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**Developing a national guidance framework for
Australian remediation and management of site
contamination: Review of Australian and international
frameworks for remediation**

K. Scott and M. McInerney



CRC for Contamination Assessment and Remediation of the Environment

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K. Scott¹ and M. McInerney²

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June 2012



A safer, cleaner environmental future

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Executive summary

Background

The Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) carries out research into the assessment and clean-up of contaminated sites. During the preparation of its successful bid for funding to 2020, the need for a nationally consistent approach to remediation of contaminated sites was identified by:

- representatives of environmental regulatory bodies from across Australia
- major corporate entities which operate and clean-up sites across multiple jurisdictions.

It was acknowledged that current guidance for the remediation and management of contaminated sites comprises some high quality, but dated, national documents, and high quality, but non-harmonised, guidance issued by some jurisdictions. Early discussions regarding the purpose, benefits and limitations of a new remediation framework identified the following elements as important in the consideration of the approach, structure and content of the document – the framework should:

- enable a nationally consistent approach to remediation of contaminated sites
- be established under the umbrella of the Standing Council on Environment and Water (SCEW)
- NOT impinge on the policy and decision-making prerogatives of the states and territories
- NOT be legally binding
- distil and utilise existing documentation and experience, and
- provide practical guidance within an overall framework which establishes the context for remediation in Australia.

This project

This project is the first of several projects required to deliver an accepted national remediation framework (NRF) and guidance. It is essentially an initial and exploratory scan of national and international sources in order to identify:

- international remediation and management frameworks which may be suitable for adoption or adaption in an Australian context
- current regulation of remediation and management of site contamination in Australia, and
- barriers to the adoption of an Australian NRF and management of contaminated sites.

The focus of the project was the gathering of information that may assist the national remediation framework steering group (NRFSG) as it considers:

- effective ways to approach the development of the framework in the Australian regulatory context
- the potential structure of the framework and the areas to be covered within the framework, and
- content to be included in the framework.

Information was gathered regarding frameworks that are used to guide the remediation and management of contaminated sites in a number of international jurisdictions. Information was also gathered regarding general approaches taken to remediation and management in the six states and two territories of Australia. Some national documents, approaches and processes for dealing with assessment of contaminated sites were also considered for their potential for adaptation to a management and remediation context.

A number of common elements exist in the structure and content of framework documents scanned for this project. There is also commonality in the way that remediation and management of contaminated sites is approached generally in jurisdictions in Australia and internationally.

In order to synthesise the information gathered in this project in a useful way, an example framework has been provided, including possible elements of a framework document. The particular priorities, requirements and content for the Australian national remediation and management framework will, of course, be developed over the coming years.

The example framework is offered simply as a tool to summarise the elements common to remediation and management as found in this scanning project, and to organise, in framework style, some of the elements and issues that could be addressed as part of the harmonisation process. In summary, the example framework comprises two distinct parts which are themselves comprised of particular elements as briefly described as follows:

Part 1: Philosophy

- Context
 - includes background and jurisdictional arrangements, as well as the purpose and intended audience for any framework documentation
- Policy and principles
 - includes discussion of agreed principles and policy approaches that do or will guide activities related to remediation and management, e.g. precautionary principle, liability, risk management, green remediation

Part 2: Practice

- Guidance
 - includes practical guidance for practitioners, provided either as specific advice or techniques outlined within the text of the framework document, or as references to tools and guidance available elsewhere.

Guidance could relate to all steps of the remediation and management process from the setting of remediation objectives to post-remediation auditing and the use of institutional controls.

A full description of the example framework is provided in Section B of this report.

Addressing barriers to a national approach on remediation and management

Barriers to a national approach toward remediation and management of contaminated sites are most likely to arise from the lack of an existing legislative and regulatory framework through which such matters can be addressed. Unlike the development of the National Environment Protection (Assessment of Site Contamination) Measure (NEPM), which provides a framework for the *assessment* of contaminated sites and was undertaken using processes established under law, the development of a national remediation and management framework is not provided for in existing legislation.

The Australian experience in developing a national approach to the assessment of contaminated sites does demonstrate the success of cooperative efforts across states and territories in the past. That this cooperation is an ongoing asset has been demonstrated during the recent review and proposed variation of the NEPM. Recent restructuring of the ministerial council system may also assist the process of developing a national framework for remediation and management of contaminated sites.

Following the 2010 review of the ministerial council system by the Council of Australian Governments (COAG), the SCEW Council was established with a number of priorities, the first being to pursue seamless environmental regulation and regulatory practice across jurisdictions.

A seamless environmental regulation thematic oversight group (SERTO) has been established to further the Council's aims, and the development of a national remediation and management framework has been selected as a pilot project. Comprising representatives from jurisdictions across Australia, SERTO has the potential to be a key resource, given the relationship its members have to regulatory practice in the states and territories. The group's membership and structure should enable it to become an effective mechanism for the identification, management and resolution of potential paths and barriers to the adoption of a national framework.

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Abbreviations

ACT	Australian Capital Territory
ANZECC	Australian and New Zealand Environment and Conservation Council
BMP	Bioremediation management plan
CCA	Certificate of contamination audit
CCME	Canadian Council of Ministers of the Environment
CEO	Chief executive officer
CL:AIRE	Contaminated Land: Applications in Real Environments
CLR	Contaminated land register
CMP	Contamination management plan
COAG	Council of Australian Governments
CRC CARE	Cooperative Research Centre for Contamination Assessment and Remediation of the Environment
CSC	Contaminated sites committee
CSMWG	Canadian Contaminated Sites Management Working Group
DEC	Department of Environment and Conservation
DEP	Department of Environmental Protection
DERM	Department of Environment and Resource Management
DoE	Department of Environment?
DoH	Department of Health
DSI	Detailed site investigation
EMP	Environmental management plan
EMR	Environmental management register
EPA	Environment Protection Authority
EPHC	Environment Protection and Heritage Council
EPO	Environment protection objective
EUGRIS	European Groundwater and Contaminated Land Information System
FAQ	Frequently asked question
GPLC(1-3)	Guiding principles for land contamination
HIL	Health investigation level
ITRC	Interstate Technology and Resource Council
NEPC	National Environment Protection Council

NEPM	National Environment Protection (Assessment of Site Contamination) Measure
NHMRC	National Health and Medical Research Council
NICOLE	Network for Industrially Contaminated Land in Europe
NRETAS	Department of Natural Resources, Environment, the Arts and Sport
NRF	National remediation framework
NRFSG	National remediation framework steering group
NSW	New South Wales
NT	Northern Territory
NWI	National Water Initiative
OEH	Office of Environment and Heritage
PA	Planning authority
PSI	Preliminary site investigation
QA	Quality assured
QC	Quality controlled
QLD	Queensland
RAP	Remedial action plan
RMP	Remediation management plan
SA	South Australia
SCEW	Standing Council on Environment and Water
SEPP	State Environment Protection Policy
SERTOOG	Seamless Environmental Regulation Thematic Oversight Group
SMP	Site management plan
SOC	Senior officials committee
SuRF	Sustainable Remediation Forum
TPR	Third party reviewers
UK	United Kingdom
USA	United States of America
VIC	Victoria

1. Preface

1.1 Example national remediation framework

1.1.1 Explanatory notes about the example framework

This project has involved an initial and exploratory scan of national and international jurisdictions to obtain information that may be useful to the NRFSG as it considers the development of a national framework for the remediation and management of contaminated sites. Existing frameworks were identified and briefly reviewed for structure and content. They include:

- *Australia: Australian and New Zealand guidelines for the assessment and management of contaminated sites*
- *Australia: National Environment Protection (Assessment of Site Contamination) Measure¹*
- *UK: UK Model Procedures for the Management of Land Contamination*
- *Canada: Guidance document on the management of contaminated sites in Canada*
- *Canada: A federal approach to contaminated sites.*

Framework summaries and further information about the process used to identify frameworks can be found in Section 2 of this report. The general approach taken by each Australian jurisdiction to remediation and management of contaminated sites was summarised, and detail of guidance available to practitioners was collected. Australian jurisdiction summaries can be found in Section 3 of this report. Details of available guidance can be found within each summary, and in Section 4 of this report.

The scan of national and international jurisdictional sources enabled the identification of some common processes that take place during the actual remediation and management of contaminated sites. The framework documents address these processes to varying degrees. Where a process was not documented in one of the identified frameworks, but was noted to occur across jurisdictions in Australia, it was also considered to be a 'common element'.

When an Australian national remediation and management framework is developed, its physical presentation will depend on the level of detail and volume of information and references to be provided. There are examples of different styles in current use – the two Canadian frameworks and the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines are all stand-alone documents, while the United Kingdom (UK) framework and the Australian NEPM both comprise a series of companion documents.

¹ Although the NEPM addresses assessment of contaminated sites only, it was included in the scan for the following reasons:

- it is used extensively across jurisdictions in Australia, with regulatory agencies referring to its schedules with regard to some aspects of remediation and management
- its structure and organisation of content has been reviewed favourably by its users who would also be the users of a remediation and management framework document, and
- the close relationship between assessment and remediation of contaminated sites and, in particular, the proposed amendment to Schedule A of the NEPM (as part of the variation process), suggests a similar structure for both framework documents.

The Canadian and Australian frameworks offer links and references to external sources of guidance throughout their text, while a distinguishing feature of the UK framework is its use of a separate ‘information map’.

1.1.2 Content of the example framework

As with the structure of the Australian framework, its content will result from the deliberations of the NRFSG. The following example framework is an amalgam of the elements that commonly feature in existing framework documents and in remediation and management processes across Australia. There are two quite distinct parts to the framework: philosophy and practice. What could feature in each part is described as follows:

Philosophy

- Background to development of the framework
- Legislative and jurisdictional arrangements
 - explanation of division of powers among Commonwealth and states/territories, role of local government in contaminated land management
 - role of intergovernmental bodies in fostering cooperation to enable development of initiatives that are non-binding but which are supported across jurisdictions
- Purpose of framework
 - Setting out aims of framework, e.g. to enable nationally consistent approach to remediation and management of contaminated sites and to provide practical guidance utilising existing documentation
- Statement on target audience, e.g. as including regulators, practitioners, members of the general community
- Principles and policies (or ‘regulatory philosophy’ – a term used by Canadian Council of Ministers of the Environment (CCME) in its framework guidance document on the management of contaminated sites in Canada)
 - linking of existing agreed principles/policies that either operate at national level or which have been agreed upon by jurisdictions

Practice

- Development of remediation plan
 - development of site-specific remediation objectives²
 - identification and evaluation of remedial options
 - selection of remedial technologies
 - treatability studies
 - cost-benefit analysis

² With the exception of the NEPM, which is concerned with assessment, the frameworks address both assessment and remediation. In most cases, the setting of site-specific remediation objectives is described as occurring as the last stage of the assessment process, prior to the development of a remediation plan. This provides for a relatively seamless shift in the document between assessment and remediation/management stages. In this example framework, the setting of objectives is included in the development of a remediation plan.

- preparation of a remedial action plan (RAP)/site management plan (SMP)/risk management plan (RMP)
- Implementation of remediation plan
 - health and safety considerations (worker and public)
 - community consultation and risk communication
 - reports, documentation and record-keeping
- Post-remediation considerations
 - remediation validation
 - long-term monitoring
 - auditing/third-party review
 - institutional controls.

1.2 The way forward

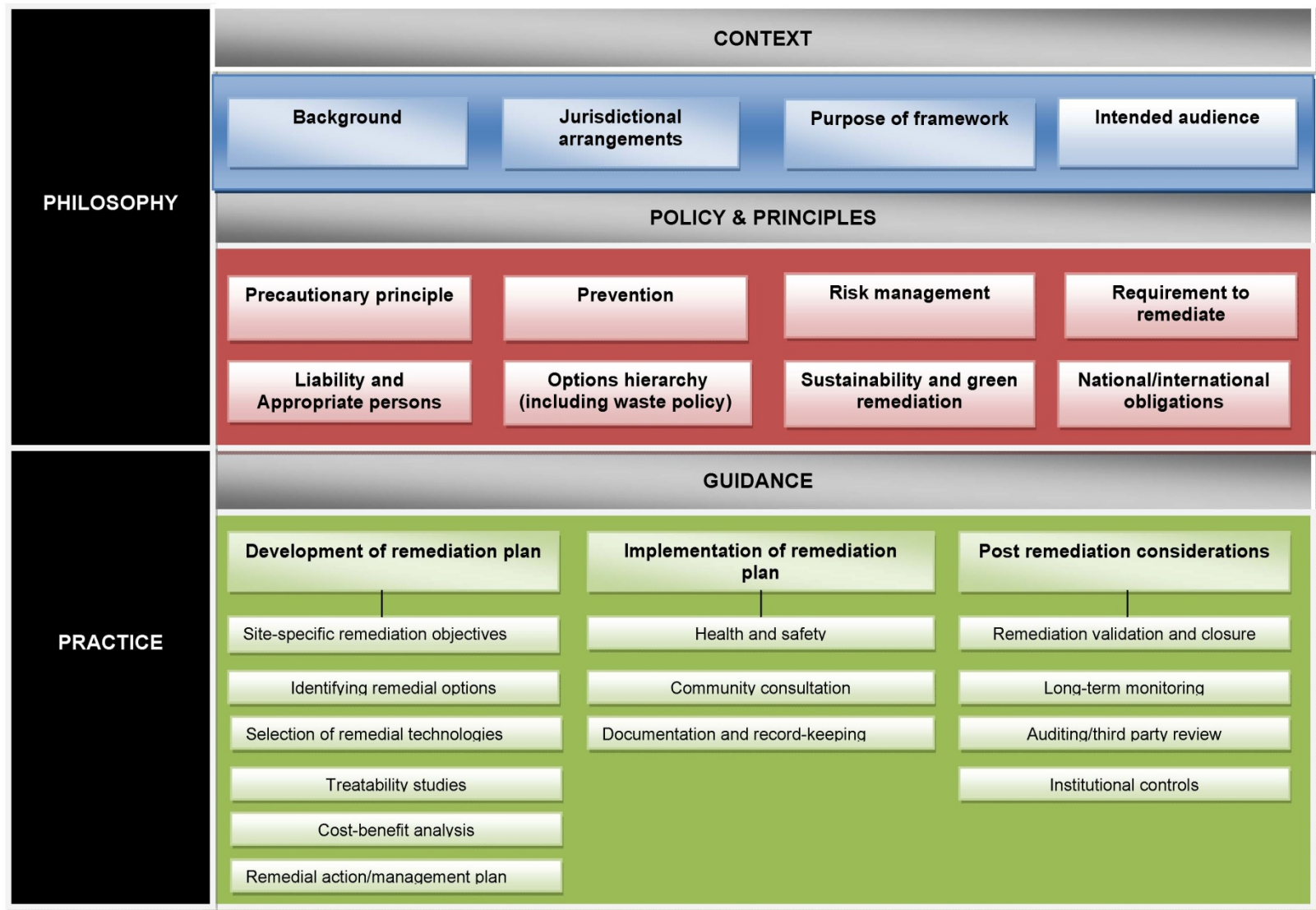
As acknowledged by the NRFSG, the development of a national remediation and management framework is a long-term project that will be best managed by a staged approach. The example framework provided above could act as a guide to this approach, with its elements being easily adapted to include other priorities or requirements identified as important. There are aspects to each part of the framework that easily translate to discrete projects which, when completed, are readily re-integrated into the wider framework structure.

Possible project arising from framework: Part 1

Developing the philosophy

- Setting the context – building on the initial work of this scanning project, and using resources identified therein, to:
 - review the legislative and jurisdictional arrangements that currently exist in order to identify and make best use of mechanisms such as SERTOG to further the development of the framework and associated documents.
- Principles and policies – linking the many principles and philosophies that already underpin regulatory practice across Australia in order to:
 - identify and synthesise principles and policies that can be adapted to a national context without compromising jurisdictional independence
 - identify areas of agreement regarding principles and policies
 - document a principle and policy basis, as well as a common purpose, that will underpin a national, harmonised approach to the remediation and management of contaminated sites.

Figure 1. Example national framework.



Possible project/s arising from framework: Part 2

Developing and organising practical guidance

Possibly a series of projects that would require significant technical input and involves:

- identification and organisation of suitable existing guidance, using the resources identified in this scanning project as a starting point
- development of new guidance where gaps in suitable guidance are identified.

Topics to be addressed could mirror the content of the example framework as follows:

- Development of remediation plan
 - development of site-specific remediation objectives
 - identification and evaluation of remedial options
 - selection of remedial technologies
 - treatability studies
 - cost-benefit analysis
 - preparation of a RAP/SMP/RMP
- Implementation of remediation plan
 - health and safety considerations – worker and public
 - community consultation and risk communication
 - reports, documentation and record-keeping
- Post-remediation considerations
 - remediation validation
 - long-term monitoring
 - auditing/third-party review
 - institutional controls

2. Background

Contaminated land is an important environmental, human health, economic and planning issue across the world. Many countries, including Australia, recognise that the redevelopment of former industrial and agricultural land, advances in scientific and technical knowledge, and changing community standards provide an opportunity for the exploration and development of effective approaches to the management of contaminated sites.

2.1 The current situation

In Australia, there is no stand-alone legislation at a national level that deals specifically with the remediation and management of site contamination. Individual state and territory jurisdictions are responsible for decisions about these matters. Provisions under the *National Environment Protection Council Act 1994* (Commonwealth) and corresponding acts of the states and territories established the National Environment Protection Council (NEPC) to ensure that:

1. people enjoy the benefit of equivalent protection from air, water or soil pollution and from noise, wherever they live in Australia
2. decisions of the business community are not distorted, and markets are not fragmented, by variations between participating jurisdictions in relation to the adoption or implementation of major environment protection measures.

According to the act, the NEPC may establish measures for the protection of the environment for the benefit of the people of Australia. In relation to site contamination, provision is given only for the NEPC to establish general guidelines for the assessment of site contamination; the NEPC does not have power to develop measures to enable a national approach to remediation and management activities. The NEPM was developed in 1999 by the NEPC. The NEPM makes clear that its guidance should only be considered in relation to the assessment of site contamination. In practice, however, there is some crossover into remediation and management aspects, for example, in using risk assessment methods to develop remediation objectives, in addressing health and safety concerns, and in establishing the credentials of professionals working on contaminated sites. Along with the NEPM, other national, non-binding guidance documents relating to contaminated sites that are used in jurisdictions are:

- *Guidelines for the assessment of on-site containment of contaminated soils*

This guidance was issued by ANZECC in 1999 and relates to the identification of on-site containment options.

- *Australian and New Zealand guidelines for the assessment and management of contaminated sites*

This guidance was issued by ANZECC and the National Health and Medical Research Council (NHMRC) in 1992 with the stated aim being to provide a systematic framework for the prevention, assessment, clean-up and management of existing and future contaminated sites.

The clean-up and management elements of this guidance are brief and broad, although some elements of the assessment sections of the document are transferable to a remediation and management context, for example, those dealing with community consultation and occupational health and safety. The assessment components were overtaken by the NEPM. The NHMRC has since rescinded the publication, meaning that it no longer represents the Council's position on the matters contained within the document. However, neither ANZECC nor its successors (the Environment Protection and Heritage Council (EPHC) or the COAG Council) have rescinded the publication which, therefore, remains relevant. However, it should be noted that, in relation to the assessment of contaminated sites, the NEPM prevails over these guidelines (CRC CARE 2011, *Contaminated sites law and policy directory* (Australia-national)).

As the remediation and management of contaminated sites is regulated at an individual jurisdictional level, approaches vary according to local requirements. Process-related and technical advice is given to practitioners through relevant regulatory bodies and, if developed locally, is usually based on, or consistent with, the national guidelines mentioned above or, at least, with the principles of environmental management that underpin them. Practitioners and other interested parties can access an advice, guidance and information through referral from local regulatory authorities, through industry associations and groups, and through a range of information 'clearinghouses', for example, the various Sustainable Remediation forums (SuRF) organisations and the Network for Contaminated Land in Europe (NICOLE).

2.2 Towards a national framework

CRC CARE carries out research into the assessment and clean-up of contaminated sites. During the preparation of its successful bid for funding to 2020, the need for a nationally consistent approach to remediation of contaminated sites was identified³ by:

- representatives of environmental regulatory bodies from across Australia
- major corporate entities which operate and clean-up sites across multiple jurisdictions.

It was acknowledged that current guidance for the remediation and management of contaminated sites comprises some high quality, but dated, national documents, and high quality, but non-harmonised, guidance issued by some jurisdictions. Early discussions regarding the purpose, benefits and limitations of a new remediation framework identified the following elements as important in the consideration of the approach, structure and content of the document. The framework should:

- enable a nationally consistent approach to remediation of contaminated sites
- be established under the umbrella of the (now) SCEW
- NOT impinge on the policy and decision-making prerogatives of the states and territories
- NOT be legally binding
- distil and utilise existing documentation and experience

³ Taken from CRC CARE (2011) documents from workshop discussions and background information for the NRFSG.

- provide practical guidance within an overall framework which establishes the context for remediation in Australia.

The NRFSG has been formed to provide overarching guidance for the development of a national framework and to oversee its planning and delivery. The terms of reference for the NRFSG bring together the elements identified above, stating that the national remediation framework will comprise guidance on the practical aspects of site remediation and management, building on guidance already promoted by states and territories.⁴

2.3 Context for harmonisation of approaches

The notion that a cooperative approach to environmental issues across Australia is desirable and achievable is apparent in the Intergovernmental Agreement on the Environment which was made between the Commonwealth, state and territory governments and the Australian Local Government Association in 1992. The agreement, provided as a schedule to the *National Environment Protection Council Act*, acknowledges that there is a benefit to Australia in establishing national environment protection standards, guidelines, goals and associated protocols. The agreement further notes that any proposed measures must be examined to identify economic and social impacts and to ensure simplicity, efficiency and effectiveness in administration.

Efforts to foster intergovernmental cooperation and a nationally consistent approach to the environment were, from 1991 until 2001, focused through ANZECC. This ministerial council provided a forum for member governments to develop coordinated policies about national and international environment and conservation issues. After 2001, work in the area of environment protection shifted to the EPHC, which replaced ANZECC. EPHC was then replaced by the SCEW (COAG Council), following a 2010 review of the ministerial council system by the COAG (COAG SCEW 2011). Following the same review, the NEPC was incorporated into the new COAG Council which, among other things, is expected to pursue and monitor priority issues of national significance which require a sustained, collaborative effort.

One of the COAG-endorsed priorities of the COAG Council is that it should pursue seamless environmental regulation and regulatory practice across jurisdictions (COAG SCEW 2011). The SERTOG is already established and provides a mechanism through which harmonisation of practice across jurisdictions could be fostered during the development of a national remediation framework.

2.4 Purpose of this project

This project is the first of several projects required to deliver an accepted national remediation framework and associated guidance. It is essentially an initial and exploratory scan of national and international sources in order to identify:

- international remediation and management frameworks which may be suitable for adoption or adaption in an Australian context

⁴ Information taken from draft terms of reference for the NRFSG, supplied by CRC CARE 2011.

- current regulation of remediation and management of site contamination in Australia
- barriers to the adoption of an Australian national framework for remediation and management of contaminated sites.

2.4.1 Extent and limitations

Being a scanning project, identification of areas and topics covered in material is provided, rather than detailed examination and analysis of content. This report refers to legislation and regulations as detailed in statutes and as explained by jurisdictional sources and the *Contaminated Site Law and Policy Directory* website. This information is used to provide a summary basis for discussion about approaches to remediation and management of contaminated sites. The legal information provided in this report is neither complete nor comprehensive and it does not, in any way, constitute legal advice.

One of the purposes of this scanning project has been to inform the NRFSG about the content of written material and guidance that appears in legislation, on regulatory agency websites, and in existing guidance material. As a result, a large amount of the information in this report has been taken from these sources.

In the interests of readability and clarity, this original material has, where appropriate, been summarised or adapted in a way that does not impact on the meaning of the content. With the same intent, the way that quoted or summarised or adapted material is presented in this report has been designed to maximise overall readability. So that the report is not filled with quotation marks, slabs of indented blocks of words and text reproduced in italics, the report is instead presented in basic style and makes footnote references to specific information being taken from a particular source of material.

As requested by CRC CARE, where references to potentially useful guidance or other sources of information were found during this project, they have been noted for possible use at other stages in the development of the NRF. These sources were often found in documents that were produced some time ago, and they have not been checked for currency or accuracy. As a result, they may have been updated or withdrawn since they were first issued.

2.4.2 Process

The focus of this scanning project has been the gathering of information that may assist the NRFSG as it considers:

- effective ways to approach the development of the framework in the Australian regulatory context
- the potential structure of the framework and the areas to be covered within the framework
- content to be included in the framework.

2.4.3 Information gathering – international

A search was conducted to identify remediation and management frameworks used in international jurisdictions that may be suitable for adoption or adaptation in an Australian context. As selected by CRC CARE, the jurisdictions considered in this project were New Zealand, the European Union (the UK, Germany and the Netherlands), Canada (federal, Ontario and British Columbia), and the United States (federal and California). The following sources were searched:

- the *Contaminated Sites Law and Policy Directory* website
- the websites of the lead agencies in each jurisdiction dealing with remediation and management of contaminated sites, as identified using normal online search tools, or as identified through credible other sources, for example, the *Contaminated Sites Law and Policy Directory* website, and the European Groundwater and Contaminated Land Information System (EUGRIS)
- the websites of industry bodies including NICOLE, Contaminated Land: Applications in Real Environments (CL:AIRE), the Interstate Technology and Resource Council (ITRC) and SuRF (UK, United States of America (USA), Australia).

2.4.4 Information gathering – Australia

Information was gathered to identify current regulation and practice relating to the remediation and management of site contamination in Australia. The project considered what was occurring at a national level as well as in each state and territory jurisdiction. The following sources of information were used:

- the websites of the lead agencies dealing with the environment and/or contamination of land in each state and territory and the Commonwealth; where appropriate and relevant, external sources referred to by those agencies were also accessed
- the *Contaminated Sites Law and Policy* website; again, external sources referred to on this website were also accessed where appropriate
- representatives from individual jurisdictions, when appropriate and necessary.

2.5 Potential barriers to adoption of a national remediation framework

The success of the NEPM and its use by practitioners as the 'bible' of site assessment has encouraged support for a national approach to remediation and management of contaminated sites. In addition, a number of mechanisms exist that could facilitate the development of a framework for remediation and management of contaminated sites without compromising the requirement for a non-binding product.

The COAG council considers matters of national significance on environment and water issues and is supported by a senior officials committee (SOC) and a new secretariat located in Canberra.

The COAG council is responsible for the delivery of COAG's strategic themes by pursuing and monitoring priority issues of national significance which require a sustained, collaborative effort, and overseeing delivery of a range of policy, implementation and governance functions, including management of projects. COAG has endorsed the following priorities⁵:

1. Pursuing seamless environmental regulation and regulatory practice across jurisdictions
2. Progressing national water reform, including through implementing the National Water Initiative (NWI), the outcomes of the forthcoming COAG review of the NWI, and other COAG commitments on water
3. Implementing the National Waste Policy
4. Implementing a national partnership approach to the conservation and management of land, waters, the marine environment and biodiversity at the landscape and ecosystem scale, and to building resilience in a changing climate
5. Developing and implementing a national plan for clean air to improve air quality and community health and wellbeing.

In relation to the first priority listed above (pursuing seamless environmental regulation and regulatory practice across jurisdictions), the development of a national remediation framework has been selected as a pilot project for SERTOOG, the group established to oversee harmonisation processes.

⁵ information about the SCEW from the EPHC website <www.ephc.gov.au/>

3. Summary of frameworks & documents relating to remediation and management of contaminated sites

3.1 Introduction

The NRFSG is interested in frameworks relating to remediation and management of contaminated sites that may be suitable for adoption or adaptation in an Australian context. As directed by CRC CARE, the scan for documents considered only the following jurisdictions: New Zealand, the European Union (the UK, Germany and the Netherlands), Canada (federal, Ontario and British Columbia) and the United States (federal and California). It became apparent very early in the search for frameworks that there are particular challenges around the terminology used for such documents. Information provided by jurisdictions about their approach to the remediation and management of contaminated sites has a variety of names, including framework, protocol, procedures, guidance and guidelines. In many cases, a 'framework' turned out to be a general, un-documented approach or understanding of an approach. In other cases, a 'framework' turned out to include procedures only, or be a description of policy only. For the purposes of this project, and in line with the discussions held by NRFSG working groups in 2011 about the type of national framework wanted for Australia, documents were considered to be 'frameworks' if they:

- comprised a stand-alone document, or an organised set of documents, that could be easily accessed and used by practitioners
- dealt with remediation and management of contaminated sites
- provided a level of advice and guidance beyond purely administrative or regulatory process (this could include information only provided within the document or reference to other sources of guidance)
- had a structure that provided for the type of framework being developed for Australia, i.e. setting the context for approach while providing practical guidance for site activities.

Only a small number of documents were assessed as a 'framework' in the form useful to the requirements of the NRFSG and are discussed individually in this report. Some jurisdictions do have documents that, although not frameworks in the sense required for this scanning project, do have elements or content that may be of interest in the development of a national framework for Australia. They include:

Germany

- *Federal soil protection and contaminated sites ordinance 1999* <www.umwelt.bundesamt.de/boden-und-altlasten/altlast/web1/berichte/pdf/bbodschv-engl.pdf>

Ontario

- *Records of site condition – A guide on site assessment, the cleanup of brownfield sites and the filing of records of site condition 2004* <www.ene.gov.on.ca/en/publications/>.

Other jurisdictions are currently working on initiatives relating to harmonisation of approaches toward land contamination.

The progress and outcomes of these initiatives may also be of interest during development of the Australian framework. They include:

Canada

The Canadian Council of Ministers of the Environment (CCME) is the major inter-governmental forum for environmental protection in Canada. CCME is comprised of the environment ministers from the federal, provincial and territorial governments, who work together to develop national strategies, norms and guidelines that each environment ministry across the country can use. CCME is not another level of government regulator, but a forum for work on issues that are national in scope and which require collective attention by a number of governments⁶. CCME sets priorities for its work each year. One of its desired outcomes for the year 2011/2012 is to develop and maintain technical products and protocols for the protection of environmental and human health. Current initiatives in support of this outcome include:

- the development and maintenance of soil quality guidelines and protocols (an example of work currently in progress is the development of *A protocol for the derivation of groundwater quality guidelines for use at contaminated sites*)
- the investigation of barriers to greater jurisdictional harmonisation of management practices.

As at January 2012, these initiatives are still in progress. The CCME's work plan can be viewed at <www.ccme.ca/assets/pdf/wkpln_smry_e.pdf>. Information about the progress of the initiatives is available at <www.ccme.ca/whatsnew/index.html>.

New Zealand

The New Zealand Ministry for the Environment has developed a program of work to address key issues and gaps that exist in how New Zealand manages contaminated land. With the aim of achieving a comprehensive policy framework for managing contaminated land, a key starting point for discussion was the 2006 paper, *Working towards a comprehensive policy framework for managing contaminated land in New Zealand: A discussion paper*. The paper is available at www.mfe.govt.nz/publications/hazardous/policy-framework-contaminated-land-position-sep07/index.html. Information about the progress of the policy framework initiative is available on the ministry's website (www.mfe.govt.nz/index.html).

The New Zealand *Resource management (national environmental standard for assessing and managing contaminants in soil to protect human health) regulations 2011* (New Zealand Ministry for Environment 2011a) came into effect in January 2012. The regulations cover consistent planning controls, use of soil contaminant values, and efficient information gathering and consistent decision-making related to contaminated sites. They will be supported by a non-binding users' guide, currently in draft form, which explains the new regulations in detail and provides guidance on their implementation (New Zealand Ministry for the Environment 2011). While not 'frameworks' in the sense used for this scanning project, both documents do make reference to specific other documents in New Zealand's *Contaminated Land Management Guidelines* series that support the remediation and management steps and processes identified in the frameworks that are discussed in the following sections (New Zealand Ministry for Environment 2011a).

⁶ Information from *About CCME* on CCME website <www.ccme.ca/about/index.html>.

Australia

In addition to frameworks from international jurisdictions, two Australian documents have been included. The NEPM (and its accompanying Schedules), and the ANZECC and NHMRC *Australian and New Zealand guidelines for the assessment and management of contaminated sites* exist as two framework documents that are already used consistently and successfully across Australian jurisdictions.

The NEPM is concerned only with assessment of contaminated sites, although jurisdictions frequently refer practitioners to particular schedules that have relevance to remediation and management of contaminated sites. The ANZECC guidelines, while addressing assessment and remediation, do not deal with remediation and management issues in a comprehensive way. However, the general structure of both documents and the way their content is organised may be of use in deliberations about the proposed national remediation and management framework. There may also be the opportunity to make good use of the information in these documents, for example, principles and general policy directions, as well as practical guidance. Recognising the jurisdictional cooperation that enabled the harmonisation of approaches towards assessment, there is potential for some information to be adopted or adapted for a remediation and management context. In particular, the NEPM may serve as a useful foundation for the development of a national framework for remediation and management. The amended assessment process flowchart proposed as part of the current variation process could be a logical and useful starting point for the consideration of a companion framework for the remediation and management of contaminated sites. The following information is organised to give an overview of the structure and content of the framework under consideration, using the following headings:

- purpose of the framework
- target audience for the framework
- principles and/or philosophies underlying the framework
- legislative basis of the framework, and
- structure of the framework.

References to potentially useful guidance and further reading were collected from a range of sources during the search for frameworks. Sources included international jurisdictions and industry bodies such as CL:AIRE, SuRF, ITRC and NICOLE. Details are provided in Section 5 of this report.

3.2 Framework summary – Canada (national approach)

3.2.1 Framework document

Guidance document on the management of contaminated sites in Canada (CCME 1997)

3.2.2 Purpose of the framework

The framework was developed in order to:

- provide procedural guidance (non-binding) to people who are managing contaminated sites
- link existing technical references produced through the CCME and the national remediation program
- educate and inform government, industry and the public about the issues involved
- assist in establishing a common approach to manage contaminated sites.

3.2.3 Target audience for the framework

The target audience for the framework is those responsible for, or involved with, identifying, assessing and remediating contaminated sites, including:

- owners/managers of contaminated sites
- government regulators
- environmental professionals
- concerned citizens
- any other person affected by contaminated sites.

3.2.4 Principles and/or philosophies underlying the framework

The framework refers to the ‘regulatory philosophy’ that has emerged in response to the issue of contaminated sites. This philosophy, and its underlying principles, are summarised as follows:

Protection of human health and the environment

Government policy and legislation relating to contaminated sites emphasises the equal protection of human health and the environment. Inherent in this philosophy is the concept that the environment (upon which human life depends) shall not be viewed as secondary to human health and shall be protected for its own sake.

Responsibility and liability

The following principles are fundamental concepts defining the general policies that should form the basis of legislation relating to responsibility and liability:

- the ‘polluter pays’ principle, where those suspected of causing the pollution are held accountable for the costs associated with the clean-up of a contaminated site
- the principle of fairness which incorporates the concepts of certainty of process, effectiveness, efficiency, clarity, consistency and timeliness in achieving environmental objectives (fairness also relates to issues associated with the principles of polluter pays and ‘beneficiary pays’)
- the concepts of openness, accessibility and participation, for the public to provide input into the development and operation of government policy and legislation
- the principle of ‘beneficiary pays’, meaning that those who will benefit from the clean-up of a contaminated site should contribute to the costs of the clean-up

- the principle of sustainable development which integrates environmental, human health and economic concerns into the decision-making process.

(Eight other recommended principles relating to substantive issues were identified by a task group and incorporated into the *Contaminated site liability report: recommended principles for a consistent approach across Canada* (CCME 1993). However, they were only referred to in this document as it was required that they be dealt with in legislation.)

Priority shift to prevention

The problems associated with contaminated sites relate both to the management of existing contaminated sites and the prevention of future contamination. Increasingly, the government focus, especially at the provincial/territorial level, will be on the reduction of pollution and elimination or reduction of such pollutants and wastes at source.

Remediation based on intended land use

In Canada, both at the federal and provincial level, the development of remedial targets is conducted with the context of specific land uses. It is the *intended* future land use that governs the decision on the level of remediation performed at a site. The generally accepted categories of land uses, which may be combined if they have common receptors and/or objectives, include agricultural, residential, parkland, commercial and industrial. To sustain the activities associated with these specific land uses, remedial targets must ensure that protection is afforded to the key receptors (both human and ecological) associated with these lands. Land-use planning using the ecosystem approach involves planning on the basis of a balance of ecosystem health, human health and quality of life including social and economic vitality. When assessing or remediating a contaminated site, the concept of the ecosystem approach should be applied to decision-making.

Protection of groundwater resources

The federal government has adopted groundwater quality guidelines and guidelines for surface water quality for a number of uses. The objective of the government in adopting these values was the protection of groundwater quality. Some provinces have passed legislation for groundwater protection and management. The use of environmental fate modelling techniques and environmental partitioning of substances are expected to play an increasingly important role in the development of regulatory guidelines.

3.2.5 Legislative basis of the framework

Canada has ten provinces and three territories. There is no 'national' legislation relating to contaminated sites – its ten provinces have exclusive power to legislate regarding contaminated sites on non-federal land within their boundaries. The Canadian approach to environmental matters results from the division of powers between the federal and provincial governments, between the provinces and their municipalities, and between different departments or ministries of the same government.

Provincial and territorial governments take the lead role in the development and enforcement of environmental legislation.

The role of the federal government has traditionally been leadership in information-gathering, research and setting national standards and objectives, generally with the participation of provincial and territorial governments, as is the case with the work of the CCME. The intention of the CCME in producing this framework document was to provide general guidance on the assessment and remediation of contaminated sites and to link existing CCME and other technical references. The document clearly states that this guidance document does not establish or affect legal rights or obligations or establish binding norms.

3.2.6 Structure of the framework

The *Guidance document on the management of contaminated sites in Canada* is a stand-alone document dealing with both assessment and remediation/management of contaminated sites. It presents in report style and is organised into sections. The first sections set the context for remediation and management of contaminated sites in Canada, and ‘set the scene’ for the practical guidance to follow. Information in these sections includes:

- the jurisdictional framework for contaminated site management in Canada
 - a discussion of the division of powers in Canada and an outline of federal and provincial environmental legislation
 - an outline of the role of municipal governments and cross-jurisdictional organisations
- government policy
 - a discussion of the regulatory philosophy underlying the approach taken to contaminated sites (as summarised above)
- strategy for contaminated site management
 - an outline of the overall strategy to guide the management of a contaminated site, incorporating the rationale for remediation, site assessment, the evaluation of results with respect to applicable/agreed remedial goals, and the development and implementation of a remedial action plan to satisfy the targets.

The next sections provide practical guidance to support the stages of contaminated site management described previously in the document. They include information about:

- contaminated site identification and assessment
 - the identification of potentially contaminated sites
 - the three phases of the assessment process
- environmental quality guidelines and remediation objectives
 - environmental quality guidelines for soil and water, and for sediment
 - the application of environmental quality guidelines at contaminated sites and the development of site-specific remediation objectives
- development and implementation of a remedial action plan
 - identification and evaluation of remedial options

- overview of existing technologies
- treatability studies
- cost-benefit analysis
- preparation of a remedial action plan
- preparation of a worker health and safety plan
- preparation of specification and tender documents; contractor selection
- documentation and record keeping
- site control/access
- changed site conditions
- remediation validation and long-term monitoring
- completion report
- occupational health and safety
 - regulations
 - training/qualifications
 - considerations for contaminated site assessments
 - considerations for contaminated site remediation
 - protection of public health and safety
- public involvement and community relations
 - identification of key community members
- post-remedial evaluation of contaminated sites.

As could be expected from the stated purpose of the document, it provides only some technical and operational advice relating to each topic. Usually, references are made to more detailed guidance available through CCME.

3.3 Framework summary – Canada (sites under federal custody)

3.3.1 Framework document: A federal approach to contaminated sites

A federal approach to contaminated sites was produced in 1999 by the Canadian Contaminated Sites Management Working Group (CSMWG), an interdepartmental committee established to investigate, propose and develop a common federal approach to the management of contaminated sites under federal custody.

3.3.2 Purpose of the framework

The mandate of the CSMWG was to establish a consistent and uniform government-wide approach to the management of contaminated sites on federal land. The development of the framework recognised that a federal approach could build on the numerous guidance documents and scientific tools developed for the CCME, Environment Canada and Health Canada.

The intention was for the framework to serve as an overview document, linking the use of existing tools and guidance within the context of the federal contaminated site management process.

3.3.3 Target audience for the framework

The target audience for the document is managers and operational personnel who are responsible for managing contaminated sites on federal lands in Canada.

3.3.4 Principles and/or philosophies underlying the framework

Although underlying principles and/or philosophies are not explicitly stated in the framework document, the stated context for the work of the CSMWG includes sustainable development, pollution prevention and budgetary considerations. The philosophical basis for the developing the framework is also suggested in the description of the potential benefits of the document which include:

- a consistent federal approach to environmental site management
- long-term strategic planning of overall investigation and clean-up effort
- more effective allocation of federal resources between departments
- better selection of cost-effective site management strategies
- implementation of risk-based clean-up criteria and management options.

3.3.5 Legislative basis of the framework

There being no specific legislation on site contamination at the federal level in Canada, the basis for this framework document is the policy-driven activity of the government with relation to remediation and management of federal contaminated sites. The framework document contains its own policy statement – that contaminated sites on federal lands should be identified, classified, managed and recorded in a consistent manner. In addition, the document refers to two other policies relevant to the development of a framework to guide remediation and management:

1. The *2000 Contaminated sites inventory policy* refers to the establishment and maintenance of a database of information to be incorporated into a central federal contaminated sites inventory and federal solid waste landfills inventory.
2. The *1999 Draft policy on accounting for costs and liabilities related to contaminated sites* refers to the reporting of costs and liabilities related to management and remediation of contaminated sites.

3.3.6 Structure of the framework

The document, *A federal approach to contaminated sites*, is a stand-alone document dealing with both assessment and remediation/management of contaminated sites. The 'federal approach' referred to in the document is a risk-based environmental management approach.

Its objective is to assess risks to human health and the natural environment under current and intended land use scenarios, and to implement risk management solutions considered to be protective of those risks.

Components to this approach include site identification and characterisation, detailed site investigations (DSIs) and risk assessment, evaluation of different risk management strategies, implementation of a selected management strategy, assessment and monitoring. These components are to be realised through a ten-step process known as the *Steps for addressing a contaminated site*. The presentation of the document reflects this 10-step structure. Each step is designed to stand alone. Each step has its own stated objective, methodology and intended output. Website references to online sources of information are provided throughout the text, while each step concludes with a list of references for relevant documentation. The steps are listed below, with additional detail given for those steps dealing with remediation and management aspects:

Step 1 – Identify suspect sites

Identifies potentially contaminated sites based on activities (past or current) on or near the site.

Step 2 – Historical review

Assembles and reviews all historical information pertaining to the site.

Step 3 – Initial testing program

Provides a preliminary characterisation of contamination and site conditions.

Step 4 – Classify contaminated site using the CCME national classification system

Prioritises the site for future investigations and/or remediation/risk management actions.

Step 5 – Detailed testing program

Focuses on specific areas of concern identified in Step 3 and provides further in-depth investigations and analysis.

Step 6 – Reclassify the site using the CCME national classification system

Updates the ranking based on the results of the detailed investigations.

Step 7 – Develop remediation/risk management strategy

Develops a site-specific plan to address contamination issues. Involves the following elements:

- the development of a remediation strategy, using either a guideline approach or a risk assessment approach (human health/ecological); and/or
- the development of a RMP.

Step 8 – Implement remediation/risk management strategy

Implements the site-specific plan that addresses contamination issues. Involves the following elements:

- evaluating applicable technologies, including the use of treatability studies where appropriate
- conducting a cost-benefit analysis
- preparing a remedial action plan, including a worker health and safety plan and tender documents
- selecting a contractor
- maintaining proper documentation, quality control, and communication with stakeholders during implementation of the remedial action plan.

Step 9 – Confirmatory sampling and final reporting

Verifies and documents the success of the remediation/risk management strategy. The following items are included in the confirmatory sampling of a remediated site:

- A sampling of contaminated media (soil and/or groundwater) is conducted to ensure that remediation or risk management objectives have been achieved.
- Sample results are compared with remediation objectives.
- If confirmatory sampling results indicate that remediation objectives were not attained, further remediation may be necessary.
- A final report is prepared to present data collected throughout the remedial process, including a record of sampling events.
- Reports and documents should be retained in perpetuity or until such time as the property is transferred from the federal government portfolio.

Step 10 – Long-term monitoring

If required, ensures remediation and long-term risk management goals are achieved. A number of appendices provide information about statements of work that may be required in a Canadian context. Another appendix contains a reference table to guide the use of numerous scientific tools and guidance documents during each step of the approach.

3.4 Framework summary – UK model procedures

3.4.1 Framework document

UK Model Procedures for the Management of Land Contamination (UK Environment Agency 2004)

Accompanying documents

- *GPLC1 Guiding Principles for Land Contamination* (UK Environment Agency 2010b)
- *GPLC2 FAQs, technical information, detailed advice and references* (UK Environment Agency 2010a)
- *GPLC3 Reporting checklists* (UK Environment Agency 2010c)

The *Model procedures for the management of land contamination* and its accompanying documents have a technical focus quite different to the Canadian frameworks (Sections 2.2 and 2.3), but are of interest because of their structure and the organisation of their content.

3.4.2 Purpose of the framework

The document was developed in order to present a technical framework for applying a risk management process when dealing with land affected by contamination. The process involves identifying, making decisions on, and taking appropriate action to deal with land contamination in a way that is consistent with government policies and legislation. It was intended that the framework would enable consistent decision-making as well as improve procedural understanding of a risk-based approach to site contamination. The framework is designed to be applicable to a range of non-regulatory and regulatory contexts, including:

- development or redevelopment of land under the planning regime
- regulatory intervention under the relevant legislation
- voluntary investigation and remediation
- management of potential liabilities of those responsible for individual sites or portfolio of sites.

3.4.3 Target audience for the framework

The target audience for the framework document encompasses all those involved in dealing with land contamination, including landowners, developers, professional advisors, regulatory bodies and financial service providers.

3.4.4 Principles and/or philosophies underlying the framework

Although the framework document sets the concept for the development of a risk management process for dealing with contaminated sites, it does not set out principles or philosophies in a structured way. However, the document refers to its alignment with the approach taken in the *Guidelines for environmental risk assessment and management GPLC2 FAQs, technical information, detailed advice and references* (UK Environment Agency, 2000), which does include a discussion of the principles of sustainable development and the precautionary principle, summarised as follows:

Environmental risk management and sustainable development

Sustainable development aims to achieve a better quality of life for everyone now and for generations to come. The needs of the present should not compromise the ability of future generations to meet their own needs (intergenerational equity). Sustainable development is concerned with achieving economic development in the form of higher living standards while protecting and enhancing the environment. The overall aim is to ensure that these economic and environmental benefits are available to everybody.

The government's vision of sustainable development is based on four broad objectives:

- social progress which recognises the needs of everyone
- effective protection of the environment
- prudent use of natural resources
- maintenance of high and stable levels of economic growth and employment.

The achievement of sustainable development requires collective partnership approaches to decision-making for environmental protection. It is about integrating economic demands and social needs with the capacity of the environment to cope with discharges, pollution and other perturbations, and to support human and other life. Decisions based on environmental risk assessments must therefore also take account of the likely economic and social impacts of the options under consideration.

Risk management and the precautionary principle

In the Rio Declaration adopted by governments at the United Nations Conference on Environment and Development in 1992, the precautionary principle was interpreted as follows: 'Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation'.

The UK Government's interpretation, which is set out in chapter 4 of its sustainable development strategy (*A better quality of life*) is based on the Rio definition. It states that precautionary action requires assessment of the costs and benefits of action and transparency in decision-making. The precautionary principle means that it is not acceptable just to say 'we can't be sure that serious damage will happen, so we'll do nothing to prevent it'. Precaution is not just relevant to environmental damage - for example, chemicals which may affect wildlife may also affect human health. At the same time, precautionary action must be based on objective assessments of the costs and benefits of action. The principle does not mean that we only permit activities if we are sure that serious harm will not arise, or there is proof that the benefits outweigh all possible risks. That would severely hinder progress towards improvements in the quality of life.

There are no hard and fast rules on when to take action: each case has to be considered carefully. We may decide that a particular risk is so serious that it is not worth living with. In other cases society will be prepared to live with a risk because of other benefits it brings. Transparency is essential; difficult decisions on precautionary action are most likely where there is reason to think there may be a significant threat, but evidence for its existence is as yet lacking or inconclusive. Decisions should be reviewed to reflect better understanding of risk as more evidence becomes available.

The extent to which precautionary action is necessary should be given careful thought for three reasons. First, action that is taken to protect one aspect of the environment can sometimes cause damage elsewhere (unintended consequences). Second, it may be better in certain circumstances not to take action if the consequences of doing so are irreversible (reversibility). Third, a decision on whether to take precautionary action should take account of the potential benefits forgone as a result of such action.

Because of the general lack of consensus over practical application of the precautionary approach, the use of risk assessment to inform decisions about environmental protection has sometimes been presented as being in conflict with the precautionary principle. In reality, risk assessment is often employed where issues are not clear and can be used to identify effects considered serious enough to warrant precautionary action. Risk assessments can sometimes point to the possibility of significant environmental damage, albeit in the presence of large uncertainties, and it is in such cases that precautionary action is particularly valid.

3.4.5 Legislative basis of the framework

The framework document was developed as guidance for the UK Department for Environment, Food and Rural Affairs which oversees the contaminated land legislative regime under Part 2A of the *Environmental Protection Act 1990*.

3.4.6 Structure of the framework

The main document, *Model procedures for the management of land contamination*, deals with both assessment and remediation/management of contaminated sites. There are three other 'guiding principles' documents associated with the framework document:

- *GPLC1 Guiding principles for land contamination* – explains the purpose of the guiding principles; includes a reminder of the key stages in the model procedures.
- *GPLC2 FAQs, technical information, detailed advice and references* – this document provides answers to a series of questions and includes numerous references to other published guidance.
- *GPLC3 Reporting checklists* – this document contains eight example checklists which correspond to key reporting stages.

The structure of each of the documents reflects the three main components of the risk management process used to develop the model procedures, namely:

- risk assessment – establishing whether unacceptable risks exist and, if so, what further action needs to be taken in relation to the site
- options appraisal – evaluating feasible remediation options and determining the most appropriate remediation strategy for the site, and
- implementation of the remediation strategy – carrying out the remediation strategy and demonstrating that it is, and will continue to be, effective.

The main document is presented in three parts – procedures, supporting information and an information map. They provide a hierarchy of information, in which Part 1 sets out the framework of the process, Part 2 provides further technical detail to support the process, and Part 3 contains sources of further information and guidance.

3.5 Framework Summary – ANZECC guidelines

3.5.1 Framework document

- *Australian and New Zealand guidelines for the assessment and management of contaminated sites* (ANZECC and NHMRC 1992).

This document preceded the establishment of the NEPM and considered issues related to both assessment and management of contaminated sites.

3.5.2 Why was the framework document developed?

The document was developed in response to what was seen as an ‘ad hoc approach’ in Australia and New Zealand towards the problems associated with contaminated land. The main purpose of the guidelines is to provide a framework to ensure a consistent standard of site assessment and subsequent management across jurisdictions. It was intended that the guidelines would provide a consistent basis for the development of strategies to manage contaminated sites, while also leaving room for site-specific approaches.

3.5.3 Who is the target audience for the framework document?

The guidelines aim to inform and educate government, industry, unions and the general community.

3.5.4 What are the principles and/or philosophies underlying the framework?

The guidelines include a number of principles developed to provide a policy basis for the approach described within the framework. Many of the principles were later adapted for the NEPM. The principles outlined in the framework are as follows:

Prevention

Prevention of site contamination is of paramount importance. Steps need to be taken to minimise the creation of additional contaminated sites and to prevent the further contamination of already contaminated sites which can occur either as a result of accidents or of on-going, poorly managed industrial, agricultural or commercial activities. Management should seek to minimise the risk of contamination associated with day to day operation of processes and accidents, spillages, fires and explosions. Contingency plans should also be developed to minimise the risk of contamination in the event of an accident. Appropriate precautionary measures need to be taken when decommissioning industrial premises. Such measures include exercising of care during dismantling, containment of residual and hazardous materials and the carrying out of clean-up procedures as decommissioning takes place.

Management

Contaminated site management strategies should reflect the need to protect all segments of the environment both biological and physical (air, land and water, including groundwater).

It is important that consideration be given to the potential consequences and impacts of polluted soils, groundwater, surface water and air on the environment, on the health and well-being of the community and on structures and service conduits. The primary motive for the stringent soil criteria employed in other countries is to protect groundwater which is often used for domestic consumption. While Australia on the whole does not use a great deal of groundwater for domestic purposes, there are some cities and towns which do. It is possible the use of this resource could be expanded in the future and therefore, it is important that groundwater should be protected. The cost of underestimating the importance of groundwater protection may be high. Polluted groundwater has the potential to contaminate soil and surface waters at a distance from the source of the original contamination. Trans-media movement of contaminants needs to be prevented and properly managed.

The fundamental goal of contaminated site clean-up should be to render a site acceptable and safe for a long term continuation of its existing use and to maximise to the extent practicable the potential future uses of the site. New Zealand has a slightly different approach (outlined in the policy framework document referred to in Section 2).

Wherever human health is at risk, either on or off site, or the off-site environment is at risk, a contaminated site should be cleaned up to the extent necessary in order to minimise such risks in both the short and long terms. However, in cases where there is no threat to human health and the environment is not at risk, it may be appropriate to clean-up the site to some lesser degree, and in some cases to accept a strategy of containing contaminants on the site or using planning controls to limit site use.

Consideration of technical feasibility and of net social benefit should always play a part in influencing the clean-up strategy adopted for a particular site. Clean-up should not proceed if the process is likely to create a greater adverse effect than leaving the site undisturbed. This stance would need to be revised when new technologies or clean-up strategies became available. A multi-disciplinary approach is essential to the clean-up of contaminated sites, as no single discipline or profession is likely to be able to deal effectively with the range and complexity of technical, health, environmental, social and other issues which may arise. Consideration must be given to public and occupational health and safety in the development of a strategy to assess, clean up and manage a contaminated site. The preferred order of options for site clean-up and management are:

- on-site treatment of soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level
- off-site treatment of excavated soil which, depending on the residual levels of contamination in the treated material is then returned to the site, removed to an approved waste disposal site or facility or used as fill for landfill.

Should it not be possible for either of these options to be implemented, then other options that should be considered include:

- removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill
- isolation of the soil by covering with a properly designed barrier
- choosing a less sensitive land use to minimise the need for remedial works which may include partial remediation

- leaving contaminated material in-situ providing there is no immediate danger to the environment or community and the site has appropriate controls in place.

In cases where a limited number of highly localised 'hot spots' are involved, responsible authorities may agree to mixing with clean soil or subsoil to reduce the concentration of contaminants to acceptable levels. However, it should be emphasised that this is not seen as a preferred clean-up strategy. It should also be emphasised that the appropriateness of any particular option will vary depending on a range of local factors. Acceptance of any specific option or mix of options in any particular set of circumstances is therefore a matter for the responsible authority.

Polluted soil should be regarded as potentially hazardous waste and as such should be subjected to the same controls over its use, storage, transport and ultimate disposal as industrial waste.

3.5.5 What is the legislative basis of the framework?

The guidelines were jointly developed by ANZECC and the NHMRC in 1992. At that time, ANZECC provided a forum for member governments to develop coordinated policies about national and international environment and conservation issues. The NHMRC has since rescinded the publication, meaning that it no longer represents the council's position on the matters contained within the document. However, neither ANZECC nor its successors (the EPHC or the COAG Council) have rescinded the publication which, therefore, remains relevant. It should be noted that, in relation to the assessment of contaminated sites, the NEPM prevails over these guidelines.⁷

3.5.6 What is the approach taken by the document?

The framework describes the context for a consistent approach to the assessment and management of contaminated sites across jurisdictions. It recognises the independence of separate jurisdictions and the need to enable site-specific strategies, but focuses on the advantages of coordinated policy relating to environmental protection.

3.5.7 How is the practical guidance organised?

The document sets a strategic framework for the practical guidance to follow, outlining principles to serve as the basis for policy initiatives and the development of contaminated sites programs. The framework considers policy basis, implementation strategies, community involvement and future directions. There is detailed guidance relating to assessment procedures, with less detailed attention given to matters around remediation and management of contaminated sites. Under some topics, guidance is brief and summary in nature. The topics covered in the guidance are listed below, including those relating to assessment so as to give a sense of the overall content of the document.

⁷ CRC CARE 2011, Contaminated sites law and policy directory – *Australia-national* <www.cslawpolicy.com>

Assessment and clean-up:

- preventive measures
- decommissioning considerations
- identification of a potentially contaminated site
- initial evaluation

Determining the nature and extent of contamination; development of a work plan

- site investigation
- sampling and analysis
- health considerations
- environmental considerations
- community involvement
- occupational health and safety considerations

Determination of the environmental and health impact of contaminants

- toxicity assessment
- exposure assessment
- risk assessment

Development of site-specific guidelines

- development of public health based guidelines
- development of environment based guidelines

Management and clean-up

- health risk management

Validation and future monitoring

There are two appendices to the document – one dealing with reporting, and one relating to risk characterisation and health appraisal of site assessment.

3.6 Framework summary – NEPM

3.6.1 Framework document

- *National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM) (NEPC 1999)*

Accompanying documents

The NEPM is accompanied by 10 schedules which contain extensive and detailed guidance relating to the assessment of site contamination. The schedules are listed below. Specific schedules that have been identified by jurisdictions as having relevance to the remediation and management of contaminated sites appear in bold type.

Title of guideline

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

3.6.2 Purpose of the framework

The NEPM states that its purpose 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, land owners, developers and industry. The desired environmental outcome for the NEPM is to provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination.

3.6.3 Target audience for the framework

As mentioned above, the target audience is broad and includes regulators, site assessors, environmental auditors, land owners, developers and industry.

3.6.4 Principles and/or philosophies underlying the framework

The NEPM contains a list of principles that guide policy and practice relating to contaminated sites in Australia. All of the principles are listed here; however, additional explanatory information from the NEPM is only given if the principle relates to remediation and management. Complete information is available in the NEPM document.

3.6.5 Assessment of site contamination principles

Individual responsibility

The primary responsibility for ensuring the assessment of site contamination rests with the states and territories, excluding sites owned by the Commonwealth which are the responsibility of the Commonwealth.

Implementation of jurisdictional responsibility

There should be a consistent approach to the assessment of site contamination across Australia but each participating jurisdiction may implement the necessary controls in its own manner.

Prevention

Contamination, or further contamination, of a site should be prevented.

Regulatory control of site contamination

Contaminated soil and associated ground and surface waters should be categorised by the nature and concentration of contaminants and subject to appropriate controls over their use, storage, transport and ultimate disposal.

Planning

Planning authorities of participating jurisdictions should ensure a site, which is being considered for a change in land use, and which planning authorities ought reasonably to have known to have a history of use that is indicative of potential contamination, is suitable for its intended use.

Availability of site contamination information

Without detracting from any obligation of disclosure, which may exist at law, all relevant information on site contamination should be accessible to the community and particularly to those who need to make informed decisions, for example, potential land purchasers. Prospective purchasers of land should also make appropriate enquiries to satisfy themselves regarding the condition of a site and any financial liabilities that may apply for the current use or the proposed future use of the land.

Community consultation

Where there are reasonable grounds to expect an impact on the community, the community has the right to be informed of, and to be consulted on, the decision-making process from an early stage in the assessment of site contamination.

Cultural and spiritual significance

Due regard should be given to sites of cultural or spiritual significance, in particular, the significance that indigenous people attach to land.

Education

Education programs should be implemented in the community, industry and all levels of government to raise awareness and understanding of site contamination issues, including the prevention of soil, air and water contamination.

Site assessment

Site assessment work should be conducted by professionals who are able to demonstrate to regulatory authorities that they have relevant qualifications and experience.

Human health

Human health should be a primary concern when assessing land use and exposure scenarios. There should be appropriate occupational health and safety measures (including training) for personnel involved in assessment of site contamination. Community health assessment and monitoring for specific health effects may be warranted where appraisal has indicated a significant risk of exposure to a contaminant.

Environmental impact

During the assessment of site contamination there should be management of on-site and off-site impacts of contaminants, particularly of emissions to air and surface water and groundwater.

Data collection and chemical analyses

Site assessors should implement data quality objectives, and data quality assurance and quality control procedures that address sampling, contaminant identification and chemical analyses.

Risk assessment

The preliminary assessment of human health risk and ecological risks may be undertaken by comparing levels of contaminants on the site with appropriate investigation levels, provided in supporting documents.

An investigation level refers to the concentration of a contaminant above which further appropriate investigation and evaluation will be required. The preliminary assessment may lead to a more detailed assessment of health and ecological risks. Human and ecological health risk assessment should take into account, where practicable, any additive, synergistic and antagonistic effects of mixtures of chemical substances.

Objectives of assessment

The purpose of site assessment is to determine whether site contamination 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. In assessing that risk a balance is to be achieved between optimising the current or intended use of the site, and the need to adequately protect human health and the environment. The broader objective of assessment is to ensure:

- that the people of Australia enjoy the benefit of equivalent protection from air, water and soil pollution wherever they live
- that the capacity of the soil is maintained for future generations
- that there is consistency of approach between jurisdictions to aid government and business decision making.

Attainment of environmental outcome

In general, to achieve the desired environmental outcome, the process of the assessment of site contamination should be placed within the context of the broader site assessment and management process. In particular, in assessing the contamination, the site assessor and others should take into account the preferred hierarchy of options for site clean-up and/or management which is outlined as follows:

- if practicable, on-site treatment of the contamination so that it is destroyed or the associated risk is reduced to an acceptable level
- off-site treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level, after which soil is returned to the site

or, if the above are not practicable,

- consolidation and isolation of the soil on site by containment with a properly designed barrier
- removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material

or

- where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

In cases where no readily available or economically feasible method is available for remediation, it may be possible to adopt appropriate regulatory controls or develop other forms of remediation. It should be emphasised that the appropriateness of any particular option will vary depending on a range of local factors. Acceptance of any specific option or mix of options in any particular set of circumstances is therefore a matter for the responsible participating jurisdiction.

Specialist areas

In the assessment of site contamination the following sources are recognised as requiring specialised forms of assessment and initially, information should be sought from the relevant environmental protection agency for advice on assessing sites with:

- unexploded ordnance
- radioactive substances
- biologically pathogenic materials and waste
- contaminated sediments.

Heritage sites

Heritage values should, wherever possible, be assessed prior to any physical assessment of contamination of a site. Where appropriate, advice should be sought from the local representatives of the Aboriginal and Torres Strait Islander Commission, the Australian Heritage Commission, jurisdictional heritage bodies and local councils.

Best practice

In observing the principles and guidelines in this measure, each participating jurisdiction should give consideration to the most current advice and best practice.

3.6.6 Legislative basis of the framework

As each member jurisdiction of the NEPC is able, through its own legislation, to adopt NEPMs and provide them with the force of law, the NEPM is part of the law of each state and territory of Australia (CRC CARE 2011, *Contaminated sites law and policy directory* (Australia-national)). The NEPM has been under review since 2006 and a draft varied NEPM (assessment of site contamination, including revised schedules) is currently being considered.

3.6.7 Structure of the framework

The NEPM is presented in a framework format, providing an overview document which is accompanied by a number of separate schedules dealing with specific aspects of the investigation and assessment of contaminated sites. The NEPM makes clear that its guidance should only be considered in relation to the assessment of site contamination.

In practice, however, there is some crossover into remediation and management aspects, for example, in using risk assessment methods to develop remediation objectives, in addressing health and safety concerns, and in establishing the credentials of professionals working on contaminated sites. Recognising this, many jurisdictions refer practitioners to these guidelines to inform and assist remediation and management activities. Each schedule is presented in a similar format, taking into account the type of content that it contains and the knowledge requirements of practitioners and other readers. In general, each schedule acts as a kind of mini-framework. As an example, *Schedule B (8) Guideline on community consultation and risk communication* (NEPC 1999) contains information organised in the following way:

- purpose and application of the schedule (with a clear statement regarding the non-binding nature of the information contained within the document)
- principles underlying the preparation of the guideline
- goals of community consultation
- perceptions and perspectives
- guiding principle of consulting with the community
- techniques
- case studies
- bibliography.

The schedule includes detailed guidance and also provides references to other sources of information.

These references included links to other schedules and references to other guidance material throughout the text, as well as a detailed bibliography and reference list provided at the end of the document.

Following review of the NEPM in 2006, the NEPC has been working on a draft varied NEPM (assessment of site contamination, including revised schedules). The stated aim of the proposed variation is to ensure that the NEPM remains the premier document for the assessment of site contamination in Australia by drawing on the latest methodologies for assessing human and ecological risk from site contamination, and updating guidance on site assessment methods in line with technological changes in Australia and overseas.⁸

The draft varied NEPM and schedules contain a number of major changes relating to various aspects of the assessment process.⁹ Of particular relevance to the remediation and management of contaminated sites is the incorporation of improved guidance on:

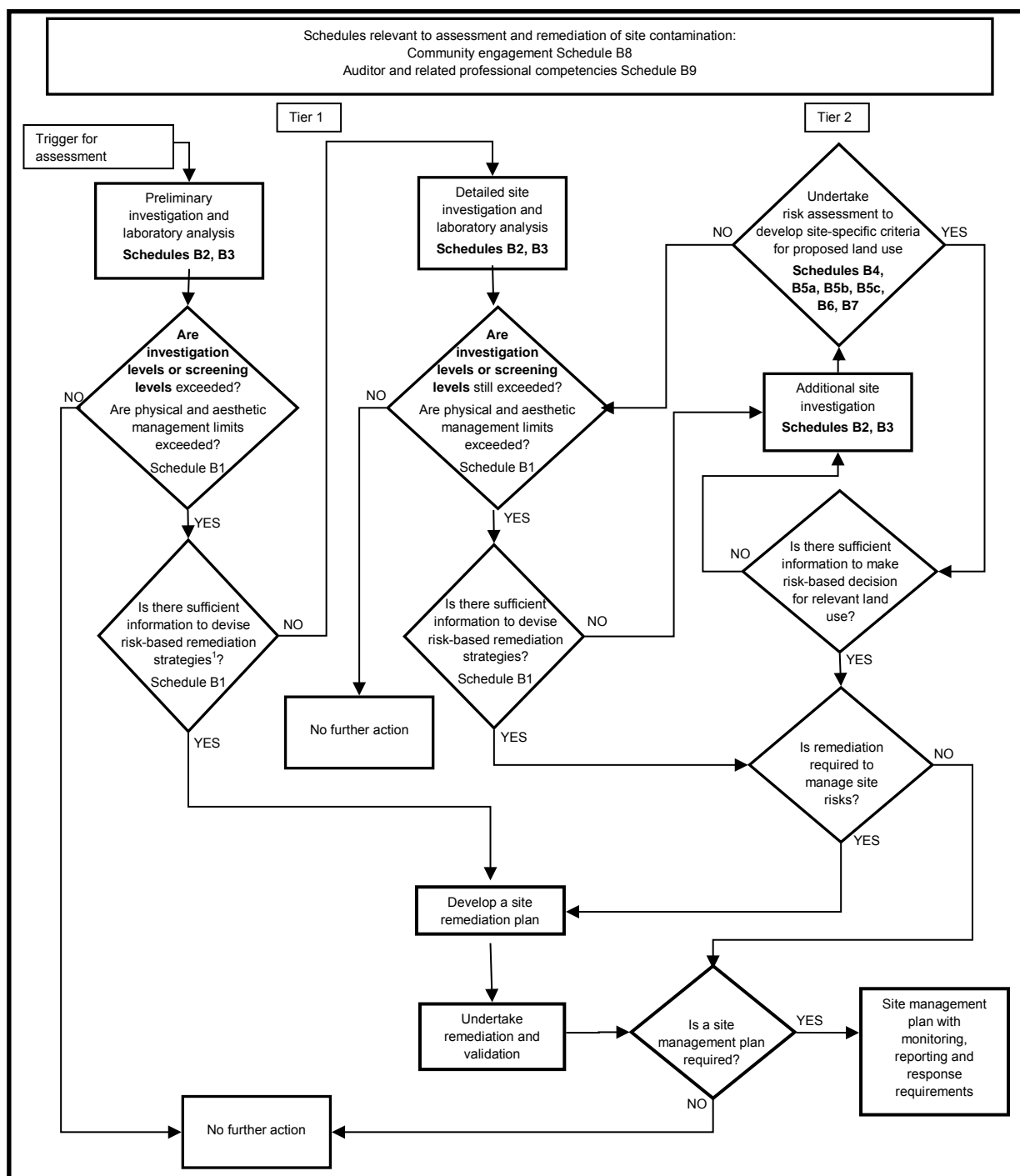
- community engagement – Schedule B8
- expected competencies of consultants and auditors engaged in site assessment work – Schedule B9.

Also of relevance to the development of a national remediation and management framework is the proposed variation to Schedule A of the NEPM which comprises a flowchart identifying the recommended process for the assessment of site contamination. The proposed variation flowchart expands on the remediation aspects of the management process, potentially offering a useful starting point for consideration of potential structure and content for a national framework document. The proposed variation to Schedule A flowchart is provided in Figure 2.

⁸ NEPC website 2011, *Assessment of site contamination NEPM, general information*, available at <www.ephc.gov.au/contam>.

⁹ Variance process information, including access to draft documents, is available at <www.ephc.gov.au/contam/pdocs>.

Figure 2. Proposed variation to the site assessment NEPM process flowchart.



Note ¹: Remediation and/or management can be considered at this point for sites with localised or low-level exceedance.

Schedule B refers to Schedule B of the NEPM

4. Remediation and management of contaminated sites in Australia

4.1 Introduction

Australia's federal system of government ensures the regulatory independence of its eight states and territories. There is, however, a consistent history of cooperation between jurisdictions, enabled through the ministerial council system that provides a forum for the development of coordinated policies about environmental issues. The NEPM is one result of this cooperative work. The NEPM forms the basis for the approach to the assessment of site contamination taken in all jurisdictions, providing a framework structure that encourages consistent practice across states and territories without compromising legislative and regulatory independence.

As there is no similar framework in place for the remediation and management of contaminated sites, practice across jurisdictions is not consistent or harmonised. Along with the tradition of cooperative work among the jurisdictions which can serve as a solid basis for the development of another national framework, consideration of the approach to remediation and management taken by individual states and territories does show that there are many areas of common regulation and practice.

CRC CARE has established the *Contaminated Sites Law and Policy Directory*, a website that aims to provide readers with a clear understanding of the way that remediation and management of contaminated sites is dealt with in both national and international jurisdictions. Of particular interest in future stages of the development of a harmonised approach via a national framework will be the Australian summary matrix provided in the directory. The matrix enables comparison of critical issues relating to contaminated sites regulation across Australian jurisdictions (CRC CARE 2011, *Contaminated sites law and policy directory* (Australian summary matrix)). As at January 2012, the directory contains detailed information about each Australian jurisdiction as well as Singapore and Hong Kong, with more jurisdictions to be included in the near future. The directory provides clear and comprehensive information about the approach taken to remediation and management of contaminated sites in each Australian jurisdiction. The regulatory and operational activities of the jurisdictions are covered in the directory under the following headings:

- responsibility for remediation
- role of private professionals
- identification, investigation and assessment
- remediation process
- voluntary remediation (brownfield measures)
- remediation under the land-use planning process
- post-remediation controls
- public participation, and
- liability in tort and contract.

Given the comprehensive and detailed analysis of regulatory and administrative processes that is available in the CRC CARE directory, it is an aim of this scanning project to simply provide a 'snapshot' of the regulatory approach taken in Australian jurisdictions towards the remediation and management of contaminated sites. Another aim is to gather information about existing documentation and experience that may be suitable for adaptation and use in the national framework to be developed. Consequently, the information provided as part of this scanning project is organised below in a way to best facilitate its use in future projects relating to the development of the national framework. The following topics are considered for each jurisdiction:

- principles underpinning the approach taken towards remediation and management of contaminated sites
- the structure of administrative and regulatory arrangements
- the general process of remediation and management
- general practical guidance offered or referred to by regulatory agencies
- source material for specific requirements for various aspects of the remediation and management process, provided under the headings of:
 - remediation and management planning, implementation and validation
 - auditing/third party review.

Information about existing documentation and guidance is referenced when mentioned (as follows), but is also provided in a more practical format in Section 4 of this report.

4.2 New South Wales¹⁰

4.2.1 Principles underpinning the approach to remediation and management

New South Wales (NSW) approaches the management of contaminated land according to principles of ecologically sustainable development, which are described in the *Contaminated Land Management Act 1997* (NSW Government 1997) as follows:

Ecologically sustainable development requires the effective integration of economic and environmental considerations in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:

- (a) the precautionary principle – namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:
 - (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment
 - (ii) an assessment of the risk-weighted consequences of various options

¹⁰ This material provides an overview of regulatory practice in this jurisdiction. For complete and comprehensive information about legislation and regulatory approach, see the *Contaminated sites law and policy directory* <www.cslawpolicy.com.au>

- (b) intergenerational equity – namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations
- (c) conservation of biological diversity and ecological integrity – namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration
- (d) improved valuation, pricing and incentive mechanisms – namely, that environmental factors should be included in the valuation of assets and services, such as:
 - (i) polluter pays – that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement
 - (ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste
 - (iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The key principles identified in the NSW planning guidelines involve an understanding that the integration of land contamination management into the planning and development process will:

- ensure that changes of land use will not increase the risk to health or the environment
- avoid inappropriate restrictions on land use, and
- provide information to support decision making and to inform the community.

In the guidelines, these principles are translated into a need for planning authorities to:

- consider the likelihood of land contamination as early as possible in the planning and development control process
- link decisions about the development of land with the information available about contamination possibilities
- adopt a policy approach that will provide strategic and statutory planning options based on the information about contamination, and
- exercise statutory planning functions with a reasonable standard of care (NSW Department of Urban Affairs and Planning & NSW EPA 1998).

4.2.2 The regulatory basis for the remediation and management of site contamination

- *Contaminated Land Management Act 1997*
- *Environmental Planning and Assessment Act 1979*
- *State Environmental Planning Policy (SEPP) no. 55*
- *Managing land contamination – Planning guidelines*

- *Guidelines for consultants reporting on contaminated sites*

4.2.3 Responsibility for regulating and/or administering processes

In NSW, the management of contaminated land is shared by the Office of Environment and Heritage (OEH), the Department of Planning and Infrastructure, and planning consent authorities (usually local councils). The OEH deals with contamination significant enough to warrant regulation under the act given the site's current or approved use. The Environment Protection Authority (EPA) is part of OEH and has a range of powers. OEH also administers the state's site auditing scheme, makes or approves guidelines for use in the assessment and remediation of contaminated sites, and administers the public record of regulated sites. OEH may also be involved with the remediation of contaminated sites by:

- performing technology reviews and assessing proposed technologies for treating certain chemical wastes
- assessing licence applications for remediation proposals (where required) as part of the integrated development assessment process
- issuing and enforcing licences (where required) that regulate waste treatment, storage and/or disposal facilities
- issuing clean-up and prevention notices.

Local councils deal with contamination on sites which, though contaminated, do not pose an unacceptable risk under their current or approved use. In these cases, the planning and development process determines what remediation is needed to make the land suitable for a different use.¹¹

4.2.4 General process followed for the remediation and management of contaminated sites

Process followed under the OEH regime

If the OEH declares land to be significantly contaminated (to an extent as to warrant regulation), it notifies those responsible for the contamination, owners, occupiers and local authorities. The declaration is published in the government gazette and online via the contaminated land management public record as well as via direct consultation with identified interested parties.

There is a 'duty to notify' requirement under the act whereby anyone whose activities have contaminated land, or owners of contaminated land, must notify OEH as soon as practicable after becoming aware of the contamination, if the contamination meets certain criteria. OEH may order a person to carry out a preliminary investigation of land. These preliminary investigation orders are intended to provide a 'snapshot' for OEH to determine whether the land is contaminated and, if so, whether it is significant enough to warrant regulation. If land is considered significantly contaminated, OEH may issue a management order which can include actions to investigate and/or remediate the land.

¹¹ NSW OEH, *Management of contaminated sites* <www.environment.nsw.gov.au/clm/management.htm>

Anyone can put forward a voluntary management proposal for the management of significantly contaminated land. OEH may approve the proposal with or without conditions.

The Minister for the Environment can allow those responsible for significantly contaminated land to implement offsets to mitigate the impact of contamination. Importantly, offsets are not an alternative to remediation.¹² A site audit report and site audit statement is provided to OEH. This statement indicates the suitability (or otherwise) of the land for proposed future uses and provides, in effect, a 'sign off' following remediation.¹³

Process followed under planning and development control

The planning and development control process under the *Environmental Planning and Assessment Act 1979* aims to ensure that land is not allowed to be put to a use that is inappropriate because of the presence of contamination. It incorporates mechanisms to ensure that:

- planning authorities consider contamination issues when they are making rezoning and development decisions
- local councils provide information about land contamination on planning certificates that they issue
- land remediation is facilitated and controlled through SEPP no. 55 (NSW Government).

Under SEPP 55, planning authorities are required to consider, at the development approval and rezoning stage, the potential for contamination to adversely affect the suitability of a site for its proposed use. The policy states that land must not be developed if it is unsuitable for a proposed use because it is contaminated. If the land is unsuitable, remediation must take place before the land is developed. SEPP no. 55:

- makes remediation permissible across NSW
- defines when consent is required
- requires all remediation to comply with standards
- ensures land which is going through the development consent process is investigated if contamination is suspected (for instance, based on site history), and
- requires councils to be notified of all remediation proposals.

Planning authorities consider, at the development approval and rezoning stage, the potential for contamination to adversely affect the suitability of a site for its proposed use. Guidance for planners is provided through SEPP 55 planning guidelines which provide advice on:

- the early identification of contaminated sites
- consideration of contamination in rezoning and development applications
- recording and use of information

¹² Process information from *Contaminated land: Role of the OEH* <www.environment.nsw.gov.au/clm/regulation.htm>.

¹³ CRC CARE 2011, *Contaminated sites law and policy directory – NSW*, <www.cslawpolicy.com>.

- ways to prevent contamination and reduce the environmental impact of remediation activities.

A revised version of the guidelines is being finalised and will reflect changes in its underlying regulatory framework, and will clarify advice. The guidelines outline the use of planning certificates (Section 149 certificates) which provide a record that:

- the land is declared significantly contaminated
- the land is subject to a management order issued by OEH
- a voluntary management proposal for a site has been approved
- the land is subject to an ongoing maintenance order
- the land is the subject of a site audit statement if a copy of such a statement has been provided.

Councils may also use these certificates to record other information, particularly anything else of a factual nature about contamination which the local council deems appropriate.¹⁴

4.2.5 Practical guidance offered or recommended by regulatory agencies

Practitioners in NSW are provided with general guidance in the form of the *Guidelines for consultants reporting on contaminated sites*, developed by OEH (NSW OEH 2011). Although the guidelines are concerned with reporting requirements, they also provide some information about the activities expected to be undertaken at each stage of the assessment and remediation process.

4.2.6 Remediation and management planning, implementation and validation

There is no specific guidance document relating to the development of a remediation or management plan – which in NSW is known as a site RAP. Consultants are advised on what such a plan must include, however, in the reporting guidelines. In general, the RAP should:

- set remediation goals that ensure the remediated site will be suitable for the proposed use and will pose no unacceptable risk to human health or to the environment
- document in detail all procedures and plans to be implemented to reduce risks to acceptable levels for the proposed site use
- establish the environmental safeguards required to complete the remediation in an environmentally acceptable manner
- identify and include proof of the necessary approvals and licences required by regulatory authorities.

Once remedial work is complete, a report should be prepared detailing the site work conducted and regulatory decisions made.

¹⁴ Information about the planning process from *Role of planning authorities* <www.environment.nsw.gov.au/clm/planning.htm>.

The guidelines provide a checklist for consultants writing such a report and this gives further detail about what a RAP should include, as follows:

- remediation goal
- discussion of the extent of remediation required
- discussion of possible remedial options and how risk can be reduced
- rationale for the selection of recommended remedial option
- proposed testing to validate the site after remediation
- contingency plan if the selected remedial strategy fails
- interim SMP (before remediation), including e.g. fencing, erection of warning signs, stormwater diversion
- SMP (operation phase):
 - site stormwater management plan
 - soil management plan
 - noise control plan
 - dust control plan, including wheel wash (where applicable)
 - odour control plan
 - occupational health and safety plan
- remediation schedule
- hours of operation
- contingency plans to respond to site incidents, to obviate potential effects on surrounding environment and community
- identification of regulatory compliance requirements such as licences and approvals
- names and phone numbers of appropriate personnel to contact during remediation
- community relations plans (where applicable)
- staged progress reporting (where appropriate), and
- long-term SMP.

Detailed guidance about documentation and record-keeping is provided through the reporting guidelines. Their purpose is to assist consultants, site auditors, council staff and other interested parties in reporting on the investigation and remediation of contaminated sites. The guidelines address reporting in relation to four stages of the process to manage contaminated sites:

- preliminary site investigation
- DSI
- site remedial action plan (RAP)
- validation and site monitoring.

Information is given about the requirements of the various reports so as to comply with NSW regulation. Throughout the document, reference is made to further sources of information to guide the reader.

As with the development of a RAP, there is no specific guidance document relating to the validation of a site where remedial action has taken place, but the reporting guidelines give information about the requirements of a validation report (and offer references to other sources of useful guidance). Information in the guidelines includes the following:

Where remedial action has been carried out, the site must be 'validated' to ensure that the objectives stated in the RAP have been achieved. A report detailing the results of the site validation is required. The extent of validation required will depend on the degree of contamination originally present, the type of remediation processes that have been carried out and the proposed land use. Validation must confirm statistically that the remediated site complies with the clean-up criteria set for the site. The validation report must assess the results of the post-remediation testing against the clean-up criteria stated in the RAP. Where targets have not been achieved, reasons must be stated and additional site work proposed to achieve the original RAP objectives. The validation report should also include information confirming that all OEH and other regulatory authorities' licence conditions and approvals have been met. In particular, documentary evidence is needed to confirm that any disposal of soil off-site is done in accordance with the RAP. Again in checklist form, further information is given about the elements of remediation validation. The report should include:

- rationale and justification for the validation strategy including:
 - clean-up criteria and statistically based decision-making methodology
 - validation sampling and analysis plan
- details of a statistical analysis of validation results and evaluation against the clean-up criteria
- verification of compliance with regulatory requirements set by OEH, WorkCover and local government.

The reporting guidelines provide instruction as to the way ongoing site monitoring must be reported, with a checklist again giving an indication of what must be addressed to comply with regulations. According to the guidelines, where full clean-up is not feasible, or on-site containment of contamination is proposed, the need for an ongoing monitoring program should be assessed. If a monitoring program is needed, it should detail the proposed monitoring strategy, parameters to be monitored, monitoring locations, frequency of monitoring, and reporting requirements. The ensuing report should include information about:

- ongoing site monitoring requirements (if any), including monitoring parameters and frequency
- results of monitoring analyses including all relevant quality assurance/quality control (QA/QC) reporting requirements stated above
- ongoing site/equipment maintenance, e.g. containment cap integrity
- details of party(ies) responsible for maintenance and monitoring program.

4.2.7 Auditing/third party review

NSW operates a site auditor scheme, with detailed information and guidance available in the *Guidelines for the NSW site auditor scheme* (NSW DEC 2006). The guidelines cover a range of information relating to the accreditation, role, and requirements of auditors. Topics addressed include:

- accreditation
- conducting site audits
- contamination assessment, remediation and management.

The guidelines also contain a number of appendices to provide further guidance and information for auditors. Topics covered include:

- decision-making process for assessing urban redevelopment sites
- soil investigation levels for urban development sites in NSW
- recognition of applicants under other schemes under the *Mutual Recognition (New South Wales) Act 1992*
- data quality objectives: outline of the process
- quality assurance and quality control
- examples of consent, licence, notification and other requirements
- human health risk assessment checklist.

4.3 Victoria¹⁵

4.3.1 Principles underpinning the approach to remediation and management

The principles of environment protection that underpin Victoria's approach to site contamination are detailed in the *Environment Protection Act 1970* and are as follows:

Principle of integration of economic, social and environmental considerations

- (1) Sound environmental practices and procedures should be adopted as a basis for ecologically sustainable development for the benefit of all human beings and the environment.
- (2) This requires the effective integration of economic, social and environmental considerations in decision making processes with the need to improve community well-being and the benefit of future generations.
- (3) The measures adopted should be cost-effective and in proportion to the significance of the environmental problems being addressed.

The precautionary principle

- (1) If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

¹⁵ This material provides an overview of regulatory practice in this jurisdiction. For complete and comprehensive information about legislation and regulatory approach, see the *Contaminated sites law and policy directory* <www.cslawpolicy.com.au>

- (2) Decision making should be guided by
 - (a) a careful evaluation to avoid serious or irreversible damage to the environment wherever practicable; and
 - (b) an assessment of the risk-weighted consequences of various options.

Principle of intergenerational equity

The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

Principle of conservation of biological diversity and ecological integrity

The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making.

Principle of improved valuation, pricing and incentive mechanisms

- (1) Environmental factors should be included in the valuation of assets and services.
- (2) Persons who generate pollution and waste should bear the cost of containment, avoidance and abatement.
- (3) Users of goods and services should pay prices based on the full life cycle costs of providing the goods and services, including costs relating to the use of natural resources and the ultimate disposal of wastes.
- (4) Established environmental goals should be pursued in the most cost effective way by establishing incentive structures, including market mechanisms, which enable persons best placed to maximise benefits or minimise costs to develop solutions and responses to environmental problems.

Principle of shared responsibility

- (1) Protection of the environment is a responsibility shared by all levels of government and industry, business, communities and the people of Victoria.
- (2) Producers of goods and services should produce competitively priced goods and services that satisfy human needs and improve quality of life while progressively reducing ecological degradation and resource intensity throughout the full life cycle of the goods and services to a level consistent with the sustainability of biodiversity and ecological systems.

Principle of product stewardship

Producers and users of goods and services have a shared responsibility with government to manage the environmental impacts throughout the life cycle of the goods and services, including the ultimate disposal of any wastes.

Principle of wastes hierarchy

Wastes should be managed in accordance with the following order of preference:

- (1) avoidance
- (2) re-use
- (3) recycling
- (4) recovery of energy

- (5) treatment
- (6) containment
- (7) disposal

Principle of integrated environmental management

If approaches to managing environmental impacts on one segment of the environment have potential impacts on another segment, the best practicable environmental outcome should be sought.

Principle of enforcement

Enforcement of environmental requirements should be undertaken for the purpose of:

- (a) better protecting the environment and its economic and social uses;
- (b) ensuring that no commercial advantage is obtained by any person who fails to comply with environmental requirements;
- (c) influencing the attitude and behaviour of persons whose actions may have adverse environmental impacts or who develop, invest in, purchase or use goods and services which may have adverse environmental impacts.

Principle of accountability

- (1) The aspirations of the people of Victoria for environmental quality should drive environmental improvement.
- (2) Members of the public should therefore be given:
 - (a) access to reliable and relevant information in appropriate forms to facilitate a good understanding of environmental issues
 - (b) opportunities to participate in policy and program development.

These principles were applied in the development of Victoria's *SEPP (Prevention and management of contaminated land)* (EPA Victoria 2002). That policy provides further detail about the application of the principles to Victoria's approach as follows:

- The quality of the land environment will be maintained, and where necessary enhanced, to maximise to the extent practicable the beneficial uses of the land environment, consistent with the aspirations of the Victorian community.
- Human health and the environment will be protected through the prevention of contamination of land and clean-up and management of pollution of the land environment.
- All occupiers will give effect to their duty to prevent contamination of land which they occupy. Without derogating any responsibility incurred by the polluter, occupiers will clean-up or manage pollution of the site for which they are the occupier (or ensure the pollution is cleaned-up or managed). These actions will ensure that the site is suitable for its current use and that other elements and segments of the environment are protected.
- Occupiers will also use the site and manage any contamination in a manner which takes account of any relevant statement of environmental audit that may have been issued for the site.

- Any pollution of land will be cleaned-up or otherwise managed to protect the beneficial uses of the land and to ensure the condition of the land does not cause detriment to the beneficial uses of other elements at the site or off-site.
- Any clean-up of pollution of land will reflect the order of preference set out in the waste hierarchy i.e. treatment and reuse on-site is preferred to treatment and reuse off-site (provided an equivalent environmental outcome is achieved) and where long term containment off-site is least preferred.
- The clean-up of pollution of land will be carried out in a manner that does not result in detriment to the beneficial uses of other segments of the environment.
- Any decision which has the effect of allowing a use or development of a site to occur, consistent with the *Planning and Environment Act 1987*, will be made having regard to: any contamination of land at the site and any significant effects that contamination may have on any proposed use or development; the potential for any use or development to contaminate land; and the need to impose any conditions necessary for the prevention of contamination of land or the ongoing management of existing contamination of land.
- Information will be made available to the public regarding the condition of the land environment. Information about land contamination will be disclosed by an occupier where another person proposes to become the occupier of a site.
- Statutory programs related to environment protection, planning, public health, agriculture and natural resource management will be coordinated for the effective prevention and management of contamination of land.

In the SEPP, the environment protection principles and intent of the policy are synthesised into the goal to maintain and where appropriate and practicable improve the condition of the land environment sufficient to protect current and future beneficial uses of land from the detrimental effects of contamination by:

- (a) preventing contamination of land
- (b) where pollution has occurred, adopting management practices that will ensure:
 - (i) unacceptable risks to human health and the environment are prevented; and
 - (ii) pollution is cleaned-up or otherwise managed to protect beneficial uses.

4.3.2 The regulatory basis for the remediation and management of site contamination

- *Environment Protection Act 1970*
- *State Environment Protection Policy (Prevention and Management of Contamination of Land) (SEPP)*
- *Planning and Environment Act 1987*
- *Minister's Direction no. 1 – Potentially contaminated land*

4.3.3 Responsibility for regulating and/or administering processes

The regulation of processes relating to land contamination in Victoria occurs through the Environmental Protection Authority (EPA) and the Department of Planning and Community Development. The EPA issues works approvals, licences or notices requiring an occupier of a site to undertake assessment and clean-up works. It also administers the environmental audit system. The EPA directs clean-up and management at sites presenting an unacceptable risk to human health or to the environment and which must be dealt with as a priority. Land contaminated by former waste disposal, industrial and similar activities is frequently discovered during changes to land use – for example, from industrial to residential use. In most cases these can be managed at the time that the change of land use occurs.¹⁶ Guidance is provided to assist planning authorities in considering potential site contamination when undertaking planning tasks. The practice note, *Potentially contaminated land*, outlines key points from the *Planning and Environment Act*, *Ministerial Direction No. 1 – Potentially contaminated land* and the *SEPP (Prevention and management of contaminated land)*, and describes how the environmental audit system can be used within the planning system (Victoria Department of Sustainability and Environment 2005).

4.3.4 General process followed for the remediation and management of contaminated sites

The EPA publication, *Environmental auditing of contaminated land* provides the following information about the general process followed for the remediation and management of site contamination in Victoria (EPA Victoria 2007a). The expectation is that an environmental auditor will be involved from the outset to undertake an environmental audit of a site. If there is reason to suspect that clean-up may be required, an appropriately qualified individual or company is engaged to undertake an assessment. If an assessment indicates that a clean-up should be implemented, the person conducting the clean-up is expected to liaise with the auditor to ensure acceptable clean-up standards are met. The auditor must not be directly involved in the detailed design or implementation of the clean-up.

At the completion of the assessment and clean-up works, the auditor will prepare an environmental audit report and determine whether to issue a certificate or statement of environmental audit. If there are good grounds for believing that the site will be suitable for the intended use without clean-up (for example, because little or no contamination is expected), the auditor may be employed from the outset to undertake any necessary investigations (including sampling and analysis) as part of the environmental audit. If contamination requiring clean-up is subsequently found, the auditor may at the discretion of the person who engaged them to undertake the audit:

- complete the audit for the site in its current condition and usually, issue a statement indicating the site is detrimental to certain beneficial uses; or
- if serious contamination is identified, immediately cease work and allow any clean-up (and associated sampling and analysis) to be undertaken by others before completing the audit.

¹⁶ CRC CARE 2011, *Contaminated sites law and policy directory – Victoria* <www.cslawpolicy.com>.

Where some requirement for clean-up is anticipated at the outset, a person other than the auditor should be engaged to undertake the necessary investigation work and provide advice regarding clean up. This process provides the continuity of strategic advice regarding the assessment and management of the site. If the auditor did not undertake the primary sampling and analysis at the site, in most circumstances, the auditor will undertake limited additional sampling to confirm the results obtained by others. The auditor must provide EPA and the relevant planning authority (PA) with a copy of the environmental audit report and certificate or statement within seven days of completing the environmental audit report.

4.3.5 Practical guidance offered or recommended by regulatory agencies

Victoria's SEPP provides general guidance, while other documents provide more detailed information about specific aspects of the remediation and management process.

4.3.6 Remediation and management planning, implementation and validation

There is no detailed guidance available to practitioners relating to the development of a remediation or management plan. Requirements for setting remediation objectives are set out in the SEPP as follows (EPA Victoria 2002):

- Where clean-up is required to protect beneficial uses, clean up will either:
 - (a) meet the relevant objectives of Table 2 (Table 2 in the SEPP gives indicators and objectives for land) for the protected beneficial uses subject to clause 10 (3) (particular requirements detailed later in the SEPP); or
 - (b) be determined through a site specific risk assessment in accordance with the methodology set out in the NEPM or another risk assessment methodology approved by the authority.
- Where clean-up is required to protect any beneficial use, the appropriate depth for clean-up must be determined through a site-specific assessment, taking into account site characteristics, the nature of any contamination and the range of activities expected at the site in its current or anticipated use.

The SEPP addresses management strategies, setting out requirements under the *Environment Protection Act*. The following requirements are outlined in the policy (EPA Victoria 2002):

1. Where contamination has occurred, site management strategies must:
 - (a) be consistent with the provisions of this or any other policy, regulation, licence or notice under the *Environment Protection Act 1970*
 - (b) prevent further contamination
 - (c) where practicable, maximise all potential uses of a site.
2. The preferred management strategy should be determined with reference to:
 - (a) the principle of the waste hierarchy;
 - (b) achieving the best practicable environmental outcome; and

- (c) protection of beneficial uses.
- 3. Management of any waste soil that is a prescribed industrial waste must be in accordance with the industrial waste management policy (prescribed industrial waste).

Occupational health and safety during remediation of a contaminated site is addressed in the EPA's *Environmental auditor (contaminated land) guidelines for issue of certificates and statements of environmental audit* (EPA Victoria 2007c). The guidelines provide the following advice:

In determining whether the beneficial use to 'human health' is protected at a site, the auditor must assess the risk to all users of the site, including workers involved in:

- a) remediation works (if the site is not currently suitable for the intended use)
- b) construction works
- c) installation and maintenance of sub-surface utilities.

The risks associated with the site being audited should not be considered in isolation from other exposures to which such workers may come in contact, including those related to other contaminated sites.

EPA has a strong preference for clean-up and management options that leave the site in a condition such that specific occupational health and safety measures (above those normally employed by construction and/or maintenance workers) are not required to render the site safe for construction and/or maintenance works.

Where ordinary work practices would not fully protect the health of workers from the hazards associated with contaminated soil or other media or the presence of waste, the auditor must include conditions in any statement that provide for the adequate protection of worker health. This may involve requiring specific precautions or work practices to protect worker health. Alternatively, the statement may include a condition that a health and safety plan addressing certain nominated hazards be prepared and implemented. In most circumstances, where the condition of a site is such that it poses a significant acute risk to the health of workers unless specific precautions are taken, the auditor should generally issue a statement indicating the site is not suitable for any use in its current condition. In some cases, remediation of a site to a level where exposure to the contaminated material would not pose a significant acute risk is not practicable. In these cases, a statement indicating suitability for nominated uses may be issued, providing control measures commensurate with the risk are implemented.

WorkSafe Victoria and EPA Victoria have also jointly developed the *Industry Standard – Contaminated sites to provide a guide to safe work practices on contaminated construction sites* (2005). This standard includes guidance on maintaining an acceptable level of protection for workers and sub-contractors on such sites. It specifically states that it does not cover remediation or environmental management *except* where the information can help manage occupational health and safety on a contaminated site. For this reason, it is included here as a resource of potential interest in the development of more specific occupational health and safety guidance. WorkSafe Victoria (2010) has also produced a guidance note called *Asbestos-contaminated soil*, providing advice for any person (including employers, removalists and commercial contractors) inspecting, removing, transporting or disposing of asbestos-contaminated soil.

EPA auditor guidelines provide the following information regarding the validation of remediation (EPA Victoria 2007c):

At the completion of clean-up works, the auditor prepares an environmental audit report and issues either a certificate or statement of environmental audit. A certificate of environmental audit indicates the auditor is of the opinion that the site is suitable for any beneficial use; that there is no restriction on use of the site due to its environmental condition. A statement of environmental audit indicates that the auditor is of the opinion that there is, or may be, some restriction on use of the site. The statement specifies:

- a) the condition of the site is (or is potentially) detrimental to any (one or more) beneficial use
- b) beneficial uses for which the condition of the site is not (or is not potentially) detrimental.

Depending on the condition of the site, a statement may indicate that the site is:

- not suitable for any use, or
- suitable for specific uses (that is, not detrimental to the beneficial uses associated with the nominated land use) without further conditions or limitations, or
- suitable for specific uses (that is, not detrimental to the beneficial uses associated with the nominated land use) subject to conditions and/or limitations related to its use and management.

The certificate or statement is designed to inform decisions by the community, PA, prospective purchasers, financial institutions and others regarding the environmental condition of a site and its suitability for use. A statement of environmental audit usually contains one or more conditions that must be implemented for the site to be suitable for the proposed use. Ongoing monitoring of remedial activities would usually be addressed in this way (Victoria Department of Sustainability and Environment 2005).

4.3.7 Auditing/third party review

The Victorian environmental audit system provides for an environmental auditor to undertake an independent assessment of the condition of a contaminated site and form an opinion regarding its suitability for use. The auditor must provide EPA and the PA with a copy of the environmental audit report (and certificate or statement). A certificate indicates the auditor is of the opinion that the site is suitable for any beneficial use; that there is no restriction on use of the site due to its environmental condition. A statement indicates that the auditor is of the opinion that there is, or may be, some restriction on use of the site (EPA Victoria 2007a). The following detailed guidance is available for the conduct of environmental audits and the issue of certificates and statements:

- Environmental auditor guidelines for conducting environmental audits (EPA Victoria 2007b)
- Environmental auditor (contaminated land) guidelines for issue of certificates and statements of environmental audit (EPA Victoria 2007c)
- Environmental auditor guidelines, provision of environmental audit reports, certificates and statements (EPA Victoria 2007d)

- Environmental auditor guidelines for appointment and conduct (EPA Victoria 2008)
- Environmental auditor guidelines for the preparation of environmental audit reports on risk to the environment (EPA Victoria 2007e).

4.4 Queensland¹⁷

4.4.1 Principles underpinning the approach to remediation and management of site contamination

The *Environmental Protection Act 1994* is underpinned by the principle of ecologically sustainable development which, in the act, is described as development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

4.4.2 The regulatory basis for the remediation and management of site contamination

- *Environmental Protection Act 1994*
- *Environmental Protection Regulation*
- *Sustainable Planning Act 2009*
- *Sustainable Planning Regulation*

4.4.3 Responsibility for regulating and/or administering processes

Responsibility for regulating and administering processes relating to remediation and management of site contamination lies with the Department of Environment and Resources Management (DERM). The Department of Local Government and Planning administers the *Sustainable Planning Act* through the land-use planning system. Planning authorities regulate the process where contaminated sites are identified and remediated. In particular circumstances, DERM has an overriding power in the development application process.¹⁸

4.4.4 General process followed for the remediation and management of contaminated sites

The following information from DERM describes the general process followed with regard to the remediation and management of site contamination.¹⁹ Through the *Sustainable Planning Act*, the land-use planning process is used when there is a change of land use or when a subdivision application is made, to determine the public and environmental exposure to contaminated land and environmental harm.

¹⁷ This material provides an overview of regulatory practice in this jurisdiction. For complete and comprehensive information about legislation and regulatory approach, see the *Contaminated sites law and policy directory* <www.cslawpolicy.com.au>

¹⁸ CRC CARE 2011, *Contaminated sites law and policy directory – Queensland* <www.cslawpolicy.com.au>.

¹⁹ Information taken from *Management of contaminated land*, Department of Environment and Resources website <www.derm.qld.gov.au/environmental_management/land/contaminated_land/management_of_contaminated_land.html>.

It provides a process to appropriately investigate the land (through a contaminated site investigation) using the process stipulated in the *Environmental Protection Act* for contaminated land management.

DERM reviews contaminated site investigations and approves SMPs in addition to providing advice to local government, industry and the community on legislative and technical requirements for contaminated land matters. Under the *Environmental Protection Act*, the department maintains two public registers that contain land-use planning information – the environmental management register (EMR) and the contaminated land register (CLR).

Land that has been or is being used for a notifiable activity (a list of these activities is provided as a schedule to the *Environmental Protection Act*) and is notified to the department is recorded on the environmental management register. The register provides information on historical and current land use, including whether the land has been or is currently used for a notifiable activity, or has been contaminated by a hazardous contaminant. Sites on the EMR in most circumstances pose a 'low risk' to human health or the environment under their current land use. Entry on the register does not mean that the land must be cleaned up or that the current land use must stop.

The CLR is a register of proven contaminated land ('risk' sites) that is causing or may cause serious environmental harm. Land is recorded on the CLR when a scientific investigation shows that the land is contaminated and that action needs to be taken to remediate or manage the land (for example, technical measures to prevent migration of contaminants or full removal and off-site treatment) to prevent serious environmental harm or adverse public health risks.

Under the *Sustainable Planning Act 2009*, when a development application is made for a material change of use or reconfiguration of a lot recorded on the EMR or the CLR, a site investigation and, where necessary, remediation are required.

Landowners and occupiers have responsibilities under the act to notify DERM when they become aware that their land has been or is being used for a notifiable activity or contaminated by a hazardous contaminant. When a landowner notifies the department that the land has been used for a notifiable activity, the land is recorded on the EMR.

Local governments also notify the department of land in their local government area that has been used for a notifiable activity or has been contaminated by a hazardous contaminant. Before land is entered on the environmental management register, the department informs the landowners of the notification. The landowners may make a submission to the department about the notification if they believe the information to be incorrect. The department decides whether or not to record the land on the environmental management register. The department issues written notices to landowners and local governments advising them when the land is recorded on the environmental management register.

Land will be removed from the EMR if, at any time, the landowner or local government provides evidence to the department that no notifiable activity has occurred on the site, or that the land has not been contaminated.

When land has been investigated by a suitably qualified person or consultant, a site investigation report about the land is submitted to the department for assessment.

If the department is satisfied that the land is not contaminated, the land is removed from the environmental management register.

Land is also removed from the CLR after work has been done to remediate the land and a site investigation report satisfies the department that the land no longer poses a risk to the environment or public health. In addition, land can be transferred from the CLR to the EMR where there is a SMP for the land to manage the contamination so it no longer causes environmental harm or poses a risk to human health.

Local governments have obligations under the act relating to the identification, notification and management of contaminated land. Under the act, all local governments in Queensland are required to notify the department of land that has been or is currently used for a notifiable activity within their local government area. This information is gathered by local governments through sources such as historical information, local knowledge and town planning records. In some cases, (e.g. land used for industrial purposes or park land), it is not necessary or practical to remove the entire contaminated area. The land can be partly remediated, and the department can approve a SMP which states the conditions under which the site can be used while preventing the contamination from causing environmental harm or posing a risk to human health. SMPs are recorded on the EMR and are provided with any related search of the registers. Information on whether land is recorded on the EMR or CLR can be obtained by a search of those registers.

4.4.5 Practical guidance offered or recommended by regulatory agencies

Practitioners in Queensland are provided with general guidance in the form of the *Draft guidelines for the assessment and management of contaminated land in Queensland* (QLD DERM 1998).

4.4.6 Remediation and management planning, implementation and validation

The guidelines contain a list of the information that should be included in a remediation plan:

- remediation goal
- extent of remediation required, including areas off-site which have been affected
- discussion of possible remedial options and how risk can be reduced
- rationale for the selection of the recommended remedial strategy
- extent (if any) of public consultation and any local nuisance abatement required before and during remediation
- plans to protect health and the environment during remediation, including health and safety considerations
- proposed validation sampling plan
- outline of a SMP if a partial remediation is proposed, and
- timeframes for implementation (including submission of validation report).

The guidelines also advise that, as a polluter is responsible for remediating any off-site impacts caused by his or her site, the plan should incorporate a strategy and time-frames for doing this, and should include discussions of the impact of the works on neighbouring owners and operators. The plan should be accompanied by a statement from those stakeholders agreeing to the proposed work. In addition, in situations where off-site disposal of contaminated soil is proposed, the remediation plan should be accompanied by an application for a disposal permit.

Within the guidelines, further information is given about preferred remediation strategies, while a separate attachment covers the development of a SMP (to be a stand-alone document which becomes a condition on the use of the land). The guidelines do not provide detailed information about other elements of the remediation plan. The guidelines provide information to assist practitioners in the preparation of site assessment and remediation plans and reports (Appendix 7 to the guidelines). They also contain information on the presentation of data (Appendix 8 to the guidelines). The guidelines advise the following information about validation of remedial works (Queensland Department of Environment 1998).

Validation that the site has been satisfactorily remediated is essential and is achieved by conducting a validation sampling program. If sampling shows that the targets have not been achieved, additional work to fulfil the agreed plan should be proposed. Statistical analyses of results should be provided in validation reports to support recommendations that a site is no longer contaminated, or no longer poses an unacceptable health or environmental risk.

Written in 1998, the guidelines refer to the *Australian Standard, Guide to the sampling and investigation of potentially contaminated soil* (AS4482) and the then-proposed NEPM module on data collection as useful references to establish the sampling pattern and density required. The reported results of the validation sampling program should include:

- rationale and justification for the selected validation sampling program
- statistical analyses of post-remediation results
- evaluation of results against goals of remediation plan.

Land is removed from the CLR after work has been done to remediate the land and a site investigation report satisfies the department that the land no longer poses a risk to the environment or public health. In addition, land can be transferred from the CLR to the EMR where there is a SMP for the land to manage the contamination so it no longer causes environmental harm or poses a risk to human health. Long-term monitoring is addressed in the guidelines as an aspect of a SMP where on-site containment or capping has been a requirement. Monitoring and reporting details are expected to be incorporated into the plan, with the example given being that the frequency of inspections of the cap (by a qualified person) should be recorded. Full details of the monitoring locations, parameters, duration and frequency should be proposed. Documentation of relevant monitoring data, including excavation details, soil disposal and safety records may be necessary. Reporting intervals (e.g. annual, twice-yearly etc.) should also be established.

4.4.7 Auditing/third party review

In order to provide consistency with the third party auditing systems used in other Australian jurisdictions while allowing for state-specific circumstances, Queensland has a system of third party review of contaminated site work. The process requires that contaminated site assessment and clean-up is reviewed and certified by independent and accepted professionals known as third party reviewers (TPRs). Generally, the TPR is engaged by the site owner/developer and accepted by the department prior to the development of the RAP. This ensures that there is early and regular review and liaison with the department regarding issues specific to the site.

After the completion of site work, the TPR reviews investigation and validation reports and associated risk assessment and prepares a summary report of site activities that is submitted to the department along with material required of the practitioner conducting the remediation or management activities. This summary report is supported by a statutory declaration, in which the TPR certifies:

- that the health and environmental risks associated with the contamination have been addressed
- that the site is suitable for unrestricted low density residential 2 use and uses permitted in the planning scheme for the area
- that he or she has considered any site-specific advice provided by the DERM
- that the site may be removed from the EMR or the CLR

OR

- that the site has been assessed and/or remediated to a standard such that the contamination may be safely managed under the conditions of an attached draft SMP and listed on the EMR as a managed site.

TPRs are expected to meet a range of criteria to establish their competency to perform the role. The criteria that are used in Queensland were based on, and are consistent with, the *NEPM – Schedule B (10) Guideline on competencies and acceptance of environmental auditors and related professionals*. Detailed guidance about the criteria and process relating to the third party review system is provided in the operational policy document, *Third party reviewer terms of reference* (QLD DERM 2010).

4.5 Western Australia²⁰

4.5.1 Principles underpinning the approach to remediation and management

Principles underlying WA's approach to the remediation and management of contaminated sites support the objective of protecting human health, the environment and environmental values, and are described in the state's *Contaminated Sites Act 2003*. They include:

- The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement.

²⁰ This material provides an overview of regulatory practice in this jurisdiction. For complete and comprehensive information about legislation and regulatory approach, see the *Contaminated sites law and policy directory* <www.cslawpolicy.com.au>

- The principle of full life cycle costs – the users of goods and services should pay prices based on the full life cycle consists of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes.
- The principle of waste minimisation – all reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.

4.5.2 The regulatory basis for the remediation and management of site contamination

- *Contaminated Sites Act 2003*, complementing the measures of the *Environmental Protection Act 1986*
- *Contaminated Sites Regulations 2006*
- *Planning and Development Act 2005*

4.5.3 Responsibility for regulating and/or administering processes

Responsibility for regulating and administering processes relating to remediation and management of site contamination lies with the contaminated sites branch of the Western Australia (WA) Department of Environment and Conservation (WA DEC). Also taking a role in the regulation process is the contaminated sites committee, which is an independent committee, established to make decisions about responsibility for remediation of contaminated sites and to determine appeals against certain decisions of WA DEC. The committee is appointed by the Minister for the Environment, is fully independent of WA DEC in its decision-making role and is empowered under the act to establish its own procedures. Its decisions are final, except on points of law which may be appealed to the Supreme Court (WA CSC).

Senior managers from WA DEC, LandCorp, departments of health, treasury and finance, and planning and infrastructure comprise the contaminated sites advisory panel. This panel is responsible for prioritising the investigation and remediation for orphan or state-owned sites.

The Western Australian Planning Commission and local government planning authorities are responsible for placing conditions on subdivision, rezoning, building and other planning applications where contamination requires investigation and/or remediation before redevelopment/development/building occurs. LandCorp is responsible for the investigation and remediation of orphan sites on behalf of the State Government. The Department of Health (DoH) assists WA DEC with classifying sites and issuing investigation, clean-up and hazard abatement notices. DoH also provides health advice on certain aspects of contaminated site management. The Department of Land Information is responsible for registering memorials on certificates of title, under instruction from WA DEC (WA DEC, contaminated sites fact sheet 8).

4.5.4 General process followed for the remediation and management of contaminated sites

WA DEC follows a staged process in dealing with remediation and management of site contamination as known by the department or when identified through the land-use planning process. The steps to this process are as follows (WA DEC, contaminated sites fact sheet 2):

1. Preliminary site investigation (PSI)

Involves collecting background knowledge, such as historical and geographical information to determine if past or present land uses have the potential to cause contamination. A PSI does not normally include soil or water testing. The WA DEC may classify a site as *uncontaminated*, and no further investigations are necessary if the available data determines that contamination is not likely. If it is determined that contamination may exist, then the site is likely to be classified as *possibly contaminated – investigation required*, and a DSI may then be required.

2. DSI

Involves soil and/or groundwater testing to determine if contaminants are present on the site. A DSI can also identify substance types, concentrations and location. Further DSIs may be required to accurately delineate the extent of contamination, particularly in groundwater.

3. Remediation

If contamination is causing, or may cause an adverse effect on human health or the environment, it must be remediated (cleaned up). This may involve treating it on site, treating it at an offsite specialised treatment centre or excavating contaminated soil and disposing of it to landfill. The method of remediation may vary depending on the type and extent of contamination; where the contamination is (soil, sediments or ground/surface water); and the risk that the material poses.

4. Validation

Following remediation, it must be proven that all contamination has been removed or successfully treated. This includes sampling treated soil or, where soil material has been excavated, sampling the walls and floor of the excavation pit. Validation of groundwater requires ongoing groundwater monitoring over a pre-determined period of time.

5. Monitoring

Where in-situ (on-site) remediation methods are used, ongoing monitoring of the remediation process is required to ensure contamination levels are dropping (i.e. the remediation is working). This is generally in the form of regular soil or groundwater monitoring. Monitoring events are often conducted at regular intervals to take into account seasonal changes in groundwater levels. A contingency plan is often required (i.e. a change in remedial method or further remediation) if the chemical levels identified during monitoring exceed a pre-determined trigger level.

4.5.5 Practical guidance offered or recommended by regulatory agencies

WA DEC has developed the *Contaminated sites management series of guidelines* to assist with the assessment and management of contaminated sites in Western Australia. The series includes topics from assessment to reporting requirements.²¹ The Department of Health (DoH) and DEC have jointly published *Guidelines for the assessment, remediation and management of asbestos-contaminated sites in Western Australia*. A guidelines summary sheet provides additional clarification of the guidance document to assist in its implementation (WA DoH and WA DEC).

4.5.6 Remediation and management planning, implementation and validation

There is no specific guidance document relating to the development of a remediation or management plan – which in WA is known as a SMP. However, practitioners are advised on what such a plan must include in the guideline, *Reporting on site assessments* (WA DEP 2001). According to that guidance, if a site investigation indicates that the site poses unacceptable risks to human health or the environment, on-site or off-site, and under either the present or the proposed land use, then an SMP needs to be developed and implemented. The SMP should:

- detail specific data gaps identified during DSIs
- identify the additional information required for the selection and/or design of remedial and/or management options (e.g. active remediation, risk mitigation)
- identify the required baseline data for sites subject to monitored natural attenuation (passive remediation)
- document the community consultation process undertaken, and demonstrate how the community's input was taken into consideration when choosing the management strategy for the site.

Where remediation of the site is the chosen management strategy, the SMP should:

- detail the chosen remediation strategy including ongoing monitoring (e.g. monitored natural attenuation)
- provide an outline of remediation objectives
- compare the chosen remedial strategy against other available remedial strategies and justify the choice
- should be considered for remedial strategy comparison
- provide details of decommissioning and removal of infrastructure, where applicable
- provide details of location(s) of any off-site disposal sites used, volumes of waste requiring off-site disposal, soil/groundwater handling requirements and vehicle washdown
- establish environmental safeguards to protect on-site and off-site receptors (e.g. dust management, odour and noise control, waste management, site security)
- establish performance indicators, to be validated through monitoring to avoid contamination rebound in the long term and to ensure successful remediation.

²¹ The Contaminated Sites Management Series <www.dec.wa.gov.au/content/view/2871/2063/>.

With regard to remediation options, practitioners are guided by the remediation hierarchy outlined in an EPA-produced guidance statement as follows (WA EPA 2000):

The following principles should be considered and addressed when determining remediation methods or options for the remediation of contaminated land.

Principle 1

Contaminated material shall preferably be either treated on-site and the contaminants reduced to acceptable levels, or be treated off-site and returned for reuse after the contaminants have been reduced to acceptable levels.

Principle 2

Disposal of contaminated material to an approved waste disposal facility or landfill or 'cap and contain' management options will only be considered if:

- treatment of the contaminated material is shown or demonstrated not to be practicable;
in an environmentally acceptable manner; and
- the risk of disturbance of the contaminant exceeds the risk of leaving it undisturbed and contained on site.

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There is detailed guidance available in WA relating to occupational health and safety on contaminated sites. The guidance covers all stages of assessment and management, with advice for the remediation stage including the following (WA Commission for Occupational Health and Safety 2005):

1. Remediation should not commence until the level of contamination has been determined and a remedial action plan (RAP) has been developed by a competent person.
2. Site owners/employers/consultants should ensure competent contractors, drillers, employees and/or other workers are engaged to carry out remediation
3. Work should be conducted according to a SMP prepared in accordance with the Department of Environment (DoE) guidelines and requirements. Where appropriate, information should be sought from a competent person/government agency.
4. Site owners/consultants (when they are 'the principal') and employers must ensure that before work starts:
 - the risk management process of identifying hazards and assessing and controlling the risks is carried out, as far as practicable, addressing potential contaminants and hazards
 - safety and health information, instruction and training are provided to all workers engaged so they are not exposed to hazards, including, for example, a SMP (containing a RAP and a waste management plan), a revised or newly prepared site-specific safety and health plan that is made readily available for workers onsite, and any other information or reports prepared or obtained during the PSI and DSIs.
5. As work progresses, the risk management process must be repeated whenever circumstances change.

It should be conducted on an ongoing basis to check the control measures are working and no new hazards have been introduced as a result of them and whether any new hazards or risks have arisen from changes in the work environment.

Practitioners in WA can refer to the *Community consultation guideline* (WA DEC 2006) that refers to the different stages of contaminated sites management and provides guidance on the community consultation requirements for each stage. The guideline is not prescriptive, but sets out the factors that practitioners should consider when planning consultation and public involvement as part of remediation and management of contaminated sites. The guideline covers such areas as:

- the principles underlying effective community consultation
- the extent of consultation required (site-specific)
- the identification of stakeholders
- the timing of consultations throughout the remediation and management process
- techniques for consultation
- reporting on consultations.

The guideline refers to other sources of guidance that contain tools, tips and techniques to assist practitioners, including WA DEC's *Community involvement framework* (WA DEC 2003a), the *Interim industry guide to community involvement* (WA DEC 2003b), and the International Association for Public Participation's *Public participation toolbox* (2006). The guideline also refers practitioners to the NEPM Schedule B(8) *Guideline on community consultation and risk communication* (NEPC 1999b) for general guidance community consultation and risk communication in the assessment and management of contaminated sites. A WA DEC-produced guideline, *Reporting on site assessments* (WA DEP 2001), defines the stages of contaminated site investigation and provides a standard for practitioners reporting on site assessments, including investigations, remediation and validation. It aims to encourage consistent and accurate reporting by informing practitioners, industry and landowners of the information required by the WA DEC to enable efficient assessment of contaminated land and groundwater in Western Australia. It is expected that the guideline be used when reporting on contaminated site assessments, including preliminary and DSIs, SMPs, site remediation and validation, and ongoing management programs. Specifically, the guideline outlines what must be shown at each stage of the assessment and management process (keeping in mind that site-specific factors need to be taken into account and may affect the content of reports):

Stage 1

The PSI stage; determines whether a DSI should be conducted.

Stage 2

The DSI stage; confirms potential or actual contamination through a comprehensive sampling program. The decision-making processes involved in determining remedial and/or management strategies are dependent on the data obtained during this stage of investigation.

Stage 3

The development of a SMP; involves the documentation of the type and extent of remediation required to ensure that the site is suitable for its current or intended future use, and to protect the surrounding environment and land uses. This plan details the remediation techniques proposed to achieve remediation objectives and generally sets levels against which the clean-up can be assessed through the site validation process.

Stage 4

The remediation, validation and ongoing management stage; the process of demonstrating that a contaminated site has been successfully remediated and that the objectives of the plan have been achieved. Validation requires sampling to demonstrate that the remaining soil/sediment, the backfill material, the in-situ remediated material and/or any groundwater affected by the site contamination no longer poses a risk to human health or the environment.

A number of appendices to the guideline provide comprehensive checklists detailing the information requirements for each of the four stages discussed above.

The primary 'sign-off' mechanism provided by the WA government regarding the contamination status and land-use suitability of a site is the issuing of a certificate of contamination audit (CCA) which details the characteristics and extent of any contamination (WA DEP 2000).

The requirements for a remediation and validation report (as advised in the WA DEC reporting guideline) illustrate the expected measures to be taken in order to enable a CCA to be issued by WA DEC. The guideline (WA DEP 2001) advises as follows:

Post-remediation validation enables the success of the remediation to be assessed. The remediation and validation report should clearly demonstrate that the land is suitable for its current or intended use, that the beneficial use of groundwater or surface water is not compromised and that all the objectives of the remediation have been achieved and accounted for. The remediation and validation report should:

- document methods of remediation including excavation of soil (volumes), the off-site destination and/or treatment of contaminated media
- detail the validation sampling undertaken to prove that the previously identified contaminants no longer pose a risk to the environment and/or human receptors
- compare monitoring data with pre-determined remediation levels or site-specific generated criteria
- identify and include proof of any necessary approvals and licences required by regulatory authorities
- provide details of completed remediation
- document proposed land use(s) and suitability of the site for the land-use(s).

Where remedial targets have not been met, reasons must be stated and a management strategy proposed to ensure that the land and groundwater, on-site and off-site, is not subjected to unacceptable risk.

WA's approach to the long-term monitoring of contaminated sites is described in its reporting guideline (WA DEP 2001) as follows:

Many contaminated sites will require some form of post-remediation monitoring to avoid problems associated with contamination rebound. Ongoing monitoring is also required where groundwater is contaminated, to determine the performance of the remedial works or support natural attenuation, or where on-site containment ('cap and contain') is proposed. The development of an ongoing monitoring program is recommended to ensure the effective management of the contamination. The ongoing monitoring program should document the following:

- identify all responsible parties and detail commitments to the monitoring program
- provide timeframes (e.g. commencement and expected length of program)
- monitoring locations
- frequency of monitoring
- methodology of monitoring, including field and laboratory techniques
- monitoring parameters
- any pre-determined trigger levels for further action, i.e. to trigger active remediation
- frequency of reporting
- parties to be reported to (this may include certain community groups).

4.5.7 Auditing/third party review

WA has developed an auditor scheme that is similar to those in other Australian jurisdictions, but which requires final 'sign-off' by WA DEC as opposed to clearance given by the auditor. WA DEC has produced a guideline to describe its processes and to outline requirements for the accreditation, conduct of, and reporting by, auditors in WA (WA DEC 2009). The guideline is consistent with the principles for appointment of contaminated sites auditors that is outlined in Schedule B(10) of the NEPM, *Guidelines on competencies and acceptance of contaminated land auditors and related professionals*. The primary role of an auditor is to provide a written report to the chief executive officer (CEO) after independently reviewing investigation, assessment, monitoring and remediation work undertaken by other professionals (e.g. environmental consultants) in relation to site contamination. According to the contaminated sites regulations, an audit is defined as a review of the investigation or remediation of a site to determine one or more of the following:

- the nature and extent of any contamination of the site
- the nature and extent of the investigation or remediation of the site
- whether any restrictions on the use of the site are required
- the suitability of the land for a specific use, or a specific range of uses
- whether any further investigation of the site is required, recommended or necessary
- whether any further remediation of the site is required, recommended or necessary so that the site is suitable for all uses, or for a specific use, or a specific range of uses, and
- the suitability or appropriateness of a management plan.

In some cases, an auditor may be engaged to provide guidance on site assessment, remediation and validation, and possibly a voluntary auditor's report.

A mandatory auditor's report is required when:

- a regulatory notice is issued under the *Contaminated Sites Act*
- a CCA is requested
- contamination has moved away from the property on which it originated, to affect other properties (i.e. the site is a 'source site')
- a report is submitted in order to comply with a planning or Ministerial condition or similar statutory requirement
- the CEO of WA DEC requests a report for a site which presents complex technical issues or sites where inadequate reports have been provided (WA DEC contaminated sites fact sheet 5).

Detailed information is provided in the auditor guideline regarding all aspects of the contaminated site auditor scheme, including:

- the application process for auditor accreditation
- selection criteria, e.g. qualifications, experience and core competency areas
- the selection process
- the duties and responsibilities of auditors
- the conduct and reporting of contaminated sites audits (WA DEC 2009).

4.6 South Australia²²

4.6.1 Principles underpinning the approach to remediation and management

The objectives of South Australia's (SA) *Environment Protection Act 1993* contain and describe the principles underpinning the approach to remediation and management of site contamination in SA as follows:

The objects of the act are –

- (a) to promote the following principles (principles of ecologically sustainable development):
 - (i) that the use, development and protection of the environment should be managed in a way, and at a rate, that will enable people and communities to provide for their economic, social and physical wellbeing and for their health and safety while:
 - (a) sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations
 - (b) safeguarding the life-supporting capacity of air, water, land and ecosystems

²² This material provides an overview of regulatory practice in this jurisdiction. For complete and comprehensive information about legislation and regulatory approach, see the *Contaminated sites law and policy directory* <www.cslawpolicy.com.au>

- (c) avoiding, remedying or mitigating any adverse effects of activities on the environment
- (ii) that proper weight should be given to both long and short term economic, environmental, social and equity considerations in deciding all matters relating to environmental protection, restoration and enhancement
- b) to ensure that all reasonable and practicable measures are taken to protect, restore and enhance the quality of the environment having regard to the principles of ecologically sustainable development, and
 - (i) to prevent, reduce, minimise and, where practicable, eliminate harm to the environment
 - (a) by programmes to encourage and assist action by industry, public authorities and the community aimed at pollution prevention, clean production and technologies, reduction, reuse and recycling of material and natural resources, and waste minimisation
 - (b) by regulating, in an integrated, systematic and cost-effective manner:
 - activities, products, substances and services that, through pollution or production of waste, cause environmental harm; and
 - the generation, storage, transportation, treatment and disposal of waste
 - (ii) to establish processes for carrying out assessments of known or suspected site contamination and, if appropriate, remediation of the sites
 - (iii) to co-ordinate activities, policies and programmes necessary to prevent, reduce, minimise or eliminate environmental harm and ensure effective environmental protection, restoration and enhancement
 - (iv) to facilitate the adoption and implementation of environment protection measures agreed on by the State under intergovernmental arrangements for greater uniformity and effectiveness in environment protection
 - (v) to apply a precautionary approach to the assessment of risk of environmental harm and ensure that all aspects of environmental quality affected by pollution and waste (including ecosystem sustainability and valued environmental attributes) are considered in decisions relating to the environment
 - (vi) to require persons engaged in polluting activities to progressively make environmental improvements (including reduction of pollution and waste at source) as such improvements become practicable through technological and economic developments
 - (vii) to allocate the costs of environment protection and restoration equitably and in a manner that encourages responsible use of, and reduced harm to, the environment with polluters bearing an appropriate share of the costs that arise from their activities, products, substances and services
 - (viii) to provide for monitoring and reporting on environmental quality on a regular basis to ensure compliance with statutory requirements and the maintenance of a record of trends in environmental quality

- (ix) to provide for reporting on the state of the environment on a periodic basis
- (x) to promote
 - (a) industry and community education and involvement in decisions about the protection, restoration and enhancement of the environment, and
 - (b) disclosure of, and public access to, information about significant environmental incidents and hazards.

4.6.2 The regulatory basis for the remediation and management of site contamination

- *Environment Protection Act 1993*
- *Environment Protection Regulations 2009*
- *Development Act 1993*
- *Planning Advisory Notice 20*

4.6.3 Responsibility for regulating and/or administering processes

In South Australia, the EPA is the lead agency for the management of contaminated sites with support from local government and the police. If re-zoning of contaminated or potentially contaminated land is addressed through the planning processes under the *Development Act* either the local council or the minister administering the *Development Act* will be responsible for initiating that process.²³

4.6.4 General process followed for the remediation and management of contaminated sites

The general process followed by the EPA in managing contaminated sites is described below. The assessment stages of the process are included here to enable a sense of the staged nature of the approach.²⁴ Public health is a paramount consideration at every step in the process and if a risk of harm to people is identified, a community engagement process to inform the potentially affected community is activated immediately.

Step 1

When notified that actual or potential site contamination (soil and groundwater) exists in an area, the EPA's first step is to:

- make a preliminary assessment, particularly to ensure exactly which properties/certificate of titles are affected
- directly advise utilities and local and state government authorities so that they can be aware when planning any excavations in the area

²³ CRC CARE 2011, *Contaminated sites law and policy directory – South Australia* <www.cslawpolicy.com>.

²⁴ Information taken from the SA EPA website <www.epa.sa.gov.au/environmental_info/site_contamination/faqs>.

- place a copy of the notification on the EPA Public Register, the EPA website and a public notice in the local media to advise that a notification has been received.

The EPA writes to the site owner outlining their responsibilities and obligations and assesses the notification to determine what further action may be needed. It also starts an ongoing dialogue with relevant parties, including SA Health, in determining the level of risk that may be posed to people and the environment. This process continues throughout each of the next steps.

Step 2

Once the potential site contamination has been verified, the EPA needs to ascertain whether the contamination poses a risk to the public. This requires further investigation to determine the nature of the contaminant, such as:

- What are the concentration levels of the chemicals found?
- Are they able or likely to move (i.e. via groundwater or air)?
- If movement is possible or likely, where might it move to and how quickly?

This assessment is usually conducted by a site contamination consultant or auditor employed by the site owner or developer – who may not have been the person or company who originally caused the contamination. As contamination usually relates to industrial use, the site owners are usually companies, who then engage consultants to undertake testing. The EPA may require that the process be supervised by an independent and accredited site contamination auditor and reports must be submitted to both the site owner and the EPA. The consultant and auditor's fees are paid by the site owners.

Step 3

The assessment process typically continues in an outwards direction from the source of contamination to determine its boundary and extent. This may occur in a series of stages, which can take several months for each stage. It can include a range of activities such as modelling to determine the direction and rate of groundwater flows, as well as drilling of monitoring bores to sample groundwater. This is a complex and specialised process and is only undertaken by qualified professionals. If not done properly, there are risks that the contamination may not be adequately identified, or may be spread further.

Step 4

Once the outer boundary of contamination is determined, the EPA considers a management plan with the site owner for managing the now defined contamination. This typically includes ongoing monitoring requirements and independent site audits, implementation of environmental guidelines relevant to the site and codes of practice to which the company must adhere. If at any stage in the process the EPA becomes aware of test results or other information indicating a potential risk to public health, the EPA consults with SA Health. If real and actual risk to the community has scientific basis, either the responsible party and/or the EPA and/or SA Health communicates directly with affected residents and neighbourhoods.

Step 5

If the results of the assessment indicate that there is need for further testing inside private homes, then, with the informed consent of the owner and/or occupier, testing will be conducted by the EPA.

4.6.5 Practical guidance offered or recommended by regulatory agencies

Guidance is provided to practitioners in a series of documents produced by the SA EPA, including:

- *Guidelines for environmental management of on-site remediation* (2006)
- *Guidelines for the assessment and remediation of groundwater contamination* (2009)
- *Guidelines for the site contamination audit system* (2010a), and
- *Soil bioremediation* (2005).

4.6.6 Remediation and management planning, implementation and validation

The EPA guidelines for environmental management of on-site remediation provide advice for the preparation of the four types of plans that need to be considered in the remediation and management of contaminated sites in SA. The content of the plans are summarised below, with further detail supplied in the guideline (SA EPA 2006). The four plans to be considered in remedial/management activities are:

Remedial action plan

The preparation of a RAP, or components of it on smaller projects, is expected for all remediation projects. The RAP should:

- set remediation goals that ensure that, on completion of the remediation and validation, the site will be suitable for the proposed use and will provide adequate protection of human health, property and the environment. The RAP author should note the auditor's role
- document the nature and extent of remediation necessary (for soils and groundwater) and describe the rationale for the recommended remedial option or combination of options
- detail all procedures and plans to reduce human health and/or environmental risks to acceptable levels for the proposed site use
- establish the environmental safeguards required to complete the remediation in an environmentally acceptable manner
- identify and include proof of the necessary approvals and licences required by regulatory authorities.

The RAP should focus on the remediation technology and its expected effectiveness, especially with respect to the remediation goals. The RAP should detail the following information:

- the technology to be used

- the expected by-products, wastes, discharges and outputs (including the management of these substances)
- timelines for on-site and off-site activities
- the expected endpoints and outcomes
- results of trials on similar sites or the same site
- how the technology will be implemented
- contingency plans for equipment failure.

Environmental management plan

An environmental management plan (EMP) must detail how the proposed remediation activities will affect the environment and the nearby receptors, and how these effects will be managed or mitigated. The EMP should demonstrate to all stakeholders that all of the potential environmental impacts from the proposed remediation activities have been considered, and that the recommended control measures take into account site-specific conditions. The document must be clearly articulated and not vague when discussing aspects, impacts and management measures.

Bioremediation management plan

A bioremediation management plan (BMP) is a specific document forming part of a bioremediation process. Bioremediation is a unique type of remediation that generally requires considerable time and careful planning to achieve successful outcomes. Details for preparing a BMP are provided in the EPA guideline *Soil bioremediation*. The BMP can stand alone or form part of an RMP or RAP.

Remediation management plan

A RMP is a detailed document. It can incorporate the EMP and RAP and, if relevant, the BMP. The preparation of an RMP avoids the need to produce numerous documents and provides sections on remediation management, environmental management and, if applicable, bioremediation management. An RMP is useful on both small and large projects because it can save cost and time in document preparation and avoid duplication. It is not a summary document and in no way diminishes a person's responsibility to prepare a well-constructed, detailed and clear plan for the entire remediation project. There is no stand-alone legislation dealing with occupational health and safety on contaminated sites. The protection of the health and safety of persons at work is covered in the SA's general occupational health and safety legislation, and the EPA requires that consideration be given to appropriate measures from the time of preliminary assessment of a site through to completion of remediation. Its general guidelines provide some direction, and practitioners are also referred to other sources of guidance, including the following:

- Schedule B(9) Guideline on protection of health and the environment during the assessment of site contamination (NEPC 1999b)
- Protocol for the health risk assessment and management of contaminated sites (SA Health Commission 1991)
- Websites for the Workcover Corporation of SA (<www.workcover.com.au>), United Trades and Labor Council (<www.utlc.org.au>), SA Department of Health (<www.health.sa.gov.au>) and SA Workplace Services (<www.eric.sa.gov.au>).

In its *Guidelines for environmental management of on-site remediation*, the EPA provides advice regarding community relations in the context of remediation and management of contaminated sites. The justification for the early implementation of a community involvement and consultation process is given to be the public's legitimate right to understand and be involved in decisions that may affect them.

The guideline goes on to offer specific tools and tips, and also refers practitioners to guidance provided in *Schedule B(8)* of the NEPM (*Guideline on community consultation and risk communication*) and the Western Australian guideline on community consultation (WA DEC 2006).

To the extent that a site contamination auditor provides a written and signed copy of the relevant audit report and audit statement, it is the auditor who 'signs off' on a site remediation. However, in so far as the auditor is required to supply copies to the EPA, the authority assumes a quality assurance statutory compliance role in relation to the outcomes. In the case of non-sensitive land uses consultants are permitted to 'sign off' on remediation of sites. The report must take into consideration the NEPM and provide statements that the site (taking into account its use) does not pose an unacceptable risk to human health or the environment.²⁵

4.6.7 Auditing/third party review

The EPA administers the audit system, accredits site contamination auditors and ensures site contamination audits are carried out according to the legislation and relevant guidelines issued by the EPA. The key components of the audit system are the:

- accrediting, by the EPA, of expert and experienced individuals as site contamination auditors
- carrying out of a site contamination audit by an auditor
- issuing of a site contamination audit report and a site contamination audit statement by an auditor on completion of the audit.

Under the SA Act, a site contamination audit is defined as a review carried out by a person that:

- a) examines assessments or remediation carried out by another person of known or suspected site contamination on or below the surface of a site
- b) is for the purpose of determining any one or more of the following matters:
 - the nature and extent of any site contamination present or remaining on or below the surface of the site
 - the suitability of the site for a sensitive use or another use or range of uses
 - what remediation is or remains necessary for a specified use or range of uses.

An audit may be carried out or required for one or more of the following reasons:

- to satisfy the requirements of orders or voluntary agreements under the act
- to satisfy the requirements of the planning process under the *Development Act 1993*

²⁵ CRC CARE 2011, Contaminated sites law and policy directory – South Australia <www.cslawpolicy.com>.

- for other purposes (i.e. not specifically required by legislation, such as due diligence).

The general audit process is contained in the Figure 3, although the process may vary, depending on the point at which the auditor is commissioned and the complexity of the audit (SA EPA 2010b). Detailed guidance is provided to site auditors through the EPA's *Guidelines for the site contamination audit system* (SA EPA 2010a), and includes advice and information regarding all aspects of the auditing process.

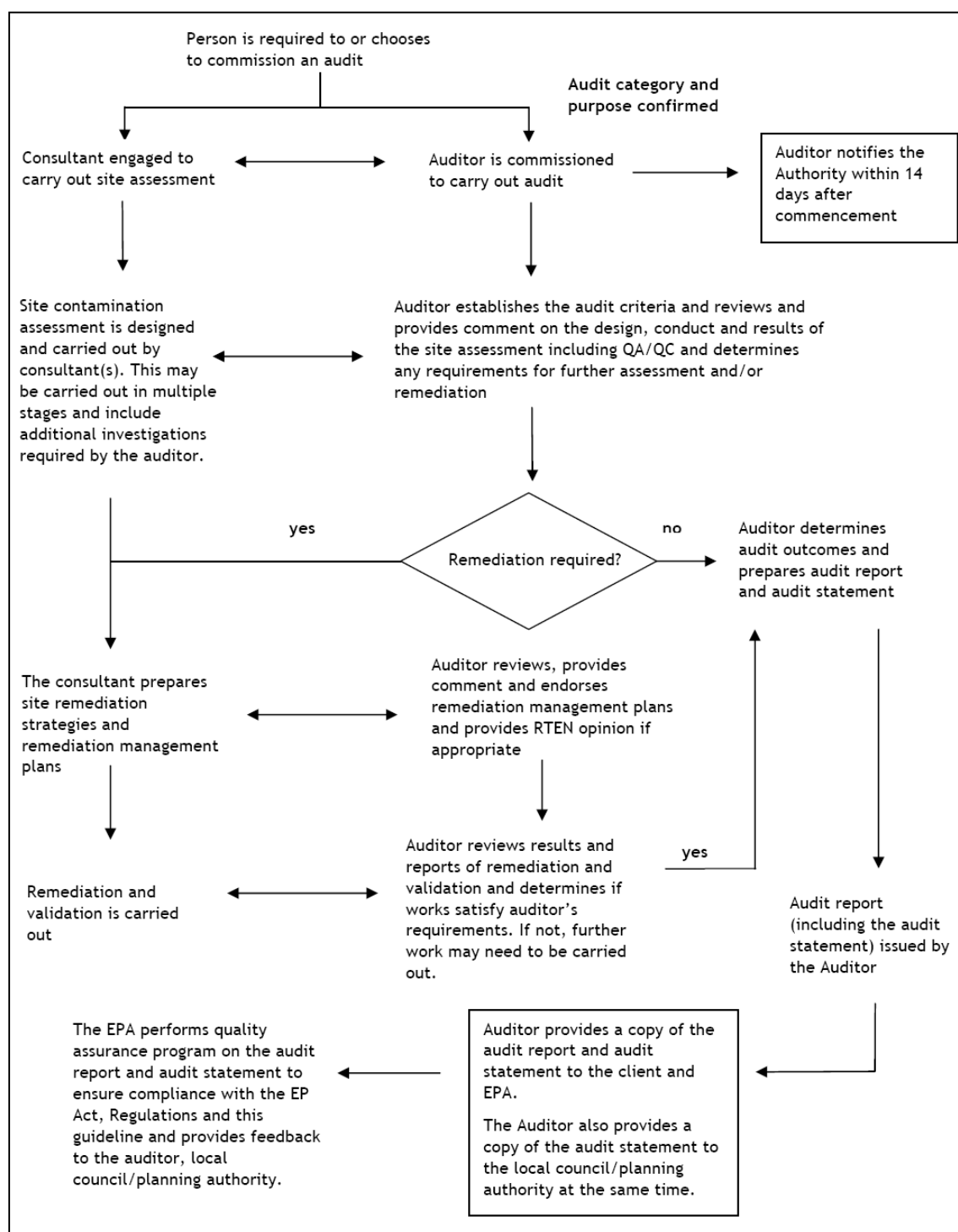


Figure 3. SA general audit process flowchart.

4.7 Tasmania²⁶

4.7.1 Principles underpinning the approach to remediation and management

Underpinning the approach to the remediation and management of site contamination in Tasmania are principles outlined in the objectives of the primary environmental legislation dealing with contaminated sites, the *Environmental Management and Pollution Control Act 1994*. The act states that the objectives of the environmental management and pollution control system are:

- (a) to protect and enhance the quality of the Tasmanian environment
- (b) to prevent environmental degradation and adverse risks to human and ecosystem health by promoting pollution prevention, clean production technology, reuse and recycling of materials and waste minimization programmes
- (c) to regulate, reduce or eliminate the discharge of pollutants and hazardous substances to air, land or water consistent with maintaining environmental quality
- (d) to allocate the costs of environmental protection and restoration equitably and in a manner that encourages responsible use of, and reduces harm to, the environment, with polluters bearing the appropriate share of the costs that arise from their activities
- (e) to require persons engaging in polluting activities to make progressive environmental improvements, including reductions of pollution at source, as such improvements become practicable through technological and economic development
- (f) to provide for the monitoring and reporting of environmental quality on a regular basis
- (g) to control the generation, storage, collection, transportation, treatment and disposal of waste with a view to reducing, minimizing and, where practicable, eliminating harm to the environment
- (h) to adopt a precautionary approach when assessing environmental risk to ensure that all aspects of environmental quality, including ecosystem sustainability and integrity and beneficial uses of the environment, are considered in assessing, and making decisions in relation to, the environment
- (i) to facilitate the adoption and implementation of standards agreed upon by the State under inter-governmental arrangements for greater uniformity in environmental regulation
- (j) to promote public education about the protection, restoration and enhancement of the environment
- (k) to co-ordinate all activities as are necessary to protect, restore or improve the Tasmanian environment.

²⁶ This material provides an overview of regulatory practice in this jurisdiction. For complete and comprehensive information about legislation and regulatory approach, see the *Contaminated sites law and policy directory* <www.cslawpolicy.com.au>

4.7.2 The regulatory basis for the remediation and management of site contamination

- *Environmental Management and Pollution Control Act 1994*
- *Land Use Planning and Approvals Act 1993*

4.7.3 Responsibility for regulating and/or administering processes

The management of contaminated sites in Tasmania is shared by the EPA and local councils.

4.7.4 General process followed for the remediation and management of contaminated sites

The management of contaminated sites, including land and groundwater, in Tasmania, is shared by the EPA division and local councils. If a contaminated site poses a significant risk of harm to human health and/or the environment or harm is likely to occur, a Notice (an investigation notice, a remediation notice, a site management notice or an environment protection notice) may be issued by the EPA to a person or company.²⁷ The general process taken towards the remediation and management of site contamination through the land-use planning process is outlined in an information bulletin provided by the EPA, briefly summarised as follows (Tasmania EPA 2011):

There are three situations in the Tasmanian planning process that trigger consideration of land contamination and ensuring the site is suitable for its intended use:

- rezoning that would allow for more sensitive land uses to occur
- change of land use to a more sensitive use, and
- development where the associated works may cause the creation of exposure pathways that could result in a risk to human health and the environment during development.

The PA can either refer a site to the EPA director for sign-off, or make an independent decision on whether the information provided by the applicant is appropriate to determine that the site is suitable, and appropriate management controls can be implemented through permit conditions to manage any contamination and the associated risks to human health and the environment.

Site contamination sign-off is simply a written endorsement provided by the EPA director that appropriate works and investigations have been undertaken by a suitably qualified and experienced consultant and that it is reasonable to rely on the consultants' recommendation that the land is suitable for its intended use. The sign-off process is triggered by a request to the EPA director from a PA.

Where a PA determines, based on the information provided, that the site is suitable for its intended use and does not require sign-off from the EPA director but there needs to be appropriate management of the site, appropriate conditions should be included in the planning permit. Management measures may include, but are not limited to:

²⁷ Tasmania EPA website, *introductory material*, <<http://epa.tas.gov.au/regulation/contaminated-sites>>.

- development and implementation of a contamination management plan (CMP) to manage human health and environmental risks during construction.
- erection and maintenance of signage to identify the site as a contaminated site and ensure appropriate management of the site (access control, personal protective equipment requirements, etc)
- the erection and maintenance of a fence, bund or other barrier to control access.

Where remediation is required, the EPA director will correspond directly with the applicant to provide guidance on the development and implementation of remediation goals and clean-up criteria for the site in order for the site to obtain sign-off, with correspondence copied to the PA. Sign off is provided when the EPA director is satisfied that:

- the information provided is of an appropriate standard and has fully delineated the nature and extent of contamination on- and off-site
- where remediation is required, the remediation has been completed and the validation program has determined that remediation has been successful (i.e. it has met the remediation goals and clean-up criteria)
- risk assessments have been conducted to an appropriate standard and have identified that the site is appropriate for its intended use
- the consultant has provided a statement regarding the suitability of the land for its proposed use, and
- the management actions proposed for the site are appropriate to manage any remnant contamination.

Where sign-off from the Director, EPA for a proposed use or development is provided the PA should ensure that any conditions associated with the sign-off (e.g. development of an SMP or CMP) are in the planning permit. Environmental auditors and consultants carry out assessment and remediation works, but there is currently no provision for accreditation of professionals who implement remediation plans. Sign-off is provided by the EPA through the issuing of a completion certificate, or through the revocation of an investigation, remediation or site management notice by the issuing of a further notice.²⁸

4.7.5 Practical guidance offered or recommended by regulatory agencies

The Tasmanian EPA does not provide detailed guidance on specific subjects relating to the remediation and management of contaminated sites, apart from that contained within the information bulletin (2011), *The site contamination sign-off process*. That document directs readers to contact the EPA for assistance in working through the remedial process.

²⁸ CRC CARE 2011, *Contaminated sites law and policy directory – Tasmania* <www.cslawpolicy.com>.

4.8 Australian Capital Territory²⁹

4.8.1 Principles underpinning the approach to remediation and management

The objectives of the *Environment Protection Act 1997* contain and describe the principles underpinning the approach to remediation and management of site contamination in the Australian Capital Territory (ACT) as follows:

The particular objects of the act are –

- (a) to protect and enhance the quality of the environment
- (b) to prevent environmental degradation and adverse risks to human health and the health of ecosystems by promoting pollution prevention, clean production technology, reuse and recycling of materials and waste minimisation programs
- (c) to require people engaging in polluting activities to make progressive environmental improvements, including reductions of pollution at the source as such improvements become practical through technological and economic development
- (d) to achieve effective integration of environmental, economic and social considerations in decision-making processes
- (e) to promote the concept of a shared responsibility for the environment by acknowledging environmental needs in economic and social decision-making
- (f) to promote the concept of a shared responsibility for the environment through public education about and public involvement in decisions about protection, restoration and enhancement of the environment
- (g) to promote the principles of ecologically sustainable development
- (h) to regulate, reduce or eliminate the discharge of pollutants and hazardous substances into the air, land or water consistent with maintaining environmental quality
- (i) to allocate the costs of environmental protection and restoration equitably and in a way that encourages responsible use of, and reduces harm to, the environment with polluters bearing the appropriate share of the costs that arise from their activities
- (j) to facilitate the implementation of national environment protection measures under national scheme laws
- (k) to provide for the monitoring and reporting of the environmental quality on a regular basis in conjunction with the commissioner for the environment
- (l) to control the generation, storage, collection, transportation, treatment and disposal of waste with a view to reducing, minimising and, where practical, eliminating harm to the environment
- (m) to adopt a precautionary approach when assessing environmental risk to ensure that all aspects of environmental quality, including ecosystem sustainability and integrity and beneficial use of the environment, are considered in assessing, and making decisions in relation to, the environment

²⁹ This material provides an overview of regulatory practice in this jurisdiction. For complete and comprehensive information about legislation and regulatory approach, see the *Contaminated Sites law and policy directory* <www.cslawpolicy.com.au>

- (n) to ensure that contaminated land is managed having regard to human health and the environment
- (o) to coordinate all activities as are necessary to protect, restore or improve the ACT environment
- (p) to establish a process for investigating and, where appropriate, remediating land areas where contamination is causing or is likely to cause –
 - (i) a significant risk of harm to human health; or
 - (ii) a significant risk of material environmental harm or serious environmental harm; and this act must be construed and administered accordingly.

Under the act, ‘ecologically sustainable development’ means the effective integration of economic and environmental considerations in decision-making processes and to be achievable through implementation of the following principles:

- (a) the precautionary principle, namely, that if there is a threat of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- (b) the inter-generational principle, namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
- (c) conservation of biological diversity and ecological integrity
- (d) improved valuation and pricing of environmental resources.

4.8.2 The regulatory basis for the remediation and management of site contamination

- *The Environment Protection Act 1997*
- *The Planning and Development Act 2007*
- *Contaminated Sites Environment Protection Policy 2009* (ACT EPA 2009)

4.8.3 Responsibility for regulating and/or administering processes

The ACT EPA is responsible for the administration of *the Environment Protection Act*. Under the provisions of *the Planning and Development Act*, the EPA can also determine whether or not a site needs to be assessed and/or remediated.³⁰

4.8.4 General process followed for the remediation and management of contaminated sites

The *Contaminated sites environment protection policy* provides guidance regarding remediation and management of contaminated sites in the ACT (ACT EPA 2009).

³⁰ CRC CARE 2011, *Contaminated sites law and policy directory – Australian Capital Territory* <www.cslawpolicy.com>.

The following information is taken from that policy document and, summarised and adapted, describes the general approach taken in the ACT.

Remediation is required where an assessment indicates there is a significant risk of harm to human health or significant risk of material or serious environmental harm. It can be undertaken voluntarily, which is the preferred option of the EPA.

Generally the EPA will take a cautious approach and require an environmental audit on voluntary remediation. The EPA can also order remediation be carried out by the appropriate person. An environmental audit must be carried out on remediation ordered by the EPA. The EPA is required, under the act, to keep a register of contaminated sites. Any site subject to a remediation order will be placed upon the contaminated sites register. The site is removed from the register when requirements regarding remedial actions and review by an accredited auditor have been met and the land is found not to be contaminated. Information about sites being entered to, or removed from, the register is provided by the EPA to relevant planning authorities. In the ACT the EPA manages an approval process for controlling the beneficial reuse and disposal of contaminated soil. Should remediation be proposed in-situ the approval of the EPA must be sought.

Where the EPA has reasonable grounds for believing that the land to which an audit relates is contaminated and this contamination presents, or would be likely to present, a significant risk of harm to human health and/or a significant risk of material or serious environmental harm the EPA may order the appropriate person to remediate the land contamination; or conduct the remediation itself. The act provides for penalties for non-compliance with the requirements to conduct remediation and to commission an environmental audit of such remediation.

4.8.5 Practical guidance offered or recommended by regulatory agencies

The principal guideline for the remediation and management of contaminated sites in the ACT is the *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites* (ANZECC & NHMRC 1992).

4.8.6 Remediation and management planning, implementation and validation

The ACT EPA does not provide detailed guidance on specific subjects relating to the remediation and management of contaminated sites, apart from that contained within the *Contaminated sites environment protection policy*. Practitioners are instead referred to a range of external sources for guidance of particular aspects of the remediation/management process. These sources are listed in the policy document (ACT EPA 2009).

Actions to remediate a contaminated site may range from managing the effects without destroying or removing the contaminants to a complete clean-up of the site. Examples of actions to manage the effect of contamination are fencing off areas, sealing areas with concrete, covering with well-maintained grass, or changing land use at the site to a less sensitive use. If the preferred option is clean-up, there are two broad approaches to determining clean-up standards.

The first is to decontaminate the site, by bringing the level of contamination back to background levels. This approach preserves the multi-functionality of the land, rendering the site suitable for any future land use. The second approach is to set the standard of clean-up no higher than necessary to be compatible with the intended or permitted uses of the site. This fit-for-use approach recognises that resources are always limited; and in some circumstances it may not be necessary or desirable for economic, social or environmental reasons to have the site suitable of any use. For example, if the site were in an industrial area, there would be no benefit in cleaning the site to a level suitable for residential housing. Remediation in relation to contaminated land includes:

- preparing a long-term management plan
- removing, dispersing, destroying, reducing, mitigating or containing the contamination
- eliminating or reducing any hazard arising from the contamination, including restricting access to the land.

Due to the complex nature of contaminated land remediation, remedial actions are developed on a site-specific basis utilising best practice methodology and remedial techniques. The preferred order of options for site remediation and management are:

- on-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level
- off-site treatment of excavated soils which, depending on the residual levels of contamination in the treated material, is then returned to site, removed to an EPA approved site for beneficial re-use or removed as waste to an EPA approved landfill (ACT EPA 2009).

4.8.7 Auditing/third party review

Auditors are used to certify to the EPA that the site has been evaluated and any contamination identified and addressed. An independent audit is required if the EPA has issued an order to assess or remediate contaminated land or if the EPA wishes to verify a voluntary assessment or remediation of contaminated land.

An audit is usually required when a more sensitive land use is proposed for a site where past activities may have caused land contamination. Generally the EPA will take a precautionary approach where past activities at a site may have resulted in land contamination, and will require that a site audit be conducted to ensure the accuracy of any assessment or remediation.

A site audit involves an independent review of an assessment or remediation by an accredited contaminated land auditor. The main purpose of an audit is to determine whether a site is suitable for a particular use or range of uses. An audit can be conducted for the purpose of determining any one or more of the following matters:

- the nature and extent of any contamination of the land;
- the nature and extent of the assessment or remediation;
- what assessment or remediation remains necessary before the land is suitable for any specified use or range of uses

- the comprehensiveness of a remedial action plan for contaminated land.

On completion of an audit, the auditor is required to issue a site audit statement (or certificate of environment audit). Prior to issuing a site audit statement, the auditor must complete a site audit report which summarises the basis and rationale for the conclusions in the site audit statement (ACT EPA 2009).

4.9 Northern Territory

4.9.1 Principles underpinning the approach to remediation and management

Underpinning the approach to the remediation and management of site contamination in the Northern Territory (NT) are principles outlined in the objectives of the primary environmental legislation dealing with contaminated sites, *the Waste Management and Pollution Control Act 1998*. The act states that its objectives are:

- to protect, and where practicable to restore and enhance the quality of, the territory environment by:
 - preventing pollution
 - reducing the likelihood of pollution occurring
 - effectively responding to pollution
 - avoiding and reducing the generation of waste
 - increasing the re-use and re-cycling of waste
 - effectively managing waste disposal
- to encourage ecologically sustainable development
- to facilitate the implementation of national environment protection measures made under the *National Environment Protection Council (Northern Territory) Act*.

4.9.2 The regulatory basis for the remediation and management of site contamination

- *Waste Management and Pollution Control Act 1998*
- *Planning Act 1999*

4.9.3 Responsibility for regulating and/or administering processes

In the NT, the lead agency for the management of contaminated sites is the Department of Natural Resources, Environment, the Arts and Sport (NRETAS).

4.9.4 General process followed for the remediation and management of contaminated sites

The assessment and management of contaminated land in the Northern Territory (NT) is implemented through the auditing and pollution control provisions of *the Waste Management and Pollution Control Act*.

When land use changes to a more sensitive use, provisions of the *Planning Act* may also be used.³¹ The current approach is to deal with contaminated sites on a case-by-case basis, generally following guidance set out in the NEPM during the investigation stages. Remediation activities reflect the NEPM principles and follow the risk-based approach outlined in the ANZECC and NHMRC *Guidelines for the assessment and management of contaminated sites*.³²

An environment protection objective (EPO) for the management of site contamination in the NT is currently being developed. The proposed EPO will cover specific requirements for site contamination assessment, management and verification.³³ The following information relates to what is expected to occur following the formalisation of the approach. Where sites are being redeveloped from industrial to a more sensitive land use such as residential, schools, child care centers, the planning authority (PA) is the lead agency to manage the following steps:

- a PSI prepared by a suitably qualified person with demonstrated experience in undertaking contaminated site investigations
- a DSI prepared by a suitably qualified person with demonstrated experience in undertaking contaminated site investigations
- remedial action plans and validation prepared by a suitably qualified person with demonstrated experience in undertaking contaminated site remediation
- a review of remediation plans and the validation of the remediation by a site auditor who is required to prepare an audit report and statement for submission to relevant stakeholders including NRETAS. Also required are recommendations regarding any ongoing monitoring that will be required for the site in question, and
- ongoing monitoring where relevant.

Other sites on which contamination is likely to or has caused harm (as defined in the *Waste Management and Pollution Control Act*) are managed in a similar way by NRETAS.³⁴

4.9.5 Practical guidance offered or recommended by regulatory agencies

Practitioners in the NT are provided with general guidance in the form of the *Working guidelines for consultants reporting on environmental issues*, developed by NRETAS and adapted from the NSW EPA's *Guidelines for consultants reporting on contaminated sites* (NT Department of NRETAS 2010). Although the guidelines are concerned with reporting requirements, they also provide some information about the activities expected to be undertaken at each stage of the assessment and remediation process. For detailed guidance on specific aspects of the remediation and management process, practitioners are referred to the ANZECC *Guidelines for the assessment and management of contaminated sites* (ANZECC & NHRMC 1992), as well as to other Australian jurisdictional websites.

³¹ NT Department of NRETAS website 2012, *introductory material*, <www.nretas.nt.gov.au/environment-protection/waste/contaminated>.

³² Pers. comm., Helen Davies, NT Department of NRETAS, 16 December 2011.

³³ NT Department of NRETAS website 2012, *introductory material*, <www.nretas.nt.gov.au/environment-protection/waste/contaminated>

³⁴ Pers. comm., Helen Davies, NT Department of NRETAS, 16 December 2011.

4.9.6 Remediation and management planning, implementation and validation

Similar to all other jurisdictions and consistent with the ANZECC guidelines approach, remediation goals and strategies are site-specific and based upon such factors as assessed risk, cost and proposed use of the land. Site-specific remediation criteria can be developed but largely, and again similar to all other jurisdictions, the NEPM investigation levels form the remediation targets. In the case of remediation of groundwater, a risk-based 'clean up to the extent practicable' approach is used, similar to the approach used in NSW and Victoria, but this is driven by the use of the receiving waters.³⁵ The requirements for a RAP are set out in the guidelines on reporting as follows (NT Department of NRETAS 2010). The RAP should:

- set remediation goals that ensure the area of the activity or contaminated site will be suitable for the proposed use and will pose no unacceptable risk to human health or to the environment
- document in detail all procedures and plans to be implemented to reduce risks to acceptable levels for the proposed site use
- establish the environmental safeguards required to complete the remediation in an environmentally acceptable manner
- identify and include proof of the necessary approvals and licences required by regulatory authorities.

Once remedial work is complete, a report should be prepared detailing the site work conducted and regulatory decisions made. Detailed information about reporting requirements is given in the NRETAS document, *Working guidelines for consultants reporting on environmental issues*. Checklists are also provided to assist practitioners in the preparation and submission of reports. Where remedial action has been carried out, the site must be 'validated' to ensure that the objectives stated in the RAP have been achieved. A report detailing the results of the site validation is required.

The extent of validation required will depend on:

- the degree of pollutant originally present
- the type of remediation processes that have been carried out
- the proposed land use.

Validation must confirm statistically that the remediated site complies with the clean-up criteria set for the site. The validation report must assess the results of the post-remediation testing against the clean-up criteria stated in the RAP. Where targets have not been achieved, reasons must be stated and additional site work proposed to achieve the original RAP objectives. The validation report should also include information confirming that all NRETAS and other regulatory authorities' licence conditions and approvals have been met. In particular, documentary evidence is needed to confirm that any disposal of soil offsite is done in accordance with the RAP. There is no specific guidance relating to particular monitoring strategies to be used, but the following reporting requirements provide an indication of the elements expected to be included:

³⁵ Pers. comm., Helen Davies, NT Department of NRETAS, 16 December 2011.

Where a monitoring program is needed, the monitoring report should detail the proposed monitoring strategy, parameters to be monitored, monitoring locations, frequency of monitoring, and reporting requirements. The monitoring report must include sufficient information on the location of the site, site history and surrounding environment (including geology and hydrogeology) field and laboratory sampling and analysis plans, quality control and assurance to enable robust regulatory decision-making.

4.9.7 Auditing/third party review

The NT seeks third party review of the suitability of remediation strategies proposed by consultants in any remediation plans. NRETAS may require an environmental audit to, for example, assess the ability of management systems to manage or clean up pollution. The site auditor is expected to certify that the terms of the audit have been met and to suggest ongoing monitoring, if required. The chief executive of NRETAS has approved persons who are accredited under either the NSW site auditor scheme or the Victorian environmental auditor scheme as a class of persons suitable to undertake environmental audits in the NT. It is not envisaged that NRETAS will develop its own auditor system.³⁶

³⁶ Pers. comm., Helen Davies, NT Department of NRETAS, 16 December 2011.

5. Resources

5.1 Philosophy

5.1.1 Australia – national

National Environment Protection Council (NEPC) 1999, *National Environment Protection (Assessment of Site Contamination) Measure*, viewed December 2011, <www.ephc.gov.au/contam>.

Australian and New Zealand Environment and Conservation Council & National Health and Medical Research Council (ANZECC and NHMRC) 1992, *Australian and New Zealand Guidelines for the assessment and management of contaminated sites*, viewed December 2011, <www.ephc.gov.au/node/10>.

Australian and New Zealand Environment and Conservation Council (ANZECC) 1999, *Guidelines for the assessment of on-site containment of contaminated soil*, viewed December 2011, <www.ephc.gov.au/node/365>.

Australian and New Zealand Environment and Conservation Council (ANZECC) 1994, *Financial liability for site contamination: a position paper*, The Council, Canberra.

CRC CARE 2011, *Contaminated sites law and policy directory*, CRC CARE, Mawson Lakes, South Australia, viewed December 2011, <www.cslawpolicy.com>.

Intergovernmental Agreement on the Environment 1992, Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT, viewed December 2011, <www.environment.gov.au/about/esd/publications/igae/index.html>.

5.1.2 Australia - jurisdictions

New South Wales

Principles underlying the regulation of environmental management in NSW are described in:

- New South Wales Government 1997, *Contaminated Land Management Act 1997 No 140*, viewed December 2011, <www.legislation.nsw.gov.au/maintop/view/inforce/act+140+1997+cd+0+N>.
- NSW Department of Urban Affairs and Planning & NSW EPA 1998, *Managing land contamination planning guidelines, SEPP 55 – Remediation of land*, viewed December 2011, <www.planning.nsw.gov.au/assessingdev/pdf/gu_contam.pdf>.

Victoria

Principles underlying the regulation of environmental management in Victoria are described in:

- State Government of Victoria 1970, *Environment Protection Act 1970*, viewed December 2011, <www.legislation.vic.gov.au/>.

- Victoria Government Gazette 2002, *State Environment Protection Policy (Prevention and Management of Contamination of Land)*, viewed December 2011, <www.gazette.vic.gov.au/gazette/Gazettes2002/GG2002S095.pdf>.

Queensland

Principles underlying the regulation of environmental management in Queensland are described in:

- Queensland Government 1994, *Environmental Protection Act 1994*, viewed December 2011, <www.legislation.qld.gov.au/LEGISLTN/ACTS/1994/94AC062.pdf>.
- Queensland Government 2009, *Sustainable Planning Act 2009*, viewed December 2011, <www.legislation.qld.gov.au/LEGISLTN/CURRENT/S/SustPlanA09.pdf>.

Western Australia

Principles underlying the regulation of environmental management in Western Australia are described in:

- Government of Western Australia 1986, *Environmental Protection Act 1986*, viewed December 2011, <www.slp.wa.gov.au/legislation/agency.nsf/dec_menu.htmlx>.
- Government of Western Australia 2003, *Contaminated Sites Act 2003*, viewed December 2011, <www.slp.wa.gov.au/legislation/agency.nsf/dec_menu.htmlx>.
- WA EPA 2000, *Guidance statement for remediation hierarchy for contaminated land*, Guidance for the Assessment of Environmental Factors No. 17, viewed December 2011, <www.epa.wa.gov.au/docs/1019_GS17.pdf>.

5.2 Initiatives in progress

5.2.1 Australia

The National Waste Policy was agreed to by all Australian environment ministers in November 2009, has been endorsed by COAG, and sets Australia's waste management and resource recovery direction to 2020. The policy sets directions in key areas and identifies priority strategies that would benefit from a national or coordinated approach. In July 2010, eight EPHC working groups were established in order to achieve commitments made under the policy's implementation plan. Information about the progress of the policy implementation is available at <www.environment.gov.au/wastepolicy/implementation/index.html>.

5.2.2 New Zealand

The New Zealand Ministry for the Environment has developed a program of work to address key issues and gaps that exist in how New Zealand manages contaminated land. With the aim of achieving a comprehensive policy framework for managing contaminated land, a key starting point for discussion was the 2006 paper, *Working*

towards a comprehensive policy framework for managing contaminated land in New Zealand: A discussion paper (<www.mfe.govt.nz/publications/hazardous/policy-framework-contaminated-land-nov06/policy-framework-contaminated-land-nov06.pdf>). Information about the progress of the policy framework initiative is available on the ministry's website at <www.mfe.govt.nz/index.html>.

5.2.3 Canada

The CCME sets priorities for its work each year. One of its desired outcomes for the year 2011/2012 is to develop and maintain technical products and protocols for the protection of environmental and human health. Current initiatives in support of this outcome include:

- the development and maintenance of soil quality guidelines and protocols (an example of work currently in progress is the development of *A protocol for the derivation of groundwater quality guidelines for use at contaminated sites*)
- the investigation of barriers to greater jurisdictional harmonisation of management practices.

The CCME's work plan is available at <www.ccme.ca/assets/pdf/wkpln_smry_e.pdf>. Information about the progress of the initiatives is available at <www.ccme.ca/whatsnew/index.html>.

5.3 Further reading

Bardos, P, Bone, B, Boyle, R, Ellis, D, Evans, F, Harries, ND & Smith, WN 2011, 'Applying sustainable development principles to contaminated land management using the SuRF UK framework,' *Remediation*, Spring, pp.77–100.

Canadian Council of Ministers of the Environment (CCME) 2006, *Recommended principles on contaminated sites liability*, PN 1361, viewed December 2011, <www.ccme.ca/publications/list_publications.html#link4>.

CLARINET 2002, *Sustainable management of contaminated land: an overview*, report from the Contaminated Land Rehabilitation Network for Environmental Technologies, viewed December 2011, <www.commonforum.eu/Documents/DOC/Clarinet/rblm_report.pdf>.

EU 2007, *Framework for sustainable land remediation and management*, EURODEMO deliverable reference no. D5.3, Federal Environmental Agency, Austria, viewed December 2011, <www.eurodemo.info/project-information-2/>.

EU 2004, *Liability Directive 2004/35/EC*, directive of the European Parliament and of the council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage, viewed December 2011, <www.eurlex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=en&type_doc=Directive&an_doc=2004&nu_doc=35>.

European Commission 2008, *Waste Directive 2008/98/EC*, viewed December 2011, <www.eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0098:EN:NOT>

Gilmore, E 2001, 'A critique of soil contamination and remediation: the dimensions of the problem and the implications for sustainable development', *Bulletin of Science, Technology & Society*, vol 21, no. 5, pp. 394–400.

ITRC 2011, *Green and sustainable remediation: A practical framework*, Interstate Technology and Regulatory Council, Washington, viewed December 2011, <www.itrcweb.org/gd.asp>.

ITRC 2011, *Green and sustainable remediation: state of the science and practice*, Interstate Technology and Regulatory Council, Washington, viewed December 2011, <www.itrcweb.org/gd.asp>.

NICOLE 2010, Road map for *Sustainable Remediation*, NICOLE Sustainable Remediation Working Group, Network for Industrially Contaminated Land in Europe, Netherlands, viewed December 2011, <<http://www.nicole.org/uploadedfiles/2010-wg-sustainable-remediation-roadmap.pdf>>.

SuRF Australia, CRC CARE & ACLA 2011, *A framework for assessing the sustainability of soil and groundwater remediation*, viewed December 2011, <<http://www.surfanz.com.au/pdfs/SuRF-Australia-A-Framework-for-Assessing-the-Sustainability-of-Soil-and-Groundwater-Remediation.pdf>>.

SuRF UK 2010, *A framework for assessing the sustainability of soil and groundwater remediation*, CL:AIRE, London, viewed December 2011, <www.claire.co.uk/index.php?option=com_resource&controller=article&article=88&category_id=18&Itemid=61>.

US EPA 2008, *Green remediation: incorporating sustainable environmental practices into remediation of contaminated sites*, Office of Solid Waste & Emergency Response, viewed December 2011, <<http://clu.in.org/greenremediation/>>.

Vanheusden, B 2009, 'Recent developments in European policy regarding brownfield remediation', *Environmental Practice*, vol. 11, no. 4, pp. 256–262.

5.4 Guidance

5.4.1 General guidance – International and national

Australian and New Zealand Environment and Conservation Council (ANZECC) 1999, *Guidelines for the assessment of on-site containment of contaminated soil*, viewed December 2011, <www.ephc.gov.au/node/365>.

Australian and New Zealand Environment and Conservation Council & National Health and Medical Research Council (ANZECC and NHMRC) 1992, *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*, viewed December 2011, <www.ephc.gov.au/node/10>.

Canadian Council of Ministers of the Environment (CCME) 1997, *Guidance document on the management of contaminated sites in Canada*, PN1279, viewed December 2011, <www.ccme.ca/publications/list_publications.html#link4>.

Contaminated Sites Management Working Group 1999, *A federal approach to contaminated sites*, Government of Canada, viewed December 2011, <www.federalcontaminatedsites.gc.ca/publications/index-eng.aspx>.

National Environment Protection Council (NEPC) 1999, *National Environment Protection (Assessment of Site Contamination) Measure*, viewed December 2011, <www.ephc.gov.au/contam>.

UK Environment Agency 2010, *FAQs, technical information, detailed advice and references*, GPLC2, viewed December 2011, <www.environment-agency.gov.uk/research/planning/121619.aspx>.

UK Environment Agency 2010, *Guiding principles for land contamination*, GPLC1, viewed December 2011, <www.environment-agency.gov.uk/research/planning/121619.aspx>.

UK Environment Agency 2010, *Reporting checklists*, GPLC3, viewed December 2011, <www.environment-agency.gov.uk/research/planning/121619.aspx>.

UK Environment Agency 2004, *Model procedures for the management of land contamination*, CLR 11, viewed December 2011, <www.environment-agency.gov.uk/research/planning/33710.aspx>.

5.4.2 General guidance – Australian jurisdictions

ACT EPA 2009, *Contaminated sites environment protection policy*, viewed December 2011, <www.environment.act.gov.au/environment2/environment_protection_authority_legislation_and_policies>.

QLD Department of Environment 1998, *Draft guidelines for the assessment and management of contaminated land in Queensland*, viewed February 2013, <www.ehp.qld.gov.au/land/contaminated-land/index.html>.

SA EPA 2009, *Guidelines for the assessment and remediation of groundwater contamination*, viewed December 2011, <www.epa.sa.gov.au/documents.php?cat=14&subcat=61&q=&x=23&y=8>.

SA EPA 2006, *EPA guidelines for environmental management of on-site remediation*, viewed December 2011, <www.epa.sa.gov.au/documents.php?cat=14&subcat=61&q=&x=23&y=8>.

WA DEC has developed the *Contaminated sites management series guidelines* to assist with the assessment and management of contaminated sites in Western Australia. The series includes topics from assessment to reporting requirements and is available at <www.dec.wa.gov.au/pollution-prevention/contaminated-sites/guidelines.html>.

5.4.3 Guidance – development of remediation plan

California EPA, Department of Toxic Substance Control 2001, *Guide to selecting a consultant*, viewed December 2011, <www.dtsc.ca.gov/SiteCleanup/Brownfields/upload/PUB_SMP_Guide-to-Selecting-a-Consultant.pdf>.

Canadian Council of Ministers of the Environment (CCME) 1996, *A framework for ecological risk assessment: general guidance*, PN 1195, viewed December 2011, <www.ccme.ca/publications/list_publications.html#link4>.

- Canadian Council of Ministers of the Environment (CCME) 1996, *A framework for ecological risk assessment: technical appendices*, viewed December 2011, <www.ccme.ca/publications/list_publications.html#link4>.
- Canadian Council of Ministers of the Environment (CCME) 1996, *Guidance manual for developing site-specific soil quality remediation objectives for contaminated sites in Canada*, PN 1197, viewed December 2011, <www.ccme.ca/publications/list_publications.html#link4>.
- Department of Health and Ageing & enHealth Council 2002, *Guidelines for assessing human health risks from environmental hazards*, viewed December 2011, <www.nphp.gov.au/enhealth/council/pubs/ecpub.htm>.
- Environment Canada, *In-situ remediation technologies for contaminated sites*, TAB #22, viewed December 2011, <www.on.ec.gc.ca/pollution/ecnpd/tabs/tab22-e.html>.
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