National Environment Protection (Assessment of Site Contamination) Measure

NEPM Review

Discussion Paper

Prepared for the National Environment Protection Council

April 2006

NOTE

This Discussion Paper has been developed by a Project Team of government officers from Environmental Protection and Health portfolios, at the request of the National Environment Protection Council. The Paper is provided as a basis for discussion and does not necessarily reflect the views of NEPC Committee. The paper does not carry the endorsement of the National Environment Protection Council nor any member government.

The contents of the Paper should not be used for any purpose other than as a basis for providing comment to NEPC Committee.

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1 INTRODUCTION

1.1 NATIONAL ENVIRONMENT PROTECTION COUNCIL

The National Environment Protection Council (NEPC) is a national body established by State, Territory and Commonwealth Governments. The objective of the NEPC is to work cooperatively to ensure that all Australians enjoy the benefits of equivalent protection from air, water, soil and noise pollution and that business decisions are not distorted nor markets fragmented by variations in major environment protection measures between member Governments.

The NEPC stems from the Inter-Governmental Agreement on the Environment 1992, which agreed to establish a national body with responsibility for making National Environment Protection Measures (NEPMs). The NEPC and its operations are established by the *National Environment Protection Council Act 1994* (Commonwealth) and corresponding State and Territory Acts.

NEPMs are broad framework-setting statutory instruments, which, through a process of inter-governmental and community/industry consultation, reflect agreed national objectives for protecting particular aspects of the environment. NEPMs may consist of any combination of goals, standards, protocols, and guidelines, although for the assessment of site contamination, the NEPC Acts specify that guidelines may be developed.

Implementation of NEPMs is the responsibility of each participating jurisdiction. Any supporting regulatory or legislative mechanisms that jurisdictions might choose to assist in implementation of proposed NEPMs are developed using appropriate processes in those jurisdictions.

1.2 THE ASSESSMENT OF SITE CONTAMINATION NEPM

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

Australia, as a signatory to the Rio Declaration, is committed to conserving, protecting and restoring the health and integrity of Australia's ecosystems. The development of the National Environment Protection (Assessment of Site Contamination) Measure (hereinafter in this document referred to as the NEPM) was a significant step in ensuring that commitment was met.

In developing the NEPM, the NEPC recognised that, in the face of increasing pressure to redevelop former industrial and agricultural land, there was a need to ensure that appropriate processes were in place to properly assess potentially contaminated sites. There was also a growing recognition that the developmental and environmental needs of present and future generations must be considered when dealing with contaminated sites. The development of the NEPM was a significant move to ensure that environmental protection became an integral part of the assessment of site contamination.

The NEPC also recognised that the development of the NEPM was only part of the necessary requirements to ensure that site contamination is managed in an environmentally responsible manner. Those matters that are outside the province of the NEPC Act, such as the management and remediation of contaminated sites, will continue to be dealt with through other processes.

The purpose of the 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 this 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."

1.3 THE REVIEW OF THE ASSESSMENT OF SITE CONTAMINATION NEPM

Clause 10 of the NEPM outlines the requirements for a review of the NEPM and states:

> 10 This Measure will be subject to a review five years from the date of commencement, or within any lesser period determined by the Council, which will consider:
>
> i. the effectiveness of the Measure in achieving the desired environmental outcome set out within it;
>
> ii. the resources available for implementing the Measure; and
>
> iii. the need, if any, for amending the Measure, (in accordance with the Act) including:
>
> – whether any changes should be made to the Schedules; and
>
> – whether any changes should be made to improve the effectiveness of the Measure in achieving the desired environmental outcome set out within it.

The NEPM was gazetted on 22 December 1999, and so the five-year review was due to commence in December 2004. Accordingly, in April 2004 NEPC Committee agreed to develop a proposal for review of the NEPM for consideration by Council in December 2004.

1.4 PROCESS FOR REVIEW

The review was initiated in December 2004 and is due to be completed in September 2006. It is anticipated that NEPC Committee will consider the review report in October 2006. This time-line will enable Council to consider the report and to make any decisions as to whether a variation process to the NEPM should be initiated, in November 2006.

In summary, the components in the review process include:

- establishment of Review Team and JRN and NGO Advisory Group
- development of a draft Issues Paper
- release of the Issues Paper, public consultation and call for submissions
- analysis of submissions and preparation of a Discussion Paper canvassing options
- release of Discussion Paper, public consultation and call for submissions
- analysis of submissions and development of review report and recommendations to NEPC Committee.
- consideration by Council to initiate a variation process
- variation process to make changes to the NEPM

The following table provides summary information on the tools, processes, timelines to undertake the review of the NEPM.

OUTCOME	PROCESS	TIMELINE
ISSUES PAPER Identification of barriers to effectiveness of NEPM	• Establish review team, JRN and NGO	December 2004
	• Identify stakeholders	December 2004
	• Develop Issues Paper	Feb-April 2005
	• Consult with JRN and NGO on Issues Paper	May 2005
	• Report to Committee to release Issues Paper for public consultation	March 2005 May 2005
	• Public consultation period	June – July 2005
DISCUSSION PAPER Development of options to address issues raised from stakeholders	• Analysis of submissions and development of options to address issues raised in review	Sept-Dec 2005
	• Prepare Discussion Paper	Jan– Feb 2006
	• Consult with JRN on Discussion Paper	Feb 2006
	• Report to Committee to release Discussion Paper for public consultation	April 2006
	• Public consultation period	April - May 2006
	• Analyse submissions and prepare Summary of Submissions document	June - Aug 2006
	• Undertake broad "cost-benefit" scenarios on recommendations	Sept 2006
	• Report to NEPC Committee	October 2006
	• Consideration of report by NEPC	November 2006
	• Decision by NEPC to initiate variation	November 2006
VARIATON	• Prepare draft NEPM variation • Prepare draft Impact Statement/RIS • Prepare cost-benefit or multi-criteria (or similar) analysis • Prepare report to Committee and Council • Public consultation • Making of variation (if required)	

1.4.1 Progress to date

A Review Team, comprising a project chair from Western Australia and members from South Australia, Western Australia, Queensland, Victoria as well as the health sector (Commonwealth Dept of Health and Ageing), with an observer from New Zealand and a corresponding member from New South Wales, is conducting the Review. The NEPC Service Corporation provides the Project Manager. The Review Team is accountable to NEPC through NEPC Standing Committee and will prepare a report and recommendations to NEPC Committee and the NEPC.

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A Jurisdictional Reference Network (JRN) and a Non-government Organisation (NGO) Advisory Group have been established to provide policy, technical and operational advice and information.

An Issues Paper was prepared to assist in the identification and discussion of key issues that are to be addressed in the Review of the Assessment of Site Contamination NEPM, and on which stakeholder comments were invited. Twenty-three submissions were received.

The Issues Paper addressed the terms of reference for the review as detailed in the NEPM, together with issues arising from proceedings from site contamination workshops, and outcomes from a recent meeting of jurisdictional officers involved in site contamination work. The major issues contained within the Issues Paper include:

- assessing NEPM effectiveness
- investigation levels (EILs, HILs, GILs)
- fuel components
- total petroleum hydrocarbons
- fuel storage sites
- assessing asbestos impacts
- data quality objectives
- collection of field data
- vertical delineation
- groundwater assessment
- laboratory methods and techniques
- bioavailability/leachability
- volatile substances
- community consultation
- consultant competencies.

1.5 ISSUES PAPER CONSULTATION SUMMARY

Submissions were generally supportive of the NEPM. A number of submissions agreed that the NEPM provided an adequate basis for a nationally consistent approach to the assessment of site contamination. A few submissions did not agree that the NEPM provided a reasonably consistent approach and some raised the varied approaches to implementation between jurisdictions as a barrier to national consistency. There were some submissions that raised the need for national guidance on the management and remediation of site contamination. Nine submissions suggested that the NEPM would become more useful if there was a mechanism to update it more regularly to accommodate new technologies and research.

1.5.1 Guidance

The NEPM currently includes a suite of ten guidelines. Submitters were asked to provide comment on the current guidelines and also on the need for the development of additional guidance. Some submissions stated that there is a need for guidance on:

- the investigation and assessment of asbestos issues
- the assessment of the impacts and risks from volatile substances
- the risk assessment of carcinogens
- application of the Data Quality Objectives process
- the technical aspects of groundwater assessment
- sites involving fuel storage
- bioavailability and leachability
- the engagement of suitably qualified and experienced contaminated land practitioners.

Eight submissions considered that the current guideline on community consultation and risk communication is adequate. Other submissions suggested that further guidance should be provided or that the guideline should be updated. Five submissions stated that the current guideline on competencies of auditors is adequate. Some submissions felt that changes could be made to the guideline.

1.5.2 Investigation Levels

The NEPM refers to three different types of investigation levels: Ecologically-based Investigation Levels (EILs), Health-based Investigation Levels (HILs) and Groundwater Investigation Levels (GILs). Investigation levels are fundamental to the operation and implementation of the NEPM. The topic received particular attention in the submissions, and warrants a specific focus.

Most submissions suggested that there was misuse of the investigation level in site and risk assessments e.g. use of investigation levels as clean-up criteria. Some submissions suggested a range of options to address issues, including:

- review the current HILs and GILs
- develop HILs for other substances not currently listed in the NEPM such as volatile organic compounds, individual Polycyclic Aromatic Hydrocarbon (PAH) compounds and Polybrominated Diphenyl Ethers (PBDEs).
- adopt existing investigation levels for Total Petroleum Hydrocarbons and fuel additives in soils, surface waters and groundwater
- develop HILs, EILs and GILs for persistent organic pollutants (POPs) – although some felt that this would not be a priority for dioxins.

Refer to *Summary and responses received in relation to the issues paper and NEPC's responses to those submissions* on the EPHC website www.ephc.gov.au for further information on submissions received during public consultation on the issues paper.

1.6 THIS DISCUSSION PAPER

The purpose of this paper is to encourage discussion on the options put forward to address issues raised during the review. The feedback provided will help ensure the process and its outcomes are as transparent as possible.

This paper examines options to address issues such as the derivation and use of ecological-based investigation levels and health-based investigation levels, investigation levels for substances currently not included in the NEPM, various aspects of assessment procedures and quality control mechanisms, community consultation, and consultant competencies. It is particularly aimed at establishing preferred options to recommend to NEPC to consider in initiating potential variations to the NEPM.

2 DISCUSSION OF ALTERNATIVE SOLUTIONS TO ISSUES

2.1 ASSESSMENT OF NEPM EFFECTIVENESS

The NEPM comprises an overarching framework for the assessment of site contamination and its relationship to the management of site contamination. It is supported by ten guidelines on various technical and administrative aspects of site assessment.

The nature of the NEPM as a set of assessment guidelines is such that it is difficult to provide quantitative measurements of effectiveness. Difficulties involve the highly site specific nature of site contamination, the various possibilities for proposed land uses, planning requirements in each location and the differing legislative frameworks that apply to the assessment and management of site contamination in each jurisdiction. An appropriate standard of assessment work is required to provide protection of human health and the environment; however, there are no set criteria to measure this standard.

The attainment of consistent national practice in site assessment (transparent processes, resource use and improvements in the standard of site assessment work) is the goal that all jurisdictions aim to achieve.

Guidance for the review maybe provided by Section 15 of the *National Environmental Protection Council Act 1994*, which sets out the factors that Council must take into account in *making* national environmental protection measures. These considerations include:

- the environmental, economic and social impact of the NEPM;
- the simplicity, efficiency and effectiveness of the administration of the NEPM; and
- any regional environmental differences in Australia.

The above considerations assist in developing a useful framework for assessing the effectiveness of the NEPM. In terms of assessing the environmental, economic and social impacts of the NEPM, annual evaluation of the progress of jurisdictions towards meeting the NEPMs standards and goal provides one means of measuring the effectiveness of the NEPM framework. Annual jurisdictional compliance reports provided under the NEPM are designed to allow progress to be assessed.

In relation to the simplicity, efficiency and effectiveness fo the administration of the NEPM, submissions from stakeholders have been assessed to determine components of the NEPM that are providing administrative simplicity, efficiency and effectiveness and those that require amendment to improve the administration of the NEPM.

Some respondents to the Issues Paper stated that it would be useful if the NEPM were explained more simply. Some submissions suggested that approaches to simplify the NEPM could include a summary document and flowcharts. These suggestions are being explored.

A number of submissions raised the need for NEPC to develop a mechanism to update the NEPM more regularly to accommodate new technologies and research in the assessment of site contamination field. There are difficulties associated from regular updates of the NEPM as it is a legal instrument that requires and review and variation process to amend. As a legal instrument it must contain all relevant and constant information for implementation. However, the review team is examining the structural requirements of the NEPM in order to make recommendations to NEPC.

The main emphasis of issues influencing the effectiveness of the NEPM relates to the individual Schedules of the NEPM and are dealt with in detail. Options for addressing these issues are presented in this Discussion Paper, sections 2.2 to 2.9.

Some submissions stated that the NEPM should include recommendations to deal with best practice in management and remediation. While the NEPM can only relate to assessment, agreements for management could be formed at a policy level nationally (through jurisdictional agreement) and endorsed through EPHC.

In terms of any regional environmental differences in Australia, the effectiveness in implementation of the NEPM raises issues that seem to be particularly relevant to auditor and consultant competencies and professional support mechanisms. Options have been presented in sections 2.8 and 2.9 of this Discussion Paper.

2.2 INVESTIGATION LEVELS

2.2.1 Ecological Investigation Levels

Background

The current NEPM has two components relating to terrestrial ecological risks: Interim Urban Ecological Investigation Levels (EILs) (Schedule B1 Table 5-A) and a framework for ecological risk assessment (Schedule B5).

EILs

The purpose of EILs is to determine whether contamination of a site warrants further investigation from an ecological point of view. If the measured concentration does not exceed the EIL, the contamination at the site is considered of sufficiently low risk that no further investigation is required. If however, the contamination at a site exceeds the EIL then site-specific investigation should be commenced to determine whether further actions are warranted.

The EILs are not cleanup or response levels. The NEPM warns of inappropriate use of investigation levels as default remediation criteria and the potential for unnecessary disturbance of local environments, unwarranted remediation costs and waste of landfill space.

The EILs were based on considerations of phytotoxicity of heavymetals (i.e. As, Cd, Cr, Cu, Pb, Hg, & Zn) and soil survey data from four Australian capital cities and ANZECC B values (ANZECC/NHMRC 1992).values. Those EILs based on phytotoxicity data have limited application for urban land, as they are only really applicable to sandy loams with a pH of 6 – 8 (ref: NSW DEC Guidelines for the NSW Site Auditor Scheme, 1998). The limited scope of these EILs arose from a lack of appropriate data. There is no published methodology to explain how the phytotoxicity based EILs can be modified for other soil types or soil pH.

The majority of submissions to the Issues Paper agreed that there was misuse of EIL values generally, particularly concern with their use as default remediation criteria and general concern about inherent conservatism in applying the EILs and the associated cleanup impacts and cost considerations. Similarly there was general support for the development of EILs for other substances.

Ecological risk assessment methodology

The NEPM Guideline on Ecological Risk Assessment (Schedule B5) provides a framework for ecological risk assessment that consists of three levels of assessment: comparison with generic EILs, modify EILs based on desktop study and finally site-specific risk assessment.

There is no nationally agreed derivation methodology for terrestrial EILs; the proposed food-web methodology proposed during the preparation of the NEPM was considered to be premature. There continues to be a paucity of ecologically relevant data, behaviour patterns and cause and effect data for most Australian species, that limit the use of this approach and its further development would be expensive and resource intensive. However, the approach may have site-specific application if relevant data are available for the particular species of concern. In current site assessment practices site-specific criteria that consider relevant ecological receptors and risk are often derived by consultants (with jurisdictional and auditor review) for proposed land uses. These approaches include assessment of the mobility and availability of the contaminant in soil, water and air; impact on sensitive receptors, using pathway analysis and relevant ecological toxicology data; reference existing ecologically based guideline criteria (e.g. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, ANZECC/ARMCANZ 2000 (WQG 2000); and, consider the practical means by which contaminant exposure could be effectively managed. These approaches rely on professional judgement and jurisdictional requirements.

Alternatively a tiered site-specific risk assessment approach for soils, similar to that of the WQG 2000 could be considered. It may involve the following stages:

- The development of national terrestrial ecological investigation levels that account for the background concentrations of the chemicals. The EILs would be derived using a Species Sensitivity Distribution (SSD) method, which is a statistical method to predict concentrations that should protect any chosen percentage of species. This approach is used internationally and recommended by the OECD. This approach requires far less data than the food-web methodology.
- Consideration of physicochemical properties that may affect the toxicity. For example, research results have shown that the toxicity of zinc and copper to wheat are controlled by soil pH and percentage clay content. Statistically based models can be developed to predict the toxicity of chemicals to terrestrial organisms using soil physicochemical properties. Site-specific soil characteristics and these models can be used to calculate values that are added to the background concentration to produce site specific EILs.
- Deriving site-specific ecological value using direct toxicity assessment that is an ultimate test of bioavailability. The site-specific data can be used together to derive the modified criteria for the chemicals of concern.

A two-year research project funded by the NSW Environmental Trust and undertaken by CSIRO Land and Water is currently underway to establish a framework for the development of soil ecological investigation levels. The project aims to develop a tiered risk assessment framework for contaminants, analogous to the framework used in WQG 2000. The framework will be developed for two inorganic contaminants (arsenic and zinc) and two organic contaminants (DDT and naphthalene) as test cases.

The development of an agreed national approach to deriving EILs is desirable. The available information on the toxicity data of soil contaminants to specific Australian species continue to be an area of deficiency in the establishment of EILs and this issue was raised in some submissions.

However, there are currently some large terrestrial ecotoxicology studies being undertaken within Australia that should be able to provide considerable data for a limited number of metals.

Some submissions indicated that the EIL setting framework should be revised using the SSD approach while others sought a review of international approaches. Others did not support any changes to the current approach to EILs, maintaining that a site-specific approach was more practical. Some submissions sought more advice on the application of EILs and decision trees or diagrams that would facilitate their proper use.

The responses in relation to the application and framework for derivation of EILs were mixed and indicative of the multiple complexities associated with this issue.

Options

The following options for EILs are presented for consideration.

Option	Action	Ramifications
1	Retain existing EILs	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Retain the existing Interim Urban EILs but provide more contextual information on their derivation and application use/misuse (e.g. by clearer guidance and references, use of decision flow charts).	This option would help clarify the application of the EILs and does not require significant resources. However, the restrictive nature associated with the application of the existing EILs will remain
3	Retain the existing interim Urban EILs and provide a process to derive site-specific EILs that can be applied to a wider range of contaminants and consider proposed land uses and local sensitive receptors.	This approach it would require significant work in reaching national consensus regarding an acceptable derivation process.
4	Eliminate generic EILs and adopt a site-specific approach for all sites that can be applied to a wider range of contaminants.	This approach would involve more resources from jurisdictions for reviewing site specific risk assessments. This option is contingent on a nationally agreed derivation methodology. There are risks of inconsistency as practitioners may conduct site-specific derivation without audit or review.
5	Replace EILs with "acceptable levels" for various land uses in defined settings (e.g. various residential, parkland and industrial uses in disturbed urban environments with and without sensitive ecological receptors).	Use of "acceptable levels" may provide clearer guidance to consultants and auditors for contaminated site work in urban environments. In the best circumstances it would lower the number of questionable risk assessments and subjectivity in an area where the background science is limited. Defined levels would enable stakeholders to cost site works with greater certainty. The process of determining these levels would require significant data development.
6	Develop an agreed framework/ methodology for deriving and setting EILs and apply to existing EILs and derive new EILs. Approaches to developing the	Adoption of an acceptable scientifically based derivation process may be considered the ideal approach to development of EILs. It would be expected to involve a more

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Option	Action	Ramifications
	framework/methodology may include the following: • a tiered risk framework similar to that of WQG 2000 and derive national EILs employing SSD methodology • adoption of an accredited international approach reviewed for regional applicability • food-web methodology where sufficient toxicity data exist • combination of the above approaches.	expensive and entail a longer development process, especially if it incorporates peer review by national and international experts and stakeholders.
7	Revise the existing Interim Urban EILs (only) using research that has been conducted since making of the NEPM including use of phytotoxicity microbial and invertebrate ecotoxicity data gathered by CSIRO Land and Water and collaborating organisations from the National Biosolids Research Program.	This process may provide a scientific basis for reviewing the limited range of current interim EILs using relevant Australian data. It would not provide a basis for deriving EILs for a wider range of contaminants. It may form part of a lower key strategy that involves a combination of improved guidance and greater use of site-specific risk assessment.

Question 2.2.1:
a) Which is your preferred option(s) and why?
b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.2.2 Health-based Investigation levels

Background

For soil contaminants, the Health-based Investigation level (HIL) is generally derived by first using toxicological and epidemiological evidence to generate an estimate of what is acceptable or tolerable intake; the second step is to consider what the total intake of a sensitive individual like a young child would be, in a model exposure scenario such as a suburban house block. These values are aimed to be protective of human health. They are are conservative, and exposure to soil levels below these can be considered very unlikely to result in adverse human health effects. Hence Health-based investigation levels for contaminated sites are the concentrations above which further assessment and considerations for site management are required.

It should be remembered that site- and context-specific considerations may make concentrations above the guidance values acceptable. Currently, a 'residential' land use setting is employed for deriving the guidance value and values are based on a default exposure scenario for a 2-year-old child. The general method for deriving HILs is to allocate a proportion of the Tolerable Intake to the various sources of exposure, either as a fixed percentage, or as a percentage derived from local data on background exposures for each medium.

Schedule B(7a) of the NEPM lists HILs for more than 24 common contaminants or groups of contaminants in soil in 'residential' land use areas. These levels were compiled from various National Workshops on Health Risk Assessment and Management of Contaminated Land held

up to 1999. A subsequent National Workshop (2002) recommended additions or changes to the listed HILs. At present these latter recommendations are not included in the NEPM.

It was acknowledged that the adopted values were generally conservative and were derived using varying assumptions about exposure factors, percentage of Tolerable Intake, exposure routes and body weights, and using the methodology outlined in the World Health Organization Environmental Health Criteria No.170 monograph *Assessing Human Health Risks of Chemicals: Derivation of Guidance Values for Health-based Exposure Limits* (1994). Some of these values may need to be revised to reflect recent Australian and international developments in risk assessment methodology, and the availability of new internationally peer reviewed hazard assessments, and newly refined Tolerable Intakes.

Schedule B (4) provides guidance on Health Risk Assessment Methodology. Some submissions described the current methodology for deriving HILs as adequate but others felt they could be improved by incorporating bioavailability of the different substances, if known. Several submissions advocated the Risk-Based Corrective Action (RBCA) approach which is a framework to develop a corrective action plan based on exposure assessment and risk assessment. The RBCA has not been endorsed in Australia. Most submissions favoured some means of reviewing current HILs, and supported the involvement of national health advisory bodies in any review of the HIL development process and in development of individual HILs.

Schedule B (7b) provides guidance on Exposure Scenarios and Exposure Settings. Submittors generally felt that more guidance was needed in the application of HILs. Several raised the need to consider different soil types and other factors such as topography and fraction of organic carbon. The fraction of organic carbon in the soil is the total mass of organic carbon divided by a unit mass of soil - the amount of naturally occurring carbon in the soil will influence the amount of leaching, especially of hydrocarbons, into the groundwater. Soil samples that are analysed for fraction of organic carbon must be collected outside the area of contamination.

No criteria currently exist for exposure scenarios B and C associated with home vegetable growing, and several submissions suggested these scenarios be removed. There were suggestions from submitters that a clear understanding, through educational approaches, of the HIL development processes would improve their application.

<u>Options</u>

The following options for HILs are presented for consideration.

Option	Action	Ramifications
1	Retain existing HILs	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2.1	Review current Health Risk Assessment (HRA) methodology which is used to derive the Tolerable/Acceptable Daily Intakes	A useful step before going on to review existing or create new HILs. Any review could incorporate the most recent national and international developments in HRA. Any revision should engage the competent Health authorities (eg NHMRC).
2.2	Review methodology for deriving the HILs	The revision process could include: • The manner of use of the TDI/ADI to derive the HIL

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Option	Action	Ramifications
		• A review of the current exposure scenarios • Available information of bioavailability Any revision should engage the competent Health authorities (eg enhealth). One outcome of this process may be less conservative or more realistic HIL values
3	Revise HILs	This process could encompass revising all the existing HILs, including HILs developed at the 2002 workshop, and well as the derivation of new HILs for priority compounds. The process could incorporate the outcomes of option 2. Any revision should engage the competent Health authorities (eg enHealth).
4	Replace HILs with "acceptable levels" for various land uses in defined settings (eg various residential, parkland and industrial uses in disturbed urban environments.	This option would probably still require the steps listed under option 2 to be carried out, followed by a further step to derive "acceptable levels" from the HILs. The "acceptable levels" may provide clearer guidance to consultants and auditors for contaminated site work in urban environments. It may also reduce overall costs and especially unnecessary cleanup.

Question 2.2.2:
a) Which is your preferred option(s) and why?
b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.2.2.1 Carcinogenic substances

The current NEPM has limited guidance on the conduct of a risk assessment for carcinogenic substances at contaminated sites. HILs have only been developed for a limited number of carcinogenic substances as general methodologies do exist for conducting risk assessments for carcinogens in any environmental media and these are applicable to carcinogens in soils. The NHMRC Toxicity assessment for carcinogenic soil contaminants (1999) that describes a modified Benchmark Dose methodology (mBMD) has not as yet found general acceptance among regulators and assessors, but could possibly be revised to achieve acceptance. The NHMRC is currently reviewing the document to assess its currency.

Options

The following options are presented for consideration and discussion.

Option	Action	Ramifications
1	Retain current guidance	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Develop HILs for a priority list of carcinogenic contaminants.	This would require considerable technical input and extensive consultation, and there is no guarantee that any agreed HILs would be developed for all the agreed contaminants due

Option	Action	Ramifications
		to resource constraints. A preliminary step of evaluating methodologies for assigning HILs to carcinogens would need to be conducted.
3	Evaluate existing methodologies for risk assessment of carcinogens in site assessment.	This would require cooperation of national bodies and management by a peak body such as the NHMRC.

Question 2.2.2.1:
a) Which is your preferred option(s) and why?
b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.2.3 Groundwater Investigation Levels (GILs)

Background

The current GILs in Schedule B(1) of the NEPM are based on the ANZECC *Australian Water Quality Guidelines For Fresh And Marine Waters 1992* and the NHMRC/ARMCANZ *Australian Drinking Water Guidelines 1996*. The framework for the risk-based assessment of groundwater contamination associated with site contamination utilising GILs is provided in Schedule B6. The majority of submissions to the Issues Paper supported the updating of the GILs to the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, ANZECC and ARMCANZ 2000 (WQG 2000)) and the *Australian Drinking Water Guidelines*, NHMRC & National Resource Management Ministerial Council, 2004 (ADWG 2004).

Some submissions indicated that the NEPM should not duplicate existing national guidance and considered that appropriate references would be sufficient for defining GILs. Other comments were that acceptable soil criteria, protective of groundwater uses, needed development and that inconsistency had arisen due to differences in State policy overriding use of NEPM GILs. Consequently, it would be more relevant to provide a decision process for selection and use of GILs.

More detailed proposals involved derivation of GILs from first principles, using toxicity data (such as chronic 'no observable effect concentration' and/or short-term acute toxicity data) known to cause adverse effects on groundwater dwelling organisms, and methods consistent with the WQG 2000 approach. Other submissions accepted the merits of use of updated water quality guidelines but sought additional guidance on their relevance in assessment.

Varied perspectives on the need and nature of further guidance ranged from clarification of the use of GILs as investigation levels at the point of extraction and response levels at the point of use to abandonment of this approach in favour of site- specific direct assessment of the potential damage to receptors. Guidance was also sought on the development of GILs for Light Non-Aqueous Phase Liquids (LNAPL) such as TPH compounds and Dense Non-Aqueous Phase Liquids (DNAPL) such as chlorinated solvents that are denser than water and relatively insoluble and accumulate at the base of groundwater aquifers causing ongoing contamination by slow dissolution and leaching.

Options

The following options for GILs are presented for consideration.

Option	Action	Ramifications
1	Retain the existing guidelines	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Update the GILs to the WQG 2000 and ADWG 2004.	Updating is essentially editorial and is consistent with the intent of the original NEPM as discussed in the 1999 Summary Response document.
3	Delete tabulated water quality criteria for GILs in the NEPM and reference relevant water quality guidelines under WQG 2000 and ADWG 2004.	Regular users could prefer this approach. It may be convenient for a variety of users to include relevant data tables for reference eg Table 3.4.1 of the WQG 2000 showing trigger values for fresh and marine waters.
4	Provide clearer linkages between Schedules B1 and B6 of the NEPM for the application of GILs	This may overcome confusion about the application of GILs.
5	Revise Schedule B6 on risk based assessment of groundwater contamination and provide greater prescription on developing site-specific criteria based on land use and exposure pathways, potential for receptor damage and the degree of protection required.	This approach would require further consideration of the contaminants in soil and their impact to groundwater and Consideration would also need to be given to jurisdictional groundwater policies and local groundwater protection plans.
6	Develop GILs from first principles that can be applied to a variety of groundwater ecosystems, beneficial uses and potential land uses.	This is an ideal approach, however it would incur high costs with relevant research and a long development period and consultation.

Question 2.2.3:

a) Which is your preferred option(s) and why?

b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.3 SUBSTANCES

2.3.1 Total Petroleum Hydrocarbons

Background

The presence and impact of Total Petroleum Hydrocarbons (TPH) compounds are important in contaminated sites assessment because of the importance of petroleum to the economy and industry, and because of the frequency with which former fuel storage and sales sites are being assessed and converted to other uses.

There was a strong response from submissions on the Issues Paper on the need for Investigation Levels and from where these might be adopted. Many of these suggestions drew on work done recently, in Australia and overseas. There was general agreement that the aromatic components of petroleum mixtures were the major contributors to risk, and that further information was

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needed to ensure that all the priority compounds in this group had Investigation Levels assigned to them.

However, choosing from the range of approaches to developing Investigation Levels, or establishing site criteria, still requires further consideration. Some mechanisms for choosing from the array of data and pre-existing site criteria were canvassed in the submissions, but there was sufficient diversity of opinion to warrant further exploring of options.

TPH is not a single compound, being intended as a measure of the extent of contamination by petroleum mixtures. It is based on relatively unsophisticated measurement technology, which has now been supplanted by advances in analytical and computing technology. The use of this parameter in assessing environmental risks is limited by the lack of criteria with which to compare site condition and limited information on the risk posed. This latter factor is influenced by the availability of information both on the hazard/toxicity of the petroleum components and the possible exposure pathways from petroleum in soils and in groundwater.

Options

The following options for TPH are presented for consideration.

Option	Action	Ramifications
1	Retain the present guidance in the NEPM.	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Adopt existing site criteria, based on overseas or Australian values, for TPH as presently defined. This would entail selecting criteria.	This may not meet stakeholder needs in a timely manner due to the need to decide on criteria. However, it may be faster than attempting to develop new criteria from the beginning
3	Incorporate within the NEPM specific guidance on the risk assessment methodologies to be used when petroleum hydrocarbons are encountered, ensuring that all the most common exposure settings are included.	This may not fully address the issue if there is exposure settings not included.
4	Define TPH within the NEPM so that it is understood what the term means, and develop or adopt relevant criteria based on this. This may be linked with specifying laboratory methods for identifying and quantifying hydrocarbon components.	It may not be possible or practical to agree on laboratory methods, nor feasible for laboratories to change their methods.
5	Replace reference to TPH with reference to the aliphatic, aromatic and polycyclic aromatic hydrocarbons, as appropriate. Include within the NEPM site criteria or Investigation Levels for the specified fractions.	While this may provide greater clarity for conducting risk assessments, the development of criteria may not happen in a timeframe that meets all stakeholder expectations.
6	Provide specific guidance on Investigation Levels for aliphatic and aromatic (monocyclic & polycyclic) hydrocarbons.	While this may provide greater clarity for conducting risk assessments, the development of criteria may not happen in a timeframe that meets all stakeholder expectations.

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Option	Action	Ramifications
7	Adopt as standard, the new analytical methods that allow better speciation of aliphatic and aromatic hydrocarbons.	This option may represent a resource/cost burden on industry if some laboratories do not have the equipment that is required for the new analytical methods.

Question 2.3.1:
a) Which is your preferred option(s) and why?
b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.3.2 Fuel additives

Background

In assessing the environmental impacts of fuels, most focus tends to be on the petroleum products present, which are the bulk of the material. However, small amounts of additives in fuel may add appreciably to the health and environmental risks arising from the presence of fuels in soils or groundwater. However, Australian data in defining the scope of the problem arising from these additives are scarce. This can be attributed to the proprietary nature of many of the additives used, the number of suppliers in the fuels market with individual additives, the use of fuel imported directly to Australia and the ease with which fuel from different sources may be mixed at any one location.

Submissions to the issues paper were generally supportive of inclusion in the NEPM of guidance related to fuel additives, and of development of Investigation Levels for the most commonly used or well-known additives.

There was an almost equal division among submissions on the Issues Paper on the development of specific guidance for the assessment of fuel storage sites. One approach might be to test any proposed modifications to guidance on site assessment against the requirements of a site assessment at a fuel storage site.

Options

The following options for fuel additives and fuels storage sites are presented for consideration.

Option	Action	Ramifications
1	Do not change current NEPM guidance	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Develop, or adopt existing, criteria, for specified fuel additives based on overseas or Australian values	While this might be readily done, it is dependent on the availability of criteria for additives that have been used in Australia.
3	Derive Investigation Levels for common fuel additives.	The time taken to derive these Investigation Levels may not meet stakeholder expectations, and duplicate work already done elsewhere. This may not be worthwhile given the number of additives actually used, and their distribution or prevalence of use.

Question 2.3.2:
a) Which is your preferred option(s) and why?
b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.3.3 Asbestos impacts

Background

Asbestos may be encountered in the assessment of site contamination as bonded (asbestos sheet materials) or as free fibres (eg insulation or lagging). The main exposure pathway is through inhalation, but the setting of soil guidelines is complicated by the absence of reliable and validated data on the relationship between soil and air levels of respirable fibres.

The different asbestos fibre types have differing physical, chemical and biological properties resulting in different potential risks to human health. The dose-response characteristics of the various fibre types have been extensively studied, and a number of them indicate that there may be a threshold concentration for the onset of the effects of asbestos. The risk associated with site contamination by asbestos cement products is considered low as the fibres are bound together in a solid cement matrix. However, the presence of asbestos-containing materials on sites may pose aesthetic and practical limitations as well as health-based limitations on potential land uses. It is currently general practice to use qualitative methods in assessing the extent of asbestos contamination due to the unusual nature of this substance and the difficulties of determining its concentration in soil.

The issues in dealing with asbestos are:

- whether appropriate assessment has been undertaken to implement a suitable remediation strategy
- to ensure the sustainable and adequate protection of human health and the environmental for the reasonable and usual long-term use of a site
- the health management measures necessary during the conduct of investigations and particularly any remediation activities
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It is noted that asbestos receives only very nominal consideration in the NEPM and that Schedule B(7a) does not include a numeric HIL for asbestos. Unofficial soil levels of 0.001% have been proposed in the United Kingdom, below which no further action is required. Clean up levels between 0.25% and 1% is used by various regions of the US EPA. Victoria has a 1% land fill criterion. In Manukau City Council, New Zealand, where extensive remediation of asbestos cement fragments has occurred, a semi-quantitative estimate of 0.001% asbestos content has been accepted as a guideline, based on the mass of fibres in handpicked samples and the mass of soil examined. The Australian Contaminated Land Consultants Association document *Asbestos in soils ACLCA code of practice* (2001), suggests a HIL guideline value (0.01% fibres in soil). These numbers are not HIL's nor have they been endorsed by Australian governments and suggest a significant disparity. The setting of soil guidelines is complicated by the absence of reliable and validated data on the relationship between soil and air levels. The variable composition of many sites, and the various types and conditions of asbestos waste, creates difficulty in developing representative sampling plans and interpreting the results.

New guidance materials have become available since the publication of the NEPM including: the enHealth Council document *Management of asbestos in the non-occupational environment (*2005);NOHSC documents such as the *Code of Practice for the Safe Removal of Asbestos 2nd ed.* (2005)] and the *Code of Practice for the Management and Control of Asbestos in Workplaces* (2005).

Options

The following options for asbestos are presented for consideration.

Option	Action	Ramifications
1	Retain existing guidance in NEPM	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	The NEPM be revised to provide more information relating to the investigation and assessment of asbestos issues.	Appropriate guidance could be incorporated or referenced within the NEPM. An extension of this option is that the NEPM could distil the relevant information from these documents and produce a single guidance document. Such guidance would include a methodology for qualitative assessment.
3	The NEPM be revised to provide guidance for quantitative assessment including a HIL.	The practical difficulties of a quantitative limit include the current lack of consensus on the technical aspects of sampling and analysis.

Question 2.3.3:

a) Which is your preferred option(s) and why?

b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.3.4 Persistent Organic Pollutants

Background

Australia is a signatory to the Stockholm Convention on Persistent Organic Pollutants (POPs Treaty) and is currently developing a National Implementation Plan to manage our obligations under the treaty. Production, import and use of aldrin, chlordane, DDT, dieldrin, hexachlorobenzene, heptachlor, endrin, and toxaphene are not permitted in Australia. Production and import of PCBs are also not permitted in Australia, with phase-out of existing PCBs being managed under the National Strategy for the Management of Scheduled Waste. HILs have already been developed for the POPs that are commonly found in contaminated sites such as PCBs, Aldrin/dieldrin, chlordane, DDT, and heptachlor. There are six chemicals or groups of chemicals listed in the POPs treaty for which Australia has no HILs, including dioxins (polychlorinated dibenzo-p-dioxins) and furans (polychlorinated dibenzofurans). There is currently no consistent national system for collecting information on all the POPs chemicals.

Submissions were generally supportive of developing HILs for those POPs that currently do not have one, with the exception of the dioxins and dioxin-like furans. Several submissions felt that HILs should only be developed as required in a prioritised manner. There was qualified support for the development of guidance on the use of "indicator" substances to screen sites for the potential presence of dioxin-like substances.

Options

The following options for POPs are presented for consideration.

Option	Action	Ramifications
1	Retain existing guidance in the NEPM	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Develop HILs in a prioritised fashion, for all non-dioxin-like POPs that currently do not have one.	Such HILs may provide a useful set of guidelines for input into the overall national management strategy for POPs, but may also lead to unnecessary and burdensome screening of sites for all non-dioxin-like POPs. If screening for such POPs could be limited to sites where site history indicates their likely presence then the existence of HILs would be advantageous.
3	Develop HILs for dioxin-like POPs.	This may lead to expensive, unnecessary and burdensome screening of sites for dioxins, furans and PCBs unless analysis could be restricted to sites where the site history or the presence of an indicator substance suggested potential dioxin contamination.
4	Develop guidance on how "indicator" substances could be used to screen sites for the potential presence of dioxin-like substances.	This may be useful regardless of whether HILs are developed for dioxin-like POPs. However such guidance would need to include comments on the relevance of site history and the reliability of the chosen indicators as dioxin signals.

Question 2.3.4:

a) Which is your preferred option(s) and why?

b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.3.5 Assessment of Impacts from Volatile Substances – Schedule B(7a) & B(7b)

Background

The current NEPM provides limited consideration of volatile substances and, in particular, highly volatile substances are excluded from consideration in setting the current HILs. In this regard, the NEPM states:

> the derivation of soil criteria for volatile substances has been complicated by their complex environmental behaviours and the absence of a generally accepted model that could be used to determine exposures. A process for the appraisal of the methodologies and determination of soil criteria is warranted as part of the future work plan that may arise from the Measure.

All respondents to this issue in the Issues Paper called for more guidance and models on the assessment of impacts and risks from volatiles. There were additional comments also made on the analytical approaches and field methods to be employed in risk assessment. Two respondents specifically raised the need for a validated model on the movement of volatiles into buildings in Australian conditions.

Worldwide, there are few major indoor vapour intrusion models and it may be considered that none of these is based on modelling specifically for Australian conditions. For example, the US EPA has issued draft guidance on this issue, and this remains open for comment. It is noted that this draft guidance is not recommended for use at underground storage tanks sites at this time, although further developments in this area are progressing. In Australia, research is continuing in developing and validating an indoor vapour intrusion model for homes with a sub-floor crawl space, with the aim of developing a matrix of health-based investigation levels (HILs) to assist in the health risk assessment and management of site contamination involving volatile substances. Outcomes from this work are unlikely to be available for several years.

It is noted that the CSIRO Land and Water completed a literature review for the Western Australian Department of Environment in July 2004 relating to this issue. Updating and widening this review may assist in providing assistance in including appropriate guidance in the NEPM.

In addition, consideration, as raised in the submissions, should be given to providing guidance on the analytical approaches and field methods used in measuring volatiles and to validate and monitor predictions from any models used in risk assessments. It is recognised that this is a complex and rapidly developing field of science and any guidance in the NEPM should reflect this.

Options

The following options for volatiles are presented for consideration.

Option	Action	Ramifications
1	Retain the existing guidance in the NEPM	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Provide general guidance on the processes and procedures to be considered in undertaking modelling and analytical approaches and field measurements of volatile substances without specifying a particular model or field method.	This option will not provide definitive guidance, and thus may not fully satisfy the suggestions for further guidance by respondents to the Issues Paper. However, it may not need major amendment as this rapidly developing field of science evolves.
3	Undertake a follow up review of worldwide models and field methods and adopt as interim guidance a model(s) and analytical approaches and field methods from a "best fit" scenario most suited to Australian conditions.	This option would provide more specific guidance, and more likely satisfy respondents to the Issues Paper. It is recognised that the NEPM process would limit the application of this option to include updated guidance in this rapidly developing field of science
4	Review processes and procedures, including models, analytical approaches and field methods, currently used in risk	This option by itself, without consideration of the previous option, although providing more specific guidance, would be limited to the

Option	Action	Ramifications
	assessment across Australia by environmental auditors and consultants and adopt as interim guidance a "best fit" scenario as used by the industry as most suited to Australian conditions.	processes and procedures currently used in Australia.
5	Support the research for development and validation of a non-steady state model to assist in the health risk assessment and management of site contamination involving volatile substances specific to Australian conditions and recommend NEPC adopt this as guidance in future reviews of the NEPM.	This option is reliant on the instigation, progress and outcomes of Australian specific research. Adopting an interim guidance approach may be considered consistent with overseas approaches, but may need regular updating as the science evolves.

Question 2.3.4:
a) Which is your preferred option(s) and why?
b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.3.6 Mixtures

Background

Contaminated sites frequently contain mixtures of substances; these may be commonly occurring combinations arising from a single activity or a more unusual mix arising from multiple diverse activities at a site. Guideline values for soil contaminants are generally derived for single substances and there are no established techniques for deriving soil guidelines for such mixtures.

However, methodologies for dealing with mixtures have been developed for human health risk assessment; eg guideline values for total exposure from all sources have been derived for complex mixtures such as dioxins. The NHMRC established a tolerable monthly intake (TMI) for dioxins of 70 pg TEQ/kg bodyweight from all sources combined. This tolerable intake includes polychlorinated dioxins, polychlorinated furans and dioxin-like PCBs, as specified under the WHO 1998 TEF scheme. The substances included in the scope of the TMI have been grouped as having a common mechanism of action and ranked according to potency and assumed additive effects. There are other methodologies such as the USEPA Hazard Index that allow the grouping of dissimilar substances according to their common mechanism of action. It is much more difficult to develop methodologies for human health or ecological guidelines for mixtures that may exhibit synergistic and antagonistic effects.

As a comparison, the WQG 2000 provides a method for estimating the toxicity of mixtures in water using a general formula. The WQG also suggest that the best method to take into account the toxicity of mixtures is direct toxicity assessment of the concerned water. Direct toxicity assessment is a complementary method adopted in many OECD countries to characterise the toxicity of wastewater and establish discharge criteria. (ANECC/ARMCANZ 2000).

Options

The following options for mixtures are presented for consideration.

Option	Action	Ramifications
1	Retain the existing guidance in the NEPM	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Provide guidance on deriving guideline values based on a review of any or all of the following: • published information on the integrated toxicity of several commonly found mixtures • published information on current best practice, including the utility of probabilistic modelling • the use of direct toxicity measurements to measure the effect of mixtures, including the use of suitable biomarkers	There are some practical difficulties with this option including its prioritisation within the overall NEPM review process. However it is clear that further work will need to be undertaken before useful information can be incorporated into the derivation of investigation levels.

Question2.3.5:

a) Which is your preferred option(s) and why?

b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.4 DATA QUALITY OBJECTIVES, LACK OF VERTICAL DELINEATION

Background

It is the experience of regulatory agencies that many sites are not being adequately investigated in terms of sufficient and valid field data being collected, sufficient vertical delineation of contamination, and the adequacy of information to enable decisions on management of contamination to be made.

These gaps may occur because neither the Data Quality Objectives (DQOs) of the investigation nor a conceptual model of the site during the planning of site investigations are properly prepared and considered.

2.4.1 Data Quality Objectives

Data Quality Objectives will need to be identified and considered in the scoping and planning of soil and groundwater investigations to ensure that the information obtained is sufficiently robust to achieve the objectives of the investigation. The DQO process is used to define the type, quantity and quality of data needed to support decisions relating to the environmental condition of a site.

Most submissions indicated that more guidance on data quality objectives is required to standardise methodologies and consolidate current practices. DQOs were noted as being particularly critical where analytical procedures are many and varied. More guidance would minimise the uncertainty in technique selection and would increase the confidence of regulators and consent authorities in the information provided. Submissions suggested the guidance

include a review of QA/QC procedures. It is noted that QA/QC procedures need to be transparent and verifiable.

Options

The following options for DQO are presented for consideration.

Option	Action	Ramifications
1	Retain existing guidance in the NEPM	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Provide general guidance on identifying and considering DQOs without providing lists of DQOs for specific investigations.	It is anticipated this would require a literature search and careful documentation
3	Provide detailed guidance on identifying and considering DQOs that includes a review of QA/QC procedures. Guidance needs to consider varying scenarios and lists of DQOs for specific investigations and contaminants of concern.	It is anticipated this would require a literature search and assessment so that the required details could be provided

Question2.4.1:

a) Which is your preferred option(s) and why?

b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.4.2 Collection of Field Data

The largest gaps in the investigations completed are in the collection of field-based information such as:

- soil type and soil properties
- detailed field observations
- site specific information about hydrogeological conditions (instead of field measurements, consultants use generic published parameters and assumptions for input into numerical models)
- depth of sample collection (this information is generally obtained for soil samples, but not for groundwater samples where it is important, as stratification of substances may occur in an aquifer).

Gaps in the collection of field data at the investigation stage mean that significant uncertainties are created in the application of numerical models and fate and transport models for contaminants. As a result, risk assessment and management decisions regarding remediation options, are often rendered difficult which may lead to inappropriate decisions.

Submissions to the Issues Paper generally indicated that the collection of field parameters should be encouraged and further guidance would be useful in achieving the collection of appropriate parameters for a range of potential contaminants and site conditions. Submissions indicated guidance should be provided on the preferred methods of data collection and the limitations of the data obtained.

Submissions suggested guidance be provided on field parameter objectives to provide a basis for parameter selection and incorporation, while allowing for professional judgement to be incorporated. Most submissions indicated that checklists would be beneficial in ensuring the collection of appropriate field parameters and assessing whether appropriate field data had been collected. However, there was concern that the range of parameters could make such a checklist overly cumbersome.

Options

The following options for collection of field data are presented for consideration.

Option	Action	Ramifications
1	Retain existing guidance in the NEPM	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Provide details of the field parameters that should be collected depending on the objectives of the investigations and the contaminants of concern.	This would require sourcing of the appropriate information and careful documentation relating the field parameters to the objectives of the investigation and contaminants of concern
3	Provide checklist (or checklists) for field use that detail the parameters that should be collected based on the objectives of the investigation and the contaminants of concern.	The requirements to complete this task are similar to the previous option with additional documentation required. It is anticipated that a single checklist could be developed that would address the majority of situations. (It would be unrealistic to attempt to provide checklists for all possible investigation objectives and contaminants of concern)
4	Provide checklists as a separate Internet tool that can be updated, altered or expanded.	This would require the establishment and maintenance of an appropriately linked web based data tool in addition to the tasks indicated for the options above.

Question 2.4.2:
a) Which is your preferred option(s) and why?
b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.4.3 Delineation and Characterisation of Contamination

Section 5.2.6 of Schedule B(2) "Delineating the Plume" refers to lateral and vertical variability in contamination (groundwater) being critical in targeting remediation.

Delineation and characterisation of contamination in all relevant media – soil, sediment and groundwater – is important to ensure that:

- the extent of contamination is understood so that appropriate data are used for modelling purposes
- the contamination has been adequately defined and characterised both laterally and vertically.

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Submissions received generally noted that delineation of the lateral and vertical extent of contamination is critical and often poorly completed. Further, the information is essential in assessing health and ecological risks. It was suggested that the delineation is used to establish a "criteria boundary" (eg delineation of hydrocarbon compounds to residential criteria).

Suggestions to assist in the delineation of contamination and interpretation of the data included:

- use of the DQO process or equivalent design framework to design site investigations and assessment
- references or links in the NEPM to appropriate published guidance including a detailed statistical approach published by the US EPA
- the use of suitable data presentation such as three-dimensional pictorial presentation
- data presentation that considered the fate and transport potential of the contaminants of concern
- conceptual models for different types of contaminants that consider how they behave in different environments and suggest appropriate methods for their investigation.

Options

The following options for delineation are presented for consideration.

Option	Action	Ramifications
1	Retain existing guidance in the NEPM	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Provide guidance on appropriate methods for establishing the vertical and lateral extent of the contamination.	This would require guidance on appropriate sampling methodologies and data quality objectives to achieve the required delineation. What constitutes delineation is likely to be a factor of the contaminant of concern.
3	Include references or links to published guidance on the delineation of the lateral and vertical extent of contamination.	This would require a literature search and documentation
4	Provide guidance on appropriate data presentation and assessment.	This would require a literature search and documentation.

Question2.4.3:

a) Which is your preferred option(s) and why?

b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.5 GROUNDWATER INVESTIGATION

Background

The NEPM provides guidance on aspects of the investigation of groundwater in Schedule B(2) Section 5. This information provides a basis for groundwater assessment including gathering groundwater data, consideration of site specific conditions, monitoring well construction, sampling and monitoring/delineating groundwater levels and plumes. There is an overview on fate and transport modelling including the limitations of this technology.

Most submissions to the Issues Paper on this matter supported a revision of the Schedule mainly by referencing guidance available in Australian jurisdictions. Some commentators considered that more information should be provided on fate and transport modelling and the potential for attenuation of groundwater over time. Others indicated that specific issues should be more definitively addressed such as preferred well construction and implications for different well types, quantitative data for aquifer characteristics and prevention of cross contamination of both samples and aquifers. Comments were also made that the NEPM should avoid prescription.

All jurisdictions and contaminated land professionals accept the clear linkage of site contamination and associated groundwater impacts for many sites as an issue of concern. There appears to be general consensus for revising and updating groundwater investigation guidance.

Options

The following options for groundwater investigation are presented for consideration.

Option	Action	Ramifications
1	Retain existing guidance in the NEPM.	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Undertake a revision of Schedule B2 Section 5 and update the procedures and methodologies with reference to current guidance provided in Australian and other developed jurisdictions	Updating the Schedule is an approach involving expert consideration of technical developments and guidance that have become available since the making of the NEPM.
3	Make minor revisions to the current guidance and provide more detailed information on groundwater fate and transport modelling	Fate and transport modelling is an area subject to continuous development and usually involves proprietary products

Question2.5:
a) Which is your preferred option(s) and why?
b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.6 LABORATORY METHODS AND TECHNIQUES

Background

Use of sound analytical procedures underpins the assessment of site contamination by providing an element of quality assurance in the generation of data upon which decisions can be made. The NEPM defines procedures for the analysis of some, but not all, commonly encountered contaminants. For those not defined in the NEPM, and for contaminants that are encountered less often, jurisdictions and regulators may determine the appropriate approved analytical techniques to be used in site assessments.

There was a divergence of opinion among the submissions to the Issues Paper on the specification of analytical procedures to use. There was also an apparent misunderstanding of what specifying a procedure means. Some submittors saw it as defining the steps in a procedure. The intention of the authors of the Issues Paper was to explore the issues around specifying which particular (already defined) procedures were to be used for particular analytes.

There was support both for a prescriptive list specifying the procedures to use, and support also for a set of performance standards which analytical procedures would be required to meet. There was little detail provided on what types of performance standards might be suitable, although the role of NATA in accrediting laboratories to use procedures was recognised. In reality, without specifying either a set of procedures to be used, or setting out the performance measures and standards to be met, achieving uniformity in analytical procedures will be difficult. NATA accreditation for a particular test procedure is not accreditation to a technical standard. It is verification that a range of quality assurance measures are in place and being used, and that the results of the test are generally within an acceptable range.

A prescriptive list of analytical procedures could not possibly encompass every contaminant likely to be encountered during site assessment. Nor could it accommodate the emergence of new contaminants of concern.

Some jurisdictions overcome this problem by specifying acceptable sources of analytical procedures that can be relied upon to provide defined laboratory procedures. Examples of these include USEPA, ASTM, APHA and Australian Standards. However, this approach does not fit within the NEPM development framework, in that it would entail endorsement of procedures that are yet to be developed and have not been tested or validated. This approach also relies on the ability of organisations developing procedures maintaining their capacity to produce reliable and robust procedures.

In a similar vein, the submissions to the Issues Paper were divided on the process for approving analytical procedures for contaminants for which there have not previously been procedures. Increased flexibility in the NEPM was identified as an option. However, this, and other options, still did not address which body would have the role of approving such procedures and identifying those that were important. Also, some submissions discussed the monitoring and enforcement of whichever approach was adopted. There was no identifiable body or individual which would enforce the use of standard or specified procedures, or which could monitor that the procedures being used were meeting any specified performance standard. In some jurisdictions, such tasks fall to auditors or third party reviewers, usually by reference to the requirements of Australian Standard *Guide to Sampling and Investigation of Potentially*

Contaminated Soil AS4482.1 and AS4482.2. Whether this approach is adequate is, possibly, still open to debate.

Options

The following options for laboratory methods/techniques are presented for consideration.

Option	Action	Ramifications
1	Retain existing guidance in the NEPM	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Retain the present guidance, but delete the detailed definitions of analytical procedures	This may result in large variability in the conduct of those tests directly described. However, they are all included elsewhere in standard analytical methods references.
3	Replace the present guidance with a list specifying which analytical procedure(s) should be used for the most commonly encountered contaminants, and provide guidance on how to select an analytical procedure for other contaminants	The list so specified may not be able to keep abreast of new developments in methodologies or instrumentation. It would, however, give a prescriptive list.
4	Include within the NEPM a mechanism for periodically reviewing and updating the analytical methods to be used and for which contaminants	This may be a resource-intensive process if there are rapid and frequent developments that need to be accommodated.
5	Replace the present guidance with a list specifying which sources of analytical methods are acceptable for use in selecting procedures	This may not keep abreast of new developments in the absence of a mechanism for updating the NEPM.
6	Develop a list of performance standards that analytical procedures must meet in order to be acceptable under the NEPM. Provide guidance to regulators, auditors and third party reviewers on assessing procedures against these performance standards	This would give flexibility to adapt to new developments in methodologies. However, it would take time to develop and would also require that a monitoring or enforcement mechanism be developed and implemented. The latter may be resource-intensive.
7	Develop a protocol with NATA to ensure that laboratories working in the contaminated sites area are using procedures that meet the performance standards.	This would only occur if NATA saw it as part of its core business. It may take time to develop and would need to take into account resource implications, given that the NATA technical assessors conducting laboratory assessments are volunteers from other laboratories.

Question2.6:

a) Which is your preferred option(s) and why?

b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

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2.7 BIOAVAILABILITY AND LEACHABILITY

Background

The NEPM defines bioavailability as a "measure of the ratio of the amount of chemical exposure (applied dose) and the amount of chemical that enters the tissues of exposed biota (absorbed dose)." The NEPM Schedule B(4) indicates that "where bioavailability data for ingested soil contaminants is unknown, the value of 100% absorption should be used. If bioavailability data are available it can be used providing the values are able to [be] justified". A similar logic is applied to the bioavailability of substances that are inhaled or absorbed through the skin. There is no specific reference in the NEPM to leachability – rather guidance on leachability is limited to some references to USEPA procedures for determining leachability (e.g. TCLP testing).

Though the NEPM supports the use of bioavailability in site-specific risk assessments, it does not include any guidance on how to do this. Some of the HILs incorporate bioavailability considerations but this is not consistently applied in the NEPM risk assessment framework. Research programs carried out in Australia and New Zealand have developed lab-scale procedures for estimating the bioavailability of certain substances, particularly metals. However there is no recognised or accredited laboratory method for estimating bioavailability for the full range of substances in the NEPM.

The majority of submissions on the Issues Paper supported the NEPM providing more guidance on incorporating bioavailability and leachability in risk assessments. Submitters either supported specific guidance on methods for determining bioavailability or more general guidance associated with other aspects of human health and ecological risk assessment.

Some overseas jurisdictions have developed standardised bioavailability estimation techniques. Some submitters suggested the use of methods such as those approved by NATA and other methods specified in WQG 2000. The selection of an appropriate method for incorporation into the NEPM should be based on a consistent set of criteria.

Options

The following options for bioavailability and leachability are presented for consideration.

Option	Action	Ramifications
1	Retain existing guidance in the NEPM.	This may mean that issues discussed in the Issues Paper and public responses are not addressed.
2	Provide no further specific guidance on bioavailability and leachability within the NEPM but provide more explanation of the benefits, uncertainties, and key principles for estimating these parameters.	This option will not provide definitive guidance on the appropriate method for estimating these parameters. However practitioners will have flexibility to select methods they use for specific situations. Any changes to the scientific knowledge on bioavailability and leachability will not require a change to the explanation of benefits, uncertainties, and key principles.
3	Provide clear guidance in the NEPM on appropriate methods through an investigation of alternative methods to	This option will benefit practitioners who feel that the methods specified in the NEPM (e.g. TCLP testing) are not appropriate for specific

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Option	Action	Ramifications
	assessing leachability not specified in the NEPM.	situations.
4	Select a single recognised international method for estimating bioavailability and provide a reference to this model in the NEPM Schedules B(4) and B(5).	This option will provide certainty to users of the NEPM. However the selection of a single method will limit flexibility in specific situations.
5	Provide a list of international, Australian, and New Zealand bioavailability estimation methods, including lab-scale methods, for consideration by users of the NEPM during site-specific risk assessment.	This option will provide a good level of flexibility for practitioners. There may be disagreement between practitioners (e.g. regulators and industry) over the most appropriate method to apply. This option will not provide definitive guidance on the best method to apply.
6	Develop in collaboration with researchers in Australia and New Zealand NEPM-specific methods for estimating bioavailability and leachability.	This option will result in a method that will likely be accepted by practitioners. It will be expensive and time-consuming to develop a NEPM-specific method. It may be possible to alter an existing method to save time and expense.
7	Specify a default set of bioavailability factors for certain contaminants (e.g. arsenic) and use these to modify the existing HILs, EILs or soil exposure factors.	This is the simplest option but provides the least amount of flexibility for specific situations. The determination of the default factors may require further discussion and debate.

Question 2.7:
a) Which is your preferred option(s) and why?
b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.8 COMMUNITY CONSULTATION

Background

The assessment of site contamination can become a major issue of public anxiety, particularly when a site has actual or perceived adverse health or environmental impacts from previous land uses. The concerns can become the major driver for any actions or works associated with such sites. There have also been instances where contamination concerns are exacerbated due to public opposition to the proposed site development. It is more common for site management or remediation activities to initiate public complaints from offensive odours, other fugitive air and water emissions, excessive noise, truck movements, traffic disruption and difficulties with access to private property.

Schedule B8 has been directed to community consultation associated with site assessment. However, many of the principles outlined are applicable to programs for site cleanup. It is an important consideration in potentially contentious sites that the community is informed from the early stages of site assessment regarding the assessment program, the means by which potential impacts will be managed and how the process may relate to subsequent works.

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The majority of submissions to the Issues Paper considered that the current NEPM guideline adequately addressed the issues of community consultation and risk communication. Some considered that the guideline should reflect new developments and approaches to risk communication.

Detailed comments questioned reliance on public meetings and their limitations in obtaining representative public views of acceptable risk. The use of checklists for risk communication points and consistency with enHealth risk assessment guidelines were proposed.

Options

The following options for community consultation are presented for consideration.

Option	Action	Ramifications
1	Make no amendments to the current guideline	This approach has general support
2	Undertake minor revisions to the guideline to expand information on risk communication approaches utilising, and make reference to, current related guidance on risk communication that may be available in Australian jurisdictions.	There is growth in jurisdictional regulation requiring professional risk communication for issues of public concern. Updating the guideline may improve national consistency in approaches to this problem.

Question 2.8:
a) Which is your preferred option(s) and why?
b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

2.9 THIRD PARTY AUDITOR ACCEPTANCE AND COMPETENCY OF CONSULTANTS

Background

The specialised multidisciplinary nature of contaminated site assessment and the application of legislation in most jurisdictions to address site contamination issues in the development process has resulted in the growth of private sector services and specialised consultants in this area. Consultants need a range of competencies, relevant qualifications and experience and need to be able to identify and access specialist advice in areas beyond their expertise.

Most Australian jurisdictions utilise a system of independent professional certification of the assessment work of consultants by third party auditing or review. Schedule B10 of the NEPM provides a basis for jurisdictions to accredit such persons and identifies relevant competencies, experience, ethical behaviours and professional associations. Accredited persons undergo expert panel appraisal and are typically more senior consultants with demonstrated advanced skills in core competencies, specialist support teams and independent audit/review capability. Some jurisdictional agencies appoint persons to undertake audits with conditional appointments.

Schedule B10 does not provide guidance on acceptable competencies for consultants working in contaminated site assessment. Providing guidance on minimum requirements for qualifications and experience for consultants preparing assessment reports for audit or statutory decisions

may assist with national consistency, adequate quality standards and public confidence in the work undertaken. This issue has only limited legislative prescription in Australia. While audit systems should ensure that adequate quality is provided, the process is not used for all site assessment work in Australia. The provision of guidance on appropriate competencies for consultants may assist in consistent decision making for jurisdictions, auditors/reviewers, various stakeholders and clients including property owners, developers and financiers.

Submissions to the NEPM on the adequacy of the current guideline for auditor accreditation generally considered the framework to be sufficient to provide an adequate standard of professional overview of site assessment.

Some submissions considered that the guideline was beyond the scope of the NEPM and that individual States should determine the competency requirements for third party auditors/reviewers. Others called for a national accreditation process, more detailed guidance on competencies and adoption of systems that are comparable to requirements for full membership of professional bodies following a period of accumulation of relevant experience.

There was majority support in submissions to the Issues Paper for further guidance on the competency of consultants. Comments included shortcomings in consultant competency, the need for access to a competent support team and specialist advice, and usefulness to stakeholders and clients to balance selection of consultants on lowest tendered price.

Some submissions did not consider that there was a need for guidance on this issue in the NEPM and others indicated that, while provision of advice on minimum qualifications and experience may have benefits, it could be better to leave the issue to market forces.

Options

The following options for auditor and consultant competencies are presented for consideration.

Option	Action	Ramifications
1	Leave the guideline in its current state without changes or additions.	This approach will not address issues raised by stakeholders
2	Delete the guideline from the NEPM.	Auditor systems and appointment processes are considered implementation issues for jurisdictions, however, some Authorities use this Schedule to operate their third party auditing arrangements
3	Revise the guideline providing additional guidance on third party auditor/reviewer competency and accreditation issues.	Updating of the guidelines may promote greater national consistency in auditor appointment processes
4	Revise and extend the current guideline to include acceptable qualifications and experience of consultants for jurisdictional and stakeholder use.	This may more clearly establish the basis for professional practice in site contamination and generally improve public confidence in work standards.

Question 2.9:

a) Which is your preferred option(s) and why?

b) Do you have an alternative solution to offer? If so, please describe and explain the benefits

3 WHERE TO FROM HERE?

3.1 YOUR VIEWS ARE IMPORTANT

3.1.1 Making a Submission

NEPC encourages you to express your views, and to make available any information that you consider pertinent to the review of the Assessment of Site Contamination NEPM. Your input will ultimately ensure that when NEPC makes a decision to vary/not vary the NEPM that decision can be made on the basis of the best possible information available.

Written submissions on the discussion paper should be sent to:

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The closing date for submissions is 2 June 2006

All submissions are public documents, unless clearly marked "confidential", and may be made available to other interested parties, subject to Freedom of Information Act provisions.

3.1.2 Form of Submission

An electronic form for lodging comments is available. The form can be emailed to you by the NEPC Service Corporation or downloaded from the NEPC website (www.ephc.gov.au). This form can be filled out and submitted electronically. Consideration of your submission will be facilitated if it is provided, if possible, in this format. Should you wish to provide your comments in another format, submissions may be made in hardcopy, on a 3.5 inch floppy disk or CD, or emailed to mgilbey@ephc.gov.au.

To allow ease of photocopying, hardcopy submissions should be unbound. Electronic submissions should preferably be provided as a Word for Windows file.

3.2 THE NEXT STEPS

The paper examines options to address issues such as the derivation and use of ecological-based investigation levels and health-based investigation levels, investigation levels for substances currently not included in the NEPM, various aspects of assessment procedures and quality control mechanisms, community consultation, and consultant competencies. It is particularly aimed at establishing preferred options to recommend to NEPC to consider in initiating potential variations to the NEPM.

Public consultation will be undertaken on this paper and submissions called. Results of consultation and submissions will contribute to the development of the NEPM Review Report in which recommendations to initiate a variation to the current NEPM, which reflects the outcomes of the consultation with stakeholders, will be made to NEPC.

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4 ACRONYMS

ADI	Acceptable Daily Intake
ADWG	Australian Drinking Water Guidelines
ANZECC	Australia and New Zealand Environment and Conservation Council
APHA	American Public Health Association
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
ASTM	American Society of Testing and Materials
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DNAPL	Dense Non-Aqueous Phase Liquid
EIL	Ecological Investigation Level
EPHC	Environment Protection and Heritage Council
DQO	Data Quality Objectives
GIL	Groundwater Investigation Level
HIL	Health-based Investigation Level
JRN	Jurisdictional Reference Network
LNAPL	Light Non-Aqueous Phase Liquids
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NGO Advisory Group	Non-Government Organisation Advisory Group
NHMRC	National Health and Medical Research Council
NOHSC	National Occupational Health and Safety Commission
NWQMS	National Water Quality Management Strategy
OECD	Organisation for Economic Cooperation and Development

PCB	Polychlorinated Biphenyls
POPs	Persistent Organic Pollutants
QA/QC	Quality Assurance/Quality Control
RBCA	Risk-Based Corrective Action
SSD	Species Sensitivity Distribution
TCLP	Toxicity Characteristic Leaching Procedure
TDI	Tolerable Daily Intake
TEF	Toxic Equivalency Factor
TEQ	Toxic Equivalents
TMI	Tolerable Monthly Intake
TPH	Total Petroleum Hydrocarbons
USEPA	United States Environmental Protection Agency
WHO	World Health Organisation
WQG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality

5 REFERENCES

Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, published by Australian and New Zealand Environment and Conservation Council (ANZECC) and the National Health and Medical Research Council (NHMRC), January 1992

Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Paper No 4, October 2000

Contaminated Sites: Guidelines for the NSW site auditor scheme, NSW Department of Environment and Conservation, June 1998

Guide to Sampling and Investigation of Potentially Contaminated Soil, Part 1: Non Volatile and Semi Volatile Compounds, AS4482.1, Australian Standard, 2005.

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OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), November 2002 http://www.epa.gov/epaoswer/hazwaste/ca/eis/vapor.htm)

Both of the following papers are available directly from the PROCEEDINGS OF THE FIFTH NATIONAL WORKSHOP ON THE ASSESSMENT OF SITE CONTAMINATION May 2002 from the EPHC website (http://www.ephc.gov.au/nepms/cs/workshop_con_sites.html).

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