



*National Environment Protection
(Assessment of Site
Contamination) Measure
Review*

Review Report

Prepared for the National Environment Protection Council

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1. EXECUTIVE SUMMARY

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

This review is the first review of the NEPM since it was made in 1999. In summary, this review assessed whether the current NEPM is operating efficiently and effectively, examines operational issues, considers international experience, and considers where improvements should be made.

Stakeholder and community acceptance

The NEPC Service Corporation receives regular reports on the number of hits to the EPHC website. Since its release in December 1999, the Assessment of Site Contamination NEPM and a number of its associated schedules have consistently been the most downloaded of national environment protection measures and associated documents (130,000 per annum), by consultants, educational institutions and members of the public, from within Australia and internationally.

The NEPC Service Corporation also receives phone calls or e-mails from members of the public regarding the application or use of NEPMs. The bulk of public contact is in relation to the Assessment of Site Contamination NEPM. In most cases, the queries relate to obtaining a specific guideline in the NEPM or how the NEPM applies in certain jurisdictions. Occasionally, technical advice on the application of a guideline is required. This demonstrates that the NEPM has been well received as the national guideline on assessment of site contamination and that it is relatively user friendly.

Review issues

It is clear from this review that the NEPM has delivered benefits to its users. To date, the NEPM has satisfied many, but not all of the needs of most groups. However, the NEPM does have potential to better meet these needs and deliver greater benefits to jurisdictions and their stakeholders. For example, it is evident that there are concerns about inappropriate use of investigation levels as clean-up criteria that result in unwarranted cost in site remediation and inadequate guidance regarding asbestos matters.

Many submissions supported revision of the Ecological Investigation Levels, Health-based Investigation Levels, Groundwater Investigation Levels and the provision of additional guidance in the Schedules for assessment procedures for a range of substances, risk assessment methods, laboratory methods, consultant competencies and community consultation processes. These revisions would assist in addressing concerns raised during consultation.

In addition to the issues raised in relation to the application of the NEPM, there was support from stakeholders for national guidance on management and remediation approaches.

The current approaches to the assessment and management of contaminated land varies across the OECD countries. Only three (USA, Canada, UK) are presented in brief detail in this report. The approaches used by these three countries are similar to the Australian policy framework.

Internationally, there is an increasing trend in policy development to address environmental sustainability issues and spatial planning issues simultaneously. Most OECD countries, including Australia, have yet to adopt a policy framework which would give full expression to this approach.

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Recommendations

There are 27 recommendations arising from the review. These recommendations are summarised here on the basis of priority. Some of the recommendations are high priority, of which some involve significant consultation and scientific research to produce a practical and scientifically based outcome. Other recommendations can be addressed by a jurisdictionally based project team requiring minimal resourcing. A full list of recommendations can be found in section 2 of this report.

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High priority areas

This review found that the areas for **priority attention** are:

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- **NEPM framework effectiveness (Recommendation 1)**

Revise the NEPM policy framework and Schedule A to improve clarity and understanding of the fundamental site assessment principles and emphasise the appropriate use of the NEPM, in particular to address the misuse of investigations levels.

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- **Ecological investigation levels (Recommendations 3 and 4)**

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Development of an agreed national approach to deriving Ecological Investigation Levels (EILs). The available information on the toxicity of soil contaminants to specific Australian species continues to be an area of deficiency in the establishment of EILs and this issue was raised in many submissions. However, there are currently some large terrestrial ecotoxicology studies being undertaken within Australia that should be able to provide data for a limited number of metals. Revising existing Interim Urban EILs, taking into account current additional data, is a priority to address immediate needs.

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- **Health-based investigation levels (Recommendations 5, 6,7,8,14,15)**

A revision of existing Health-based Investigation Levels (HILs) in the light of current knowledge, leading to more accurate and often less conservative numbers, the derivation of additional HILs for priority substances, and the development of HILs for a priority list of carcinogenic contaminants

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The current 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. These recommendations have not yet been included in the NEPM.

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- **Groundwater investigation levels (Recommendation 9)**

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Update the Groundwater Investigation Levels (GILs) to be consistent with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2004* and the *Australian Drinking Water Guidelines 2004*. 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 NEPM needs to be consistent with the recent revisions of both these documents. .

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- **Asbestos (Recommendations 12 and 13)**

Revision and expansion of information in the NEPM relating to the investigation and assessment of asbestos issues. The assessment of asbestos at contaminated sites is

complicated by such uncertainties as the condition of asbestos containing material (ACM) products, mixtures of asbestos types and products, soil types and meteorological conditions. Consequently, the determination of potential human health risks is often highly subjective.

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The assessment of risk for asbestos is also inextricably linked to the consideration of suitable management options. Respondents requested that a consistent approach be defined to allow an effective and defensible regulatory framework to be established.

10 • **Petroleum and other hydrocarbons (Recommendations 10,11, 16,17)**

A follow up review of worldwide models and field methods (including Australia) for the assessment of volatiles, and adopting as interim guidance a model(s), analytical approaches and field methods, from a “best fit” scenario most suited to Australian conditions. This will provide more specific guidance and a more standardised approach to the assessment of volatiles which can be used to determine exposures and derivation of soil criteria.

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The current NEPM provides limited consideration for 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 methodologies and determination of soil criteria is warranted as part of the future work plan that may arise from the Measure.

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25
The development of interim national screening levels for Total Petroleum Hydrocarbons based on existing Australian values with reference to relevant overseas values. Petroleum hydrocarbon contamination in soil and groundwater is of concern in Australia. At least 50% of the contaminated sites being managed or regulated by the authorities in Australia are related to petroleum hydrocarbons. The development of interim national screening values for Total Petroleum Hydrocarbons would ensure national consistency in assessment, provide an efficient screening mechanism for petroleum hydrocarbon contaminants, and provide a useful trigger for consideration of other contaminants.

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35 • **Management and remediation issues (Recommendation 2)**

Section 14 of the *National Environment Protection Council Act 1994* specifies that the NEPC can make “general guidelines for the assessment of site contamination”. However, it is recommended that the *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*, published by ANZECC and NHMRC in 1992, could be revised and updated to provide the guidance that stakeholders in site contamination are seeking of these guidelines in relation to site management.

Other priorities

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45 • **Laboratory methods and techniques (Recommendation 23)**

Inaccurate laboratory data can lead to poor assessment of human health and environmental risk, the potential for poor remediation or site management outcomes and adverse economic implications for site development. There are significant benefits in addressing these concerns for consistent and acceptable practices between laboratories. This issue is considered to be essentially a professional matter that requires input from commercial and government laboratories and related professional associations to determine the most appropriate and up to date laboratory methods for soil and water contaminants.

- **Data Quality Objectives (Recommendation 19)**

The recommendation is to provide detailed guidance on identifying and considering Data Quality Objectives to ensure a minimum level of DQOs in place for conducting site assessments. This would allow some flexibility in choosing an appropriate laboratory method for the analysis, give regulators or project managers the assurance that the data are obtained using scientifically sound procedures and processes, and increase consistency in the quality of risk assessments.

- **Groundwater investigation methods (Recommendation 22)**

The recommendation is to update the NEPM to incorporate reference to current guidance on groundwater investigation methods from Australian and other jurisdictions. This will ensure that sites are assessed using the most up-to-date methodologies capable of providing samples representative of groundwater conditions beneath a site.

- **Mixtures (Recommendation 18)**

The risk assessment of chemical mixtures is considered to some degree in most current risk assessment guidelines. The recommendation on mixtures is to provide guidance on deriving site specific guideline values based on a review of the three outlined areas. This would be a desktop exercise requiring a detailed review of the still evolving literature. The main advantage of a detailed review of this area would be the resulting compendium of current information which could be referred to by the community, consultants and regulators.

- **Collection of field data (Recommendation 20)**

The provision of checklists for field parameters will assist in the development of sampling and analysis programs for sites and will provide a baseline of measurements which should be collected to assist the quality and usefulness of investigations. Checklists will, in particular, provide a good basis for training new practitioners in the field.

- **Delineation and characterisation of contamination (Recommendation 21)**

Providing guidance on appropriate methods for establishing the vertical and lateral extent of contamination is important to ensure that the extent and characteristics of the contamination is understood so that appropriate data are used for modelling and decision making purposes.

- **Bioavailability and Leachability (Recommendation 24)**

A review of current bioavailability approaches, methods and limitations will improve the basis for their application in site assessment. Reviewing all relevant leachate testing procedures and their application and providing clearer guidance on their use will improve nationally consistent assessment practices.

- **Community Consultation (Recommendation 25)**

Undertaking minor revisions to the guideline on community consultation and risk communication will improve national consistency in approaches to problems encountered.

- **Auditor and Consultant competencies (Recommendations 26 and 27)**

Improvements to this guideline relevant to site assessors should further assist stakeholders in selection of appropriate professionals, identify the relevant competencies for individual professional development, and support policy development.

Where to from here

There is a wide divergence in the resources required to develop the recommendations for consideration of a variation to the NEPM. Development of a variation proposal would enable NEPC to determine the extent of future work to address the review recommendations.

2. RECOMMENDATIONS

The review recommendations are listed here in the order they appear in this report.

Recommendation 1

- 5 Revise the NEPM policy framework and Schedule A to improve clarity and understanding of the fundamental site assessment principles and emphasise the appropriate use of the NEPM.

Recommendation 2

- 10 EPHC to initiate an update of the management components of the *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), in 1992.

Recommendation 3

- 15 Develop an agreed methodology for deriving terrestrial Ecological Investigation Levels to revise existing Ecological Investigation Levels, and derive new Ecological Investigation Levels.

Recommendation 4

- 20 Revise the existing Interim Urban EILs taking into account the outcomes of research that has been completed since making of the NEPM including use of phytotoxicity, microbial, and invertebrate ecotoxicity data, and other relevant research, to address issues while awaiting the outcomes of an agreed methodology (Rec. 3).

Recommendation 5

25 Revise existing Health-based Investigation Levels in the light of current knowledge, leading to more accurate and often less conservative values.

Recommendation 6

- 30 Derive additional Health-based Investigation Levels for priority substances.

Recommendation 7

Develop guidance to further clarify the use of Health-based Investigation Levels to counter their inappropriate use as remediation criteria.

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Recommendation 8

Develop Health-based Investigation Levels for a priority list of carcinogenic contaminants.

Recommendation 9

- 40 Update the Groundwater Investigation Levels to be consistent with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2004* and *Australian Drinking Water Guidelines 2004*.

Recommendation 10

- 45 Develop interim national screening levels for Total Petroleum Hydrocarbon fractions based on existing Australian values with reference to relevant overseas values.

Recommendation 11

- 50 Undertake a scoping exercise to determine if there is a need to develop investigation levels for specified fuel additives based on overseas or Australian values.

Recommendation 12

The NEPM be revised to provide more information based on existing documentation relating to the investigation and assessment of various forms of asbestos.

5 **Recommendation 13**

NEPC undertake discussions with relevant stakeholders, including environment protection authorities, health practitioners, the legal fraternity and suppliers of professional liability insurance, to determine appropriate strategies to better communicate the risks of asbestos contamination to the public.

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Recommendation 14

Develop guidance on the relevance of site history and activities which may indicate the need to screen sites for the potential presence of dioxin-like substances, including comments on the use of “indicator substances” where relevant.

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Recommendation 15

Develop Health-based Investigation Levels, in a prioritised fashion, for all non-dioxin Persistent Organic Pollutants that currently do not have one. This work should be conducted as part of the overall Health-based Investigation Level revision process (Recommendation 6).

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Recommendation 16

Update the Western Australian Department of Environment and Conservation review of models and field methods on the assessment of volatiles. Select and adopt as interim guidance in the NEPM a model(s) and field methods most suited to Australian conditions.

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Recommendation 17

Develop and validate an Australian specific non-steady state model for volatile substances to assist in the development of Health-based Investigation Levels for volatile substances.

30 **Recommendation 18**

Provide guidance on deriving guideline values for mixtures based on a review of:

- published information on the integrated toxicity of several commonly found mixtures;
- published information on current best practice, including the utility of probabilistic modelling; and,
- the use of direct toxicity tests to measure the effect of mixtures, including the use of suitable biomarkers.

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Recommendation 19

Provide guidance on identifying and considering Data Quality Objectives that includes a review of current NEPM Quality Assurance/Quality Control procedures. Guidance needs to consider varying scenarios and lists of Data Quality Objectives for specific investigations and contaminants of concern.

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Recommendation 20

Provide checklist (or checklists) for field use that detail the parameters of data to be collected based on the objectives of the investigation and the contaminants of concern. It is anticipated that a single checklist could be developed that would address the majority of situations.

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Recommendation 21

Provide guidance on appropriate methods for establishing the vertical and lateral extent of contamination, which includes references or links to published guidance on the delineation of the lateral and vertical extent of contamination. Also investigate stockpile sampling issues.

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Recommendation 22

Undertake a revision of Schedule B2 (Guideline on Data Collection), Section 5 (Groundwater investigation), and update the procedures and methodologies with reference to current guidance provided in Australian and other developed jurisdictions.

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Recommendation 23

Revise the guideline on laboratory analysis in consultation with appropriate representative laboratory bodies and relevant stakeholders.

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Recommendation 24

Undertake a review of current bioavailability and leachability approaches, methods and limitations to provide general guidance in the NEPM for determining their use and application in site assessment.

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Recommendation 25

Undertake revisions to the *Guideline on Community Consultation and Risk Communication* to expand information on risk communication approaches utilising, and making reference to, current related guidance on risk communication that is available in Australian jurisdictions.

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Recommendation 26

Update the current guideline for acceptable competencies of consultants for jurisdictional and stakeholder use.

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Recommendation 27

Revise the guideline relating to auditors and third party reviewers to reflect current practices in Australian jurisdictions.

3. BACKGROUND TO THE REVIEW

3.1 PURPOSE OF 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 of 1992, 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 (NEPM) 1999 by the National Environment Protection Council was a significant step in ensuring that commitment was met (see Appendix 8.1 for background information on the National Environment Protection Council).

The NEPM is the premier guidance document in Australia for the assessment of site contamination. It addresses a complex area that is particularly subject to new developments in scientific knowledge and new technologies, as recognised during the development of the NEPM.

In developing the NEPM, the National Environment Protection Council (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 site contamination. 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 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."

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, such as the management and remediation of contaminated sites, are outside the province of the NEPC Act and are dealt with through individual jurisdictional policy and legislative frameworks.

Given these complexities the review took account of an extensive range of factors and a significant amount of information from workshops organised by the Technical Working Group and others. The review of the NEPM was initiated in December 2004.

3.2 TERMS OF REFERENCE FOR THE REVIEW

The terms of reference for this review were established by the EPHC, in accordance with Clause 10 of the NEPM.

- “1. The effectiveness of the NEPM in achieving the national environment protection outcome set out within it.
2. The resources available for implementing the NEPM.
3. The need, if any, for amending the NEPM, including.
 - 5 □ whether any changes should be made to the Schedules.
 - whether any changes should be made to improve the effectiveness of the NEPM in achieving the desired environmental outcome set out within it.”

The factors considered in assessing the effectiveness of the NEPM were:

- 10 1. How well is the NEPM achieving the purpose for which it was intended?
2. Its clarity, i.e. is it being used appropriately?
3. Its completeness, i.e. did it contain sufficient guidance to address situations commonly encountered?
4. Its currency, i.e. whether the schedules need updating in light of current technology
15 and knowledge, and
5. Whether issues surrounding the management and remediation of contaminated land impact on the effectiveness of the NEPM.
6. Whether the Australian approach to site assessment is in keeping with international
20 approaches.

This included a review of existing schedules to ascertain their relevance and the need to update information provided. Australia has recently ratified the Stockholm Convention on Persistent Organic Pollutants. The Convention currently identifies some substances for which no Health-based Investigation Levels are available.

3.3 APPROACH TO THE REVIEW

A Review Team was established by NEPC to undertake the review. The Review Team was chaired by the Western Australian NEPC Committee member and comprised representatives from Western Australia, South Australia, Queensland, Victoria, a corresponding member
30 from New South Wales, a representative from the Commonwealth Department of Health and Ageing and an observer from New Zealand’s Ministry for Environment. The Review Team was supported by a Project Manager from the NEPC Service Corporation.

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

3.4 THE PROCESS

The NEPM is pertinent to a number of stakeholders including site assessors, regulators,
40 auditors, property developers, consultants and industry. The NEPM also holds widespread interest for the community.

With this in mind, and in accordance with NEPC procedures, an Issues Paper was prepared and released in June 2005 and a Discussion Paper was released in April 2006 for targeted
45 stakeholder and broad public consultation. This report contains a summary of the outcomes and recommendations based on submissions received and public consultation. The JRN was consulted and agreement reached on the content and structure of this report.

5 The next steps in the process will comprise endorsement of this report by NEPC in November 2006 together with a direction from NEPC to prepare a proposal to initiate a variation process for its consideration in April 2007. The proposal will be developed in consultation with the Jurisdictional Reference Network and will include the process, timeframe and costs for the development of each of the recommendations contained within the review report. NEPC will consider the proposal and make decisions regarding initiation of a variation and the recommendations that it may include.

4. REVIEW ISSUES

The Issues Paper was prepared by the Review Team to assist in the identification and discussion of key issues to be addressed in the review, and on which stakeholder comments were invited in June 2005. 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 meeting of jurisdictional officers involved in site contamination work. The major issues contained within the Issues Paper included:

- assessing NEPM effectiveness;
- investigation levels (Ecological Investigation Levels - EILs, Health-based Investigation Levels - HILs, Groundwater Investigation Levels - 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; and,
- consultant competencies.

4.1 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.

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. Many submissions supported revision of the EILs, HILs, GILs and additional guidance in the Schedules for assessment procedures, consultant competencies, and laboratory methods.

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.

Some submissions raised the need for national guidance on the management and remediation of site contamination.

4.1.1 Assessment of NEPM Effectiveness

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 across jurisdictions. An appropriate standard of

assessment work is required to provide protection of human health and the environment; however, there are no set criteria to assess this standard.

5 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. Submissions to the Issues Paper emphasised issues influencing the effectiveness of the NEPM relating to the individual Schedules of the NEPM. These were dealt with in detail in the Discussion Paper.

10 Some submissions stated that the NEPM should include recommendations to deal with best practice in management and remediation. As the NEPC Act restricts the NEPM to assessment, it was suggested that agreements for management of contaminated sites could be formed at a policy level nationally (through jurisdictional agreement) and endorsed through EPHC.

15 **4.1.2 Investigation Levels**

Investigation levels are the concentration of a contaminant above which further appropriate investigation and evaluation of the impact will be required. Investigation levels provide a 'trigger' to assist in judging whether a detailed site investigation is necessary.

20 The NEPM refers to three different types of investigation levels: Ecological 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.

25 Most submissions suggested that there was misuse of investigation levels in site and risk assessments e.g. use of investigation levels as clean-up criteria. Submissions also suggested that the current investigation levels were based on out of date information and technology, were unnecessarily conservative and that there were many contaminants for which the NEPM did not provide investigation levels. Many 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; and,
- develop HILs, EILs and GILs for persistent organic pollutants (POPs) – although some felt that this would not be a priority for dioxins.

40 **4.1.3 Guidance Issues**

The NEPM 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:

- sites involving fuel storage;
- the investigation and assessment of asbestos contamination;
- the risk assessment of carcinogens;
- the assessment of the impacts and risks from volatile substances;
- application of the Data Quality Objectives process;
- technical aspects of groundwater assessment;

- laboratory methods and techniques;
- bioavailability and leachability;
- community consultation; and,
- the engagement of suitably qualified and experienced contaminated land practitioners.

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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.

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4.2 DISCUSSION PAPER CONSULTATION SUMMARY

Following analysis of submissions to the Issues Paper a Discussion Paper was developed by the Review Team and released for public consultation in April 2006. Thirty eight submissions were received.

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The purpose of the Discussion Paper was to encourage consideration and debate on the range of options put forward to address issues raised during consultation on the Issues Paper. The Discussion Paper examined options to address issues such as the derivation and use of EILs and HILs, 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 was particularly aimed at establishing the options preferred by stakeholders and regulators, so that these could be evaluated against the issues raised and recommendations made to NEPC for its consideration in initiating potential variations to the NEPM.

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Consultation meetings were held in each capital city and one regional centre (Townsville) with 312 people attending.

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There were many cases in which a particular option had the strong support of submitters, while a few cases demonstrated a lack of agreement or lack of strong opinion on the best option to address the issue. In these instances the Review Team was required to assess the best option to recommend based on regulator support and confidence in the most viable and achievable option.

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5. REVIEW OUTCOMES

5.1 ASSESSMENT OF NEPM EFFECTIVENESS

The Purpose and Desired Environmental Outcomes of the NEPM are;

- (1) "...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, land owners, developers and industry",
- (2) "...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".

As stated in section 3.2, the factors considered in assessing the effectiveness of the NEPM were:

1. How well is the NEPM achieving the purpose for which it was intended?
2. NEPM clarity, i.e. is it being used appropriately?
3. NEPM completeness, i.e. did it contain sufficient guidance to address situations commonly encountered?
4. NEPM currency, i.e. whether the schedules need updating in light of current technology and knowledge, and
5. Whether issues surrounding the management and remediation of contaminated land impact on the effectiveness of the NEPM.
6. Whether the Australian approach to site assessment is in keeping with international approaches.

5.1.1 How well is the NEPM achieving the purpose for which it was intended?

Submissions supported the NEPM as an effective and useful instrument for assessing site contamination to achieve the stated purpose and desired environmental outcomes. However, many identified areas in which improvements are required.

The NEPC is required by the *National Environment Protection Council Act 1994* (section 24) to report on the overall assessment of the implementation and effectiveness of NEPMs and to have regard to reports on NEPM implementation from the Commonwealth, State and Territory Governments.

Annual reporting on the effectiveness of the NEPM is based on "General Criteria" specified in the NEPC Implementation Reporting Protocol. "Specific Criteria" in assessing the Assessment of Site Contamination NEPM have not been established. The "General Criteria" are as follows:

- progress in implementing the NEPM
- compliance with NEPM protocols and/or other NEPM reporting requirements
- progress towards achievement of the NEPM goal, the desired outcomes and NEPM standards
- issues arising that reflect on the efficiency and simplicity of the NEPM administration.

Each jurisdiction has differing regulatory and administrative frameworks for implementing the NEPM. Annual report assessments by each jurisdiction can be found in Appendix 8.2. The following provides a summary of assessments of NEPM effectiveness by jurisdictions.

Commonwealth

Commonwealth agencies are implementing and achieving the desired outcomes of the NEPM and have noted that the NEPM's principles have provided a consistent national methodology in the assessment and detection of contaminated sites. However, the Commonwealth suggest that further training and planning when undertaking new works or modification would be an advantage to produce a better environmental outcome.

New South Wales

New South Wales state that the NEPM leads to increased consistency between jurisdictions, which has been advantageous for interactions between the NSW Department of Environment and Conservation (DEC) and equivalent agencies in other states, Territories and the Commonwealth. This process has benefits for all involved parties, as issues relating to assessment of land contamination are consistently managed.

Victoria

In Victoria the NEPM reinforces an existing framework for the management of contaminated sites by providing consistent consolidated guidance on the assessment of site contamination. Some improvements in the consistency of site assessment have resulted from use of the NEPM. Further improvements in consistency are the object of ongoing developments and improvements currently under consideration. The NEPM is well supported by environmental auditors and others in the site assessment industry, with comments indicating that it is of use as a comprehensive source of guidance.

Queensland

The current NEPM has continued as an effective 'technical tool kit' for site assessment for contaminated site professionals operating in Queensland. The quality control procedures applied by the Environment Protection Authority (EPA) in internal review of assessment reports not subject to Third Party Review (TPR) processes involves a review of the practitioners adherence to the NEPM. Additional information is requested where there is poor reporting and NEPM inconsistency.

Western Australia

In Western Australia the *Contaminated Sites Act 2003*, the *Contaminated Sites Regulations 2006* and the administrative and technical guidelines are all based on the elements of the NEPM and comprehensively ensure the establishment of a nationally consistent approach to site contamination in WA. The ecological and human health risk assessment approach will also ensure adequate protection of human health and the environment where site contamination has occurred. December 2006 will see the Act and the Regulations come into effect and will provide clear evidence of the effectiveness of the NEPM in WA.

Western Australia proposes that one factor that has hindered the NEPM's effectiveness is the misuse of ecological and health-based investigation levels as clean up criteria. To make the implementation of the NEPM more effective WA recommended that further guidance is provided on site assessment levels and that site specific clean up levels are developed.

South Australia

South Australia state that the progressive implementation of the NEPM should be instrumental in achieving the NEPM purpose and desired environmental outcomes. However, in SA this desired outcome will be improved with the passage of an enhanced legislative framework for managing site contamination.

Tasmania

In Tasmania the NEPM has been successful in establishing a nationally consistent approach to the assessment of site contamination and has provided a useful reference document. The guidelines in Schedules B1-10 provide clear direction on aspects of site contamination assessment and, when enforced, ensure sound environmental management practices are conducted by practitioners in the field of site contamination assessment.

The NEPM has also brought a greater awareness of site contamination issues to the Tasmanian public and of site contamination assessment standards to practitioners in this field. Progress towards greater protection of human health and the environment has also been achieved but further development is required to broaden the criteria for soil and groundwater health and ecological investigation levels.

Criteria for Soil and Groundwater Investigation Levels set out in Schedule B1 of the NEPM are used as the Guideline Investigation Levels for Tasmania. For criteria not specified in the NEPM, (e.g. Total Petroleum Hydrocarbons (TPH), benzene, toluene, ethylbenzene and xylene (BTEX) for soil criteria, other organic compounds, and asbestos) and until further development of the Ecological Investigation Levels, other relevant guidelines are used such as *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, ANZECC and ARMCANZ 2004, the NSW EPA 1994 *Guidelines for the Assessment of Service Station Sites* or the *Environment Quality Objectives in the Netherlands 1999*. Tasmania state that inclusion of criteria for contaminants listed above, but particularly for TPH for soil and groundwater and BTEX compounds for soil that are commonly identified in the assessment of site contamination would increase the usefulness of the NEPM and will progress the achievement of the NEPM goals and outcomes.

Australian Capital Territory

The Australian Capital Territory is of the view that the NEPM is a valuable resource tool for the assessment of site contamination in the ACT and that the NEPM has also allowed for a nationally consistent approach to site contamination assessment. The ACT states that the effectiveness can be improved by further development of methods for investigating levels for chemicals of concern at hydrocarbon-impacted sites. Hydrocarbon-impacted sites are one of the main sources of land and groundwater contamination in the ACT.

Northern Territory

The acceptance of the NEPM process as a nationally-consistent approach to the assessment of contaminated sites contributed towards the establishment of the NEPM in the Northern Territory. The establishment of the NEPM has provided a common basis for interactions between Agencies in jurisdictions across Australia. Adverse impacts to human health from historical site contamination in the Northern Territory have not been reported to date.

5.1.2 NEPM clarity

A number of issues were raised indicating that further clarification of information in the NEPM is required to improve its application. These include a lack of understanding on the use of investigation levels (EILs, HILs). Details and discussion of these issues, together with recommendations to address them, are presented in subsequent sections of this report.

In addition there appears to be insufficient understanding of the NEPM in the context of process for assessment of site contamination (Schedule A), confusion arising in regard to consideration of aesthetic issues, and the need to improve the clarity and consistency of the NEPM in a number of areas.

Recommendation 1

Revise the NEPM policy framework and Schedule A to improve clarity and understanding of the fundamental site assessment principles and emphasise the appropriate use of the NEPM.

5.1.3 NEPM completeness

The review identified a wide range of issues that needed to be addressed to enhance the completeness of the NEPM. Examples include:

- updating of ecological and human health risk assessment methodologies in line with current practices;
- development of EILs/HILs for substances not currently listed in the NEPM;
- the investigation and assessment of asbestos issues;
- the risk assessment of carcinogens; and,
- the assessment of the impacts and risks from volatile substances.

Details and discussion of these issues, together with recommendations to address them, are presented in subsequent sections of this report.

5.1.4 NEPM currency

The review identified a range of issues that needed to be addressed to ensure the currency of the NEPM, especially the mechanism and timeliness by which new information can be incorporated. An example of this is the need for NEPC to endorse newly updated EILs/HILs/GILs and their inclusion in the NEPM. It was considered that the minor variation process produced by the 2002 amendment to the NEPC Act would provide the mechanism to ensure the currency of the NEPM, recognising however that further information on whether changes are considered ‘minor’ need to be taken into account.

5.1.5 Management and remediation issues that impact on NEPM effectiveness

Section 14 of the *National Environment Protection Council Act 1994* specifies that the NEPC can make “general guidelines for the assessment of site contamination” to enable appropriate site management decisions to be made. Therefore specific guidelines for the management and remediation of site contamination are outside the scope of the NEPM.

As assessment and remediation are closely related, there remains a question as to how national guidance for the remediation/management issues can be addressed without duplicating jurisdictions’ existing legislative and policy frameworks.

Submissions suggested that there would be benefit for national guidance in the NEPM on management and remediation of contamination to be developed. The suggested topics include:

- national consistency in site remediation strategies;
- development of ‘clean up’ or ‘acceptable’ levels;
- addressing aesthetic issues following remediation; and,
- management principles for non-aqueous phase liquids.

Given the scope of the NEPM is limited by the NEPC Act to assessment only, the following options for addressing national guidance on management and remediation issues were considered by the Review Team:

1. Amending the NEPC Act

In 2000 Dr Donald McMichael, an independent consultant was engaged by NEPC to review the NEPC Acts under specified terms of reference. Several of the recommendations related to section 14 of the Acts, which deals principally with the range of environment protection matters that a NEPM might deal with. NEPC's response to the recommendations, which included a proposal to expand the guidelines of the Assessment of Site Contamination to include 'management', was as follows.

"Given our proposal for a new environment council, covering the full range of environmental issues, the question inevitably arises of whether the range of matters listed in section 14 should be significantly broader, and possibly as broad as the subject-matters coverage of the Council itself. Our recommendation is that, when the matters to be covered by the new environment council are determined, the range of issues for which a NEPM might be an appropriate policy instrument will become clearer and can be reviewed by the new council. Given this, and our view that there is no pressing need for amendment of section 14, we recommend that no amendments be made to section 14 until that review has been undertaken."

The NEPC Act is again being reviewed (2006) and a separate process of consultation provides the opportunity for jurisdictions to make representations with regard to this matter.

2. Addressing the management of contaminated sites guidance at a policy level nationally through EPHC.

Submissions supported a national approach to management and remediation. These could be developed along similar lines to *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2004*. These guidelines include advice and criteria for remediation. The guidelines were published in 2000 and the revised edition was released through the EPHC web site in 2004.

While the NEPM has addressed assessment aspects of site contamination, national guidance on the management of contaminated sites has not been revised since the *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*, was published by ANZECC and NHMRC in 1992. Updating would provide the guidance that stakeholders in site contamination are seeking of these guidelines in relation to site management.

Recommendation 2

EPHC to initiate an update of the management components of the *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), in 1992.

5.1.6 International approaches to contaminated sites

The current approaches to the assessment and management of contaminated land vary across the OECD countries. Only three (USA, Canada, UK) are presented in brief detail here. The approaches used by these three countries are similar to the Australian policy framework.

The common features include:

- acceptance of a risk-based approach to assess possible ecosystem and human health problems;
- acceptance of broad principles of risk management to address the sustainable management of contaminated land;
- a national system of providing guidance, but a State-based or regional responsibility for management of contaminated sites;
- the provision of nationally accepted extensive technical guidance for the assessment of contaminated sites.

Minor differences include:

- National contaminated sites priority lists - both the USA and Canada have a list of contaminated sites for priority action.

Internationally, there is an increasing trend in policy development to address environmental sustainability issues and spatial planning issues simultaneously. Most OECD countries, including Australia, have yet to adopt a policy framework which would give full expression to this approach.

United States

The overall approach at the federal level in the USA is to identify and prioritise existing contaminated sites, conduct risk assessments and plan remediation strategies, with funding through taxes on industry to provide a trust-fund for remediation work, primarily on abandoned sites. The work undertaken by the USEPA and its regional counterparts in developing and refining methodologies for environmental risk assessment has resulted in a significant body of relevant literature to support risk assessments.

In 1976, New Jersey's landmark Spill Compensation and Control Act pioneered the concept of government programs to clean up contaminated land. Four years later, Congress modelled the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA, generally referred to as Superfund) on New Jersey's legislation.

The 1980 federal Superfund law (CERCLA) and its 186 amendment (SARA) mandate the cleanup of contaminated sites in a coordinated approach between federal (USEPA) and State agencies. Prioritisation is provided by the National Priorities List (NPL), the list of sites with uncontrolled releases of hazardous substances that are the highest priority for long-term remediation. At NPL sites, the role of the States ranges from required cost sharing at federally funded cleanups to active site management. A large number of contaminated sites, including brownfield sites where remediation could give a considerable cost benefit, do not meet the criteria for inclusion on the NPL and remediation and management is provided by the States or regional authorities.

Canada

The Canadian arrangements for the assessment and management of contaminated sites are very similar to the Australian ones. The Canadian Council of Ministers of the Environment (CCME) is comprised of environment ministers from the federal, provincial and territorial governments (14 ministers in total). The council's mandate is to promote cooperation on and coordination of inter-jurisdictional issues such as waste management, air pollution and toxic chemicals.

One of the main objectives of the CCME is to propose nationally consistent environmental guidelines and standards. The CCME has no authority to implement or enforce legislation and, therefore, it is up to each province and territory to decide whether to adopt the CCME guidelines and standards.

5 While the majority of guidance relates to site assessment, the CCME has also developed national guidance on the derivation of remediation objectives; these are not intended to supersede management decisions taken under the authority of the agency responsible for remediation of a contaminated site.

10 The Federal Contaminated Sites Accelerated Action Plan was created to accelerate the remediation of contaminated sites for which the federal government is responsible, especially those that pose the greatest risk to human health and the environment. The Action Plan provides mechanisms to compare and rank federal priority sites. Health Canada, 15 Environment Canada and the Department of Fisheries and Oceans provide expert advice to custodial departments in their preliminary assessment.

UK

20 The UK differs from Australia and Canada insofar as the primary responsibility for managing contaminated sites rests with local government under the planning process. Part IIA of the Environmental Protection Act 1990 (EPA Act) and associated Contaminated Land Regulations for various countries within the United Kingdom (England, Scotland and Wales) have been introduced since April 2000. Under Part IIA, regulation largely takes place at the local authority level, and local authorities have the responsibility of identifying any contaminated 25 land in their areas.

Previously, contaminated land was generally dealt with in the context of redevelopment, where there was the objective of economic benefit linked to environmental enhancement. Part IIA of EPA Act means that local authorities now have a responsibility to proactively inspect 30 their areas and ensure the remediation of any contaminated land. The remediation requirements under the planning system can sometimes be wider than under Part IIA.

As with other countries, the UK provides extensive nationally accepted technical guidance on contaminated site assessment; there is also general guidance on remediation and site 35 management. The Environment Agency also has responsibilities to protect the water environment via a number of regulatory regimes; planning authorities are required to take account of risks that pollution of "controlled waters" may occur due to past contamination or future management activities (controlled waters are coastal waters, inland fresh waters and ground waters).

40 5.2 RESOURCES AVAILABLE FOR IMPLEMENTING THE NEPM

Jurisdictions have committed resources to the implementation of the NEPM to help ensure that NEPM guidelines are applied appropriately when conducting and reporting on site assessments and to report to NEPC on the implementation of the NEPM.

45 Some jurisdictions indicated that they have difficulties in meeting the information and guidance needs of consultants with limited experience in site assessments in remote areas. Lower land values, together with the significant distance from the larger population centres where the developed consultancies are located, can create greater cost burdens relative to the

process and skills available in and near capital city centres. Appendix 8.2 provides further information from jurisdictions on implementation issues.

5.3 REVIEW OF SCHEDULE B GUIDELINES

5 Schedule B of the NEPM comprises ten guidelines on various technical and administrative aspects of site assessment. Outcomes of consultation on the Issues Paper and Discussion Paper are summarised here, together with the recommendations for addressing the issues.

5.3.1 Ecological Investigation Levels

10 Background

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

15 The purpose of EILs is to determine whether contamination of a site warrants further investigation from an ecological protection 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
20 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.

25 A majority of the current interim EILs are based on limited phytotoxicity data and on surveys of metal concentrations in soils in major Australian cities. The major criticisms associated with the use of these interim EILs are that they are generally regarded as rigid and conservative and that they cannot be modified for application to different soil types and pH. These issues
30 stem from the problems inherent in the lack of a nationally agreed methodology for terrestrial ecological risk assessment.

Site contamination caused by human and industrial activity is most likely to be encountered in urban renewal environments that are being redeveloped to new, often more sensitive land
35 uses. The absence of soil criteria that provide appropriate protection of relevant environmental values in various settings has led to some costly misuse of the interim EILs as cleanup criteria.

Site assessment and remediation is a high cost activity in many property developments. The
40 misuse of EILs can result in unwarranted remediation involving earthworks, soil transport, landfill disposal and additional professional consulting services that can significantly increase property development costs. These costs are ultimately passed on to consumers. In some cases the property owner or developer may require that more stringent soil criteria be applied to counter any potential consumer concern regarding site contamination. Site assessors and
45 third party auditors may defer to more conservative criteria because of liability concerns. Scientifically developed EILs would provide an effective basis to manage unwarranted costs and consumer concerns.

The EILs were based on considerations of phytotoxicity of heavy metals (i.e. arsenic,
50 cadmium, chromium, copper, lead, mercury, & zinc) and soil survey data from four Australian capital cities and ANZECC B values (ANZECC/NHMRC 1992). Those EILs based

on phytotoxicity data have limited application for urban land, as they are only applicable to sandy loams with a pH of 6 – 8 (NSW DEC *Guidelines for the NSW Site Auditor Scheme, 2006*). The limited scope of these EILs arose from a lack of appropriate data to establish them. There is no published methodology to explain how the phytotoxicity based EILs can be modified for other soil types or soil pH.

Issues Paper

The majority of submissions agreed that there was misuse of EIL values generally. There was particular 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. There was general support for updating the EILs and for the development of additional EILs for other substances.

Ecological risk assessment methodology

Background

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 the EILs based on a desktop study and finally site-specific risk assessment.

There is no nationally agreed derivation methodology for terrestrial EILs and 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. 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; assessing the impact on sensitive receptors using pathway analysis and relevant ecological toxicology data; referencing existing ecologically based guideline criteria (e.g. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC/ARMCANZ 2004 (WQG 2004)*); and considering 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 2004 could be considered which might involve the following stages:

- The development of national terrestrial EILs 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.

- Derivation of site-specific ecological values using direct toxicity assessment that is an ultimate test of bioavailability. The site-specific data can be used to derive the modified criteria for the chemicals of concern.

5 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 EILs. The project aims to develop a tiered risk assessment framework for contaminants, analogous to the framework used in WQG 2004. The framework will be developed for two inorganic contaminants (arsenic and zinc) and two organic contaminants (DDT and naphthalene) as test cases.

Issues Paper

Some submissions to the Issues Paper 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.

Discussion Paper

The following options for EILs and ecological risk assessment methodology were presented in the Discussion Paper to stakeholders 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 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.

Option	Action	Ramifications
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	<p>Develop an agreed framework/methodology for deriving and setting EILs and apply to existing EILs and derive new EILs. Approaches to developing the framework/methodology may include the following:</p> <ul style="list-style-type: none"> • a tiered risk framework similar to that of WQG 2004 to 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. 	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 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.

Most submissions to the Discussion Paper supported option 6 and option 7. Option 6 is preferred, as a tiered approach. This would provide scientifically validated and nationally accepted levels, as well as an agreed methodology for deriving additional levels and revising existing ones. Following a framework similar to that of the WQG 2004 would also provide a consistent approach in the various national environmental quality schemes that produce 'trigger' values. Although resource-intensive, the work could be spread over several stages and draw upon existing work already underway by various research organisations. The first step would be to establish an agreed framework and a project plan that could include several benchmarks and interim outcomes. It is acknowledged that this option may take a number of years to fully develop and implement.

Consequently it would not address immediate needs. For this reason, revising existing interim EILs based on current additional data (effectively through Option 7) as one of the first interim outcomes in this process is a priority. The additional data used to revise the interim EILs could be used to inform the larger project of SSDs and tiered risk frameworks. Obviously, refinement of the feasible and preferred approaches would occur as the project

progressed. The updated NEPM could simply make reference to this work under development for setting additional guidelines as well as a revised methodology to derive and revise guidelines.

5 **Recommendations**

Option 6 and 7 are recommended. Provision of a nationally agreed methodology for terrestrial ecological assessment and scientifically derived EILs should improve environmental protection; enable site specific assessments to be conducted that are more readily accepted by regulators; reduce unsustainable practices of unnecessary soil disposal from site remediation; help to minimise the environmental, financial and personal liability risks for stakeholders; and, prevent the transfer of unwarranted remediation costs to the community. Revising existing Interim Urban EILs, taking into account current additional data, is a priority to address immediate needs.

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Recommendation 3

Develop an agreed methodology for deriving terrestrial Ecological Investigation Levels to revise existing Ecological Investigation Levels, and derive new Ecological Investigation Levels.

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Recommendation 4

Revise the existing Interim Urban EILs taking into account the outcomes of research that has been completed since making of the NEPM including use of phytotoxicity, microbial, and invertebrate ecotoxicity data, and other relevant research, to address issues while awaiting the outcomes of an agreed methodology (Recommendation. 3).

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30 **5.3.2 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, such as 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 conservative, and exposure to soil levels below these can be considered very unlikely to result in adverse human health effects. Hence HILs for contaminated sites are the concentrations above which further assessment and considerations for site management are required.

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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.

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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

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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. These latter recommendations are not yet included in the NEPM.

5 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.

Issues Paper

15 Schedule B (4) provides guidance on Health Risk Assessment Methodology. Some submissions to the Issues Paper described the current methodology for deriving HILs as adequate but others felt it could be improved by incorporating bioavailability of the different substances, if known. Several submissions advocated the USA 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.

25 Schedule B (7b) provides guidance on Exposure Scenarios and Exposure Settings. Submitters 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 fraction of naturally occurring carbon in the soil will influence the amount of leaching, especially of hydrocarbons, into the groundwater.

30 No investigation levels currently exist in Schedule B1 for exposure scenarios B and C associated with home vegetable growing, and several submissions suggested these scenarios be removed. There were also suggestions from submitters that a clear understanding, through educational approaches, of the HIL development processes would improve their application.

Discussion Paper

The following options for HILs were presented in the Discussion Paper to stakeholders 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).

Option	Action	Ramifications
2.2	Review methodology for deriving the HILs	The revision process could include: <ul style="list-style-type: none"> • The manner of use of the TDI/ADI to derive the HIL • 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.

Submissions to the Discussion Paper supported options 2.1, 2.2 and 3:

- revision of the methodology for deriving HILs;
- revising the current HILs incorporating published revisions of Tolerable Daily Intakes and current knowledge of the bioavailability of the contaminant;
- deriving HILs for priority substances that currently do not have one.

Submissions also expressed strong support for:

- the NEPM referencing appropriate Health Risk Assessment methodologies such as the EnHealth document, *Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards June 2004* (and WHO, USEPA), which sit outside the NEPM and can be revised as required;
- the use of Australia-specific exposure factors;
- HILs to be published outside the NEPM by NEPC so that revision is facilitated;
- a process of continual revision and derivation by health experts ;
- guidance on the use of international values for substances not having an Australian HIL;
- more detailed guidance than is currently provided on exposure assessment using statistical techniques such as probabilistic methods.

There was some confusion over the use of “acceptable levels” (option 4). One view was that “acceptable levels” are equivalent to USEPA Preliminary Remediation Goals (PRGs) which are risk-based concentrations that are intended to assist risk assessors and others in initial screening-level evaluations of environmental measurements. The USEPA provides generic PRGs which are calculated without site specific information. However, they may be re-calculated using site specific data. Some submissions commented that replacement of the

HILs with 'acceptable levels' would not provide measurable benefits for assessment or remediation costs because failure by site assessors to appreciate the intended purpose of the 'acceptable levels' and their limitations would produce many issues similar to those currently faced with the use of the HILs.

5 Another strongly held view is that HILs for the differing commonly encountered exposure scenarios (scenarios A, D, E, and F in Schedule 7b of the NEPM) should be established for all contaminants of concern.

10 Recommendations

There are three recommendations to update the NEPM taking into account stakeholder preferences:

1. The existing HILs need to be revised, in the light of current knowledge, leading to more accurate and often less conservative numbers (Options 2.1, 2.2 and 2.3);
- 15 2. Additional HILs need to be derived for priority substances;
3. An educative process and/or the provision of specific case-studies should be used to counter the inappropriate use of HILs as cleanup or remediation criteria.

20 The benefits of revised Health-based Investigation Levels are likely to be considerable. The use of mass transfer (dig and dump) as a remediation strategy can be a major cost during redevelopment of contaminated sites. This situation is exacerbated by the increasing costs of landfill disposal of "contaminated" soil. The appropriate use of new and revised HILs would lead to significant lowering of site redevelopment costs by minimising mass transfer costs.

25 **Recommendation 5**
Revise existing Health-based Investigation Levels in the light of current knowledge, leading to more accurate and often less conservative numbers

30 **Recommendation 6**
Derive additional Health-based Investigation Levels for priority substances.

35 **Recommendation 7**
Develop guidance to further clarify the use of Health-based Investigation Levels to counter their inappropriate use as remediation criteria.

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5.3.2.1 Carcinogenic substances

Background and Issues Paper

45 The NEPM has limited guidance on the conduct of a risk assessment for carcinogenic substances at contaminated sites. HILs have been developed for only a limited number of carcinogenic substances, but 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 methodology to assess its currency.

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Discussion Paper

The following options were presented in the Discussion Paper to stakeholders for consideration.

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 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.

10

Submissions to the Discussion Paper noted the current use of a combination of national (enHealth) and international guidance (WHO, USEPA) to conduct human health risk assessments for carcinogenic contaminants.

15 Most submissions favoured Option 2 (Develop HILs for a priority list of carcinogenic contaminants) believing that the NHMRC's modified Benchmark Dose Methodology may provide useful guidance on deriving those HILs. This option would require a review of the NHMRC methodology and the derivation of HILs for prioritised substances using that or another acceptable methodology. This work could be conducted as part of the overall HIL
20 revision process and could be undertaken in that process.

Recommendation

25 Option 2 is recommended. The presence of carcinogenic substances at a site sometimes requires site-specific human health risk assessment, and the concentration of carcinogen may drive the remediation levels for a site. The use of an appropriate HIL may minimise the need for costly site specific risk assessment.

Recommendation 8

30 Develop Health-based Investigation Levels for a priority list of carcinogenic contaminants.

5.3.3 Groundwater Investigation Levels (GILs)

Background

35 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 2004 (WQG 2004) and the *Australian Drinking Water Guidelines*, NHMRC & NRMCC, 2004 (ADWG 2004).

Issues Paper

Some submissions to the Issues Paper 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 2004 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.

Discussion Paper

The following options for GILs were presented in the Discussion Paper to stakeholders 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 2004 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 2004 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 2004 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.

Option	Action	Ramifications
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.

The majority of the submissions received on the Discussion Paper requested updating of the NEPM to include the most recent versions of the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, ANZECC and ARMCANZ 2004 and the *Australian Drinking Water Guidelines*, NHMRC & NRMCC, 2004.

Recommendation

Option 2, updating of the NEPM, will ensure that sites are assessed against the most recent National water quality standards for consistent Australian practice.

Recommendation 9

Update the Groundwater Investigation Levels to be consistent with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2004* and the *Australian Drinking Water Guidelines 2004*.

5.4 SUBSTANCES

5.4.1 Total Petroleum Hydrocarbons

Background

The term Total Petroleum Hydrocarbons (TPH) represents a broad family of hydrocarbon compounds; each individual chemical component has its environment/chemical/physical properties and toxicities. TPH is defined as the measurable amount of petroleum-based hydrocarbon in an environment media. TPH represents a mixture and itself is not a direct indicator of risk to human health or the environment.

Petroleum hydrocarbon contamination in soil and groundwater is of concern in Australia. At least 50% of the contaminated sites being managed or regulated by the authorities in Australia have petroleum hydrocarbon contamination.

Where petroleum compounds are identified as contaminants of concern at a site, analysis of appropriate fractions of TPH (eg C6-C9, C10-C14) and the relevant toxic components such as benzene, toluene, ethyl benzene, xylene and polycyclic aromatic hydrocarbons are conducted.

Issues Paper

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

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Discussion Paper

The following options for Total Petroleum Hydrocarbons were presented in the Discussion Paper to stakeholders 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.
7	Adopt as standard, 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.

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Submissions to the Discussion Paper supported options 2 and 5. 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. Consensus was reached during public

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consultation on developing interim national screening levels based on existing Australian values with reference to relevant overseas values. Screening levels are described as “levels below which further remediation or investigation is not required in settings where there is a very low risk of an adverse impact to the health and safety of humans and any local ecological receptors”.

Health based investigation levels (HILs) exist for the following non volatile TPH factions:
90 mg/kg for >C16 – C35 aromatics
5600 mg/kg for C16 – C35 and
56,000 mg/kg >C35 and aliphatics.

However, the volatiles C6-C9 are usually the risk-drivers. Some jurisdictions use the additional screening levels for TPHs in soils, to assess whether further work is required, as follows:

NSW: 65 mg/kg for C6 –C9 &
1000 mg/kg for (C10 – C14, C15 –C28, C29 – C40)
(Guidelines for the Assessment of Service Station Sites, 1994)

Queensland: 100 mg/kg for C6-C9 & C10-C14 &
1000 mg/kg for C15-C28 & C29-C36
(Jurisdictional screening levels)

Western Australia: 100 mg/kg for C6-C9,
500 mg/kg for C10-C14, and the above HILs
(Draft – Assessment Levels for Soil, Sediments and Water, 2003)

Recommendations

The development of interim national screening levels for TPHs would:

- Assist national consistency in the assessment of TPHs;
- Provide for efficient screening of petroleum hydrocarbon contaminants, given they are the most commonly found environmental contaminants; and,
- Provide a useful prompt for consideration of other contaminants, given that there are still limited threshold concentrations published by jurisdictions. For example, where there is a significant discrepancy when comparing the concentrations of BTEX and PAHs to the relevant fractions of TPHs, other substances (eg, chlorinated solvents, fuel additives and other aromatic hydrocarbons) may need to be considered for analysis.

Recommendation 10

Develop interim national screening levels for Total Petroleum Hydrocarbon fractions based on existing Australian values and with reference to relevant overseas values.

5.4.2 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. 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.

5 Issues Paper

Submissions to the Issues Paper were generally supportive of inclusion in the NEPM of guidance related to fuel additives, and of development of interim national screening levels for the most commonly used or well-known additives.

10 There was an almost equal division among submissions 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.

15 Discussion Paper

The following options for fuel additives and fuels storage sites were presented in the Discussion Paper to stakeholders 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.

20 Submissions to the Discussion Paper generally supported option 2, with some further supporting option 3. Issues relating to fuel storage sites could be addressed in the recommendations arising from the consideration of TPH and fuel additives.

Recommendation

25 As there are little existing data on the significance of site contamination by fuel additives it is appropriate to undertake a scoping exercise to determine the need for developing interim national screening levels below which further remediation or investigation is not required in settings where there is a very low risk of an adverse impact to the health and safety of humans and any local ecological receptors.

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Recommendation 11

Undertake a scoping exercise to determine if there is a need to develop investigation levels for specified fuel additives based on overseas or Australian values.

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5.4.3 Asbestos impacts

Background and Issues Paper

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

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% are used by various regions of the US EPA. Victoria has a 1% landfill 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 HILs nor have they been endorsed by Australian governments; the range of values suggests a significant disparity in assessment procedures. 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).

Discussion Paper

The following options for asbestos were presented in the Discussion Paper for stakeholder 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.

5 This is a complex issue which submitters to the Discussion Paper considered has a high priority. The assessment of asbestos contaminated sites is complicated by such uncertainties as the condition of asbestos containing material (ACM) products, mixtures of asbestos types and products, soil types and meteorological conditions. Consequently, the determination of potential human health risks is often highly subjective.

10 The assessment of risk for asbestos is also inextricably linked to the consideration of acceptable management options. Submitters requested that a consistent approach be developed to allow an effective and defensible regulatory framework to be established. A progressive approach to revising the NEPM could be considered i.e. adopt option 2 while the time consuming issues associated with Option 3 are resolved.

15 Some submissions supported the adoption of Option 3 in the longer term. The adoption of a numeric HIL for asbestos would follow from the development of technologies and methodologies for data collection, analysis and interpretation.

20 Currently small amounts of asbestos can have significant and potentially unjustified impacts on the costs of remediation projects. The current costs of unnecessary asbestos remediation arise from a combination of poor risk communication and evolving legal precedent dealing with asbestos contamination.

25 Recommendation
Option 2 is recommended.

30 Discussion with health agencies is required to address how the real risks of site contamination with asbestos can be best communicated to the public, especially as ACM fragments may pose only a negligible risk to human health. A consultation process with stakeholders including health practitioners, legal fraternity and suppliers of professional liability insurance will assist in establishing more pragmatic guidelines for asbestos assessment (see Recommendation 13).

In the first instance, the NEPM could refer to existing Australian guidance. For example, submitters felt that the 2005 enHealth document provides a good summary of the issues that need to be considered in the investigation and analysis of asbestos at contaminated sites. Further guidance is currently being developed by the Western Australian Department of Health which may contribute to the development of guidance information (see Recommendation 12).

Research would be required to satisfy those submitters who felt that the NEPM should include guidance on the link between soil concentrations, soil conditions and airborne concentrations of asbestos fibres. This could include guidance on site-specific environmental monitoring.

Recommendation 12

The NEPM be revised to provide information based on existing documentation relating to the investigation and assessment of various forms of asbestos.

Recommendation 13

NEPC undertake discussions with relevant stakeholders, including environment protection authorities, health practitioners, legal fraternity and suppliers of professional liability insurance, to determine appropriate strategies to communicate risk regarding asbestos to the public.

5.4.4 Persistent Organic Pollutants

Background and Issues Paper

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 no consistent national system for collecting information on all the POPs chemicals.

Discussion Paper

The following options for POPs were presented in the Discussion Paper to stakeholders 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.

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Submissions to the Discussion Paper were generally supportive of developing HILs for those POPs which currently don't 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.

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Recommendations

Options 2 and 4 are recommended. POPs chemicals, especially dioxins, can be a major cost factor in site assessment and remediation. Additionally, the list of POPs chemicals is growing. Considerable savings can be made if unnecessary screening or cleanup can be prevented. These recommendations will also facilitate conformity to Australia's obligations under the Stockholm treaty.

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Recommendation 14

Develop guidance on the relevance of site history and activities which may indicate the need to screen sites for the potential presence of dioxin-like substances, including comments on the use of “indicators substances” where relevant.

Recommendation 15

Develop Health-based Investigation Levels, in a prioritised fashion, for all non-dioxin Persistent Organic Pollutants that currently do not have one. This work should be conducted as part of the overall Health-based Investigation Level revision process (Recommendation 6).

5.4.5 Assessment of Impacts from Volatile Substances

Background

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 and Conservation in July 2004 relating to this issue. Updating and widening this review may assist in providing assistance in including appropriate guidance in the NEPM.

Issues Paper

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 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.

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.

Discussion Paper

The following options for volatiles were presented in the Discussion Paper to stakeholders 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 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.	This option by itself, without consideration of the previous option, although providing more specific guidance, would be limited to the 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.

5

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

10 *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 methodologies and determination of soil criteria is warranted as part of the future work plan that may arise from the Measure.*

15 Submissions to the Discussion Paper supported the adoption of option 3 with strong additional support for options 4 and 5.

Recommendations

20 Adoption of options 3 and 4 will achieve the outcome of identifying models, field methods and analytical approaches which best suit Australian conditions to provide more specific

guidance in the NEPM and a more standardised approach to the assessment of volatiles which can be used to determine exposures and determination of soil criteria.

Adoption of option 5 will progress the development and validation of an Australian specific model. This will also assist in the development of HILs for volatile substances.

Recommendation 16

Update the Western Australian Department of Environment and Conservation review of models and field methods on the assessment of volatiles. Select and adopt as interim guidance in the NEPM a model(s) and field methods most suited to Australian conditions.

Recommendation 17:

Develop and validate an Australian specific non-steady state model for volatile substances to assist in the development of Health-based Investigation Levels for volatile substances.

5.4.6 Mixtures

Background and Issues Paper

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 70pg 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 2004 provides a method for estimating the toxicity of mixtures in water using a general formula. The WQG 2004 also indicates 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.

Discussion Paper

The following options for mixtures were presented in the Discussion Paper to stakeholders 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: <ul style="list-style-type: none">• 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.

- 5 Submissions to the Discussion Paper generally supported Option 2, to provide guidance on deriving site specific guideline values based on a review of the three outlined areas. This would be a desktop exercise requiring a detailed review of the still evolving literature.

Recommendation

- 10 The risk assessment of chemical mixtures is considered to some degree in most current risk assessment guidelines. The main advantage of a detailed review of this area would be the resulting compendium of current information which could be referred to by the community, consultants and regulators, as required.

15 **Recommendation 18**
Provide guidance on deriving site specific guideline values for mixtures based on a review of any or all of the following:

- published information on the integrated toxicity of several commonly found mixtures;
- 20 • published information on current best practice, including the utility of probabilistic modelling; and,
- the use of direct toxicity tests to measure the effect of mixtures, including the use of suitable biomarkers.

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5.5 DATA QUALITY OBJECTIVES, LACK OF VERTICAL DELINEATION

Background

- 30 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 of investigations nor a conceptual model of the site during the planning of site investigations are properly prepared and considered.

5 It is essential to have appropriate data to support the assessment of contaminated sites and/or develop remediation plans. Often the information generated from environmental sampling and analysis programs is insufficient to enable appropriate decisions to be made. This can lead to further sampling and cause significant delays and costs. In limited cases, sampling and analyses can be overly prescribed leading to excessive and unnecessary costs.

10 The data quality objectives (DQO) process is a useful planning tool for environmental assessment and remediation. It is used to define the type, quantity and quality of data needed to support decisions relating to the environmental condition of a site. The DQO process provides a systematic approach for defining the criteria that a data collection design should satisfy, including when, where and how to collect samples or measurements; determination of tolerable decision error rates; and the number of samples or measurements that should be collected.

20 The US Environmental Protection Agency (USEPA) describes the DQO process as a seven-step iterative planning approach and details about the seven steps process of the DQO process can be found: *Guidance for the Data Quality Objective Process* and *Data Quality Objectives Process for Hazardous Waste Site Investigations*, USEPA, 2000. Some jurisdictions in Australia have published guidance on the use of DQOs, (e.g. *Guidelines for the NSW Site Auditor Scheme*, 2nd Edition, NSW Department of Environment and Conservation 2006.)

25 **5.5.1 Data Quality Objectives**

Issues Paper

30 Data Quality Objectives (DQOs) 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.

35 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.

Discussion Paper

The following options for DQO were presented in the Discussion Paper to stakeholders 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	It is anticipated this would require a literature search and careful documentation

Option	Action	Ramifications
	lists of DQOs for specific investigations.	
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

Most submissions preferred Option 3 which provides 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 concerns.

5 Recommendations

Option 3 has the following benefits that would:

- ensure a minimum level of DQO in place, allowing some flexibility in choosing an appropriate laboratory method for the analysis;
- give regulators or project managers the assurance that the data are obtained using scientifically sound procedures and processes; and,
- increase consistency in the quality of risk assessments.

Recommendation 19

Provide detailed guidance on identifying and considering Data Quality Objectives that includes a review of current NEPM Quality Assurance/Quality Control procedures. Guidance needs to consider varying scenarios and lists of Data Quality Objectives for specific investigations and contaminants of concern.

5.5.2 **Collection of Field Data**

Background

It is the experience of jurisdictions that 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 hydro-geological conditions (instead of field measurements, consultants use generic published parameters and assumptions for input into numerical models); and,
- 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.

Issues Paper

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.

5 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.

10

Discussion Paper

The following options for collection of field data were presented in the Discussion Paper to stakeholders 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.

15

Although varied responses to options were provided by submitters, the majority of submitters to the Discussion Paper identified Option 3 as the preferred option.

Recommendation

20 Adoption of Option 3, the provision of checklists for field parameters, will assist in the development of sampling and analysis programs for sites and will provide a baseline of measurements which should be collected to assist the quality and usefulness of investigations. Checklists will, in particular, provide a good basis for training new practitioners in the field and emphasis the importance of field investigations and observations in the overall site
25 assessment process.

Recommendation 20

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. It is anticipated that a single checklist could be developed that would address the majority of situations.

5.5.3 Delineation and Characterisation of Contamination

Background

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; and,
- the contamination has been adequately defined and characterised both laterally and vertically.

Issues Paper

Submissions to the Issues Paper 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; and,
- conceptual models for different types of contaminants that consider how they behave in different environments and suggest appropriate methods for their investigation.

Discussion Paper

The following options for delineation were presented in the Discussion Paper to stakeholders 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.

5 Option 2 and option 3 were supported by submitters to the Discussion Paper. Issues with the sampling of stockpiles of excavated material were also raised, where sampling and analysis of soil material is conducted to determine quality of the soil for backfill purposes.

10 Delineation and characterisation of contamination in all relevant media - soil, sediment, and water is important to ensure that the extent and characteristics of the contamination is understood so that appropriate data are used for modelling and decision making purposes.

Recommendation

15 Adoption of Options 2 and 3 will result in the NEPM including more detailed guidance on appropriate methods for establishing vertical and lateral extent of contamination utilising existing published guidance and establishment of guidance on appropriate sampling methodologies and data quality objectives to achieve the required delineation.

20 The NEPM should also provide guidance on stockpile sampling to ensure that samples collected from stockpiles are representative of the material of which the stockpile comprises to enable the results to be used to determine appropriate disposal locations or soil re-use options.

Recommendation 21:

25 Provide guidance on appropriate methods for establishing the vertical and lateral extent of contamination, which includes references or links to published guidance on the delineation of the lateral and vertical extent of contamination. Also investigate stockpile sampling issues.

5.6 GROUNDWATER INVESTIGATION

Background

35 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.

Issues Paper

5 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
10 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.

15 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.

Discussion Paper

20 The following options for groundwater investigation were presented in the Discussion Paper to stakeholders 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

25 Jurisdictions and contaminated land professionals accept the clear linkage of site contamination and associated groundwater impacts as an issue of concern at many sites. However, there were few submissions indicating a preference for addressing this issue with those who did respond suggesting adopting Option 2. The NEPM currently provides guidance on aspects of the investigation of groundwater including gathering groundwater data, consideration of site specific conditions, monitoring well construction, sampling and
30 monitoring/delineating groundwater levels and plumes and an overview of fate and transport modelling. Improvements of contaminated site investigation methods based on improved technology occur constantly.

Recommendation

35 Option 2, updating the NEPM to incorporate reference to current guidance on groundwater investigation methods from Australian and other jurisdictions, will ensure that sites are

assessed using the most up-to-date methodologies capable of providing samples representative of groundwater conditions beneath a site.

5 **Recommendation 22**

Undertake a revision of Schedule B2 (Guideline on Data Collection), Section 5 (Groundwater investigation), and update the procedures and methodologies with reference to current guidance provided in Australian and other developed jurisdictions.

10 **5.7 LABORATORY METHODS AND TECHNIQUES**

Background

15 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 analytical techniques to be used in site assessments.

20 Issues Paper

25 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 submitters 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.

30 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.

40 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.

45 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.

Discussion Paper

The following options for laboratory methods/techniques were presented in the Discussion Paper to stakeholders 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.

Option	Action	Ramifications
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.

Submissions to the Discussion Paper did not clearly indicate a preferred option.

5 Decisions on development of remediation plans and the sufficiency of site assessment and
clean-up depend on the results of laboratory soil analyses for the contaminants of concern.
The NEPM laboratory methods are in general use in Australian commercial and
governmental laboratories. The NEPM provides that laboratories obtain NATA or equivalent
certification for the specific methods used. However, individual laboratories have adopted
variations to existing methods and new methods that are not included in the NEPM. There is
10 a lack of consistency in accreditation sought by laboratories.

Consultancies and jurisdictions frequently forward sample duplicates and split samples to
separate laboratories for quality control/quality assurance purposes. Exercises have also been
undertaken using blind spiked samples of known contaminant levels that are forwarded to
15 different laboratories so that results can be compared. The results of this approach are mixed,
with significant variations identified in analytical results between laboratories using the same
or different methods.

Inaccurate laboratory data can lead to poor assessment of human health and environmental
20 risk, the potential for poor remediation or site management outcomes and adverse economic
implications for site development. There are significant benefits in addressing these concerns
for consistent and acceptable practices between laboratories.

There are associated issues of appropriate soil and water sampling and preservation for
25 various contaminants of concern and a lack of homogeneity of the contaminant in the
collected samples that can cause disparities between sample results.

Recommendation

30 This issue is considered to be essentially a professional matter that requires input from
commercial and government laboratories and related professional associations to determine
the most appropriate and up to date laboratory methods for soil contaminants. To overcome
the risk posed by the discrepancies between laboratories, a workshop process should be
initiated with the relevant stakeholders with the goal of obtaining consistent and acceptable
practice in laboratory methods throughout Australia.

35

Recommendation 23:

Revise the guideline on laboratory analysis in consultation with appropriate representative
analytical laboratory bodies and relevant stakeholders.

40

5.8 BIOAVAILABILITY AND LEACHABILITY

Background

5 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).
10

15 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 laboratory-scale procedures for estimating the bioavailability of certain substances, particularly metals. However there are no recognised or accredited laboratory methods for estimating bioavailability for the full range of substances in the NEPM.
20

Issues Paper

25 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.

30 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 2004. The selection of an appropriate method for incorporation into the NEPM should be based on a consistent set of criteria.

Discussion Paper

35 The following options for bioavailability and leachability were presented in the Discussion Paper to stakeholders 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.

Option	Action	Ramifications
3	Provide clear guidance in the NEPM on appropriate methods through an investigation of alternative methods to assessing leachability.	This option will benefit practitioners who feel that the methods specified in the NEPM (e.g. TCLP testing) are not appropriate for specific 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, but will be expensive and time-consuming to develop. 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 consideration.

Submissions to the Discussion Paper did not clearly indicate a preferred option.

5 There is a variety of leachability tests that can be used in contaminated site assessment to assist in determining the mobility of contaminants in situ or for determining suitable disposal strategies for excavated soil. Misuse of leachate testing can occur when laboratory procedures designed to determine the mobility of contaminated soil disposed in an active landfill are applied to soils intended to remain in situ.

10 Contaminant bioavailability is generally assumed to be 100% in contaminated site assessment. There are authoritative studies that indicate that bioavailability is often significantly less than 100% in soil contaminants. Bioavailability can be a critical factor in determining human health and environmental risks in some sites and overestimates can cause unwarranted concern in some situations and clean up costs higher than necessary.

15 There are a number of scientific methods used to determine contaminant bioavailability, each having limitations in their application and necessary differences due to the nature of the contaminants and their distribution, soil types and the species that are exposed.

20 Recommendation

A review of current bioavailability approaches, methods and limitations will improve the basis for their application in site assessment.

25 Reviewing all relevant leachate testing procedures and their application and providing clearer guidance on their use will improve nationally consistent assessment practices.

Recommendation 24

Undertake a review of current bioavailability and leachability approaches, methods and limitations to provide general guidance in the NEPM for determining their use and application in site assessment.

5.9 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 provides guidance on 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 of contamination will be managed and how the process may relate to subsequent works.

Issues Paper

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.

Discussion Paper

The following options for community consultation were presented in the Discussion Paper to stakeholders 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.

Perceived risks to health from site contamination can create as much community concern as confirmed risks; there is often no difference in the political and social effect or the costs involved.

5 Submissions to the Discussion Paper supported the second option, to undertake minor revisions to the guideline to expand information on risk communication approaches utilising, and making reference to, current related guidance on risk communication that may be available in Australian jurisdictions, for example the enHealth (2006) document *Responding to Environmental Health Incidents Community Involvement Handbook*.

10 Recommendation
Adoption of option 2, to undertake minor revisions to the guideline, will improve national consistency in approaches to this problem.

15 **Recommendation 25**
Undertake revisions to the *Guideline on Community Consultation and Risk Communication* to expand information on risk communication approaches utilising, and making reference to, current related guidance on risk communication that is available in Australian jurisdictions.

20

5.10 THIRD PARTY AUDITOR ACCEPTANCE AND COMPETENCY OF CONSULTANTS

Background

25 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.

30 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
35 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.

40 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
45 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.

Issues Paper

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.

5 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.

15 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.

20 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.

Discussion Paper

The following options for auditor and consultant competencies were presented in the Discussion Paper to stakeholders for consideration.

25

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.

There was a mixed response to the presented options.

30 The outcomes for contaminated site assessment depend on the professional competency of the site assessors, third party reviewers and auditors. Poor quality work by site assessors poses difficulties for landowners, developers and regulators and can result in inadequate environmental outcomes and costly litigation.

Recommendations

35 There is a need to better define the competencies required of consultants in site contamination assessment more clearly and therefore options 3 and 4 are recommended.

5 Improvements to this guideline relevant to site assessors should further assist stakeholders in selection of appropriate professionals, identify the relevant competencies for individual professional development, and support policy development in all jurisdictions relating to the professional aspects of site assessment. Guidance relevant to auditing and third party review needs to reflect current practices in all Australian jurisdictions.

10 **Recommendation 26**

Update the current guideline to clarify acceptable competencies of consultants for jurisdictional and stakeholder use.

15 **Recommendation 27**

Revise the guideline relating to auditors and third party reviewers to reflect current practices in Australian jurisdictions.

6. ACRONYMS

ACM	Asbestos Containing Material
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
NRMCC	National Resource Management Ministerial Council

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

7. REFERENCES

- 5 *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
- 10 *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, 2004
- 15 *Contaminated Sites: Guidelines for the NSW site auditor scheme*, NSW Department of Environment and Conservation, 2006.
- 15 *Guide to Sampling and Investigation of Potentially Contaminated Soil, Part 1: Non Volatile and Semi Volatile Compounds*, AS4482.1, Australian Standard, 2005.
- 20 *Guide to Sampling and Investigation of Potentially Contaminated Soil, Part 2: Volatile Substances*, AS4482.2, Australian Standard, 1999.
- 20 *Petroleum and Solvent Vapours: Quantifying their Behaviour, Assessment and Exposure* A report to the Western Australian Department of Environment, G.B. Davis, M.G. Trefry and B.M. Patterson, CSIRO Land and Water Report, July 2004
http://portal.environment.wa.gov.au_
- 25 *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>)
- 30 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).
- 35 *Modelling the Migration of VOCs from Soils to Dwelling Interiors*, Neville Robinson, Proceedings of the Fifth National Workshop on the Assessment of Site Contamination, EPHC, 2003.
- 40 *Establishing Health-based Investigation Levels for benzene, toluene, ethyl benzene, xylenes, naphthalene, and aromatic and aliphatic EC16 TPH fractions*, Len Turczynowicz, Proceedings of the Fifth National Workshop on the Assessment of Site Contamination, EPHC, 2003.
- 40 *Australian Water Quality Guidelines For Fresh And Marine Waters*, ANZECC 1992.
- Australian Drinking Water Guidelines*, ANZECC & ARMCANZ, 1996
- 45 *Toxicity assessment for carcinogenic soil contaminants*, NHMRC, September 1999.
- Assessing Human Health Risks of Chemicals: Derivation of Guidance Values for Health-based Exposure Limits*, World Health Organization Environmental Health Criteria No.170 monograph, 1994.

'Framework for Decision Support used in Contaminated Land Management in Europe and North America', RP Bardos, C Mariotti, F Marot and T Sullivan, in *Land Contamination & Reclamation*, Volume 9, Number 1, 2001, pp 149-163

- 5 US EPA Superfund website at www.epa.gov/superfund

8. APPENDICES

8.1 NATIONAL ENVIRONMENT PROTECTION COUNCIL

5 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 (IGAE) 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. Since May 2002, NEPC has met in conjunction with the Environment Protection and Heritage Council. NEPC remains the legal entity for
10
15 developing and making NEPMs.

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
20 combination of goals, standards, protocols, and guidelines.

Implementation of NEPMs is the responsibility of each participating jurisdiction. A NEPM will take effect in each participating jurisdiction once it is notified in the Commonwealth of Australia Gazette, but is subject to disallowance by either House of the Commonwealth
25 Parliament. Any supporting regulatory or legislative mechanisms that jurisdictions might choose to develop to assist in implementation of proposed NEPMs go through appropriate processes in those jurisdictions.

8.2 NEPM IMPLEMENTATION REPORTING

COMMONWEALTH

Legislative, regulatory and administrative framework

5 Commonwealth agencies have incorporated the requirements of the NEPM into their organisational systems. Agencies have established a variety of processes and systems to ensure the ongoing management of land contamination issues including Environmental Management Systems, national environment assessment processes, environmental management practices, contaminated site registers and environmental risk assessments. For
10 example the Australian Antarctic Division (AAD) of the Department of Environment & Heritage has developed a contaminated sites register for Australian Antarctic Territory and Australia's sub-Antarctic islands. The register is linked to the AAD's incident reporting system, GIS databases, and the Australian Antarctic State of the Environment reporting system. The register, which includes environmental risk assessment used for prioritising
15 contaminated site remediation, is a single repository to collate information on contaminated sites and, if required, provide this information to the community.

The processes and systems that Commonwealth agencies have put in place establish procedures to identify contaminated sites and to reduce the potential for contamination.
20 Agencies also undertake staff awareness and training programs as well as regular reporting to ensure staff adequately manage and monitor these contaminated sites.

Implementation summary and evaluation

The application of the NEPM is delivering a consistent approach to the assessment of
25 contaminated sites across Commonwealth agencies. Commonwealth agencies have also progressed a number of initiatives in the area of contaminated land management. For example the Department of Defence has developed a suite of Defence Contamination Guidebooks, a Contaminated Sites Register and a Priority Sites Investigation Program. These initiatives provide advice on potential contaminated site activities, assist decision makers at a
30 regional and corporate level and ensure contamination is managed in accordance with the NEPM.

Assessment of NEPM effectiveness

Commonwealth agencies are implementing and achieving the desired outcomes of the
35 NEPM and have noted that the NEPM's principles have provided a consistent national methodology in the assessment and detection of contaminated sites. However, further training and planning when undertaking new works or modification would be an advantage to produce a better environmental outcome.

40 NEW SOUTH WALES

Legislative, regulatory and administrative framework

Section 105 of the *Contaminated Land Management Act 1997* (CLM Act) allows the NSW Department of Environment and Conservation (DEC) to make or approve guidelines for purposes connected with the objects of the Act. The components of the NEPM have been
45 approved by NSW DEC as guidelines under section 105 of the Act. These Guidelines must be taken into consideration when the NSW DEC is making a decision on whether a site poses a significant risk of harm according to section 9 of the *Contaminated Land Management Act 1997* and when an accredited contaminated site auditor is conducting a site audit. Guidelines made or approved in this manner must also be publicly available for inspection or purchase.

50

Implementation activities

Written advice outlining the approved NEPM guidelines, and those guidelines which it supersedes, has been communicated to consultants, accredited auditors, local government, other state government bodies, peak environment groups, peak industry groups and peak organisations of councils in NSW. The list of all guidelines made or approved under section 105 of the CLM Act is available to the public on the NSW DEC's web site to help increase public accessibility to the guidelines. Measures to ensure relevant stakeholders are informed of the NEPM are ongoing.

As noted above, section 105 of the CLM Act requires the NEPM to be taken into consideration by the NSW DEC when making a decision on whether a contaminated site requires regulation under the CLM Act and when conducting performance reviews of accredited contaminated site auditors. The NSW DEC verifies that site audits and site audit statements have been undertaken with due regard to the NEPM.

The NEPM guidelines are generally applied by environmental consultancies in undertaking contaminated site investigation under the planning process.

Implementation summary and evaluation

New South Wales has fulfilled all its obligations under the NEPM to date. There is substantial stakeholder compliance with the recommended assessment processes because the requirements are integrated into pre-existing regulatory framework.

Since its approval as a guideline under s105 of the CLM Act, the NEPM has been taken into account by the NSW DEC, site auditors and consultants when assessing the risks posed by contaminated sites. During the year ending 30 June 2005, the NSW DEC finalised 32 significant risk of harm assessments under s 9 of the CLM Act, and approved site auditors have issued approximately 226 site audit statements (143 statutory and 83 non-statutory).

There are no legislative requirements for the application of the NEPM to the redevelopment of contaminated sites under land-use planning legislation. As the NSW DEC is not routinely advised by Councils of redevelopment projects managed through local planning processes, no state-wide data is available on the number of contaminated site assessments where the NEPM guidelines have been applied.

As NSW policies and Guidelines were already in accord with the standards established under the 1992 Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites which form the basis of the NEPM, the effect of the NEPM in NSW is to reinforce and formalise best practice.

The NEPM leads to increased consistency between jurisdictions, which has been advantageous for interactions between the NSW DEC and equivalent agencies in other states, Territories and the Commonwealth. This process has benefits for all involved parties, as issues relating to assessment of land contamination are consistently managed.

VICTORIA

Legislative, regulatory and administrative framework

The Environmental Audit System (Contaminated Land) has provides the administrative framework for the assessment of site contamination in Victoria. Prior to the development of the NEPM, the audit system in Victoria was based on a combination of national guidelines developed by the Australian and New Zealand Environment and Conservation Council

(ANZECC) (which were released in 1992) and provisions under the *Environment Protection Act 1970*. These provisions are contained in Part IXD of the *Environment Protection Act 1970*.

5 This Audit System, pioneered in Victoria, has since been adopted by other jurisdictions. It has provided a robust platform for assessing site contamination to ensure adequate protection for human health and the environment.

10 State environment protection policies (SEPPs) are key instruments made under the *Environment Protection Act 1970*, setting out the policy framework to protect environmental quality which operates in Victoria. They do this by identifying the beneficial uses of the environment, establishing environmental quality objectives and indicators and setting out an attainment program for meeting these objectives.

15 The SEPP (Prevention and Management of Contamination of Land) [SEPP (PMCL)] was declared by Governor In Council in June 2002. The SEPP (PMCL):

- integrates the various elements of EPA Victoria's existing systems for preventing, assessing and managing contaminated sites in one single, consistent statutory instrument;
- clearly specifies the beneficial uses of land to be protected, and establishes indicators and objectives to determine the level of environmental risk, and appropriate investigation levels, to protect specific beneficial uses. The SEPP (PMCL) adopts the investigation levels in the NEPM guidelines as the key objectives for land quality.
- sets out requirements for consideration of site contamination in land use planning, managing activities which can cause contamination, and the auditing of contaminated land.

Other statutory instruments of relevance to the assessment and management of site contamination include:

- the state environment protection policy (Groundwaters of Victoria), which sets out the beneficial uses of groundwater to be protected, the indicators and objectives of use in determining whether these uses are protected and an attainment program. While the SEPP (Groundwaters of Victoria) was declared before the NEPM (Assessment of Site Contamination) was finalised, it is generally consistent with the provisions of Schedule B(6)
- the Industrial waste management policy (Prescribed Industrial Waste) requires that the waste hierarchy be applied in the avoidance and management of prescribed industrial waste, including contaminated soils. This approach is generally consistent with clause 6(16) of the policy framework (Part 4 of the NEPM). The *Planning and Environment Act 1987*, Ministers Direction No.1 (made pursuant to that Act) and the Victorian Planning Provisions reflect clause 6(5) of the policy framework (Part 4 of the NEPM).

Implementation activities

Victoria has continued with a number of processes to implement the Assessment of Site Contamination NEPM. These activities include:

- The SEPP (PMCL) specifically refers to elements of the NEPM.
- Ongoing further guidance, advice to, and professional development for, Environmental Auditors, building on the Environmental Auditors (Contaminated Land) Guidelines for the Issue of Certificates and Statements. The guidelines formalise advice to environmental auditors that, in conducting audits, they should refer to the NEPM for

advice including the sampling and analysis of contaminated sites, the assessment of data and for health and ecological investigation levels. The content of the guidelines is reviewed on a ongoing basis and, as new circumstances arise, revisions are planned and implemented. The publication of these guidelines continues to be supported by a range of seminars and workshops aimed to ensure stakeholders are aware of the requirements. Such meetings are particularly important in keeping stakeholders abreast of recent developments.

- EPA Victoria appoints environmental auditors through its Audit System, in accordance with Part IXD of the *Environment Protection Act 1970*. The NEPM guidelines on the appointment of environmental auditors provide general guidance relating to the competencies of environmental auditors and related professionals. There was a significant revision of the appointment guidelines in February of 2005, and a minor revision in June 2005.
- Environmental auditors are appointed initially for a 12-month period and then subject to a subsequent appointment process periodically thereafter. A round of initial appointments took place in April – June 2005. Subsequent appointments of auditors have also been undertaken with reference to the guidelines. These occur as appointment terms expire. A number of auditors have now been appointed for a four year term, having been subsequently appointed twice, and undertaken a minimum number of audits.
- EPA Victoria holds information sessions for Environmental Auditors twice each year, to keep them abreast of developments and to assist them in their own professional development.

The NEPM policy framework identifies the role for planning authorities in ensuring that a site, which is potentially contaminated and is being considered for a change in land use, is suitable for its intended future use. Victoria has mechanisms which trigger audits in such circumstances and these have been further clarified in the SEPP (PMCL). Controls continue to be developed to ensure that conditions stipulated by environmental auditors are met and that contaminated site information is readily available through the planning process (*i.e.* land titles). These actions are consistent with the NEPM. A 'Planning Practice Note' was approved by the Planning Minister and published in June 2005. This Practice Note will assist planning authorities in properly considering site contamination in planning decisions.

Victoria now provides information through the internet identifying those sites which have been through the contaminated land Environmental Audit process. This ensures that information relating to audited contaminated sites is readily available to the community.

Implementation summary and evaluation

Victoria has a well-established process for the management of contaminated sites including the environmental auditing system. Therefore, successful implementation of the NEPM required only minor changes to Victoria's existing framework. In the five and half years that the NEPM has been in operation, substantial progress has been made in incorporating the NEPM into statutory instruments and guidelines, particularly through the declaration of the SEPP (PMCL) thereby giving effect to elements of the NEPM within Victoria.

EPA Victoria has published guidelines for environmental auditors requiring them to refer to the NEPM and that it is to be used as a key reference document when making a judgement on site assessment. EPA Victoria is also considering means by which to provide guidance on site assessment work falling outside the audit framework.

Assessment of NEPM effectiveness

The NEPM reinforces an existing framework for the management of contaminated sites in Victoria by providing consistent consolidated guidance on the assessment of site contamination. Some improvements in the consistency of site assessment have resulted from use of the NEPM. Further improvements in consistency are the object of ongoing developments and improvements currently under consideration. The NEPM is well supported by environmental auditors and others in the site assessment industry, with comments indicating that it is of use as a comprehensive source of guidance.

It is still the case that the NEPM is being implemented with a bias toward the assessment of health effects eg. Site concentrations are compared to the health based investigation levels without reference to the ecological investigation levels. EPA Victoria continues to remind environmental auditors and site assessor of the need to properly assess both health and ecological impacts in accordance with the NEPM. The greater level of guidance provided in relation to the assessment of health risk (compared to ecological risk) and the more comprehensive listing of health investigation levels (compared to ecological investigation levels) appears to have contributed to the observed bias in site assessment practice. However, there is an apparent greater awareness of the need for assessment of ecological health risk. This presents one possible area of attention for the review of the NEPM.

QUEENSLAND

Legislative, regulatory and administrative framework

The NEPM is incorporated into the Queensland Government's administration of contaminated land through the provisions of the *Environmental Protection Act 1994* (EP Act) and the *Integrated Planning Act 1997* (IPA). The Queensland Environmental Protection Agency (EPA) is the administering authority for contaminated land.

The EP Act requires the establishment, operation and maintenance of registers about contaminated and potentially contaminated land- the Environmental Management Register and the Contaminated Land Register (EMR/CLR). The EMR/CLR can be searched by the public on a fee per lot basis with the aim of providing public information in accordance with the Policy Framework in section 6 (6) of the NEPM.

The EPA sets technical guidelines for the assessment and management of contaminated land that must be used by private sector environmental professionals conducting contaminated land work. The EPA also establishes processes and procedures so that statutory decisions can be made under the EP Act to alter the status of fully and partially remediated land entered on the EMR/CLR. In all cases assessment work involving statutory decisions under the EP Act must be conducted according to the relevant Schedules in the NEPM.

In keeping with the Policy Framework section 6 (5) of the NEPM, development applications for EMR/CLR listed sites and other potentially contaminated sites must be referred through local governments to the EPA under IPA regulations. The EPA has a concurrence role for these developments. Relevant conditions are set by the EPA before development to ensure contamination issues are addressed and land is made suitable for its intended use from a contamination perspective. In this process, EPA requires that assessment work be carried out to NEPM requirements where appropriate. This link to planning legislation provides a legislative process to facilitate capture of sites of potential concern at redevelopment stage where contamination may involve human health and environmental risk.

Implementation activities

The EP Act does not devolve administration of site contamination to local government and has a centralised system for considering assessment reports by practitioners. The following relevant operational data estimates were collected in the reporting period 2004–05.

- 93 site assessment reports were reviewed for NEPM compliance before statutory decisions regarding EMR/CLR status of the land parcels involved. Of these assessments, additional information was sought from the submitters in 70 cases
- 519 development applications were reviewed for contaminated land issues. Contaminated land assessment information to NEPM requirements was sought from applicants in 119 cases
- 212 sites were finalised as being adequately assessed according to the NEPM, and decontaminated and removed from the EMR. A further 136 Site Management Plans were issued for sites that were assessed and partially decontaminated with management of residual contamination for restricted land uses.

The Third Party Reviewer (TPR) system provides independent audit and review of site assessment and management work by private sector practitioners continues to be operated in accordance with Schedule B10 of the NEPM with expert panel assessment of applicants. The EPA received two additional applications for appointment as TPRs in the operating period. Twelve senior contaminated land professionals have been appointed as TPRs including four auditors accredited in NSW and Victoria. TPRs must ensure that practitioners comply with the NEPM and Queensland's regulatory requirements for site contamination.

During the reporting period 25 medium to high-risk sites (usually involving multiple land parcels) were placed under audit by TPRs. The sites under third party review include two major gasworks sites at Newstead and West End in significant inner city urban renewal areas and former medium size facilities at Ipswich and Wynnum that are also the subject of major redevelopment for residential and parkland uses. The use of a TPR is a standard requirement for development applications that have medium to high-risk contamination. The EPA under its concurrence role for new developments that have contamination issues operates the TPR system. The system provides an additional level of quality control that assists the EPA in the implementation of the NEPM.

Implementation summary and evaluation

The NEPM has been adopted as a central reference document for assessment of site contamination in Queensland supported by Queensland's guidelines on contaminated land. Its use is firmly established into contaminated land practice.

The use of the NEPM by contaminated land practitioners is mandated by the EPA through the provisions of the EP Act and IPA and by TPRs in auditing site assessment work. All applications to the EPA for statutory decisions about site contamination and altering the status of land on the EMR/CLR must demonstrate compliance with the NEPM. The EPA seeks additional information to clarify compliance issues when necessary before altering the register status of land.

Assessment of NEPM effectiveness

The current NEPM has continued as an effective 'technical tool kit' for site assessment for contaminated site professionals operating in Queensland. The quality control procedures applied by the EPA in internal review of assessment reports not subject to TPR processes

involves a review of the practitioners adherence to the NEPM. Additional information is requested where there is poor reporting and NEPM inconsistency.

Similarly, Queensland appointed TPRs, and NSW and Victorian auditors review compliance with the NEPM by practitioners in assessment works for the sites under audit. The acceptance of accredited auditors from other Australian jurisdictions continues to provide an additional check of consistency between Queensland and other Australian jurisdictions. In the reporting period a total of 348 land parcels were either removed from the EMR/CLR or made 'fit for use' through the approval of statutory Site Management Plans. These outcomes were achieved through use of the NEPM.

WESTERN AUSTRALIA

Legislative, regulatory and administrative framework

The Western Australian *Contaminated Sites Act 2003* was proclaimed in Gazette No.134 on 8 August 2006. The *Contaminated Sites Act 2003* and the associated *Contaminated Sites Regulations 2006* will come into effect on 1 December 2006. The Act has been drafted in accordance with the principles of the NEPM. The Act contains provisions for the making of 'guidelines,' based on elements of the NEPM, which will be taken into account when making decisions on the investigations, clean up and risk classification of sites

Implementation activities

The WA Department of Environment and Conservation (DEC) has developed and released the Contaminated Sites Management Series guidelines, including 'administrative' and 'technical' guidelines. The administrative guidelines provide guidance on the provisions and operation of the *Contaminated Sites Act 2003*. The technical guidelines utilise the NEPM and its schedules (B1-10) and have been developed to further refine the protocols established under the NEPM. The first guidelines in the series were released in 2000, and further guidelines are added each year as the need for external guidance on the management of contaminated sites is identified. The series currently comprises 14 guidelines for the identification, assessment, management and remediation of contaminated sites.

The Contaminated Sites Auditor Guideline has recently been completed. This guideline, which incorporates the principles of Schedule B10 of the NEPM, provides information about the auditor accreditation scheme, the assessment and accreditation process and the responsibilities and obligations of auditors under the legislative scheme imposed by the State Government pursuant to the *Contaminated Sites Act 2003* and the *Contaminated Sites Regulations 2006*.

One of the guidelines, entitled 'Assessment levels for soil, sediment and water', which was revised in November 2003, incorporates the Ecological and Health Investigation Levels as detailed in the NEPM.

The contaminated sites management guidelines encourage a risk-based approach to the investigation and remediation of sites. The guideline entitled 'The Use of Risk Assessment in Contaminated Site Assessment – Guidance on the Overall Approach', released January 2005, outlines the ecological and human health risk assessment process used to assess and manage contaminated site issues. It directs readers to the Schedules of the NEPM relating to Ecological Risk Assessment methodologies (Schedule B5), Human Health risk assessment methodologies (Schedule B4) and Schedule 7B – Exposure Scenarios and Exposure Settings. A review of assessment levels is also being completed in WA to incorporate the most recent versions of the Water Quality guidelines.

The DEC is currently drafting a technical guideline on ecological and human health risk assessment to complement the draft policy guideline 'The Use of Risk Assessment in Contaminated Site Assessment - Guidance on the Overall Approach'.

5 A technical guideline on the completion of ecological and health risk assessments is due to be completed at the end of 2006. The NEPM review process identified the need for guidance on the assessment of asbestos and the DEC is currently working with the Department of Health to develop this. These technical guidelines will continue to improve the quality and consistency of risk assessments undertaken in WA.

10

Implementation summary and evaluation

Western Australia has used the methodology established under the NEPM to prepare and implement a successful regulatory and administrative framework for the assessment and management of contaminated sites in WA. The feedback obtained from consultants and proponents is that the WA system is comprehensive and easy to understand. The finalisation of the Contaminated Sites Regulations 2006 has meant that the *Contaminated Sites Act 2003* will now come into effect on 1 December 2006. This is a major milestone for WA in the implementation of the NEPM.

Assessment of NEPM effectiveness

20 The *Contaminated Sites Act 2003*, the *Contaminated Sites Regulations 2006* and the administrative and technical guidelines are all based on the elements of the NEPM and comprehensively ensure the establishment of a nationally consistent approach to site contamination in WA. The ecological and human health risk assessment approach will also ensure adequate protection of human health and the environment where site contamination has occurred. The next year will see the Act and the Regulations come into effect and will provide clear evidence of the effectiveness of the NEPM in WA.

25 One factor that has hindered the NEPM's effectiveness is the misuse of ecological and health investigation levels as clean up criteria. To make the implementation of the NEPM more effective it is recommended that further guidance is provided on site assessment levels and that site specific clean up levels are developed.

SOUTH AUSTRALIA

Legislative, regulatory and administrative framework

35 The NEPM operates as an environment protection policy under the *Environment Protection Act 1993* (the Act). The Act does not specifically address site contamination, which limits implementation of the NEPM to achieve the purpose and desired environmental outcomes. To address this, the State Government released the *Environment Protection (Site Contamination) Amendment Bill 2005* for public consultation on the 27 October 2005. The consultation period ended formally on 27 February 2006.

40 The proposed amendments to the Act will provide the EPA with the power to order the person responsible for causing site contamination to assess and, if necessary, remediate the property to ensure that there is appropriate protection for human or environmental health.

45 The Bill provides a consistent framework for determining the person responsible for site contamination in accordance with the 'polluter pays principle', and will allow the legal transfer of full or partial responsibility for site contamination on the sale of land from vendor to purchaser, subject to agreements. Importantly, the Bill will establish an independent audit system for the assessment and remediation of site contamination. This will provide greater

certainty for owners and developers regarding their responsibilities, and the standards and processes for assessment and remediation.

5 The EPA continues to provide guidance and advice in regard to site contamination, particularly the NEPM, to planning authorities, environmental consultants, environmental auditors, industry and the community in accordance with resolutions of the EPA Board. In addition to this, Planning Authorities work to implement the recommendations contained in Advisory Notice Planning number 20 - Site Contamination (PAN20) when assessing development proposals. PAN20 provides direction to meet the purpose and desired environmental outcome of the NEPM with respect to planning practice. It also provides 10 some direction on how to obtain information, in the preliminary stages, that should trigger the assessment of site contamination in accordance with the NEPM and to satisfy the recommendations of the EPA. When followed, PAN20 works to ensure the implementation of the NEPM for matters that require planning approval via approvals under the 15 Development Act 1993.

Implementation activities

The principles of the NEPM have been introduced, where appropriate, into licence conditions, guidelines and advice issued by the EPA

Implementation summary and evaluation

Implementation of the NEPM is progressing but is limited due to the legislative framework currently in place in South Australia

Assessment of NEPM effectiveness

25 The progressive implementation of the NEPM should be instrumental in achieving the NEPM purpose and desired environmental outcomes. However, in SA this desired outcome will be improved with the passage of an enhanced legislative framework for managing site contamination.

TASMANIA

Legislative, regulatory and administrative framework

Under section 12A of the *State Policies and Projects Act 1993*, NEPMs are taken to be State Policies immediately after they are made by the National Environment Protection Council. 35 When NEPMs become State Policies, they come within the provisions of section 13 of the *State Policies and Projects Act*, including the obligation (section 13(3)) for the Resource Planning and Development Commission to amend planning schemes to remove any inconsistencies with the State Policy. Section 13 (1) of the *State Policies and Projects Act* provides that the State Policy prevails in the event of any inconsistency.

Implementation activities

The management and regulation of contaminated sites is administered by the Department of Tourism, Arts and the Environment (DTAE) and by Local Government.

45 The NEPM has been adopted by DTAE as a set of guidelines that should be complied with when conducting site contamination assessments. For any site assessment conducted where the proponent requires DTAE's endorsement, or site 'sign-off', compliance with the NEPM is required. When the Director of Environmental Management requires site assessment works in an Environment Protection Notice issued under the *Environmental Management and 50 Pollution Control Act 1994*, compliance with the NEPM is a mandatory condition.

Implementation of the NEPM within planning schemes has commenced and a number of Councils have revised the structure and content of their planning schemes over the past few years in response to the NEPM. These Councils have incorporated the requirement of a proponent to conduct an assessment where a site is to be used or developed for a sensitive use, public open space or for recreational activities and the site has been used for a potentially contaminating activity. In these circumstances, a detailed site investigation and preparation of a report shall be undertaken by an appropriately qualified person in accordance with the NEPM and to assess the suitability of the site for its proposed use. Implementation of the NEPM within the remaining planning schemes is under discussion and is the subject of a planning guideline currently in preparation.

Implementation summary and evaluation

DTAE is currently developing amendments to the *Environmental Management and Pollution Control Act 1994*, which will ensure that notices can be served to require investigation, remediation and management of sites, that landholders notify government of contamination and that will provide for an independent review system for consultants reports. These provisions will further advance the management of contaminated sites and achievement of the NEPM goal.

Assessment of NEPM effectiveness

The NEPM is automatically a State Policy in Tasmania and has been adopted as a set of guidelines that must be referred to for any site contamination assessment being provided to the DTAE.

The NEPM has been successful in establishing a nationally consistent approach to the assessment of site contamination and has provided a useful reference document. The guidelines in Schedules B1-10 provides clear direction on aspects of site contamination assessment and, when enforced, ensures sound environmental management practices are conducted by practitioners in the field of site contamination assessment.

The NEPM has also brought a greater awareness of site contamination issues to the Tasmanian public and of site contamination assessment standards to practitioners in this field. Progress towards greater protection of human health and the environment has also been achieved but further development is required to broaden the criteria for soil and groundwater health and ecological investigation levels.

Criteria for Soil and Groundwater Investigation Levels set out in Schedule B1 of the NEPM are used as the Guideline Investigation Levels for Tasmania. For criteria not specified in the NEPM (eg. Total Petroleum Hydrocarbons (TPH), benzene, toluene, ethylbenzene and xylene (BTEX) for soil criteria, other organic compounds, and asbestos) and until further development of the Ecological Investigation Levels, other relevant guidelines are used such as the ANZECC 2000 Water Quality Guidelines, the NSW EPA 1994 Guidelines for the Assessment of Service Station Sites or the Environment Quality Objectives in the Netherlands 1999. Inclusion of criteria for contaminants listed above, but particularly for TPH for soil and groundwater and BTEX compounds for soil that are commonly identified in the assessment of site contamination would increase the usefulness of the NEPM and will progress the achievement of the NEPM goals and outcomes.

AUSTRALIAN CAPITAL TERRITORY

Legislative, regulatory and administrative framework

In the Australian Capital Territory the Department of Territory and Municipal Services (specifically Environment and Recreation) has the responsibility for the implementation and administration of the National Environment Protection (Assessment of Site Contamination) Measure. The provisions of the NEPM were achieved through amendments to the *Environment Protection Act 1997*.

Implementation activities

The Assessment of Site Contamination NEPM has been fully implemented in the ACT. The Contaminated Sites Environment Protection Policy (EPP) made under the *Environment Protection Act 1997* was finalised in November 2000. The EPP references the NEPM as a key resource for assessing contaminated land in the ACT.

Implementation summary and evaluation

Environment and Recreation continues to ensure that environmental consultants and contaminated land auditors who perform assessments of contaminated sites in the ACT use the guidelines contained in the NEPM as a primary reference tool.

Assessment of NEPM effectiveness

The NEPM continues to prove a valuable resource tool for the assessment of site contamination in the ACT. The NEPM has also allowed for a nationally consistent approach to site contamination assessment.

The effectiveness can be improved by further development of methods for investigating levels for chemicals of concern at hydrocarbon-impacted sites. Hydrocarbon-impacted sites are one of the main sources of land and groundwater contamination in the ACT.

NORTHERN TERRITORY

Legislative, regulatory and administrative framework

The Environment Protection Agency Program, Department of Natural Resources, Environment and the Arts is responsible for the implementation of the NEPM in the Northern Territory. Contamination resulting from activities impacting land and water are dealt with under provisions of the *Waste Management and Pollution Control Act 1998*. Auditing of contaminated sites in the Northern Territory is also currently administered under the *Waste Management and Pollution Control Act 1998*.

The provisions of the *Planning Act 1999* are used as a trigger where a proposal has been made to change the use of the land to a more sensitive usage. The Development Consent Authority may direct assessment of site contamination in accordance with the NEPM and may require an audit to be undertaken to determine the condition of a site and its suitability for an intended future use. Environmental Auditors – Contaminated Land, appointed pursuant to Victoria's *Environmental Protection Act 1970*, are currently recognised by the Northern Territory Government through administrative arrangements.

The *Waste Management and Pollution Control Act 1988* provides for the development of Environment Protection Objectives (EPO) that can establish principles about assessment and management of contaminated sites in the Northern Territory. In June 2003, after a public consultation process indicated that there were no objections to the Northern Territory Government drafting an EPO for contaminated sites, the statutory process for developing an Environment Protection (Site Contamination) Objective commenced.

Implementation activities

5 Implementation of the NEPM in the Northern Territory has been achieved through the application of Pollution Abatement Notices issued under the *Waste Management and Pollution Control Act 1988* and requirements imposed by the Development Consent Authority. To increase Stakeholder awareness, a Northern Territory site contamination fact sheet 'Environment Note – Site Contamination', has been posted on the Department's Internet site. Preparation of a Draft EPO is nearing finalization. The Draft EPO establishes the principles, processes and guidance of the NEPM, as the principal approach to the assessment of site contamination for all assessments conducted for the purpose of determining whether a site poses an actual or potential risk to human health and the environment, either on or off the site, of sufficient magnitude to warrant remediation appropriate to the current or proposed land use. It is anticipated that the EPO and complementary guidelines will be in place within the 2005–06 reporting period. Also, as previously stated, subject to representation being made and protocols being agreed, the NSW auditors' accreditation scheme will also be recognised in the Northern Territory.

Implementation summary and evaluation

20 Although the EPO has yet to be finalized, developers and consultants have generally accepted the NEPM process as the appropriate process for assessment of contaminated sites. Consequently, if a contaminated site presents or is likely to present a risk of harm to human health or the environment, the NEPM assessment process has been implemented voluntarily following negotiation with the developer, consultants and the Environment Protection Agency Program. In the Northern Territory to date, seven reports on assessments of sites contaminated with acids, heavy metals and hydrocarbons have been produced in accordance with provisions of the NEPM and audited by auditors appointed pursuant to Victoria's *Environment Protection Act 1970*. Two assessments are currently in progress. The proposed EPO will legally establish the NEPM as the preferred process for dealing with contaminated sites in the Northern Territory.

Assessment of NEPM effectiveness

30 The acceptance of the NEPM process as a nationally-consistent approach to the assessment of contaminated sites contributed towards the establishment of the NEPM in the Northern Territory. The establishment of the NEPM as a nationally-consistent approach to contaminated site assessment has provided a common basis for interactions between Agencies in jurisdictions across Australia. Adverse impacts to human health from historical site contamination in the Northern Territory have not been reported to date.