion from groundwater into indoor and outdoor airspace is not considered in the CSMs, Clarity should be provided regarding this pathway as chlorinated hydrocarbons may not be a likely COI for shallow soil at a site with significant groundwater contamination. | Addressed |
| 5 | 3.2.1 | *Environmental consultant*<br>p13; "Single storey". Low-density residential scenario should apply to multi-storey as well provided that ground-floor is a liveable area and there is access to soil in backyard.<br>Include reference to multi storey buildings | Addressed |
| 28 | 3.2.3 | *Environmental consultant*<br>p15, Figure 3 lists the exposure pathways considered for land use setting C. These pathways include (inter alia) ingestion and dermal contact with soil, and dust inhalation. However, neither the interim HILs nor the HSLs for land use setting C | Correct—the Interim HILs are for soil vapour only and do not include other pathways. However it is noted that the derivation of HILs for the chlorinated compounds is dominated by the vapour pathway. This is the same for |

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| | | include these exposure pathways.<br>Figure 3 needs to be clear that all the pathways listed for land use C apply only to the HILs and not to the interim HILs or to the HSLs. | all the Interim HILs. Minor text added after each CSM figure.<br>The direct contact HSLs include soil ingestion, dermal contact and dust inhalation. |
| 28 | 3.2.3 | *Environmental consultant*<br>p15, Unclear whether the land use setting for "schools" is "A" or "C". , Clarify whether schools (particularly secondary schools and non-playing field areas) are assessed under HIL A or C. | Refer revised text and footnotes to table 2 |
| 31 | 3.3.2 | *Environmental consultant*<br>18, Potential uses of the land in the future has not been highlighted as an issue that should be considered i.e. commercial includes child care. Include comment on future land uses that should be considered. Can be obtained from local town planning zones/schemes | Addressed |
| 28 | 3.3.2 | *Environmental consultant*<br>p18, The commercial land use scenarios exclude sensitive groups including hospitals, aged care centres and hospices., Guidance should be provided on the appropriate exposure scenarios for these land uses. | Addressed |
| 47 | 3.4 | *Industry peak body*<br>18—Exposure pathways considered by HILs don't including inhalation of vapors derived from groundwater—does this include interim HILs for HVOLs (refer to p11)?<br>Sentence may need to be clarified as I understand interim HILs for HVOLs are based on soil vapor which could include a groundwater source? | Addressed |
| | 4 | **Toxicity Assessment** | |
| 25 | 4 | *Environmental consultant*<br>28—Derivation of HILs and carcinogenic effects<br>Some chemicals have both carcinogenic and non-carcinogenic effects. Have both carcinogenic and non-carcinogenic TRVs been used in the derivation of HILs for | Addressed |

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| | | such chemicals? Have different GAFs been applied for different chemicals? This question may be answered elsewhere in the document or via reference to US EPA 2004b, however, a relevant statement should be made in Section 4.3 for clarity. | |
| 28 | 4.2 | *Environmental consultant*<br>p28, It is not easy to assess the adequacy of information used for the assessment of carcinogenic chemicals, A summary table indicating what carcinogenic chemicals are considered threshold or non-threshold and rationale for the decision would be helpful here | Noted. The approach is outlined in B4 and Appendix A |
| 28 | 4.4 | *Environmental consultant*<br>p29—Not easy to assess the adequacy of information regarding background/distribution/volume of exposure, A summary table indicating background and distribution/volume of exposure to COI in the environment would be helpful here | Noted—addressed on a chemical specific basis in Appendix A |
| 28 | 4.4 | *Environmental consultant*<br>p29—There is no toxicological information for HSLs, If the HSLs are to be retained, all relevant toxicological information should be included in the document to validate it appropriateness for use by practitioners who wish to carry out more detailed, site-specific, pathway risk assessment. | Noted.<br>The information can be found in the Technical Development document for the HSLs in the Toolbox (Friebel & Nadebaum 2011 ) |
| 28 | 4.5 | *Environmental consultant*<br>p30—The discussion on the definitions of bioavailability and bioaccessibility is useful. Additional guidance on ways to test or analyse for bioaccessibility would assist practitioners to obtain data on this variable.,<br>Provide guidance on methods to assess for bioaccessibility. | Addressed |
| 28 | 4.7 | *Environmental consultant*<br>31, The text on the toxicity surrogate approach has already largely been described in section 2.2.3. Combine text on surrogate toxicity approach in section 4.7 with that in section 2.2.3. | While repetitive—no change |
| 25 | 4 | *Environmental consultant* | Addressed |

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| | | p28—Some chemicals have both carcinogenic and non-carcinogenic effects. Have both carcinogenic and non-carcinogenic TRVs been used in the derivation of HILs for such chemicals? | |
| | 5 | **Exposure Assessment** | |
| 28 | 5 | *Environmental consultant*<br>p32 onwards, Significant referencing to the enHealth (2011) document that is not yet in the public domain., Extend the period of time for feedback comments on the NEPM to allow review of the Guidance (enHealth) documentation | Noted |
| 31 | 5.2 | *Environmental consultant*<br>35—Footnotes 3 &4 do not make sense, Please reword | Addressed |
| 31 | 5.2 | *Environmental consultant*<br>35—The time spent on-site indoors each day differs for derivation of HILs and HSLs, Make consistent | Noted. The HSLS have been revised to be consistent with enHealth 2011 |
| 28 | 5.2 | *Environmental consultant*<br>p32, body weight, average body weight of 15.5kg for a child appropriate for 2+ years—but a child <2 is likely crawling and low to the floor/ground so will be lower body weight with higher exposure during a very important time in terms of development of organs etc. | Noted and addressed in the same age group |
| 47 | 5.2.2 | *Industry peak body*<br>33—Thirty years total exposure is too short; Should be increased to 50–70 years (need to check references) | Noted 30 years is consistent with the Australian Exposure Factors Handbook enHealth 2012 |
| 47 | 5.2.2 | *Industry peak body*<br>33—Age group 0–6 years is 7 years duration, not 6. Change age group to 0 to 5 (6yr duration) | Addressed |
| 47 | | *Industry peak body*<br>5.2.2; p33; enHealth (2004) defined residential exposure duration as 70 years whereas this section indicates that an exposure duration of 30 years (24 adult, 6 | Noted—no change |

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| | | child) is used and references enHealth (2011). | |
| 28 | 5.2.3 | *Environmental consultant*<br>33—Unclear what the term "pro-rating" means. Suggest "averaging" may be clearer. | Addressed |
| 47 | 5.2.4 | *Industry peak body*<br>34—Inhalation rates for adults and children are low for the whole day average, as this is a 'resting' rate of inhalation<br>Should include an elevated rate for time spent outdoors (4 hrs per day) | No longer needed as RAGs F approach adopted |
| 5 | 5.2.4 | *Environmental consultant*<br>34—Inhalation rates only apply when following RAGS-A risk methodology. Using the new RAGS-F (2009) inhalation risk methodology does not require inhalation rate as an exposure parameter.<br>Include sentence explaining difference between RAGS-A and RAGS-F methodology. | Noted—changed to RAGs F approach |
| 28 | 5.3.1.1 | *Environmental consultant*<br>p1—No rationale is provided for the use of the 25% and 50% of HIL A soil ingestion rates for HIL B and C scenarios. Provide rationale for the factors used applied for soil ingestion rates. | Noted |
| 28 | 5.3.2 | *Environmental consultant* | Noted |
| 5 | 5.3.3.1 | *Environmental consultant*<br>p39—CRCCARE HSLs used old RAGS-A default values for PEF, where NEPM use new revised method for calculating PEF<br>NEPM and HSLs should use consistent values | Noted.<br>HSLs methodology has been updated |
| 47 | 5.3.3.3 | *Industry peak body*<br>40—It is incorrect to assume that PM10 is not of concern, as it is still enters the | Addressed |

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| | | upper respiratory tract and has sufficient residence time for contaminants to be absorbed. $PM_{2.5}$ is considered a more significant health issue due to the irritant effects of the particles on the lower respiratory tract.<br>All of $PM_{10}$ fraction should be included, not just $PM_{2.5}$ portion | |
| 47 | 5.3.4 | *Industry peak body*<br>p5—The text states that "Further detail on this exposure pathway is presented in this Schedule"., Include a reference to the appropriate section of the Schedule. | Addressed |
| 28 | 5.3.5.3 | *Environmental consultant*<br>p7—The CF values are not listed.<br>It would be useful to have the CF values provided in this section in a table, similar to the way the exposure parameters have been listed. | Noted—the information can be found in Appendix A |
| 2 | 5.3.5 | *Environmental consultant*<br>Consumption of Home grown produce<br>This section states that exposure to home grown produce is dependent on among other things, the bioavailability of contaminants when ingested in food. This last factor is assumed to be 100% for all contaminants with the exception of lead. This is incorrect for many substances including As, Cd, and Hg. The bioavailability in the derivation of HILs in these situations is assumed to be equivalent to the bioavailability that is inherent in the derivation of the TRV, (often considerably less than 100%)<br>This statement is inherently misleading and should be corrected. | Addressed—minor change |
| 31 | 5.4.1.1 | *Environmental consultant*<br>Pg 32, This section includes a reference to a draft public health goal (PHG) for Chromium VI in drinking water based on the non-threshold effects published by the California Office of Environmental Health Hazard Assessment (OEHHA) in August 2009. This section also states that there are no peer-reviewed data available to determine a quantitative non-threshold value for ingestion of Chromium VI. However, since the draft revised NEPM was prepared, peer review comments on the draft OEHHA PHG document have been posted on OEHHA's website - | Noted—checked but no change as not final |

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| | | http://oehha.ca.gov/water/phg/chrom092010.html. EPHC may wish to revisit OEHHA's PHG document in reference to the non-threshold effects of Chromium VI., Peer review comments on the draft OEHHA PHG document - http://oehha.ca.gov/water/phg/chrom092010.html. | |
| 28 | 5.4.2 | *Environmental consultant*<br>p8, HILs based on age range 1–2 years considered most sensitive as a result of lowest body weight with high hand to mouth activity and crawling, We would have though high hand to mouth activity and crawling is more appropriate for 6 months to 14 months—a body weight of 15.5kg for a 6 month old is not appropriate - nearer 6kg. | Noted |
| 31 | 5.5 | *Environmental consultant*<br>Pg 34, Line 2, Please explain the reasoning used to determine that the newly derived HIL A for Chromium VI of 80 mg/kg is "essentially the same as the existing HIL of 100 mg/kg," which leads EPHC to the decision that the existing HIL A should be retained. | Any criteria derived in the manner adopted in the HILs are not precise and consideration of the available science and uncertainties does not support changing the existing HIL of 100 |
| 5 | 5.5.2 | *Environmental consultant*<br>45–46—The method applied to soil-vapour HILs is different to the method used in CRCCARE HSLs. NEPM present a value which is not depth related and is not based on any soil type. CRCCARE HSLs use the attenuation factor for the advective component, but still use the diffusion component to derive HSLs at various depths and soil types.<br>The CRC CARE approach should be described in the NEPM report as an alternative approach to deriving soil vapour criteria. | Noted. Full details of the HSL methodology may be found in the HSL reports in the Toolbox. |
| 28 | 5.5.2 | *Environmental consultant*<br>p46—Interim HILs are based on exposure to these chemicals through inhalation only, justification for not considering soil values for oral and dermal exposure is warranted.<br>Provide justification. | Noted. The Interim HILs are for soil vapour only and are based on the dominant vapour pathway. |
| 5 | 5.5.2 | *Environmental consultant* | Additional explanatory text added. |

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| | | pp45–46; Attenuation factor. There is no rational for the selection of 0.01 presented. Note CRCCARE HSLs use 0.005. In the HSL documents they describe a study by Oregon Department of Environment Quality in which the USEPA is analysed indicating that low source data points are skewed by background in air, and therefore recommended using 0.005.<br><br>NEPM and HSLs should use consistent values and value should be justified. | |
| 28 | 5.5.3 | *Environmental consultant*<br><br>11—The soil gas to outdoor air attenuation factor is too low at 0.005. It can reasonably be expected that outdoor air concentrations would be an order of magnitude lower than the indoor air concentrations.<br><br>Recommend the use of a factor of 10, rather than 2 for application to the outdoor air model. | Noted<br><br>An attenuation factor of 0.01 has been used for the interim soil gas HIL. Additional explanatory text added |
| 5 | 5.5.3 | *Environmental consultant*<br><br>46—Factor 2 for outdoor air compared to indoor air. Dilution from outdoor air usually results in 2 to 3 orders of magnitude difference. Consider factor of 10 instead of 2. | Noted and likely to be the case—additional text included but no change |
| 28 | 5.5.3 | *Environmental consultant*<br><br>p46—The soil gas to outdoor air attenuation factor is too low at 0.005. It can reasonably be expected that outdoor air concentrations would be an order of magnitude lower than the indoor air concentrations. The source reference for the adjustment factor seems very old and we question its validity given the significant amount of research that has occurred since this time and our own experience.,<br><br>Recommend the use of a factor of 10, rather than 2 for application to the outdoor air model.<br><br>Recommend using more up to date literature to support assumption. | Noted. Refer updated Section 5.5 in Schedule B7. |
| 25 | 5.5.3 | *Environmental consultant*<br><br>p46—Explain why increased dilution occurs during the daytime in outdoor air. | Diurnal wind variations. |
| | 6 | **Risk characterisation – How the HILs were generated** | |

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| 28 | 6.3 | *Environmental consultant*<br>p12—A full sensitivity analysis for the parameters adopted in the derivation of selected HILs would be beneficial to present an informative discussion on the parameter choice. Provide such a discussion. | Noted. |
| 31 | 6.4 | *Environmental consultant*<br>Pg 38—Line 6, Under the discussion of classification, the meaning of Group 2A designation (i.e. probable human carcinogen) should be included as is done following the mention of Group 2B. | Addressed |
| 31 | 6.4 | *Environmental consultant*<br>Pg 38—Line 7, Also under the discussion of classification, EPHC notes that the US EPA has not evaluated cobalt. , It is assumed that EPHC is referring to evaluating cobalt in the context of the Integrated Risk Information System (IRIS). It should be noted here that the US EPA's Office of Research and Development (ORD) has established a non-threshold slope factor for cobalt based on the inhalation pathway. This value is included in the ORD's provisional peer reviewed toxicity values (PPRTVs), which the US EPA recommends as the second source (after IRIS) for establishing toxicity criteria for human health risk assessments. | Noted—minor wording change |
| 2 | 6.4.1.1 | *Environmental consultant*<br>This section states: Considering that it was unlikely that vegetables and fruit would really be cultivated in soils with Foc of 0.3%, a value of Foc= 2% was selected to apply to the vegetable pathway. This statement may not be accurate. Organic carbon levels in market gardens throughout Victoria are often less than 1%. The implications of the selection of a Foc value in specific environments should be discussed.<br>Amendment required | Addressed |
| 2 | 6.4.1.2 | *Environmental consultant*<br>This paragraph is confusing and lacks clarity to show the logic of the conclusion<br>Amendment required | Noted |

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| | | **SCHEDULE B7 APPENDICES** | |
| 47 | | *Industry peak body*<br>Appendix A1–A5—General<br>Much of information presented is risk-associated.<br>It would be useful to provide information about the behaviour of each contaminant listed in the terrestrial environment (e.g. dependency on pH, clay content, redox potential etc) | Noted. Appendix A is focused on the derivation of the HILs |
| 2 | | *Environmental consultant*<br>All equations should be consistent with proceeding equations (eg. 1 and 2).<br>Calculation for HIL pathway appears to utilise individual TRV's (eg TRVoral and TRVinhation). This does not take into account systemic effects where the inhalation route and oral route contribute to the same effect.<br>Similarly, equations in this section do not take into account situations when the exposure routes (e.g. oral and inhalation in some situations) have totally separate impacts.<br>The adding together of HILs derived for each pathway oral and inhalation based on the equations in the text would result in the total tolerable dose being exceeded by an exposed individual when HILtotal = Soil Concentration site.<br>Additionally, the use of the same TRV value in the derivation of two or more HILindividual pathways (e.g. equation 18, 3 followed by the adding together of HILindividual pathways does not take into account that additive effects of different exposure vehicles exposing an individual through the same exposure pathway (e.g. ingestion).<br>The use of "B" to account for other site sources of exposure (other vehicles and pathways) is not helpful and would provide circular equations and not be consistent with other parts of the Text eg 4.4 Schedule B7 Guideline on Health based Investigation Levels<br>The differences in bioavailability through the various exposure pathways | Noted.<br>Equations have been checked. |

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| | | compared to the reference test has not been taken into account in the equations and can lead to an underestimation of the HIL. (also note that an assumption of 100% bioavailability in various parts of the data and equation can lead to an underestimation of the HIL)<br><br>Based on equation 2 and related equations in the text, the adding together of HILsindividual pathways and vehicles would result in the total tolerable dose being exceeded by an exposed individual when HILtotal = Soil Concentration site.<br><br>It appears from calculation checks and the above evaluation that the equations presented in the text are not the equations that were applied in the derivation of the reported HILs.<br><br>Note that these comment relate to threshold contaminants. | |
| | | **GENERAL** | |
| 47 | | *Industry peak body*<br><br>ALL; enHealth Framework 2010; The revised enHealth framework is still in draft form and has not yet been endorsed. If changes are made how will this influence the HILs that have been developed? | Noted. The enHealth document was finalised in 2012. The currency of the exposure assumptions was considered in finalising the HILs. |
| 28 | | *Environmental consultant*<br><br>ALL; Exposure assessment; There is a lack of transparency in the calculations which are not presented. There was development work undertaken in exposure assessment relevant to Australian conditions when previous HILs were developed. The use of US exposure equations is inconsistent with such development work which should have been extended. Of particular note are considerations of particulate inhalation and ingestion through mucous clearance where Australian data of TSPs and $PM_{10}$ atmospheric measurements are available and such empirical data may be incorporated. The calculation of particulate emission factors is not consistent with the use of measured data for inspirable and respirable particulates.<br><br>There has also been limited review of new exposure assessment methods.<br><br>There has been no development of an Australian Exposure Assessment model. Not all pathways have been evaluated and all potential pathways should have been presented and reviewed, e.g. rainwater consumption is an increasing source of | Noted<br><br>The equations and derivation of the criteria are presented. The adopted US exposure equations are appropriate and consistent with international approaches and previous HILs.<br><br>The derivation of two example compounds (threshold and non-threshold are included in Appendix B). |

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| | | intake for Australian conditions and this has not been factored in the calculations The source of the exposure equations has not been cited. There is limited consideration of localised dermal carcinogenicity responses (not systemic). There is no consideration of other relevant toxicities and their assessment, e.g. dermal hypersensitivity.<br><br>There has been limited or no discussion of acute or other relevant toxicities due to the limited toxicological reviews e.g. phenol is volatile and necrotic to tissue—how relevant is this to recent information and the development of an HIL. | |
| 47 | | *Industry peak body*<br><br>Appdx A1, Recommends using 70% for the oral bioavailability of arsenic in risk assessments. Some references and arguments are also provided on bioavailability of arsenic. However, the following information should be considered and proposed arsenic bioavailability in the NEPM should be revisited.<br><br>Roberts *et al*. (2002) showed monkey absorption of arsenic from pesticide treated soil and cattle dip soil is 10.7 to 24.7%. In August of 2001, the USEPA Health Effects Division's Hazard Identification Assessment Review Committee (HIARC) evaluated the toxicology database for inorganic arsenic and established toxicological endpoints for incidental residential and commercial/industrial exposure risk assessments (USEPA, 2001). As a key component of that assessment, HIARC established the appropriate relative bioavailability of arsenic in soil versus arsenic in water. The basis for this value is summarized below. For purposes of health risk assessment, USEPA evaluated a number of studies of relative bioavailability of arsenic (USEPA, 2001). After careful consideration of data reported in the various bioavailability studies, USEPA determined that the monkey was considered an appropriate study model for humans due to its similarity in excretion and gastrointestinal absorption characteristics (USEPA, 2001). | Text and rationale revised to incorporate suggested text. |
| 47 | | *Industry peak body*<br><br>Appdx A1; Continued; Freeman, G.B., Schoof, R.A., Ruby, M.V., Davis, A.O., Dill, J.A., Liao, S.C., Lapin, C.A., and Bergstrom, P.D., 1995. Bioavailability of arsenic in soil and house dust impacted by smelter activities following oral administration in cynomolgus monkeys. Toxicol. Sci. 28:215-222. | Text and rationale revised to incorporate suggested text. |

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| | | Roberts, S.M., Weimer, W.R., Vinson, J.R.T., Munson, J.W., and Bergeron, R.J., 2002. Measurement of arsenic bioavailability in soil using a primate model. Toxicol. Sci. 67:3-3-310.<br>USEPA, 2001. Inorganic Arsenic - Report of the Hazard Identification Assessment Review Committee. USEPA Health Effects Division, August 21. http://www.epa.gov/scipoly/sap/meetings/2001/october/inorganicarsenic.pdf | |
| 47 | | *Industry peak body*<br>Appdx A1; Continued; The USEPA identified the comprehensive monkey study conducted by Roberts et al.(2002) as the study of choice. This study was conducted on the behalf of the Florida Department of Environmental Protection (DEP) in order to specifically establish a gastrointestinal absorption efficiency factor for arsenic in soil that could be applied to soil risk assessments. The Roberts et al. study identified the maximum of the arithmetic mean value (for five animals) for relative bioavailability for each of five soil types, 24.7%, as a "conservative, upper bound case for any particular soil type". While the maximum individual value reported in the study was 32.4%, the authors did not recommend this value for use as a reasonable maximum exposure (RME) value for risk assessment on the basis that "Only under highly specific, rare circumstances is the maximum value for a particular parameter used in environmental characterization, exposure assessment and risk assessment." | Text and rationale revised to incorporate suggested text. |
| 47 | | *Industry peak body*<br>Appdx A1; Continued; USEPA agreed with Florida DEP and selected 25% as a RME value for relative bioavailability for health risk assessments of arsenic in soil (USEPA, 2001) and both agencies currently endorse the value of 25%. While the Roberts et al. study utilized five soil types typical of Florida soils, another monkey study (using a difference species) was conducted by Freeman et al. (1995) using soil near a smelter in Anaconda Montana. The mean absolute percentage bioavailabilities, based on urinary excretion data, were 68, 19, and 14 percent for the gavage (soluble sodium arsenate in oral solution), house dust, and soil treatments, respectively. The values for house dust and soil are consistent with those reported by Roberts et al. (2002) for soil. | Text and rationale revised to incorporate suggested text. |
| 31 | | *Environmental consultant* | Addressed |

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| | | Appendix A1<br>5, Multiple locations in Section 5, It is assumed that references to ATSDR, 1997 in the Chromium VI text should be ATSDR, 2000 as this version is more up to date. | |
| 28 | | *Environmental consultant*<br>Appendix A1—Blood lead modelling. There is a considerable body of Australian data on lead exposures from Port Pirie, SA investigations over 20 years. How was this considered in the blood lead modelling?<br>Consider Australian data to validate modelling. | Addressed—it has been reviewed by SA Health in line with this data |
| 28 | | *Environmental consultant*<br>Appendix A1, Hypersensitivity. Hypersensitivity reactions may be initiated at very low levels of exposure and may be relevant depending on population prevalence of the condition. Provide consideration or highlight limitation. | The TRV adopted for Ni is noted to be protective of hypersensitive responses—no change |
| 28 | | *Environmental consultant*<br>Appendix A1—Organic mercury. If inorganic mercury is a skin sensitiser—how has this been considered in the HIL?<br>Provide clarification. | Reference to skin sensitisation deleted as not identified as a key issue for Hg |
| 28 | | *Environmental consultant*<br>Appendix A1—Plant uptake data from Australian sources- was this examined?<br>Provide consideration in updated text. | Considered where data was available |
| 28 | | *Environmental consultant*<br>Appendix A1—Nickel. Ni hypersensitivity was assessed in 1996 by both oral and dermal provocation evaluations and the dermal provocation method used in the calculation not the oral—review of new information is required. | The TRV adopted for Ni is noted to be protective of hypersensitive responses – no change |
| 31 | | *Environmental consultant*<br>Appendix A2<br>1.1, Page 3, Line 19 | <br>Noted<br>Reference included but no recommendation to |

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| | | The 16 PAHs analysed are not the most common but rather are a broad range across the equivalent carbon spectrum. The US EPA's Science Advisory Board (SAB) are currently reviewing the relative potency of PAHs with the analyte spectrum expanded from 16 to address the known toxicity for additional threshold and non-threshold PAHs and to better characterise the group.<br><br>It is recommended that following the issue of the report by USEPA's Science Advisory Board (SAB) (currently in draft), that the document be reviewed once finalised and where appropriate, updates be made to the assessment of PAHs under NEPM including the number of analytes within the priority mixture and expanded where necessary. | adopt once finalised as the relative potencies may not be appropriate to adopt without more detailed review in the Australian context. |
| 28 | | *Environmental consultant*<br><br>Appendix A2—PAHs. The dermal carcinogenicity evaluation for BaP and PAHs is limited and requires further investigation considering the significance for children.<br><br>Update assessment considering this endpoint and receptor. | Noted<br><br>Calculations revised based on the revision to the dermal slope factor as published in 2012 |
| 47 | | *Industry peak body*<br><br>Appendix A2—Not all acronyms included in the shortened forms list at the rear of the document | Addressed |
| 28 | | *Environmental consultant*<br><br>Appendix A3—PCB. Some of the material cited is quite dated, e.g. PCB data and regulatory reviews from ATSDR (2000) and RIVM (2001) and US EPA (1994).<br><br>This highlights the need for up-to-date toxicological reviews and new opinion may heavily influence the HIL. | Noted<br><br>The most recent published peer reviewed data has been considered in the development of the HIL. |
| 34 | | *Industry peak body*<br><br>Appendix A4<br><br>PACIA believes there should be a process adopted for development of an "Addendum" to this NEPM so that HILs can be developed for additional chemicals over time, and adopted as part of the NEPM. This would prevent multiple consultants developing differing values separately for various chemicals. | Noted.<br><br>Schedule B4 states that the methodology presented in Schedule B7 for the derivation of the HILs is the approach to adopt for other |

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| | | The current list of chlorinated chemicals covers TCE, 1,1,1-Trichloroethane, PCE, cis-1,2-DCE, and Vinyl Chloride Monomer. It would be worth extending the list of chlorinated chemicals covered and could include chemicals like Chloroform, Vinylidene Chloride, Ethylene Dichloride, and 1,1,2-Trichloroethane.<br>PACIA believes that once the methodology has been agreed, there should also be an agreed process for developing an addendum to cover more chemicals. This would be in preference to waiting for another addition of the NEPM to be developed. | chemicals if required |
| 31 | | *Environmental consultant*<br>Appendix A4<br>The presumption that outdoor ambient air can be the only source of chlorinated compounds in background is misleading. A number of analytes are present within common household cleaning products and thereby given usage of these products indoors, potential background exposure can result. As the analytes considered in the NEPM are highly volatile, it is unlikely that indoor usage would measured in outdoor ambient air given dilution and dispersion nor that outdoor measurements could provided be a representative measure of indoor use.<br>It is recommended that for the threshold chlorinated analytes for which HILs have been developed (trichloroethene, tetrachloroethene, 1,1,1-trichloroethane, 1,2-dichloroethene) a nominal background apportionment (e.g. 20%) be included to account for chemical use by potential receptor populations within the home. | Addressed |
| 28 | | *Environmental consultant*<br>Appendix A4—p23, Vinyl Chloride. Vinyl chloride in soil vapour has been found at Australian sites—what review for Australian conditions has been undertaken?<br>Consider Australian data to validate modelling. | Noted<br>Australian data considered where appropriate |
| 47 | | *Industry peak body*<br>Appendix B—Large amount of effort has been made to estimate HILs on the basis of exposure of receptors to contaminants in soils.<br>However less effort appears to relate to the implication of physico-chemical | Noted<br>Appendix B provides the equations used to derive the HILs and does not address additional issues which may need to be |

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| | | interactions between soils and contaminants.<br>Some guidance and/or additional information can be provided to clarify this. For example, Equation 35 considers the vapour phase of a volatile contaminant in an unsaturated soil.<br>The relationship between volumetric water content and pore pressure is complex and a reasonable estimate of the volumetric water content can be very difficult if not impossible. As another example, Equation 35 incorporates the soil-water partition coefficient. This coefficient is applicable for soils containing an organic carbon fraction of greater than 0.001 (Karickhoff *et al.*, 1979). Care should be taken if retardation by sorption is expected to play an important role in contaminant transport. It should be noted that the function and type of clay minerals are increasingly important if soils subject to investigation are clayey (e.g. Karickhoff, 1984; Mader *et al.*, 1997) | considered in a site-specific assessment.<br>Refer Schedule B4 for information on site-specific risk assessment. |
| 5 | | *Environmental consultant*<br>Appendix B: 1.3.4; pp7-8<br>These equations only consider the RAGS-A method.<br>Should also include equations for RAGS-F inhalation method | Updated to use RAGs F |
| 5 | | *Environmental consultant*<br>Appendix B: 1.6.1; p 14; Eq 38.<br>This equation is for basements. For slab on ground AB = LB x WB.<br>Include both slab-on-ground and basement versions of AB | Addressed by deleting equation for basements as not used in deriving the HILs. The purpose of Appendix B is to provide the equations used to derive the HILs and not to address additional issues which may need to be considered in a site-specific assessment. |
| 5 | | *Environmental consultant*<br>Appendix B: 1.6.1; p13<br>1) Conversion factor in Eq 35 is incorrect. Should be 1000, not 1000000000<br>Fix equation 35<br>2) Soil bulk density. Should note this is dry weight basis | Addressed by deleting equations not used in deriving the HILs as the purpose of Appendix B is to provide the equations used to derive the HILs. |

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| | | Include note on bulk density<br>3) Eq 36. This is the infinite source model.<br>Include note stating this is the infinite source model | |
| 5 | | *Environmental consultant*<br>Appendix B: 1.6.1; p14; Qsoil. The basis of Qsoil selection is different to that in the CRCCARE HSLs which uses the sub-slab to indoor air attenuation factor to set Qsoil/Qbuilding.<br>Should include a note that Qsoil/Qbuilding method can also be used. | Addressed by deleting equations not used in deriving the HILs as the purpose of Appendix B is to provide the equations used to derive the HILs. |
| 12 | | *Other*<br>As previously indicated we commenced perusing the draft NEPM document with respect to our area of interest (e.g. mercury in the environment) by first reading the document from cover to cover and was quite frankly astounded by the relative concentrations of mercury in the soil/water that were stated as being safe from any toxicity effects, despite any limitations that could be foreseen by using Investigation & Screening Levels data.<br>We continually asked ourselves (in view of our extensive database on mercury toxicity derived principally, but not exclusively, from USEPA sources); "What were we missing"?<br>And perhaps more importantly asking, "How could the stated levels of mercury in the various scenarios set out in the draft NEPM document be justified knowing full-well that the NEPM data was, in reality, many orders of magnitude higher than what the above World Authority's maximums on mercury were permitting?<br>This disparity remains unexplained at the point of writing our comments on the draft NEPM document and because of what is contained in USEPA, WHO, UN databases cannot be considered reliable.<br>We do not see it as our role to offer any explanation(s) for the alarming disparity between the NEPM data and that of the World Authorities (not that we can) but raise this as an urgent issue to be addressed by the NEPC. Both sets of data cannot be correct. | Noted<br>Additional text has been added to the tabulated HILs in Schedule B1 to clarify the use of the HILs for inorganic mercury and methyl mercury. |

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| | | Another point of incredulity resulted from eventually reading in the draft NEPM "that the derived HIL's are not relevant to the assessment of elemental mercury, which should be addressed on a site-specific basis …..".<br><br>Unfortunately, this statement surfaces approximately ¾'s of the way through the entire document in Schedule B7, Appendix A1, Section 10 "Mercury", and does little to instil credibility in the document as a whole after having read repeatedly about the real importance of Investigation & Screening Levels including their applicability to mercury, throughout the draft document prior to arriving at this point.<br><br>It is considered extremely important that such a significant disclaimer regarding the use of Investigation & Screening Levels (and particularly for its lack of applicability to mercury) should appear at the beginning of the document so that readers become aware of this situation from the outset.<br><br>Additionally, in Section 7.1.4 "Assessment of impacts from volatile substances", Impact Statement, Part 7; pg 31. "….. The NEPM currently provides limited consideration of the assessment of volatile substances". Unfortunately, elemental mercury is a very volatile substance and perhaps more importantly, is the predominant form existing in our environment, today!<br><br>And again from Schedule B7, Appendix A1, Section 10 "Mercury", "…. The most significant natural source of atmospheric mercury is the degassing of volcanoes. Man-made sources such as mining, fossil fuel combustion and industrial emissions generally contribute less on a global scale, but more on a local scale ….....".<br><br>While this statement is probably true of modern mining practices it horrendously down-plays the extent of elemental mercury actually existing in our environment, globally and locally, resulting from our historic gold mining era.<br><br>For example, using latest USEPA estimates for the amount of mercury used to extract gold in the processing of each tonne of ore mined and conservatively applying only 50% of the mercury figure to the total known tonnage of ore (based on the recovered gold content) mined from the 123 historic mining sites across Australia, gives a figure of between 30,000 to 60,000 tonnes of mercury lost to our environment! | |

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| | | When you also consider that up to 50% to 60% losses of used mercury occurred and these losses were considered "normal" for the process and that this "lost mercury" entered the environment via waterways in the respective regions and/or mine tailings on dry land where essentially most of this mercury still remains in the environment—this reality collectively paints an entirely different picture about the quantity of mercury remaining in our environment across Australia today and sheds new light on the importance of removing it from our environment.<br><br>Applying a similar ultra-conservative analogy to the Upper Goulburn River, Big River, Eildon Storage and Thomson River Catchments for the 145 known hard-rock mines for which only limited or incomplete hard data exists from the early gold mining era, results in a staggering quantity of 3,814 tonnes of mercury has been lost into these waterways and essentially remains there today!<br><br>Contrast all of this with the average global deposition of 4 nanograms mercury / m2 / year (USGS data) and then consider which has the biggest impact on our environment and therefore on our health! | |
| 28 | | *Environmental consultant*<br><br>B7—70, Cyanide—Not considering complexed cyanides (of lower toxicity) introduces unnecessary conservatism which will lead to extra costs in assessment. | Noted A site-specific assessment is required if no free cyanide is present. |
| 2 | | *Environmental consultant*<br><br>Comments on the adding together of HILindividual pathways for non-threshold contaminants are similar for the threshold approach presented in the text.<br><br>Based on equation 2 and related equations in the text for non-threshold contaminants, the adding together of HILsindividual pathways and vehicles would result in the Target risk (1x10-5 presumably) being exceeded by an exposed individual when HILtotal = Soil Concentration site.<br><br>Suggested change:<br><br>Ensure equations are consistent with the modelling of all other equations<br><br>Ensure that equations stated as being used to derive HILs are indeed the equations used to derive the reported HILs. | Noted<br><br>The equations used are exactly as presented in the text and if a forward calculation is conducted the TR would be met for all pathways |

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| | | The details of each set of equation used to calculate each HIL should be provided in spreadsheet form so that the assumptions and modelling are transparent and can be checked for accuracy. | |
| 47 | | *Industry peak body*<br>Confirm that 0–6 years means 0yrs >= Age < 6yrs ? | Confirmed and changed to 0–5 years that covers 6 years of life |
| 10 | | *State government agencies*<br>Considering and better justifying why the exposed public is divided into children (0-6 years) and adults (>6 years) especially since the HSL technical document of March 2010 uses categories of child, older child and adult and Section 5.4.2 of B(4) indicates the greater sensitivity to toxic insults of the children up to the age of 16 in comparison to real adults. | Noted<br>A finer separation of age groups does not change the HILs as the more specific age groups have been considered where age-specific adjustments apply for mutagens. |
| 10 | | *State government agencies*<br>Cover page—Title would be better as something like—Guideline on the Derivation of Health-based Investigation Levels to better distinguish it from B(1). | Addressed |
| 28 | | *Environmental consultant*<br>Epidemiology.<br>Epidemiological data relevant to population health effects for contaminants of concerns has not been reviewed in support of toxicological assessment.<br>Provide up to date epidemiological data.<br>There has been no development of an Australian Exposure Assessment model.<br>Not all pathways have been evaluated and all potential pathways should have been presented and reviewed, e.g. rainwater consumption is an increasing source of intake for Australian conditions and this has not been factored in the calculations. | Noted<br>A site-specific assessment should be carried out where the generic exposure scenarios assumed for the HILs do not adequately address the site circumstances. |
| 2 | | *Environmental consultant*<br>Equation 2<br>Equation 2 is clumsy and re-arrarranged states: | Noted<br>The equations have been checked and are correct. The equations used are consistent with |

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| | | HILtotal = HILingestion soil+ HILdermal + HILplant uptake + HILdust inhalation + HIL vapours.<br><br>This equation (equation 2) is inconsistent with related equations (derivation of HILindividual exposure pathways) and when applied in conjunction with these equations would result in error.<br><br>1. This equation (2) requires the nominal dose apportionment Factors to be applied to each exposure pathway so that the total dose received does not exceed the total tolerable dose. The application of nominal apportionment factors without scientific justification is not supported.<br><br>2. The use of apportionment factors has not been applied in the derivation of HIL (A,B,C,D).<br><br>3. The use of equation 2 does not appear to have been applied in the derivation of HIL (A,B,C,D)<br><br>4. This equation in conjunction with the related HILindividual exposure pathways equations requires TRVtotal reference = TRVingestion soil exp. + TRVdermal + TRVplant uptake + TRVdust inhalation + TRV volatile inhalation. and only relates to systemic effects. This was not taken into account in the equations.<br><br>Suggested change:<br><br>The reference to equation 1 and 2 are not helpful in understanding the approach intended (and possibly applied*) to the derivation of HILs.<br><br>Perhaps for threshold toxicants:<br><br>Dosetotal = Doseingestion soil+ Dosedermal + Doseplant uptake + Dosedust inhalation + Dosevolatile<br><br>and<br><br>TRVtotal ≥ Dosetotal<br><br>and<br><br>Dose Exposure vehicle = Concentration Exposure Vehicle * Intake Rate * EF *ED/(BW*AT) | those adopted in other jurisdictions including New Zealand. |

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| | | Reflects best reflects the intent and starting point for development.<br>There are various texts that reflect this including Walker 1998 (see below)<br>Perhaps for non-threshold toxicants:<br>RISKtotal = Riskingestion soil+ Riskdermal + Riskplant uptake + Riskdust inhalation + Riskvolatile<br>and<br>Target Risk (TR)≥ Risktotal<br>(* Note the detail presented in the document does not allow direct assessment of the calculations made to derive a HIL. Clarity and transparency must be ensured) | |
| 2 | | *Environmental consultant*<br>Equations 20, 16, 13, 10, 7<br>The inclusion of TRVi,o,v,d as toxicity reference value should more accurately be referred to as the carcinogenic slope factor and be given a symbol that is distinctive from the threshold reference values.<br>Correction required | Noted<br>The TRV may reflect a threshold or non-threshold value as appropriate |
| 2 | | *Environmental consultant*<br>Equations 20, 21<br>The inclusion of TRVo in equation 20 as a toxicity reference value should more accurately be referred to as the carcinogenic slope factor and be given a symbol that is distinctive from the threshold reference values.<br>Equation 21 is incorrect or incomplete<br>Correction required | Noted<br>The TRV may reflect a threshold or non-threshold value as appropriate |
| 27 | | *Environmental consultant*<br>Expanded list of HILS in light of recommendations - derive additional HILs, develop guidance, to counter inappropriate use as remediation criteria, develop HILs for priority list of carcinogens and for non-dioxin persistent organic | Noted |

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| | | pollutants (POPs), General—training for consultants will be required to move from using NEPM values as clean up values to using them as Tier 1 assessment criteria only<br><br>1.2—HILs- scientifically based generic tier 1 assessment criteria for human health risk from chronic exposure.<br><br>There may be future confusion when the NEMP changes due to same names for HIL D - currently High density Res but becoming commercial/industrial<br><br>Levels in excess of HIL do not imply unacceptability or significant health risk. Similarly levels under HIL do not necessarily imply acceptability or that a health risk is not likely to be present if sensitive sub-populations are receptors or the assumption for land use scenarios are not appropriate.<br><br>HILs are not clean up levels. Clean up levels are site-specific and are based on HHRA, practicality, timescale, effectiveness, cost, durability etc., Possibly needs to be elaborated. | Minor text revision<br><br>Noted<br><br>Noted |
| 47 | | *Industry peak body*<br><br>Exposure scenarios<br><br>Suggest more specificity on which numbers to use for other land uses (medium density, schools etc.), or a clear statement that site-specific risk assessment should be done at this juncture. Maybe a table detailing land uses that are covered by each of the HILs, and confirmation that otherwise site-specific risk assessment should be performed. | Noted<br><br>Refer to Section 3.2 and footnotes to Table 2 |
| 28 | | *Environmental consultant*<br><br>Figure 1, p13, Figure 1 lists the exposure pathways considered for land use setting A. These pathways include (inter alia) ingestion and dermal contact with soil, dust inhalation, and ingestion of home-grown produce. However, neither the interim HILs nor the HSLs for land use setting A include these exposure pathways., Figure 1 needs to be clear that all the pathways listed for land use A apply only to the HILs and not to the interim HILs or to the HSLs. | Additional text added to clarify that the CSM applies to non-volatile compounds.<br><br>Note the direct contact HSLs consider soil ingestion, dermal contact and dust inhalation. Refer to the HSL Technical Development document (Friebel & Nadebaum 2011) available from the NEPM Toolbox. |
| 28 | | *Environmental consultant* | Additional text added to clarify that the CSM applies to non-volatile compounds. |

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| | | Figure 2—14—Figure 2 lists the exposure pathways considered for land use setting B. These pathways include (inter alia) ingestion and dermal contact with soil, and dust inhalation. However, neither the interim HILs nor the HSLs for land use setting B include these exposure pathways.<br>Figure 2 needs to be clear that all the pathways listed for land use B apply only to the HILs and not to the interim HILs or to the HSLs. | Note the direct contact HSLs consider soil ingestion, dermal contact and dust inhalation. Refer to the HSL Technical Development document (Friebel & Nadebaum 2011) available from the NEPM Toolbox. |
| 28 | | *Environmental consultant*<br>Figure 4—p16—Figure 4 lists the exposure pathways considered for land use setting D. These pathways include dust inhalation. However, neither the interim HILs nor the HSLs for land use setting D includes this exposure pathway.<br>Figure 4 needs to be clear that all the pathways listed for land use D apply only to the HILs and not to the interim HILs or to the HSLs. | Additional text added to clarify that the CSM applies to non-volatile compounds.<br>Note the direct contact HSLs consider soil ingestion, dermal contact and dust inhalation. Refer to the HSL Technical Development document (Friebel & Nadebaum 2011) available from the NEPM Toolbox. |
| 10 | | *State government agencies*<br>For non-threshold carcinogens there needs to be a draft position articulated in regard to what is the acceptable lifetime excess level of risk. This can then be used as a part basis for deriving the associated HILs. The HSLs apply 1 x 10–5, although DOHWA use 1 x 10–6. B(7) seems to extrapolate pretty loosely based on a listing of international practices in choosing the relevant TRV, which results in a variable level of acceptable risk between different carcinogens and often less conservative than the above figures. An example, for CrVI a TRV (inhalation) is proposed of 0.0001 mg/$m^3$ based on USEPA, whereas WHO 2000 equates 1 x 10–5 excess risk with exposure to 0.0000025 mg/$m^3$ | Addressed—new short discussion included as new Section 6.2 |
| 47 | | *Industry peak body*<br>For volatiles, outdoor air attenuation factor should be lower (i.e. more attenuation); currently it is only half the value for indoor air; Should be significantly higher than this (e.g. 10x lower) | Noted |
| 2 | | *Environmental consultant*<br>General comment | Noted<br>All equations have been checked and are correct as presented. |

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| | | Many of the equations 1 to 21 presented in the document do not appear to provide accurate guidance on how reported HILs were derived and do provide suitable application to specific risk analysis.<br>The NEPM requires major corrections and MUST NOT refer to documents that are in preparation. After redrafting it is recommended that the re-draft be made available for public comment and the documents that it refers to made freely available to the public for review and prior to the NEPM being adopted. | The exposure assumptions for the HILs, interim HILs and HSLs are derived from the near-final enHealth draft (2011). The changes in the finalised version (2012) are minor. |
| 47 | | *Industry peak body*<br>General comment: some exposure parameters seem insufficiently conservative. Cannot be fully reviewed until enHealth doc released. | Noted |
| 47 | | *Industry peak body*<br>General<br>***General comments**- a great effort in the attempt to complete a robust and difficult task.* | Noted |
| 47 | | *Industry peak body*<br>General—Reference enHealth 2010 and enHealth 2011. The new HILs are developed with risk parameters are adopted from enHealth 2010 and 2011. However, these references have not been finalised and published yet. If any changes made to enHealth 2010 and 2011, new NEPM HILs will not be accurate.<br>The NEPM will be finalised prior to enHealth 2010 and 2011 based on the time limit given for the public review of the NEPM. If this is to occur and enHealth 2010 or 2011 change, can industry rely on the finalised NEPM? | The exposure assumptions for the HILs, interim HILs and HSLs are derived from the near-final enHealth draft (2011). The changes in the finalised version (2012) are minor. |
| 2 | | *Environmental consultant*<br>Genotoxic—The definition of Genotoxic is not clear which has implications for the application of threshold and non-threshold modelling for carcinogens.<br>Eg Benzo(a) pyrene may not be genotoxic* under this definition and therefore the use of a slope factor to derive a HIL (as was done) may be considered not appropriate.(* Benzo(a)pyrene is metabolised into a carcinogenic chemical that then causes damage to DNA-geneotoxicity.) | Noted<br>Relevant information is presented in Schedule B4, enHealth 2012 and the review of cancer risk assessment methodology available from the NEPM Toolbox. |

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| | | Although benzo(a)pyrene is not gentoxic (its metabolite is) it was considered genotoxic and the non-threshold model applied in the derivation of HIL<br><br>Similarly, mutagenic activity or genotoxicity of some metals (eg Cd) caused by the oxidative damage of DNA mediated by the formation of reactive oxygen means that these metals may not be considered genotoxic and are assessed using the threshold model. Although, Cadmium clearly has, potential to modify the function of genetic material, (as per definition of genotoxicity) as shown by more recent studies. Cadmium was not considered genotoxic in the document and the threshold model applied in the derivation of HIL.<br><br>The application of threshold and non threshold carcinogenic theory has been largely undiscussed in Australia and the move away from the policy stance NEPM (1999) that all carcinogens should be modelled on non-threshold modelling requires significant debate before change.<br><br>At the very least the NEPM should provide significant discussion on the genetic and epigenetic mechanisms of carcinogenicity and the relevance in the application of theoretical threshold and non-threshold modelling to each mechanism. | |
| 25 | | *Environmental consultant*<br><br>Have different GAFs been applied for different chemicals? This question may be answered elsewhere in the document or via reference to US EPA 2004b, however, a relevant statement should be made in Section 4.3 for clarity. | Addressed |
| 10 | | *State government agencies*<br><br>Health Screening Levels (HSLs)<br><br>The use of HSLs in addition to Health Investigations Levels (HILs) is a departure from previous NEPM practice. A DOHWA officer was involved in the development of the HSLs and we support their use. To make this work better it is desirable that the HSL's application and context be made clear wherever possible lest there be misunderstandings. This full integration may have been held off pending HSL approval. At present most of the NEPM Schedules are geared only to refer to HILs. This is especially the case for Schedules B4/B6 and B7 that discuss risk assessment methodology and HIL derivation, respectively. | Schedule B7 is specific to the derivation of HILs so reference to HSLs is not relevant (unless the documentation is referenced where methodology is discussed).<br><br>Noted |

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| | | It would be useful if in each relevant Schedule that the distinction of the HIL and HSLs could be made and the level of applicability to the HSLs be made clear. HSLs should also be a standard inclusion in all lists of abbreviations and glossaries. At present they are mentioned in passing in some Schedules without any explanation or definition.<br><br>Incremental Lifetime Risk of Cancer (ILRC)<br><br>Some contaminants are carcinogens and usually the investigation levels are based on this aspect as the most sensitive endpoint. Because non-threshold carcinogens have a potential adverse effect at any level it is also usual for regulators to select a level of associated risk that can be accepted. Western Australia uses an ILCR of 1 x 10-6 for a lifetime exposure, being the level of chemical that will affect one person in a million over a lifetime. This is not just for soil contamination purposes but across the board for environmental exposures, including air quality. Some other Australia jurisdictions often use<br><br>1 x 10-5.<br><br>In deriving HILs, HSLs etc it is important that the basis of these be justified and a consistent approach used where possible across the various compounds and tables. As it stands the ILCR basis for much of the work varies and is hidden in the background documents. A snapshot of various ILCRs that apply is as follows:<br><br>Asbestos 1 x 10-5 – 1 x 10-6 – stated explicitly in an external reference. Range necessary as derivation use a WHO reference with a range<br><br>(WA Asbestos Guidelines)<br><br>HSLs 1 x 10-5 – stated explicitly, with justification in external supporting documents<br><br>(Friebel and Nadebaum)<br><br>HILs 1 x10-5 – understood to be in external source document.<br><br>GILs 1 x 10-6 – stated explicitly in external references i.e. the Australian Drinking Water Guidelines and Guidelines for Managing Risk in Recreational Water. | Noted<br><br>Refer to additional discussion included as new Section 6.2 |

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| | | These differences should at least be acknowledged in the NEPMs and preferably justified. The justification may be that the differences are reasonable given the uncertainties involved and that there are additional levels of conservatism built into deriving the first three types of criteria when compared with the GILs which involves a more direct simple exposure.<br><br>A clear position on the ILCRs is also important to assist consultants if they have to derive site-specific clean up levels for carcinogenic compounds, especially ones for which there are no investigative levels derived. | |
| 47 | | *Industry peak body*<br><br>Hotspots and statistical analysis<br><br>Suggest more clarity around the methodology for identification of hotspots, their removal from the dataset and subsequent assessment; an improved list of statistical tests to be performed on the remaining samples. | Addressed |
| 29 | | *Industry*<br><br>HSLs are a significant step forward in enabling effective risk-based assessment of petroleum hydrocarbon contaminated sites. Of critical note is the recognition of biodegradation processes in reducing petroleum hydrocarbon concentrations in soil vapour. | Noted |
| 25 | | *Environmental consultant*<br><br>If there is a significant change in enHealth recommendations between 2004 and 2011, this should be highlighted and the rationale stated clearly in this section. | Noted |
| 7 | | *Industry*<br><br>In contrast to Schedule B5c, the Health-based investigation levels for Chromium VI (Cr VI), documented in Schedule B7 are justified and have been well researched. Chromium VI is a far greater environmental concern than Chromium III but low levels can be tolerated. To show the discrepancy between the Schedules, the Health-based investigation levels for Chromium VI are 240 mg/kg for open land and 3000 mg/kg for commercial/industrial land.<br><br>It should be noted that there is no Health-based investigation levels for Chromium | Noted<br><br>For human health Cr VI is the species to be addressed |

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| | | III in the Draft NEPM. The 1999 NEPM for Assessment of Site Contamination adopted Health Guidelines based on risk. The Health Investigation Levels for Cr III varied from 12% (120,000 mg/kg) for Standard residential use with garden/accessible soil (including day-care centres etc) to 60% for Commercial/Industrial use. If the Soil Quality levels for Cr III were also risk based, they would also be very high. | |
| 28 | | *Environmental consultant*<br>Land use scenarios, Justification for the selection of land use and exposure scenarios is not presented | Schedule B7 presents the exposure scenarios and assumptions made for deriving the HILs. Further information can be found in the references therein. |
| 28 | | *Environmental consultant*<br>Not consistent with NEPM Review Report Recommendations (2006) e.g. "Recommendation 10—Develop interim national screening levels for Total Petroleum Hydrocarbon fractions based on existing Australian values and with reference to relevant overseas values", | Noted<br>HSLs have been developed for various petroleum hydrocarbon fractions, refer<br>Schedule B1 for further information. |
| 10 | | *State government agencies*<br>Page 1—should include HSL | Not included as B7 addresses the derivation of the HILs only |
| 38 | | *Other*<br>Page 10, Table 2 Free cyanide (free)<br>Health-Based Investigation Levels (mg/kg)<br>Cyanide in contaminated soil is described in terms of free cyanide which is considered to be less reliable than based on the measurement of weak acid dissociable (WAD) cyanide.<br>It is proposed that the Health-Based Investigation Levels should be based on the measurement of weak acid dissociable (WAD) cyanide.<br>Issues<br>For cyanide monitoring in soil, whenever environmental compliance refers to 'free' cyanide, there is measurement challenge. The reasons are the instability of not only 'free' cyanide but also the instability of cyanide metal complexes that can | Suggestion of measuring WAD cyanide has been incorporated with some of the suggested words provided |

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| | | produce 'free' cyanide. The analytical measurement of 'free' cyanide in the presence of many other cyanide complexes is difficult. The accepted professional approach, a cautious approach, is to measure not only the 'free' cyanide but also to measure several other dissociable cyanide species that could furnish 'free' cyanide either by dilution or by other natural processes. This determination is not only a reproducible method but also able to achieve the low levels reporting that is required of compliance limits. This determination, Weak and Dissociable Cyanide (WAD), measures 'free' cyanide plus the cyanide associated with most unstable metal cyanide metal complexes. The WAD cyanide refers to any species where cyanide is liberated at the weakly acidic pH of 4.5. Such species include HCN (aq) and CN-, the majority of Cu, Cd, Ni, Zn and Ag complexes. Generally it is taken to include metal cyanide complexes with dissociation constant (log K) below 30. If the WAD result conforms to the compliance level then the 'free' cyanide level is also in compliance. Support for this as an accepted approach by cyanide specialists in the mining industry can be seen in the two references (1, 2).<br><br>The USEPA METHOD 9016 (3) gives some important details regarding proper sample collection, preservation and analysis of free cyanide in soil which are also relevant to WAD cyanide determination in soil. This method involves extraction, separation by micro diffusion and measurement of free cyanide. However weak acid dissociable cyanide forms may also give rise to free cyanide if the soil sample is not properly preserved. Solids are first extracted prior to analysis using pH 12.3-12.5 NaOH solution then the filtered extracts are then diffused and analysed.<br><br>The USEPA METHOD 9016 (3) describes the determination of cyanide in solution by the classic pyridine- barbituric acid colorimetric method. However there are other methods available as a recommended alternative test by a ligand-exchange, gas diffusion technique coupled with amperometric detection in accordance with USEPA method OIA-1677.<br><br>The following definitions are used (3):<br><br>(i) Free cyanide — Cyanide ion (CN-) or hydrogen cyanide (HCN), the distribution of which depends on the pH of the sample solution (pKHCN = 9.24);<br><br>(ii) Simple cyanide — A neutral compound comprised of an alkali metal, alkaline earth metal or ammonium cation bound to free cyanide. Simple cyanides are so | |

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| | | named because of their structural simplicity and their ability to completely dissociate in water to produce free cyanide and a free metal or ammonium cation;<br><br>(iii) Metal cyanide complex — A negatively-charged ionic complex consisting of several cyanide ions bound to a single transition metal cation;<br><br>(iv) Total cyanide — The sum total of all of the inorganic chemical forms of cyanide. Total cyanide thus may include free cyanide, simple cyanide, and anionic metal cyanide complexes.<br><br>Several aspects need to be considered when collecting soil and preserving it prior to analysis (3):<br><br>(i) Interferences, such as chlorine and sulfides which can degrade samples in soil by reacting with the free cyanide present. All aqueous samples should be checked at the time of their collection to determine the presence of oxidizing agents and/or sulfides. If found to be present, the samples should be immediately treated, as noted in the following sections, prior to their storage for future analysis;<br><br>(ii) Oxidizing agents, such as chlorine, decompose free cyanide. Chlorine reacts with free cyanide to form cyanogen chloride (CNCl), which under alkaline conditions hydrolyzes to cyanate (CNO-). Chlorine interferences can be removed by adding excess amounts of sodium arsenite or sodium thiosulfate to the sample prior to storage. Both sodium arsenite and sodium thiosulfate reduce the chlorine to chloride, which does not react with free cyanide or otherwise interfere in its analysis;<br><br>(iii) Sulfide oxidation products can rapidly convert free cyanide to thiocyanate (SCN-), especially at high pH. Sulfide interferences (namely hydrogen sulfide, metal sulfides, or other compounds that may produce sulfide) can be removed by adding an excess of either lead carbonate or lead acetate to the sample. The addition of either reagent forms insoluble lead sulfide (PbS), so that it may be removed via filtration, prior to storage or analysis;<br><br>(iv) Volatility losses of free cyanide (as HCN) can occur in samples having pH values less than 12. If samples cannot be analysed immediately after field collection and treatment for oxidizing agents and sulfides, they must be preserved by adjusting the pH to 12 or greater prior to storage; | |

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| | | (v) In addition free cyanide can react with other chemicals such as aldehydes. Because of the reactivity of free cyanide, it is important that analysis is completed as soon as possible after sample collection.<br><br>It is also identified(3) that samples should be analyse immediately; otherwise they should be preserved at the time of collection, following any treatment for oxidizing agents or sulfides , by adding 50% sodium hydroxide, until the pH is equal to or slightly greater than 12. This minimizes cyanide losses due to volatilization of HCN. Store Properly-preserved samples are stored in the dark at 4 ± 2 °C. It is also recommended that samples should be collected in plastic or glass (preferably plastic) containers that are either amber or covered with aluminium foil so as to filter light at 400 nm and below and prevent photodecomposition of metal cyanide complexes. It is also noted in (3) that spiking immediately prior to microdiffusion processing is of critical importance when preparing extracts from soil samples. This is because soils and related solid wastes typically contain relatively large levels of free transition metals, which can potentially form complexes with the spiked free cyanide, resulting in low spike recovery values.<br><br>These issues of sample collection, preservation and preparation for analysis reinforce the need to use a WAD analytical approach in the first place.<br><br>References<br><br>1. Leading Practice Sustainable Development Program for the Mining Industry Cyanide Management. Australian Government, , May 2008. See Chapter 3, page 9.<br><br>2. Auditor Guidance for Use of the Gold Mining Operations Verification Protocol, International Cyanide Management Institute, October 2009. 4.0 Operations, Standard of Practice 4.5, Item 2, page 36 of 81.<br><br>3. USEPA METHOD 9016 (2010) FREE CYANIDE IN WATER, SOILS AND SOLID WASTES BY MICRODIFFUSION | |
| 10 | | *State government agencies*<br><br>Page 13—2nd last paragraph should explicitly relate to the 2009 chemicals | Addressed |
| 10 | | *State government agencies* | Addressed |

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| | | Page 13—is "Treaty" and allowable alternative to "Convention"? | |
| 10 | | *State government agencies*<br>Page 14—Table 1—is this list sufficiently extensive and authorative? Also here and in Table 2 there should be better detail as to how TEFs work in applying the HIL to a carcinogenic PAH mixture. | Information presented is sufficient for addressing carcinogenic PAHs but not all PAHs |
| 10 | | *State government agencies*<br>Page 19—Bullet 3—HIL C refers to "secondary school playing fields" while 3.2.3 (p22) refers to "children using school playing fields". Particular care is necessary as children are defined as 0–6 year olds. | Removed as not sufficiently clear |
| 10 | | *State government agencies*<br>Page 19—Would like to see reference to 3.5 here as readers may miss this important reference to alternative use scenarios otherwise. | Noted but not included as Section 3.5 follows directly on from these sections |
| 10 | | *State government agencies*<br>Page 20–26—Figures, text and Table 4—not sure why only "shallow" soil contamination is referred to because vapours may emerge from deeper down, as exploited in the HSLs | Noted |
| 10 | | *State government agencies*<br>Page 27—Some alternative e.g. would be useful and corresponding HILs | Noted |
| 10 | | *State government agencies*<br>Page 28—Would be best place to discuss acceptable lifetime excess level of cancer risk | Additional discussion added as new section 6.2 |
| 10 | | *Stage government agencies*<br>Page 3—Cancer Slope Factor—insert "carcinogen" before "response" | Addressed |
| 10 | | *State government agencies*<br>Page 30—Paragraph 1—Definitions of Bioavailability and Bioaccessibility differ from those in the Glossary | Glossary terms revised to be consistent with B4 and text updated to be consistent with changes in B4 |

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| 10 | | *State government agencies*<br>Page 30—Paragraph 2—am uncomfortable with the text "TRVs generally derived from direct administration of the chemical to … human". Human exposure is less common and more likely to be accidental. Also Dermal TRVs are not always based on oral TRVs | Addressed |
| 10 | | *State government agencies*<br>Page 33—Paragraph 2—Although an enHealth Draft Recommendation it seems strange that residential exposure period for an adult (24 years) is shorter than occupational (30 years) | Noted |
| 10 | | *State government agencies*<br>Page 35—HILB Time spent indoors each day—HSLs use 23hrs (USEPA) which is more logical with 1hr outside, instead of HIL 20hrs. | Updated to enHealth 2012 |
| 10 | | *State government agencies*<br>Page 38—Bullet 2—Does the 3% finally used apply to all the VOCs? | Minor revision—refer to Appendix A for chemical-specific detail |
| 10 | 5.3.3.3 | *State government agencies*<br>Page 40—Not sure about restricting the toxic effects of dusts to just the $PM_{2.5}$. What about higher fractions that lodge in the higher parts of the airways and then transferred into the GI tract? | Noted and revised |
| 10 | 5.3.4 | *State government agencies*<br>Page 40—Reference to "shallow" soils again in context of vapours | Addressed |
| 10 | 5.5.1 | *State government agencies*<br>Page 44—Why are HSLs based on modeling and chlorinated H/Cs cannot? | They behave differently and the approach reflect that difference—no change |
| 10 | | *State government agencies*<br>Page 44—Paragraphs 3 and $—Not clear if the 45 and 50% bioavialablity figures apply to children and adults | Addressed |
| 10 | 6.4.1.1 | *State government agencies* | Addressed |

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| | | Page 49—Define Foc. Suggest insert "for HILs" after "unsuitable for use". What is the basis for 2%? | |
| 10 | | *State government agencies*<br>Page 7—would prefer "Toxicity Inherent property of a chemical or material to cause an adverse biological effect". Or could use "substance" instead of "material" | Addressed |
| 47 | | *Industry peak body*<br>Reasoning generally seems sound based on the source information with the majority of the HILs increasing | Noted |
| 2 | | *Environmental consultant*<br>References to enhealth (2011) in the text are not expanded in the reference section of the document.. However, it is assumed the text reference refers to enHealth 2010 (in preparation), 'Environmental health risk assessment; guidelines for assessing human health risks from environmental hazards', Department of Health and Ageing and EnHealth Council.<br>The drafting of a NEPM document for comment, that is based on documents that are not freely available and are still in preparation does not allow for the relevant scrutiny.<br>Enhealth 2010 should be made available for comment and following this opportunity to comment on its application in the derivation of HILs and inclusion to the guideline should be given, prior to the adoption of the guideline. | Noted |
| 47 | | *Industry peak body*<br>Referencing; The enHealth document in preparation is referred to as both enHealth (2010) and enHealth (2011) within the document. Need to fix this once document final or have consistency in NEPM if NEPM finalised before enHealth document finalised. | Noted |
| 10 | | *State government agencies*<br>Reviewing and amending as necessary references to HILs and interim HILs. That general reference to HILs includes interim HILs in that context is reasonable, but | Noted and addressed |

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| | | interim HILs may be a measure of both underlying soil and groundwater contamination, so tying HILs only to soil contamination is confusing. | |
| 10 | | *State government agencies*<br>Schedule B(7) is generally well presented, logical and well structured. Of a more general nature, consideration should be given to:<br>Including text explaining the role and relationship to the HILs of the HSLs. They are even mentioned in B(7) without any explanation as to what they are | Noted<br>The HILs and HSLs are introduced in Schedule B1 |
| 2 | | *Environmental consultant*<br>Schedule B7 Appendix A1 Metals and Inorganic<br>1) The method of application of TRVinhalation dust and TRV oral is not clear when and how it has been applied and when it was excluded from the derivation of HILs.<br>The inclusion of inhalation of dust using the oral TRV must account for a relative difference in bioavailabilities and assumptions stated.<br>2) The percent contribution to total dose referred to for each contaminant at times does not add to 100 %<br>3) The percent contribution for many contaminants does not concur with check calculations that were done.<br>4) Many of the check calculations (see below) undertaken as a part of this review are based on<br>Dosetotal = Doseingestion soil+ Dosedermal + Doseplant uptake + Dosedust inhalation + Dosevolatile<br>and<br>TRVtotal ≥ Dosetotal<br>For systemic effects<br>Do not concur with reported HILs<br>The data presented and the calculations described do not provide transparency | Noted. Refer to Appendix A summaries for chemical-specific detail. The values were used for these pathways as outlined in the equations.<br>The % values were rounded so there may be some minor variation in the totals. Values checked and revised as necessary.<br>Noted. Equations have been checked and are correct as presented.<br>Noted |

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| | | with respect to assumptions and modelling that was used to derive HILs.<br><br>Spreadsheet calculations showing all calculations and parameters for all contaminants should be presented in DRAFT FORM as part of the public consultation process prior to the adoption of the HILs into the NEPM.<br><br>Calculations used in the derivation of a HIL must be consistent and shown to be consistent with equations reported in the text.<br><br>The check calculations presented are for a limited number of contaminants and any review of derived HILs should not be limited to the contaminants here.<br><br>5) The move from an adult body weight of 70kg to 75Kg must have logic that does not compromise the precautionary principle.<br><br>Australian average body weights are on the increase due to unhealthy lifestyles resulting in more than 50% of Aus. adults being considered obese (ABS).<br><br>It has been accepted practice world wide to consider adult weights as 70kg. However, the use of this body mass is also not protective of Australian women who have a healthy BMI range of 20 to 25 and are of the average Australian height of 1.64m are expected to have a body weight range between 53kg and 67kg.<br><br>The change of body weight from 70 to 75kg is not supported and results in an increase in HILs by about 7%.<br><br>HILs calculated on the basis of a 75kg adult is not supported. | Noted<br><br>Noted. Refer to references provided |
| 47 | 2.2.2 | *Industry peak body*<br><br>P7—How is ageing considering in TEF? | It is assumed this comment relates to aging of source which would be addressed in application of TEFs. |
| 47 | 3.3.2 | *Industry peak body*<br><br>Table 4—P17 and 26—"General" commercial/industrial land use scenario appears to be broad.<br><br>Provision of some sub-classes and relevant risks would be helpful (e.g. commercial, heavy industrial, light industrial, fishery, forestry, agricultural etc) | Noted and some additional text included on what is excluded |
| 47 | | *Industry peak body* | Noted. Schedule B7 presents the methodology |

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| | | Should be clear that methodology for volatile HILs very different from petroleum HSL | for deriving the HILs not the HSLs |
| 47 | | *Industry peak body*<br>Should be clear that the dermal pathway has been assessed differently for petroleum HSLs | Noted. The approach and general assumptions are the same |
| 28 | | *Environmental consultant*<br>Table 2, p10, Unclear whether the land use setting for "schools" is "A" or "C". Footnote to this table implies exposure setting C, however the footnotes to table 1A(1) in schedule B1 implies pre-schools and primary schools would be assessed as setting A, Revise footnote to make it clearer whether schools are assessed under HIL A or C. | Table and footnotes revised in Schedules B1 and B7 |
| 5 | | *Environmental consultant*<br>Table 2: p11; Soil gas attenuation factor of 0.01 differs from the value of 0.005 used in the CRCCARE HSLs.<br>NEPM and HSLs should use consistent values | Noted |
| 28 | | *Environmental consultant*<br>Table 3, p11, Footnote to table 3 does not indicate what depth these concentrations apply., Include information on what depth the interim HILs apply | Table and footnotes revised in Schedules B1 and B7 |
| 28 | | *Environmental consultant*<br>Table 3—11—It is assumed that the interim HSLs are based on the inhalation pathway only. It is therefore unclear why oral toxicity values are included in Appendix A4 of Schedule B7 if these have not been used in the derivation of the interim HSLs.<br>Clarification is needed as to whether the interim HSLs use the oral toxicity TRVs provided in Appendix A4 to Schedule B7. | Noted. Refer to Appendices A4 and B for further details |
| 28 | | *Environmental consultant*<br>Table 4, p26, The exposure pathways listed under each land use are not all | Noted and addressed where relevant |

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| | | applicable to the interim HILs and the HSLs. This should be made clear in the footnotes beneath the table.<br><br>Include a footnote to the table to indicate that the exposure pathways apply to the HILs only, and not to the interim HILs or the HSLs. | |
| 47 | | *Industry peak body*<br><br>Table 5, 35, HIL-A time spent indoors (20 h/d) is different to CRCCARE HSLs which uses a value of 16 h/d, NEPM and HSLs should use consistent values | Noted. HSLs have been revised to be consistent with enHealth 2011 |
| 47 | | *Industry peak body*<br><br>Table 5, 35, HIL-B only has 21 hours exposure assessed, which is inconsistent with the HIL-A residential assessment setting 24 hours exposure on-site should be assessed | Reasonable for high density use—no change<br><br>Noted. Consistent with enHealth 2012 |
| 28 | | *Environmental consultant*<br><br>Table 5, p35, The body weight for a child at 15.5 kg is high. The average 2-year old body weight is about 12 kg; 15.5 kg would appear to be non-conservative.<br><br>Suggest a lower body weight for a child | Noted. Consistent with enHealth 2012 |
| 47 | | *Industry peak body*<br><br>Table 5—35<br><br>8 hours on-site at work is too short, most Australians spend more than 40 hrs a week at work.<br><br>Should be increased to 10 hrs on-site, 9 indoors and 1 outdoors | Noted but standard workday considered |
| 47 | | *Industry peak body*<br><br>The below is the comment I made on the section in relation to my communication with ACLCA WA Branch. A large amount of effort has been made to estimate health investigation levels (HILs) on the basis of the exposure of receptors to contaminants in soils. However, a less amount of efforts appear to have been made to relate the implication of physico-chemical interactions between soils and contaminants, to the estimate. Some guidance and/or additional information can be provided to clarify this. For example, Equation 35 considers the vapour phase | Noted and the questions relate to equations that have been removed to ensure that all equations in Schedule B7 relate only to the derivation of HILs |

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| | | of a volatile contaminant in an unsaturated soil. The relationship between the volumetric water content and the suction is complex and a reasonable estimate of the volumetric water content can be very difficult if not impossible. As another example, Equation 35 incorporates the soil-water partition coefficient. This coefficient is applicable for soils containing an organic carbon fraction of greater than 0.001 (Karickhoff et al., 1979). Care should be taken if retardation by sorption is expected to play an important role in contaminant transport. It should be noted that the function and type of clay minerals are increasingly important if soils subject to investigation are clayey (e.g. Karickhoff, 1984; Mader et al., 1997<br>REFERENCES: Karickhoff, S. W., Brown, D. S., and Scott, T. A. (1979) Sorption of hydrophobic pollutants on natural sediments. Water Res., 13, 241-248.<br>Karickhoff, S. W. (1984) Organic pollutant sorption in aquatic systems. J. Hydraul. Eng., ASCE, 110, 707-735.<br>Mader, P. T., Uwe-Goss, K., and Eisenreich, S. J. (1997) Sorption of non-ionic, hydrophobic organic chemicals to mineral surfaces. Environ. Sci. Technol., 31, 1079-1086. | |
| 2 | | *Environmental consultant*<br>The definition of "Background levels" is not consistent with the legislated NEPM guideline.<br>Alternative name to describe exposure to all other sources not from the site should be given. | Revised to be consistent with the Measure |
| 47 | | *Industry peak body*<br>There has been limited or no discussion of acute or other relevant toxicities due to the limited toxicological reviews, e.g. phenol is volatile and necrotic to tissue—how relevant is this to recent information and the development of an HIL. Provide consideration in updated text. | Noted – Section 1 states that the focus of the HILs is on chronic exposures. The limitations in Section 1.3.1 note that short-term or acute risks are not addressed in the NEPM |
| 28 | | *Environmental consultant*<br>There is a lack of transparency in the calculation of nickel carcinogenicity.<br>Provide consideration or highlight limitation. | Refer to Appendix A1 |

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| 28 | | *Environmental consultant*<br>There is limited consideration of localised dermal carcinogenicity responses (not systemic).<br>Provide consideration in updated text. | Noted but included for nickel—see appendix A1 |
| 28 | | *Environmental consultant*<br>There is no consideration of other relevant toxicities and their assessment, e.g. dermal hypersensitivity. Provide consideration in updated text. | Noted but included in Appendix A1 for nickel |
| 28 | | *Environmental consultant*<br>Toxicology.<br>Toxicological data presented are limited. Previous HILs included thorough toxicological reviews to identify up-to-date target adverse health outcomes for contaminants of concern. This has not been undertaken to ascertain the relevance of toxicological endpoints based on new information that may have been published. This is of concern in guidelines designed to protect public health on a national level. Provide up to date toxicological assessments. | Noted<br>The reviews presented in Appendix A are focused on those aspects relevant to the derivation of HILs and current information has been included where available. |
| 45 | | *Environmental consultant*<br>Little change to the land use scenarios, NEPM states that where sites have a mixed use scenario that the most sensitive HIL will apply, | Noted |
| 45 | | *Environmental consultant*<br>Where there are unclear boundaries between the various proposed land use's can the appropriate HIL's be applied. | Noted but this is should be addressed when using the values. The land use definitions are the same as current NEPM so there should be less confusion in using the revised numbers |
| 45 | | *Environmental consultant*<br>There is a large emphasis on site-specific risk assessment—however HIL values for various land use scenarios are provided. | Noted |
| 45 | | *Environmental consultant*<br>Will regulators such as local Council's have the expertise and time to review site- | Where there is site contamination and development/change of land use an auditor should be appointed to give council guidance. |

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| | | specific risk assessment, or will they just use the HIL values already tabulated in the NEPM—or always defer to a accredited auditor. | |
| 45 | | *Environmental consultant*<br>We consider site-specific risk assessment will require regulatory/auditor involvement much earlier, increased time and cost to the site owners. Results of the site-specific risk assessments are likely to vary from person to person—unless there is some consensus on the best practice models that can be used—e.g. as in UK—approved by Environment Agency. | Noted |
| 45 | | *Environmental consultant*<br>We welcome the fact derivation factors for the toxicity assessment and the exposure pathways have been updated to include more recent data, and Australian data. Additional exposure pathways have also been assessed which is considered appropriate. | Noted |
| | | **GENERAL COMMENTS** | |
| 47 | | *Industry peak body*<br>For discussion—Confirm validity of TCE toxicity values, specifically doubling of tox values. | Noted but no specific actions taken in revision |
| 47 | | *Industry peak body*<br>For discussion—Ensure consistent approach to whether PCBs are volatile or non-volatile. | In B7, PCBs have not been considered volatile—refer to Appendix A |
| 31 | 12.4 | *Environmental consultant*<br>Pg 73, Line 10, It is assumed that, in the first paragraph under "Review of available values/information", the text "present in food of the environment" should be changed to "present in food and the environment." | Addressed |

## APPENDIX J – Issues and responses – Schedule B8

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| | 1 | **Purpose and application** | |
| 28 | 1 | *Environmental consultant*<br><br>1, Identifies that 'community consultation' should be reworded to be 'community engagement'. However, in this schedule continues to identify 'community consultation' in section 1 first dot point and section 3 1st paragraph. , Change to community engagement. | Text amended. |
| 47 | 1 | *Industry peak body*<br><br>1, 1, controversial contaminants; It would be useful to provide an examples/examples of controversial contaminants and sites. | Noted.<br><br>Community perceptions of contaminants that may be seen as controversial can be expected to be influenced by both specific issues as well as by wider community perceptions. It is not considered necessary to provide specific examples for the purpose of this Schedule. |
| 28 | 1 | *Environmental consultant*<br><br>1, 1, Indication of situations that require consultation<br><br>Indication of situations that require consultation - There are some additional situations that may require consultation, specifically where:<br>- New or unproven technology may be used during the remediation<br>- Proximity to sensitive physical environments, e.g. mangroves, sensitive habitats / ecology | Text amended. |
| 47 | 1 | *Industry peak body*<br><br>1, 1, The discussion of situations where consultation would be warranted includes reference to remediation, as well as assessment.<br><br>The reference to remediation be put into context of the assessment work informing decisions on remediation strategy. | Text amended. |

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| 28 | 1 | *Environmental consultant*<br><br>1, Outlines three principles of approach to schedule in section 1 with the first point being:<br>- That no assessment of site contamination should commence until an evaluation has been made regarding the probable need, nature and extent of community consultation for the project., It is unclear how 'assessment' is defined, as the case studies later in this schedule could be interpreted to contradict statement in the researching of previous uses of the site. Would suggest rewording or clarifying the first point. Also not really sure that this is a realistic statement. It is rather explicit and in most cases a proponent wants to make preliminary enquiries to evaluate if there is a relevant issue to be dealt with or not. Community engagement at an early stage should issues be identified or should actual investigations works be likely to affect their amenity is a better approach. | Text amended. |
| 28 | 1 | *Environmental consultant*<br><br>1, The third point is as follows:<br>- That for sites with contentious issues, consultation with the community is considered to be essential. This is particularly the case when the contamination at the site has the potential (or the perceived potential) to have an impact on any stakeholder. Suggest rewording "…where land contamination may impact on a stakeholder" as all development may potentially impact upon a stakeholder and would suggest that all works require "essential" community engagement. | This principle specifically addresses sites with known contentious or controversial issues and is not intended to apply to all development sites. In such circumstances, where stakeholder or community concerns are likely to elevated, engagement with the community is considered essential.<br><br>Introductory text to bullet points amended to clarify context. |
| | 2 | **Benefits of community engagement and risk communication** | |
| 15 | 2 | *Environmental consultant*<br><br>s2; No discussion on community acceptance of potential end-use of site.<br><br>Note that community acceptance of potential end-use of site may be a beneficial outcome of community consultation. | Noted. |
| | 3 | **Key principles of community engagement and risk communication** | |
| 28 | 3 | *Environmental consultant* | Text amended. |

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| | | 3, 4, Evaluate your performance<br>- Not clear whether monitoring and evaluating the consultation process ?<br>- But also need to monitor / log concerns, issues, fears, etc raised by stakeholders<br>- a system / process for where feedback (it may be suggestions made, questions not answered during the meeting, requests for additional info, etc) to the community is required – explains how this will be done—issue and response summary notice, flyers, follow up meeting, etc<br>Section needs additional clarification on these items | |
| 28 | 3 | *Environmental consultant*<br>3, 4, It is suggested that communication should in clear, plain English. There may be occasions where other languages may be important (e.g. Aboriginal languages). This should be considered. Add text regarding the consideration of appropriate language for communication to the various stakeholders. | Text amended. |
| 28 | 3 | *Environmental consultant*<br>3, p4, Evaluate your performance<br>- Not clear whether monitoring and evaluating the consultation process?<br>- But also need to monitor / log concerns, issues, fears, etc raised by stakeholders<br>Provide clarity.<br>A system / process for where feedback to the community is required. It may be suggestions made, questions not answered during the meeting, requests for additional info, etc. The feedback needs to explains how this will be done – issue and response summary notice, flyers, follow up meeting, etc<br>Implicit in "consulting with communities" is that as a minimum, their views will be considered during the decision-making process—the schedule provides no real guidance on how to do this., Consider adding additional information<br>Resolving disputes – no guidance on how to do except 4.2.8 says "extensive international experience with alternative dispute resolution that should be pursued". In our experience grievance management is one of the hardest | Text amended.<br>New section on reporting included in Section 4.1.<br>Text amended.<br>Minor amendment to text. The purpose of this Schedule is to provide the general framework for effective community engagement rather than detailed guidance on dispute resolution. |

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| | | components of stakeholder engagement., Consider adding additional information on dispute resolution. Provide some simple and relevant guidance rather than refer to "international experience". It is not helpful to practitioners.<br><br>How do you monitor or measure the success of "good" stakeholder engagement ? It is very subjective—do you measure number of meetings, number of participants / attendees ? some guidance on this would be useful. Add further guidance on how measure the success / performance of good stakeholder engagement. Provide some suggested alternatives.<br><br>There is an emphasis on messaging, which is a tool for informing and consulting community but doesn't invite community to participate in a process or allow for two way transfer of information and participation between proponents and their stakeholders. | Minor amendment to text. The purpose of this Schedule is to provide the general framework for effective community engagement rather than detailed guidance on dispute resolution.<br><br>The need for effective community engagement to be a dedicated two way process is clearly identified in the Schedule. Noted. |
| 28 | 3 | *Environmental consultant*<br><br>p4, It is suggested that communication should be in clear, plain English. There may be occasions where other languages may be important (e.g. Aboriginal languages). This should be considered., Add text regarding the consideration of appropriate language for communication to the various stakeholders. | Text amended. |
| | 4 | **Step-by-step guide** | |
| 28 | 4 | *Environmental consultant*<br><br>Section 4, which is titled A step-by-step guide to community engagement and risk communication, provides limited assistance for planning community engagement. Instead it has more theory and rules about communication. , The document could aim to provide a more systematic approach to entering the decision-making process and designing a community engagement program which meets key objectives. The process for arriving at these objectives should include answering questions such as:<br>- What is the decision I need to consult stakeholders about / what am I asking them about?<br>- Who are my stakeholders?<br>- How do they want to be consulted?<br>- What am I going to do with the responses I get from them? How will I provide | The purpose of this Schedule is to provide the general framework for an effective community engagement plan without being detailed. Updated references are included for further information. Noted. |

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| | | formal response to queries raised?<br>How am I going to communicate my decisions back to them? | |
| 47 | 4.1 | *Industry peak body*<br>p 7, Sentence 3<br>While it is appreciated that cultural differences and language are particularly sensitive to Aboriginal and Torres Strait Islander people, this also applies to any variety and ethnic backgrounds and should be expanded upon. | Text amended. |
| 5 | 4.1 | *Environmental consultant*<br>p10 para 4 of the section;<br>This sentence could do with an emphasis on the fact that the audience has no prior knowledge - BUT they are not stupid.<br>Add emphasis | Noted. |
| 5 | 4.1 | *Environmental consultant*<br>p6, The para "in order to manage expectations" is hugely important;<br>Highlight the para "in order to manage expectations" | Text bolded. |
| 47 | 4.1 | *Industry peak body*<br>4.1, Absence of any guidance on 'Reporting'; Reporting is a section in WA Department of Environment & Conservation guideline November 2006 | New section on reporting based on WA DEC 2006 *Contaminated Sites Management Series: Community Consultation Guideline* document included. |
| 15 | 4.1.2 | *Environmental consultant*<br>P 7; Paragraph 2 & 3<br>There is detailed discussion on indigenous culture but not other cultures apart from brief mention of language.<br>Include discussion on other cultures or religious preferences like the discussion on indigenous culture. | Text amended in section 3 to highlight need to be aware of and address specific relevant cultural or religious sensitivities. |
| 5 | 4.1.2 | *Environmental consultant* | Text amended. |

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| | | p10, final para of the section;<br>"While the study found that medical doctors were the most trusted source of primary information, nearly 40% in fact relied on the media…"<br>Needs emphasis<br>Possible improvement for emphasis: "While the study found that medical doctors were the most trusted source of primary information, nearly 40% in fact relied on the media…"etc | |
| 5 | 4.1.4 | *Environmental consultant*<br>p 9, 3rd para of section, Too general; May be prudent to remove this generalisation from the written document. | Text deleted. |
| 5 | 4.1.4 | *Environmental consultant*<br>p 10; "Description of risk" dot point could do with an example of a "familiar analogy"<br>Add example | Noted. |
| 5 | 4.1.4 | *Environmental consultant*<br>p12, Refers to ANZECC 1992 Guidelines for the Assessment and Management of Contaminated Sites. Is this still current? If this document is no longer current, suggest refer to it as "superseded guideline" or similar. | Reference deleted. |
| 15 | 4.1.4 | *Environmental consultant*<br>Pg 10; dot points; No mention of risk being considered more unacceptable due to it being the subject of bad press. This comment is directed at asbestos although there may be other contaminants such as lead which have a well documented negative history in the media.<br>Consider putting in a dot point to this effect. | Text amended. |
| 5 | 4.1 | *Environmental consultant*<br>p6, The questions the comms plan should answer | Text amended. |

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| | | Could also include "how will you use the information you gather" so that community members feel there is a purpose in giving up their time. | |
| 15 | 4.1 | *Environmental consultant*<br>Pg 6; Lines 2-8 (first 3 dot points); This brief discussion on potential legal obligations to disclose or withhold certain information to stakeholders, is limited and insufficient.<br>A more detailed discussion either as part of Section 1 or as a separate section separate section after Section 1. A Brief paragraph or list of legislation dealing with disclosure of information to stakeholders or reference to where legislation can be found, e.g. Freedom of Information Act as compared to the Privacy Act etc. | The purpose of this Schedule is not to provide detailed guidance on legislative issues, which may vary in different jurisdictions. Practitioners requiring specific detail should refer to the relevant legislation particular to their jurisdiction. Noted. |
| 5 | 4.2.1 | *Environmental consultant*<br>p 13; The content of this section is inconsistent with the title.<br>Perhaps a better title would be "The need for respect in dealing with risk perception." | Heading amended. |
| 15 | 4.2.1 | *Environmental consultant*<br>p13; Subsection heading conflicts with content; "Risk is complex and inherently uncertain" then in first line risk is "inherently predictive". This section lacks a clear link to the heading.<br>Clarify what this section is about, perhaps needs to be linked to the next section 4.2.2 | Heading amended. |
| 5 | 4.2.3 | *Environmental consultant*<br>P13, Last sentence.<br>Remove "been allowed to"—it makes the process sound manipulative. | Text amended. |
| 5 | 4.2.8 | *Environmental consultant*<br>P14; Last sentence.<br>"allowed to" should be removed—should be pursued to help avoid disputes becoming unmanageable. | Text amended. |

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| 5 | 4.2.9 | *Environmental consultant*<br>p 14; Public surrogates is a weird phrase.<br>"Validate your messages and behaviour" for the title, then an additional sentence "Talk with them to remind yourself of the lay person's view" | Text amended. |
| 15 | 4.2 | *Environmental consultant*<br>Pgs 13-14; This section involves a lot of repetition of ideas stated elsewhere; this section is considered mostly unnecessary.<br>Consider incorporating new information not mentioned elsewhere into other existing sections and delete this section. | Noted.<br>This section is intended to reinforce the key principles for practitioners and summarising these principles is considered appropriate. |
| | 5 | **Community engagement techniques** | |
| 15 | 5.1 | *Environmental consultant*<br>p17; Open houses, Disadvantages. I don't understand the "conquer and divide' element fits here.<br>Readdress "conquer and divide' element | Text amended. |
| 47 | 5.1 | *Industry peak body*<br>p 18, Info bulletins read a wide audience; Info bulletins read a wide audience—should be in the advantages. | Text amended. |
| 47 | 5.1 | *Industry peak body*<br>Table 1, p18, Site office row, description column, "Temporary accommodation"—It would be useful to explain or expanded on the meaning of this. | Noted. |
| 5 | 5.1 | *Environmental consultant*<br>p 15, in On-site meetings disadvantages, in On-site meetings disadvantages, the second sentence should be removed. Safety precautions should never be portrayed as a disadvantage. | Text amended. |
| 5 | 5.1 | *Environmental consultant*<br>p 17, I think the survey section needs work. It is a more useful tool than portrayed | Section is considered to highlight the principal advantages and disadvantages for this |

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| | | here. Rework | technique. Minor text amendment. |
| 5 | 5.1 | *Environmental consultant*<br>p 17, Individual discussions, advantages, add "makes people feel satisfied and listened to" | Noted. |
| 5 | 5.1 | *Environmental consultant*<br>p 18, Open door, Open door may also not be possible for OHS reasons—but neither of these are actually disadvantages. | Text amended. |
| 5 | 5.1 | *Environmental consultant*<br>p18; Info bulletins read a wide audience<br>Info bulletins read a wide audience—should be in the advantages. | Text amended (duplication). |
| 28 | 5 | *Environmental consultant*<br>Not sure if section 5 on "Community engagement techniques" should be included in this schedule. Not sure what value they add and could be interpreted as manipulative by the general public, particularly the section on Consultation and communication DOs and DON'Ts. ,<br>Reconsider inclusion or wording of the community engagement techniques section. | Amendments to section have been made to address this issue. |
| | 6 | **Case Studies** | |
| 5 | 6 | *Environmental consultant*<br>p20<br>A case study where the community engagement happened late, or didn't happen and there were adverse outcomes would be useful. Usually the reason there is not adequate engagement is because people think it's not necessary or helpful, not because they think it's too hard per se.<br>Add case studies | The positive results of community engagement are the focus of this Schedule. Text amended to include additional reference included for further case studies. |
| 28 | 6 | *Environmental consultant*<br>The case studies provided are good scene-setters but don't contain enough detail, | Noted. The purpose of this Schedule is to provide the framework for an effective community engagement plan without being |

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| | | particularly about the reasons why techniques were used. , The case studies could be expanded, or more examples provided, at the expense of losing some of the theory in the earlier sections of the Schedule. This revision would make the Schedule more accessible for people looking for practical assistance with their community engagement needs. | prescriptive.<br>Text amended to include additional reference included for further case studies.<br>Updated references are included for further detailed information. |
| | 7 | **Bibliography** | |
| 5 | 7 | *Environmental consultant*<br>There should be an alternative to the online references, since they are subject to change.<br>Readdress referencing | Referencing in this Schedule must be consistent with requirements for NEPM document. Noted. |
| 5 | 7 | *Environmental consultant*<br>Term: bibliography<br>Perhaps "interesting reading" would be more appealing than bibliography? Is it trying to establish credibility for content, or encourage people to read further? | Noted. |
| 5 | 7 | *Environmental consultant*<br>References; The references could do with updating (there is plenty of newer material). About 90% are over 10 years old, only 10% is less than 5 years old. | Referencing has been reviewed and updated. |
| | 8 | **Glossary** | |
| 5 | 8 | *Environmental consultant*<br>8:<br>1) References to contaminated land<br>Needs a reference to the fact that these definitions are specific to contam issues<br>2) Definitions "community", "wider community", and "stakeholders"<br>Put "community", "wider community", and "stakeholders" together (next to each other) with the explanations to explain their interrelationship. | Noted.<br>Noted.<br>Text amended. |

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| | | 3) The definition of "hazard" is incorrect.<br>A hazard as potential to cause harm. In the example, the hazard is the benzene: leukeamia is a possible consequence of exposure. The hazard is DDT.<br>4) "Risk management" section doesn't read clearly to me.<br>Divide into a few sentences. | Text amended. |
| | | **General comments** | |
| 29 | | *Industry*<br>A useful guideline. It could possibly benefit from greater recognition that effective community engagement could involve various parties including not only environmental professionals but also contractors, legal, public affairs, property and engineering professionals depending on the nature of the issue or project being undertaken. | Noted. |
| 47 | | *Industry peak body*<br>ALL, Consistency with enHealth, The NEPM risk communication should be consistent with previous enHealth guidance. | Noted. |
| 15 | | *Environmental consultant*<br>General comment—a lot of repetition;<br>Schedule needs editing to streamline | Noted. |
| 47 | | *Industry peak body*<br>General, How do you monitor or measure the success of "good" stakeholder engagement? its very subjective – do you measure number of meetings, number of participants / attendees ? some guidance on this would be useful.<br>Add further guidance on how measure the success / performance of good stakeholder engagement. | Minor amendment to text. The purpose of this Schedule is to provide the general framework for effective community engagement rather than detailed guidance on dispute resolution (duplication). |
| 47 | | *Industry peak body*<br>General, Implicit in "consulting with communities" is that as a minimum, their | Text amended (duplication). |

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| | | views will be considered during the decision-making process—the schedule provides no real guidance on how to do this.<br><br>Consider adding additional information on how community views will be considered during the decision-making process | |
| 47 | | *Industry peak body*<br><br>General, Resolving disputes—no guidance on how to do except 4.2.8 says "extensive international experience with alternative dispute resolution that should be pursed".<br><br>Grievance management is one of the hardest components of stakeholder engagement. Consider adding additional information on dispute resolution | Minor amendment to text. The purpose of this Schedule is to provide the general framework for effective community engagement rather than detailed guidance on dispute resolution (duplication). |
| 5 | | *Environmental consultant*<br><br>General, This is a clear and comprehensive guide which is on target with its messages. The graphic design could be improved to make it more of a "guide for dummies"—that is, ensuring the critical points are clearly identified (the "if you read nothing else, understand this" concept.)<br><br>The graphic design could be improved to make it more of a "guide for dummies" | Noted. |
| 5 | | *Environmental consultant*<br><br>p10 para 4 of the section<br><br>This sentence could do with an emphasis on the fact that the audience has no prior knowledge—BUT they are not stupid.<br><br>Add emphasis | Noted (duplication). |
| 28 | | *Environmental consultant*<br><br>Schedule B8 Guideline on Community Engagement and Risk Communication provides extensive detail on basic/entry level communications theory which could be summarised further.<br><br>A participatory process should be a key aim for meaningful community engagement and risk management. | The purpose of this Schedule is to provide the general framework for an effective community engagement plan emphasising the need for the engagement to be a two way process. Noted. |

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| 28 | | *Environmental consultant*<br><br>The document could provide a framework for reaching decisions about techniques based on levels of engagement. The guideline could also provide more detail on techniques. The table provided does not provide enough description about various techniques or any practical examples of when such techniques might be appropriate. To encourage better engagement a more user friendly and practical format should be considered. | The purpose of this Schedule is to provide the framework for an effective community engagement plan without being prescriptive. Updated references are included for further detailed information. Noted. |
| 28 | | *Environmental consultant*<br><br>There are no references to other global practice standards., The document should refer to some of the global practice standards, which underpin leading work in this field.<br><br>These include the following:<br>- International Finance Corporation (IFC) performance standard 1: Social and Environmental Assessment and Management Systems<br>- Stakeholder Engagement: A good Practice Handbook for Companies Doing Business in Emerging Market (IFC, 2007)<br>- IAP2 Public Participation Spectrum (International Association or Public Participation, 2004)<br>- Community engagement and development – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth Australia, 2006) | The reference section has been generally updated to include current national and international publications. Noted. |
| 39 | | *State government agencies*<br><br>This is a good document. It is detailed and thorough | Noted. |
| 34 | | *Industry peak body*<br><br>This Schedule appears dated and not very practical from a company perspective.<br><br>A number of companies have established Community Advisory Panels and established Community Consultation processes which should be used by Industry where they exist.<br><br>PACIA's Responsible Care Code of Practice 'Community Right to Know' should be | References updated. |

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| | | an additional reference. This code can be downloaded from http://www.pacia.org.au/Content/ResponsibleCareToolkit.aspx<br><br>Another useful reference is 'Communicating Understanding of Contaminated Land Risks' published by the Scottish Environment Protection Agency. A copy is attached for your information. | |

## APPENDIX K – Issues and responses – Schedule B9

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|---|---|---|---|
| | 1 | **Introduction** | |
| 47 | 1 | *Industry peak body*<br>1, The second paragraph implies that Regulators and Planners are not included in having concerns regarding health and environmental issues – only the management of the land and approvals process.<br>Revise para | Text amended. |
| | 2 | **Purpose** | |
| 47 | 2 | *Industry peak body*<br>2, Given that the schedule also is indicated for "Related Professionals" the limitation to certifying site assessments under statute, or professionals "involved in contaminated site assessment" seems to leave out a third category which could be the Independent Third Party Environmental Reviewers (mentioned in Section 3) – who are neither undertaking a "statutory" audit nor the actual assessment.<br>Include third-party and non-statutory assessments | Text amended. |
| | 3 | **Use of these guidelines** | |
| 47 | 3 | *Industry peak body*<br>3, 3, final para, Establishing grades of accreditation.<br>NEPM should provide guidance on what an appropriate level of competency or requirements to demonstrate that level of competency, rather than suggesting that a less stringent interpretation may be possible.<br>NEPM should set an appropriate benchmark. It is then up to each jurisdiction to provide a case as to whether a less stringent interpretation may be appropriate. | The purpose of this Schedule is to describe essential competencies and experience for environmental professionals carrying out contaminated site assessment and a general framework for acceptance or appointment by regulatory authorities.<br>While individual regulatory bodies may establish requirements relating to levels of competency within their own jurisdiction in accordance with specific legislative or |

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| | | | guideline requirements, it is not the intent of this Schedule to provide this detail.<br><br>Text amended to remove reference to grades of accreditation. |
| 47 | 3 | *Industry peak body*<br><br>3, 3, Last paragraph grades of accreditation, Is this to be formalised and should categories be defined within NEPM? | The purpose of this Schedule is to describe essential competencies and experience for environmental professionals carrying out contaminated site assessment and a general framework for acceptance or appointment by regulatory authorities.<br><br>While individual regulatory bodies may establish requirements relating to levels of competency within their own jurisdiction in accordance with specific legislative or guideline requirements, it is not the intent of this Schedule to provide this detailed guidance.<br><br>Text amended to remove reference to grades of accreditation. |
| 47 | 3 | *Industry peak body*<br><br>3, 3, Professionals, Is the recognition of these professions intended to be under a national scheme? Would there be value in a national qualification/recognition or national body such as the Certified Environmental Professionals (CEnvP) scheme. | It is indicated in section 1 of the Schedule that it is intended to be used to assist in the development of a consistent national approach to the recognition of contaminated land professionals. However the establishment of such a national system is not within the scope of the current NEPM.<br><br>Individual jurisdictions may also have specific requirements for contaminated land professionals in accordance with specific legislative or guideline requirements which typically include memberships of related organisations. |

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| | | | Noted. |
| 47 | 3 | *Industry peak body*<br><br>3, 3, Second last paragraph—The word "complex" should be removed from this paragraph. It is covered in the next paragraph—but as a general rule the "high level of technical competency assessment" should apply to all auditors whether the sites are complex or not. It is difficult to see how some jurisdictions could apply grades of accreditation—but as a guideline—I think this should aim for the higher level of competency as the default. If some distinction is to be drawn—I believe it should be around the difference between a statutory audit to be relied upon by the public and a third party review that would be primarily relied upon by a client or landholder, rather than a matter of complexity of the site.<br><br>Distinction should be around the difference between a statutory audit to be relied upon by the public and a third party review that would be primarily relied upon by a client or landholder, rather than a matter of complexity of the site. | Text amended. |
| | 4 | **Professional roles in the assessment of site contamination** | |
| 31 | 4 | *Environmental consultant*<br><br>4, 4, Doesn't seem to differentiate between Auditor type appointment and assessment consultants who might be registered or otherwise recognised. | Text amended. |
| 47 | 4, 4.1, 4.2, | *Industry peak body*<br><br>4, 4.1, 4.2, the assessment professional is almost being asked for a greater degree of competence that the auditor.<br><br>The list of qualifications and experience should also apply to section 4.1, only to a greater extent—i.e. greater range and depth of experience and demonstrated competence. | Text amended. |
| 47 | 4 | *Industry peak body*<br><br>4, 5, The introductory discussion is not clear on what category this section provides guidance on—it is presumed it is for jurisdictions assessing applications for auditor or third party reviewer accreditation. | Text amended. |

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| | | Clarify the introductory discussion in relation to what application or accreditation this section is intended to be providing guidance on. | |
| 47 | 4.1 | *Industry peak body*<br>4.1, 4, The discussion presented is not relevant to competencies of auditors, but reads more like a general discussion re the competencies of practitioners. There is not enough emphasis on the importance of consultants being appropriately qualified and experienced to be planning and implementing the investigation of a particular site and contamination issues. This could perpetuate the current problems being experienced with independent reviewers for some sites being pressured to provide more than just an independent review role, and to provide advice on design and conduct of the assessment work (a situation which commonly arises when the consultants on a project are not appropriately qualified or experienced).<br>This section would read better if it was written as an introduction including a general discussion to clarify the roles of the assessment consultants and auditors or other independent review roles. It would also be helpful to provide an overview of the range of competencies required in the field of contaminated sites work, and not limit this to the discussion of auditor competencies for accreditation purposes. | Text amended. |
| 31 | 4.1 | *Environmental consultant*<br>Section 4.1 talks, almost exclusively, about assessors/assessment professionals. | Text amended for clarification. |
| 31 | 4.2 | *Environmental consultant*<br>Section 4.2 talks about competencies for consultants, but there is no description of the levels of skill/expertise which differentiates an auditor from an assessor. | Text amended for clarification. |
| 33 | 4.2 & 6.6 | *Other*<br>4.2 & 6.6, pp4 & 8<br>Environmental Consultants and Profssional Associations<br>Furthermore to strengthen the requirements of competent professional (esp non-auditors) and to pave the way for a national accreditation system for Contaminated Land Specialists in Australia (something which is currently actively pursued by | Individual jurisdictions already have specific requirements for memberships of contaminated land professionals. While it is not the intent of this Schedule to provide prescriptive detail of all professional organisations that may be relevant for membership the importance of the |

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| | | industry bodies and which may result in some similar designation like currently offered in the UK—SiLC Specialist in Land Condition - www.silc.org.uk ) following should be included:<br><br>1. Explicitly require a professional accreditation by a relevant professional body as a pre-requisite (e.g. Engineers Australia (Professional Engineer), Australian Institute of Geoscientists (Registered Professional Geoscientist), Environment Institute of Australia and New Zealand (Certified Environmental Practitioner), etc).<br><br>2. Also explicitly include membership of relevant professional associations including Environment Institute of Australia and New Zealand, Australasian College of Toxicology and Risk Assessment, Society for Sustainability and Environmental Engineering etc). | requirement for membership is recognised.<br><br>Text amended to clarify requirements for membership with relevant professional bodies. |
| 33 | 4.2 & 6.6 | *Other*<br><br>4.2 and 6, pp4 & 7<br><br>Environmental Consultants and Assessment Criteria<br><br>The new NEPM document is an appropriate update reflecting the extensive advances in the science and engineering fields related to contaminated land assessment in the last 10 to 15 years.<br><br>With this the complexity of site investigations and assessments has risen tremendously which is reflected in the complexity of the new NEPM. This obviously shows the requirement for highly trained scientists and engineers specialising in the field of contaminated land assessment and management to competently implement the new NEPM.<br><br>Hence it considered of outmost importance to raise the bar for the requirements of competent professionals (non-auditors) to be defined in a similar manner like for auditors with application of assessment criteria for environmental consultants (section 6) to be applied. | Noted.<br><br>Text amended. |
| 47 | 4.2 | *Industry peak body*<br><br>4.2, 4, The discussion re competencies for consultants is too general. It is not clear on the competencies required for practitioners. | Text amended. |

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| | | Upgrade the discussion of competencies for consultants, to provide a better overview of the breadth of skills and technical competencies required. | |
| 47 | 4.2 | *Industry peak body*<br>4.2, 4. Last paragraph "further advice"<br>Would it be useful to have a publicly available database for accredited consultants? Is this advocated by NEPM? | The usefulness of such a database or other information regarding selection of appropriate contaminated land professionals is recognised. It is indicated in section 1 of the Schedule that it the Schedule is intended to be used to assist in the development of a consistent national approach to the recognition of contaminated land professionals. However the establishment of such a national system is not within the scope of the current NEPM.<br>Individual jurisdictions may choose to provide such information within their own jurisdictions.<br>Noted |
| 47 | 4.2 | *Industry peak body*<br>4.2, P4 Para 2, Requirements should include employee of an ACLCA member company. The ACLCA requires member companies to demonstrate a commitment to safety, quality and a code of practice and employee developments and as the peak body representing consulting companies in the contaminated land industry there should be a recommendation that recognizes those companies. Amend as appropriate and obtain input from the ACLCA as to the requirements for membership. | Requirements in relation to professional memberships clarified. |
| | 5 | **Application for acceptance** | |
| 47 | 5 | *Industry peak body*<br>5, 5, Application for acceptance. Without reading Section 4 of the document, it would be unclear whether the requirements are for auditors, consultants or both.<br>Separation of the requirements for auditor/third party reviewer accreditation and clarification that some components may be useful for decision making regarding | Text amended. |

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| | | selection of consultants. | |
| 47 | 5 | *Industry peak body*<br><br>5, 5, line 3, Requirement of information.<br>The use of the term "require" resembles a duty for people to request the information specified. In the case of engaging consultants, this list of requirements is extensive and would be impracticable.<br><br>Separation of the requirements for auditor/third party reviewer accreditation and clarification that some components may be useful for decision making regarding selection of consultants. | Text amended. |
| 47 | 5.8 | *Industry peak body*<br><br>5.8, This section appears to assume that the applicant has not been involved in assisting or working with or under an auditor. Many of the most competent individuals have undertaken several years of work with an appointed auditor and prepared many parts or the main body of work that was incorporated into several or many audit reports. In doing this, they may not have had the opportunity to undertake within the 2 year period one or more relevant site contamination assessment/clean-up reports.<br><br>A sentence could be included that indicates that evidence of assisting with preparation of the bulk of an audit report already supplied to the jurisdiction within that period, would be accepted as part of the evidence of the applicant's expertise. | Provision of audit reports substantially prepared by the applicant would not be excluded by this requirement. However it would be expected that where applicants were submitting audit reports they would be accompanied with documentation from the relevant auditor confirming the extent of the applicant's involvement. Noted. |
| | 6 | **Assessment Criteria** | |
| 31 | 6 | *Environmental consultant*<br><br>6, 7, Not clear whether it relates to Auditors or assessors to be registered. | Text amended. |
| 31 | 6.1 | *Environmental consultant*<br><br>6.1, 7, Maybe needs to specify what is core expertise/knowledge held by an individual and what is acceptable to access from others. Otherwise, someone could meet these criteria only in the sense that they can access such expertise. Any half good experienced barrister would fit the bill on the basis of accessing expertise. | Text amended. |

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| | | Be specific about level of expertise that must be held personally by applicant. | |
| 47 | 6.1 | *Industry peak body*<br>6.1, 9, Training, Is there a recommended minimum hours of training or professional development that is recommended? Can this be added to provide guidance? | Applicants should be able to demonstrate their commitment to relevant professional development and training as ongoing and active. Given the variation in quality between different activities, and requirement for memberships of professional societies it is not considered necessary to specify an acceptable minimum amount of hours. Text amended for clarification. |
| 31 | 6.4 | *Environmental consultant*<br>6.4, 8, Given operation of the Mutual Recognition Act 1992, I think there should be more explicit guidance on "comprehension to the level required" rather than leaving it to what states/Territories require. National uniformity/consistency is the key. | Text amended for clarification. |
| 47 | 6.6 | *Industry peak body*<br>6.6, 8, Relevant professional societies; It would be really useful to list such societies. Could an appendix be included with an expanded list of examples/recommended societies? | Individual jurisdictions already have specific requirements for memberships of contaminated land professionals. While it is not the intent of this Schedule to provide prescriptive detail of all professional organisations that may be relevant for membership the importance of the requirement for membership is recognised.<br>Text amended to clarify requirements for membership with relevant professional bodies. |
| 47 | 6.6 | *Industry peak body*<br>6.6, 9, line 3, Professional experience.<br>It is considered that 5 years experience is not sufficient to be able to accomplish the high level of expertise required for auditing. Currently most jurisdictions stipulate 8 years as a minimum requirement. | Text amended. |

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| | | Suggest increasing the minimum to 8 years relevant experience. | |
| 47 | 6.7 | *Industry peak body*<br>6.7, 9, lines 6-10, Professional experience. NEPM should provide guidance on what an appropriate minimum number of years experience should be, rather than suggesting that a less stringent interpretation may be possible.<br>NEPM should set an appropriate benchmark. It is then up to each jurisdiction to provide a case as to whether a less stringent interpretation may be appropriate. | Applicants with less than the minimum years experience may be considered if their expertise and experience is considered by a regulatory body to be particularly relevant. Individual jurisdictions have specific levels of experience established by legislation and/or guideline requirements. Text amended for clarification. |
| 47 | 6.7 | *Industry peak body*<br>6.7, 9, The section currently suggests applicants for accreditation as auditors or independent reviewers should have a minimum 5yrs of experience in assessment and management of contaminated sites. Industry experience amongst practitioners and auditors would suggest that 5 years is not insufficient to allow a person to attain the level of experience necessary to fulfil a role as an accredited independent reviewer or auditor. It is noted the nearest equivalent international role (UK SILC) requires a minimum 8 yrs experience which seems more reasonable. Suggest amending the min level of experience to 7 or 8 years. | Text amended. |
| 47 | 6.7 | *Industry peak body*<br>6.7, in the example – to the end of ".....as a member of an accredited auditor's expert support team, could add – "or as principal assistant and project manager for two or more audits undertaken by that auditor". | The criterion identified is that of having broadly based experience in contaminated site or environmental auditing experience. The example listed in the Schedule would not preclude the additional examples suggested if considered relevant. Noted. |
| 47 | 6.8 | *Industry peak body*<br>6.8, 7, Whilst it mentions ".... demonstrated ability to act independently on the basis of factual evidence" nowhere does it define what "acting independently actually means"<br>Similar words are used in Section 6.8 ".....be able to act independently using balanced professional judgement based on site-specific data and the advice of specialised support professionals". | Text amended |

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| | | Somewhere in the Schedule it should therefore define—independence, i.e. "to act on behalf of the best interests of the community and environment, ahead of those interests of the client, planning authorities, regulatory authorities, or the interests of the auditor—in coming to decisions on the environmental status of a site"—It perhaps should also indicate the requirement for avoidance of actual or perceived conflicts of interest that could bring a loss of confidence in the audit system by the community. | |
| 47 | 6.10 | *Industry peak body*<br>6.10, 9, last para, Professional development. A "commitment" to ongoing training does not necessarily equate to "actual" ongoing training. Similar to the requirements of many professional societies, a minimum number of hours for ongoing training and professional development would be appropriate.<br>Suggest incorporating a minimum number of hours of ongoing training and professional development to be undertaken. 40–50 hours over a 2 year period would be consistent with other professional societies. | Applicants should be able to demonstrate their commitment to relevant professional development and training as ongoing and active i.e. actual. Given the variation in quality between different activities, and requirement for memberships of professional societies it is not considered necessary to specify an acceptable minimum amount of hours. Text amended for clarification. |
| | 7 | **Acceptance process and general conditions** | |
| 31 | 7.1 | *Environmental consultant*<br>7.1, 10, I would also advocate more specific guidance on assessment/ appointment processes, particularly if "registration" of practitioners is within the scope of the Schedule. | Individual jurisdictions have specific legislative requirements in relation to the implementation of acceptance processes. The purpose of this Schedule is to provide a general framework for the process rather than detailed administrative processes. Noted. |
| 47 | 7.1 | *Industry peak body*<br>7.1, 10, Last sentence, Should this also include an adherence to ethical standards? | Text amended. |
| 47 | 7.2 | *Industry peak body*<br>7.2, 10, Ongoing practice. The requirement to update training and experience should also include the need to be actively involved in the auditing of contaminated sites, similar to the requirements in some jurisdiction where a number of audits are expected to be completed or demonstrated auditing activity. | Individual jurisdictions may have specific requirements for ongoing experience. It is also necessary to recognise the variability in availability of audit work and the fact that an auditor may be carrying out a single complex audit that may take significant time to |

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| | | Suggest adding a requirement for active involvement in auditing of contaminated sites. | complete. Text amended for clarification. |
| 47 | 7.2 | *Industry peak body*<br>7.2, 10, Paragraph 2 "periodic review", Is there a suggested period of review? | The period of review is best determined by individual regulatory bodies taking into account factors such as auditor performance issues, and availability of resources. However the review process is expected to be regular. Text amended for clarification. |
| 47 | 7.2 | *Industry peak body*<br>7.2, 10, Paragraph 3 "proven malpractice", It would be useful to note what this would comprise of. | Text amended. |
| 39 | 4 & 5 | *State government agencies*<br>DEC notes that the requirements and standards set out in the B9 Schedule are consistent with the Application Process requirements and Selection Criteria set out in sections 4 and 5 of the CSMS guideline.<br>However DEC highlights the following specific inconsistencies: | Noted. |
| 39 | 6.7 | *State government agencies*<br>The level of professional experience proposed in 6-7 of the B9 Schedule, set at minimum of five years, is not consistent with WA guidelines or other jurisdictional requirements, which typically require at least 8 years relevant professional experience. DEC strongly recommends this requirement be increased to at least eight years relevant professional experience, and provides no scope for jurisdictions to consider candidates with less than eight years experience. | Text amended. |
| 39 | 6.1 | *State government agencies*<br>DEC refers to ten Core Competencies in section 5.5 of the CSMS guideline. In addition to the six Core Competencies listed in 6-1 of the B9, DEC recommends the inclusion of five additional Core Competencies consistent with CSMS guideline.<br>Forming and Managing multidisciplinary teams (identified as Item 5-6 of the B9 Schedule) | Experience in multi-disciplinary teams is specifically addressed in sections 6.4 and 6.7 of the Schedule. Text amended to clarify requirements.<br>Knowledge and experience in the principles and methodology of conducting audits is |

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| | | Principles and methodology for conducting environmental audits,<br>Occupational Health and Safety in relation to Contaminated Sites,<br>Communication of contaminated sites and risk information,<br>Field and laboratory quality control/assurance procedures.<br>DEC considers these competencies to be essential skills for any contaminated sites professional and therefore should be consider Core Competencies for the purposes of accrediting Contaminated Sites Auditors. | specifically addressed in section 6.8 of the Schedule. Noted.<br>While risk communication is currently identified in section 6.1 as a technical competency to be demonstrated to the level required by individual regulatory bodies, effective risk communication has an increasing significance in relation to all contaminated land assessment. Text amended.<br>While quality assurance and quality control procedures is currently identified in section 6.1 as a technical competency to be demonstrated to the level required by individual regulatory bodies, the importance of this ability in relation to contaminated land assessment is recognised. Text amended.<br>It is noted that the Schedule states that all or a majority of the competencies may be required to be demonstrated as core by individual regulatory bodies. |
| 39 | 6.6 | *State government agencies*<br>The membership of a relevant "Professional Society" as a prerequisite for accreditation, as set out in section 6-6 of the B9 Schedule, is strongly welcomed. The WA guideline currently does not prescribe membership of a professional body as a requirement of accreditation, but rather requires that candidates demonstrate their commitment to on-going professional development, including through membership of a relevant professional organisation. | Noted. Requirements in relation to memberships and professional development also clarified. |
| 39 | 6.6 | *State government agencies* | Noted. |

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| | | 4. DEC welcomes the "professionalization" of the contaminated sites assessment and management industry and welcomes the criteria for acceptable professional "societies" as proposed in section 6-6 of the B9 Schedule. In addition to the criteria proposed DEC would include,<br><br>i) Memberships should be a "individual" membership rather than "corporate" membership.<br><br>ii) Membership should be determined by an independent and accountable panel of professionals. The Panel should conduct a transparent and rigorous assessment of the candidates technical ability, performance and conduct, such as by technical examination, written submissions, evidence of relevant experience, professional interview before a panel of senior professionals and professional references, and,<br><br>iii) The maintenance of Membership should be dependent on the adherence to a written Code of Conduct, maintenance of professional standards and following an assessment of written evidence a Continuous Professional Development program and learning outcomes. | Text amended for clarification.<br><br>Membership of professional societies is one of the criteria required to be assessed, in accordance with guidance provided in the Schedule. Text in Section 7.1 amended for clarification.<br><br>Text amended. |
| 39 | 6.6 | *State government agencies*<br><br>5. DEC notes that section 6-6 of the B9 Schedule refers to examples of relevant professional societies (e.g.. Engineers Australia, The Royal Australian Chemical Institute and Australian Institute of Geoscientists). DEC has no knowledge of the activities or membership requirements of these organisations in WA and cannot comment of the relevance or acceptability. DEC does not, therefore, consider it appropriate or helpful to provide such specific examples of acceptable societies with the NEPM. | Noted. |
| | | General comments | |
| 39 | | *State government agencies*<br><br>DEC welcomes the opportunity to comment on the draft for public consultation.<br><br>Following the enactment of the Contaminated Sites Act 2003 (the Act) on 1 December 2006 DEC has accredited Contaminated Sites Auditors (Auditors) in | Noted. |

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| | | accordance with section Part 7 of the Act and Part 9 of the Contaminated Sites Regulations 2006 (the Regulations).<br><br>DEC has published a Contaminated Sites Management Guideline "Contaminated Sites Auditors: Guidelines for Accreditation, Conduct and Reporting" (DEC, August 2006) (CSMS) setting out the role, responsibilities and process for accreditation of Auditors and this guideline was revised and updated in November 2009. DEC currently accredits 25 Auditors of which 3 were accredited as "first-time candidates" and 22 accredited through the Mutual Recognition of an existing interstate accreditations. One first-time WA Auditor has been mutually recognised as an Auditor in New South Wales.<br><br>The WA accreditation process is set out in section 4 and 5 of the guideline and was designed to be consistent with the requirements for accreditation set out in the NEPM (1999) Schedule B10 and New South Wales and Victorian guidelines for the accreditation of Auditors.<br><br>DEC supports the purpose of the revised NEPM 2010 (Schedule B9), (B9) to provide a general framework for the appointment or acceptance of contaminated land professionals and in setting a consistent minimum standard of competency and experience for accreditation across Australia.<br><br>DEC believes that the NEPM revision provides an opportunity for jurisdictions to collaborate to establish a national Auditor accreditation scheme of significant professional standing and in doing so establish, develop and maintain a higher professional standard in the fields of contaminated land assessment and management.<br><br>DEC recognises and supports the acknowledgement within the B9 Schedule that individual jurisdictions will have their own legislative, administrative and technical requirements and that these take precedent over the minimum standards set out in the NEPM revision. | |
| 28 | | *Environmental consultant*<br><br>General, The introductory sections are too general and this tends to blur the objective of the Schedule by creating a sense that the Schedule is also generally applicable to Consultants. I could not find a specific section of text which | Text amended for clarification. |

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| | | explained how this Schedule would be applied to Consultants who are not Auditors.<br><br>Include section on how this guidance can be used for non-auditors | |
| 42 | | *Industry peak body*<br><br>Increased Auditor Demand<br><br>A major consequence of the draft NEPM is the anticipated increase in demand for contaminated site auditors. ASBG's considers the following reasons support this prediction:<br>- Use of the new risk assessment processes will require more time and effort from contaminated site auditors due to:<br>- The newness of the risk assessment processes<br>- Requirement to be satisfied the consultant undertaking the risk assessment has covered it an acceptable level.<br>- Level of familiarisation by the auditor of the expertise of the consultant and their capability of its implementation<br>- Type of risk assessment used and whether it has been used here or overseas<br>- The level of familiarisation of the risk assessment process used by the auditor<br>- Planning consent authorities which are less confident with the massive changes to the NEPM will increase their reliance on the use of auditors to assess industrial land transfers.<br><br>ASBG expects the increased use of auditor time reviewing consultants using the new risk assessment process will diminish over time as the auditors become more use to the new processes and gain increased confidence with consultancies which use them. This however, favours the larger consultancies over the smaller ones, as they more likely be able to drawn on international experiences and build their use of risk ASBG's assessment processes at a faster pace. | Noted. |
| 27 | | *Environmental consultant*<br><br>No specific issues with the document but as a company which contains a large number of Auditors per capita, we feel that one of the major issues in attaining high standards is that apart from ACLCA which has a semi rigorous system of acceptance of consultants, we favour the use of Appropriately Qualified | This system falls within the guidance of the Schedule.<br><br>Noted. |

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| | | Individuals used in Queensland—this will allow the whole system to operate more efficiently. | |
| 28 | | *Environmental consultant*<br><br>The introductory sections are too general and this tends to blur the objective of the Schedule by creating a sense that the Schedule is also generally applicable to Consultants. It is not clear how this Schedule would be applied to Consultants who are not Auditors.<br><br>Clarify the objective of this schedule.<br><br>Competencies—A framework needs to be implemented that ensures that consultants are qualified in the disciplines they work in and provides advice in to clients and the community | Text amended for clarification. |
| 42 | | *Industry peak body*<br><br>The second point is perhaps the more important as there will be again an education gap following the implementation of the draft NEPM. This issue is particularly acute in NSW where Local Government, rather than environmental regulatory agencies, have planning decision making powers over contaminated land development. Many NSW Councils lack resources and knowledge in this area to deal with the current contaminated site legislation. A doubling of the NEPM will simply make them more cautious. Turing to auditors will result shifting Council's risks to the auditor and their professional liability insurance. ASBG considers a simple fix is to provide more auditors. The problem is that there is a predicted shrinkage of the number of auditors as a number are expected to retire soon. Again the means to assist in correcting this issue includes:<br>- Increasing the number of auditors<br>- Running educational programs for planning consent authorities on contaminated land and the NEPM changes<br>- Contaminated site consultants prepare capability statements on their key risk assessment methodologies for pre assessment by land owners and contaminated site auditors.<br><br>The last dot point should help in preparing contaminated site consultants to demonstrate up front they have the capability and capacity to undertake risk | The demand for auditors will be determined by specific jurisdiction requirements and development opportunities. Regulatory bodies in individual jurisdictions are responsible for ensuring, as far as possible, an adequate supply of auditors to carry out this work. This is outside the scope of the NEPM.<br><br>The importance of education and professional training and development to assist in the implementation of the varied NEPM is recognised. Relevant professional organisations such as ACLCA, consultant companies, professionals and regulatory bodies in individual jurisdictions share responsibility for ensuring the appropriate implementation of the NEPM, and the ongoing education and training of environmental professionals to carry out contaminated site assessment in accordance with the NEPM. |

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| | | assessments at least up to the standard in Schedule B6. While this should not be a mandatory condition, it should be a recommended one. If such statements are comprehensive enough, and perhaps, call up overseas experience with the risk model, this should better prepare both the land owner and the site auditor for dealing with that consultancy. The outcome being lower cost remediation and more efficient use of resources. R4 ASBG recommends increasing the number of contaminated site auditors to cater for the increased predicted demand following the implementation of the draft NEPM. R5 ASBG recommends support for educational programs for planning consent authorities to better understand the changes to the NEPM and other contaminated site legislation. R6 ASBG recommends that contaminated site consultants provide risk assessment capability statements in compliance with schedule B6 for review by clients and site auditors. | Noted. |

## APPENDIX L – Issues and responses – Impact Statement and comments regarding costs

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| 19 | *Industry peak body*<br>The variation to the NEPM is based upon relevant international and Australian research. The additional requirements will add cost and time to contaminated land investigations. Preliminary investigation costs may increase due to the upfront localised site dataset information requirement.<br>Remediation and site management costs are likely to be reduced for sites with bonded asbestos, metals, pesticides, herbicides and petroleum hydrocarbons. This is due to greater Preliminary Investigations being conducted at the beginning of site assessment.<br>Remediation and site management costs are likely to increase for sites with friable asbestos, groundwater contamination and contaminants where there are no NEPM guidance levels… | Noted. It is acknowledged that the costs for assessment may increase for some sites however this in many cases will be offset by reduced remediation costs. |
| 20 | *Industry peak body*<br>The revised NEPM Schedule B2 now addresses the extent of data requirements for 'adequate' characterisation of contaminated sites, which balances the uncertainties in risk assessments and the cost-effectiveness of remediation strategies, given a set or limited quantum of data……<br>…It provides scope for significant benefits to be realised by industry, regulators and the community in terms of effective environmental policy, public health, safety, cost and environmental amenity and can be expected to remove current obstacles to cost-effective assessment and remediation of contaminated sites for site owners and developers.<br>From an AIP perspective, the most essential ingredient to achieving better assessment outcomes is a harmonised national approach to the assessment of contaminated sites. The NEPM Schedule B2 addresses this, and its tiered approach will significantly reduce the cost | Noted. |

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| | of site characterisation project delays, and the over-remediation or understatement of risks on individual sites…… | |
| 20 | *Industry peak body*<br>*'The adoption of [CRC CARE outputs] is expected to deliver significant cost benefits to assessment and development of affected sites.'*<br>AIP concurs with NEPC in its assessment of the financial implication of these changes to the ASC NEPM. AIP considers there will also be significant spill-over benefits to the wider public as a result of the changes to the NEPMs, through more harmonised policy and governance, better protection of public health, and improved economic and environmental outcomes. | Noted. |
| 21 | *Industry peak body*<br>…Master Builders welcomes the changes to the NEPM as an important step in providing the building and construction industry with greater certainty about how to establish asbestos contamination of sites. The NEPM is also a sound basis on which to establish a consistent regulatory framework which appropriately protects the health and safety of workers and others whilst not imposing costs on industry which are unreasonable and unjustified. | Noted. |
| 23 | *Government agency*<br>There is no cost-benefit analysis.<br>A cost-benefit analysis should have been conducted to fully address any additional costs that changes to the NEPM could impart to public and private entities. | Noted. A semi-quantitative approach which extrapolates from the available information is included in the D-RIS. |
| 30 | *Industry*<br>Caltex appreciates the enormous amount of work clearly evident in the revision of the ASC NEPM. We are hopeful that it will result in significant economic, societal and environmental | Noted. |

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| | benefits as well as improved jurisdictional alignment in the management of contaminated sites. | |
| 36 | *Industry peak body*<br>Overall, UDIA supports the proposed changes within NEPM however there is some concern about the extent of investigation and documentation required for site assessments. | Noted. |
| 44 | ***Industry***<br>…the erroneous conclusion in the Impact Statement regarding the lack of deleterious and severe impacts on our export business.<br>The conclusion that the Variation's proposed EILs bring significant cost savings to industry are "alice in wonderland" stuff in respect to Cr(III). Northern Coop Meat Co operates a large tannery with irrigation of tannery effluent to land as authorised by its environmental licence. Under the existing 1999 NEPM EIL, there is little impact on the business.<br>The Cr(III) EIL for commercial/industrial category proposed 2010 Variation will have a catastrophic impact on the business – as for some other tanneries. The tanning industry relies entirely on Cr(III) in the tanning process to preserve leather. While every effort is taken to reclaim Cr(III) from the wastewater prior to land irrigation, it is infeasible to remove it to levels which meet the proposed EIL. In many instances, legacy activities already exceed the proposed EIL values.<br>Further the recent emergence of an international environmental accreditation scheme for tanneries risks overseas auditors inappropriately applying the proposed EILs to the business resulting in loss of customers and closure, regardless of the cute comments in the Variation introduction to the effect that this should not occur. Our experience is that inappropriate use of guideline values is all too common.<br>The proposed Cr(III) EIL – based on dubious scientific validity – is a major business risk for NCMC's tannery operation. The Impact Assessment's assessment of no adverse business | The issue raised relates to potential beneficial reuse of a waste which is dealt with by separate jurisdictional legislative processes.<br>NEPM guidance states that EILs are for the assessment of existing contamination and are not to be interpreted as "condoning contamination to these levels". This approach has been maintained in the amendment.<br>Notwithstanding this position, specific authoritative ecotoxicity research into soil application of various tanning sludges could be undertaken to determine the effect of the waste on an appropriate range of species. |

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| | impact is completely erroneous, ill-judged and unacceptable to NCMC management and risks the jobs of 300 employees in Northern NSW.<br>The Impact Statement has seriously understated business risks from this proposed Variation. | |
| 46 | ***Industry peak body***<br>Overall the review process and the thrust of the outcomes of the review of the ACS NEPM is welcomed and supported. Increase in details and options available especially for remediation practices provide for increased flexibility and serve to lower remediation costs. This is largely achieved by the increase in type and number of investigation thresholds, variations according to soil types and the recognition of European and North American approaches to risk assessment for contaminated site remediation. …<br>ASBG particularly congratulates the draft NEPM team on the development of pragmatic and effective, both from an environmental and health basis, investigation criteria for asbestos. One member commented that if this was in a few years ago it would have saved over $2 million in landfill and clean up bills on one of their sites. It appears a lot of unnecessary costs have been allocated to asbestos remediation where in fact the risks have been minimal…..<br>In order to meet the draft requirements an increase in the number and types of samples will be required in most cases. This will lead to increased costs. However, such costs are considered to be limited as the establishment costs of a sampling program will be in the majority. Once a sampling regime has been set, economies of scale should limit costs for additional sampling and analysis further. Guestimates of up to 25% increase in such costs have been provided by some members to ASBG, though many sites are thought to be lower than this…<br>ASBG is concerned the complexity of the NEPM will result in increased use of phase 1 assessment on most industrial land. Many of these will not result in the need for remediation.<br>…the changes to investigation and sampling will result in higher costs. Where remediation is required then even if based on investigation limits alone there should be some reduction in the costs for remediation. In the longer run the sheer number of phase 1 investigations will | Noted.<br>Noted that the cost savings would be at the remediation stage and can be substantial.<br>Noted.<br>Noted. The amendment does not affect the triggers (such as land use change) for requiring an investigation. The revision to the *Draft for consultation* clarifies the application of investigation and screening levels to industrial land. |

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| | result in overall increased costs especially for industrial land transactions. … | |
| 49 | *Environmental consultant*<br>…Impacts on the changes Schedule A are considered to be very positive – a site-specific risk based approach that enables more sustainable and less conservative remediation and use of site management controls. There will be more upfront costs for clients when doing site-specific qualitative risk assessments – but this will probably save money on remediation, as otherwise conservative remediation on exceedence of soil investigation levels (HIL or EIL). [Schedule A]<br>We totally agree with the financial impacts on the industry [Schedule B2]<br>The impacts of the changes, being less conservative assessment and remediation and cost savings for reduced need for remediation and timescales for assessment with clearer guidance are welcomed. [Schedule B4]<br>All the impacts we agree are positive [Schedule B5a]<br>Where a more detailed investigation is required (where investigation concentrations are exceeded) the groundwater guidelines are compared to concentrations potentially occurring at the 'point of use'. This may mean more complex investigations using fate and transport modelling etc (i.e., maybe more expensive especially for a small site). [Schedule B6]<br>We consider site-specific risk assessment will require regulatory/auditor involvement much earlier, increased time and cost to the site owners. Results of the site-specific risk assessments are likely to vary from person to person – unless there is some consensus on the best practice models that can be used – e.g. as in UK – approved by Environment Agency. [Schedule B7] | Noted.<br>Noted, however, the application of the GILs has not changed from the original document.<br>Noted. Early consultation with regulators and auditors, e.g. when commencing a site-specific risk assessment, is recommended practice and likely to be more cost effective as when consultation/ regulatory oversight occurs at the 'end' of the process, additional costs can be incurred in additional sampling or modelling costs. |
| 49 | *Environmental consultant*<br>…The requirement to analyse for pH, CEC and Fe% will increase the cost of each sample by | Noted. It should not be necessary to analyse these parameters for every sample. Sufficient samples for analysis should be selected to provide representative |

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| | up to $67 (based on 2010 prices).<br><br>The requirement to analyse samples for clay content will increase the cost of each sample by up to $150. This analysis would also require an additional sample as most contaminant laboratories will not undertake this analysis. This sample would have to be a bulk sample – up to 6kg depending on the largest particle size – and would therefore impact on the use of a drill rig to sample or would be collected over a large depth profile, which may not be appropriate for contaminant testing of specific layers. [Schedule B5c] | results for the soil units of interest.<br><br>Particle size analysis is only required to differentiate between the sand, silt and clay fractions where field description does not provide sufficient certainty. The large sample size referred to (<6kg) is applicable to very coarse materials (much larger than sand size) which could readily be differentiated in the field. |

## Shortened forms

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| ADWG | Australian Drinking Water Guidelines |
| ANZECC | Australian and New Zealand Environment and Conservation Council |
| APHA | American Public Health Association |
| ARMCANZ | Agricultural and Resource Management Council of Australia and New Zealand |
| AS | Australian Standard |
| ASTM | Australian Society for Testing and Materials |
| AWQG | Australian Water Quality Guidelines - Australian and New Zealand Guidelines for Fresh and Marine Water Quality |
| BTEX | benzene, toluene, ethyl-benzene and xylenes |
| Bonded-ACM | bonded asbestos containing material |
| COAG | Council of Australian Governments |
| CRC CARE | Cooperative Research Centre for Contamination Assessment and Remediation |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| CSM | conceptual site model |
| DQO | data quality objective |
| DECCW | NSW Department of Environment, Climate Change and Water (now NSW Environmental Protection Agency) |
| EC | effective concentration |
| EILs | ecological investigation levels |
| EPHC | Environment Protection and Heritage Council |
| ESLs | ecological screening levels |
| GILs | groundwater investigation levels |
| HILs | health-based investigation levels |
| HSLs | health screening levels |
| ILAC | International Laboratory Accreditation Cooperation |
| ISO | International Standards Organisation |
| LOEC | lowest observed effect concentration |
| LOR | limit of reporting |
| NATA | National Accreditation and Testing Authority |
| NEPC | National Environment Protection Council |
| NEPM | National Environment Protection Measure |
| NHMRC | National Health and Medical Research Council |
| PAHs | polycyclic aromatic hydrocarbons |
| PBET | physiologically-based extraction tests |
| POPs | persistent organic pollutants |
| QC | quality control |
| SAQP | sampling and analysis quality plan |
| SSD | species sensitivity distribution |

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| TPH | total petroleum hydrocarbon |
| TRH | total recoverable hydrocarbon |
| US EPA | United States Environmental Protection Agency |
| VOCCs | Volatile organic chlorinated compounds |