

# Remediation Australasia

Remedial strategies  
and techniques:  
**EVALUATING  
SUSTAINABILITY**



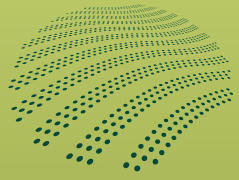
**PROTECTING OUR  
COMMUNITIES**  
Assessing the risks to health



**CHEMICAL  
MANUFACTURING SITES**  
Remediating land for re-use



**BIOAVAILABILITY  
AND REMEDIATION**  
New methods for determining risk



**CRC CARE™**

## Cooperative Research Centre for Contamination Assessment and Remediation of the Environment

CRC CARE is Australia's leading science-based partnership in assessing, preventing and remediating contamination of soil, water and air. With a unique mix of industry, university and government agency partners, CRC CARE research has five main programs:

- Risk assessment
- Remediation technologies
- Prevention technologies
- Social, legal, policy and economic issues
- National contaminated sites demonstration program

As part of an ambitious delivery agenda, CRC CARE has created the Australian Remediation Industry Cluster (ARIC) to promote SME access to new technology and knowledge, and developed an industry training and workshop program. It has forged key partnerships with major industry players and has a growing list of technology patents.

With university partners and strong ties to Asia, CRC CARE's support and supervision will enable 50 students to complete PhDs during its first seven-year term. Building regional leadership in this field represents an excellent investment for Australia as an international market for services emerges worth tens of billions of dollars.

**A cleaner, safer future for all**  
**[www.crccare.com](http://www.crccare.com)**



Welcome to the first edition of *Remediation Australasia*, a magazine produced by the Australian Remediation Industry Cluster (ARIC) – an initiative of CRC CARE.

The magazine is supported by a new internet site of the same name which will become an important resource for industry and members of ARIC.

The purpose of *Remediation Australasia* is to provide a resource to help industry, government and research groups to keep abreast of new developments and better understand what is happening in the remediation industry. In essence the magazine is expected to bridge the gap between different enduser groups via exchange of information on contaminants, risks, remediation and community involvement in public policy.

Being an Australasian magazine our principal audience will be Australia, New Zealand, Papua New Guinea, East and West Timor and the Pacific Islands.

CRC CARE has been the catalyst in bringing together industry, regulators and research groups in Australia to tackle important industry challenges that require national consensus. This process has been driven by our partners.

To build on this important role and broaden participation in important industry debates, ARIC has been formed.

ARIC's goal is to improve access to information, facilitate networking, provide a forum for resolving important national issues and promote the remediation industry to the broader community.

ARIC is a membership-based group that provides both public and member-based services. Active involvement of industry participants will be the key to ARIC's success so broad participation is essential.

The *Remediation Australasia* e-magazine and internet site are important tools in helping ARIC and the remediation industry achieve their goals.

I would like to invite you to explore the possibilities of ARIC and help it be successful. Three ways you can do this are:

- Consider joining ARIC so you or your organisation can participate in the process of improving the professionalism, effectiveness and efficiency of remediation services in Australasia. Membership is free until 1 Jan 2010.
- Contribute to Remediation Australasia by sending relevant information on coming events, new publications (not promotional material) and training opportunities in Australasia to **aric@crccare.com**.
- Tell us how we can improve Remediation Australasia so it can better meet your needs by sending your comments to **aric@crccare.com**.

CRC CARE is proud to have initiated ARIC and welcomes you to Remediation Australasia.

**Prof Ravi Naidu**

Managing Director, CRC CARE  
Editor, *Remediation Australasia*

*Remediation Australasia* is a quarterly industry magazine produced by the Australian Remediation Industry Cluster (ARIC) for the Australian remediation industry.

**Circulation**

The publication is currently distributed to more than 2,000 recipients throughout Australasia, free of charge.

**Editorial and production**

Editor: Ravi Naidu  
Sub-editor: Leigh Walters  
Sub-editor, online production: Meredith Loxton

**Editorial enquiries**

Andrew Beveridge, CRC CARE  
T. 08 8302 3937 / M. 0429 779 226  
E. Andrew.Beveridge@crccare.com

**Front cover image: Site remediation taking place at a contaminated site in Brompton, Adelaide, South Australia**

Articles which appear in *Remediation Australasia* may be reproduced with written permission from ARIC and CRC CARE. Acknowledgement of the source of both the research and the story will be a requirement. This publication is provided for the purpose of disseminating information relating to scientific and technical matters. Participating organisations of ARIC and CRC CARE do not accept liability for any loss and/or damage, including financial loss, resulting from the reliance upon any information, advice or recommendations contained in this publication. The contents of this publication should not necessarily be taken to represent the views of the participating organisations.



# 12

# cover story



# 14



# 06



## features

# contents

**06 Protecting our communities**  
 Brian Priestly and Ross Sadler discuss the importance of health risk assessment in protecting communities who may have inaccurate perceptions of risk

**09 Taking the risks and cost out of cleanup**  
 Using new technologies to identify risk from contaminated sites, level of risk, and risk management techniques

**10 Improving assessment of site contamination**  
 Variation to the NEPM for the Assessment of Site Contamination

**12 Evaluating sustainable remedial strategies and techniques**  
 Remediation isn't always sustainable, and in certain cases it can be more of a hindrance than a help. SuRF UK shares an approach to sustainable remediation assessment using environmental, social and economic approaches.

**14 Community engagement during the Rhodes Remediation Projects**  
 Government, community and remediation perspectives



16



27

every issue

**16 Towards bioavailability as a basis for risk assessment and remediation**

Integrating bioavailability into risk assessment, risk characterisation, and decision-making for remediation plans

**20 Contaminated sites law and policy**

Providing international access to contaminated site legislation and guidelines

**20 ARIC – the value to industry**

Reflecting on new resources in soil and groundwater remediation technology

**15 Publications Update**

**21 ALGA Updates**

**22 ACLCA Updates**

**27 Shorts**

An update on current research focused on environmental contamination assessment and remediation in Australia



# Protecting our communities

Brian Priestly, Monash University and Ross Sadler, Griffith University

It is almost inevitable that when a site is found to be contaminated with toxic chemicals, the people in the affected communities become concerned about the potential impact on their health and the health of their families.

This concern occurs regardless of the actual health risk. The mere perception that there is a risk may be sufficient to cause alarm in the affected community and result in them demanding action to be taken to deal with the problem.

On the other hand, site owners or developers may be bewildered by the technical reasons for the need to reduce contaminants to such low levels, when higher levels would considerably reduce the cost and difficulty of clean-up.

## Perception of risk

In the broader community risk perception, associated with contaminated sites, may fall into two polarised camps, with the viewpoints including:

- 'Those chemical 'nasties' in the ground will harm my health, or that of my family. Get rid of them!' or
- 'So what! I don't eat dirt and I presume that any nasty chemicals will stay where they are.'

Both statements are, to some extent, incorrect. The likelihood of the first is often not substantiated when an appropriate health risk assessment (HRA) is carried out. Indeed, the purpose of doing a

HRA is to estimate how large the risk may be or whether it is small enough not to warrant any clean-up or other actions.

With regard to the second point, the amount of contaminated dirt a person needs to ingest (eat, drink or swallow from dust) to exceed a health-based safe level can be quite small when soils are heavily contaminated. Amounts of 25 - 100 mg/day can be of concern in some instances.

The second point also ignores the possibility that the chemicals may be mobile which can lead to significant exposure through other pathways such as wind-borne dust, movement of volatiles (contaminants in gaseous form) into the indoor or outdoor air, contamination of water (both surface and groundwater), and via plants and animals used for food.

## Protecting our food chain

The significance of contaminants entering the food chain cannot be overestimated. Some common food plants grown in home gardens (notably lettuce) can act as concentrators for soil contaminants such as cadmium. This means the contaminant is taken into the plant and accumulates in the plant



tissues. If sufficient contaminant accumulates in the plant parts which are to be eaten, then this is of concern.

Beef cattle can also be very efficient in absorbing organochlorine pesticides from soil or contaminated feed. If sufficient chemical is ingested by the cattle, especially when exposed to contaminated soil or feed over time, then tissue levels can exceed the acceptable maximum residue level, rendering them unfit for human consumption for several months. All of these

potential exposure pathways need to be considered in a health risk assessment.

### **Regulatory tools**

While a site-specific health risk assessment is an important management tool for remediation of a contaminated site, an important regulatory tool is the National Environment Protection Measure (NEPM) for contaminated sites.

The purpose of the NEPM is to provide guidance on how

to undertake a site assessment and includes a set of health investigation levels (HILs). These are concentrations for some of the more important toxic chemicals found in contaminated sites, above which further investigation and evaluation will be required.

The HILs often assume a worst-case exposure scenario for different types of site usage and are deliberately conservative.

Once a HIL is exceeded, this triggers the need for further investigation which may include a



more refined exposure assessment or developing more realistic conceptual site models.

Many of the current NEPM HILs use the risk of soil ingestion by young children as a significant driver of the health risk assessment. In situations where there are volatile or mobile chemicals present though (e.g. petroleum, fuel products or solvents), the inhalational and groundwater pathways become more important.

“Health risk assessment provides an important tool for the remediation of contaminated land and the protection of our communities.”

### Where a community may become concerned

The following are some typical scenarios which can lead to high levels of community concern:

- A child-care centre where there is high levels of toxic metals such as cadmium, arsenic, or lead in the soil.

- A housing estate built on or near a former industrial site, or waste disposal dump, where the range of toxic chemicals present can be quite broad.
- Communities that live near active or former mining sites, transport pathways for mine ores or sites where ores are smelted.

Health risk assessment provides an important tool for the remediation of contaminated land and the protection of our communities. It is also noteworthy that the NEPM has provision to take into account home grown produce – further work though needs to be done before these will be included.

### Health risk assessment

There is usually a significant amount of conservatism built into the health risk assessment process, especially when the potential health effect is a serious disease like cancer or where children are likely to be exposed. The conservatism also takes into account any uncertainties in our understanding of the risk and to ensure that more susceptible or vulnerable members of a community are protected. ■



## Developing environmental experts.

CRC CARE supports the growth of highly qualified and suitably trained researchers and decision makers in environmental risk assessment and remediation through:

- ▶ PhD and Honours research opportunities
- ▶ workshop training for environment industry professionals
- ▶ linkages with other industry peak bodies
- ▶ focusing on end user needs
- ▶ a suite of publications and guidance documents
- ▶ hosting the biennial ‘CleanUp’ industry conference

Contact CRC CARE for further information.



Cooperative Research Centre for Contamination Assessment and Remediation of the Environment

[www.crccare.com](http://www.crccare.com)



# Taking the risks and cost out of cleanup

Ravi Naidu, CRC CARE

Sound science and technology now exist to sharply reduce the cost and difficulty of cleaning up contaminated land and water – while assuring the health and safety of the community and environment. It is time for Australia to move to the next level of clean-up, using the latest technologies to identify precisely which sites pose a risk, the extent risk is, and how it can be effectively managed.

Around the world, most remediation guidelines are still based on the total contaminants present at a site. Many of these are harmless, which means we are paying to clean up things which do not in fact pose any danger to the community or ecosystems. In Europe, and in the Australian states of Victoria and South Australia especially, the move is on towards risk-based land management – defining exactly what contaminants are present at a site, whether or not they are available at levels capable of harming humans, plants or animals – and how to remove or stabilise them with high confidence.

It comes down to bioavailability. The contaminant – such as a heavy metal – may be present, but is it available in quantities that could harm life? Or is it bound to soil particles and unavailable? Is it breaking down naturally? We now have techniques that can tell us this, quickly and with extreme precision.

The principle of risk-based management is that ‘the dose makes the poison’: sufficient exposure has to occur before harm can result. The distinction is between when harm is possible (risk) and when it is likely (hazard). Decisions about whether or not to remediate thus depend on whether the contaminant is above or below a predetermined safety threshold, for humans and the environment.

With the cost of landfill rising sharply almost everywhere, old solutions such as excavating and disposing of suspected contaminated soil elsewhere are rapidly becoming untenable. In any case, when we carry out proper analysis, we frequently find this is unnecessary: the soil or water can be treated in-situ, with far more efficient and less costly techniques. These techniques have been under research and trial around the world for well over a decade, and many of them are by now well-established and proven reliable. For example, instead of pumping up contaminated groundwater and treating it on the surface – which is expensive – you can use underground barriers to intercept and clean it, you can introduce special microbe to bioremediate it, or you can monitor the organisms naturally present to be certain they are doing the job.

The science on these techniques is now largely in and it is time we had the confidence to use them more widely.

For sites with a mix of contaminants, CRC CARE is testing a novel triple-layer underground barrier. The first layer uses biosorption to remove and neutralise biodegradable hydrocarbon compounds. The second layer breaks down persistent organic pollutants using oxidation. The third layer scavenges heavy metals and either immobilises them or converts them into safer compounds. Instead of excavating and disposing of soils contaminated by heavy metals, they can be amended with compounds that immobilise the toxins, or else the target metals can now be extracted using special plants (phytoremediation), electrical and physical methods.

The key to risk-based land management lies in having highly sensitive tools to measure changes in the bioavailability of the target contaminants. For example, CRC CARE has recently patented an ultra-sensitive device for sensing levels of lead or cadmium in soil water, even if only a few atoms are present, using the physics and chemistry of bonding. Such developments will soon lead to arrays of low cost sensors capable of continuously monitoring the level of contaminants at a site and reporting whether the clean-up methods are working. Another patent is the CRC’s Anionic Surfactant Test Kit, which can detect and measure the concentration of highly toxic surfactants from widely used fire-fighting foams in ground and surface water in the field.

Sensitive measurement is also the key to remediation methods such as monitored natural attenuation – a technique which CRC CARE researchers now consider could be far more widely used within Australia, in which naturally-occurring soil and water microbes break down or modify the contaminants of concern either on their own or with some human encouragement. CRC’s researchers have identified native microbes capable of breaking down benzene, toluene, ethylene and xylene (BTEX) contaminants or dealing with problem metals like arsenic.

There is a growing awareness, worldwide, of two important principles – first that remediation should be driven by the management of real risks, not presumed ones; and second, that not all contaminants require the same degree of intensive management. These principles and the technologies which surround them have been extensively tested around the world and especially here in Australia for almost 15 years – and it is time we had the confidence to fully adopt and apply them. ■



# Improving assessment of site contamination

Bruce Kennedy, NEPC Service Corporation

Following a review of the National Environment Protection Measure (NEPM) for the Assessment of Site Contamination in 2007, improvements were proposed by the National Environment Protection Council (NEPC).

Ecological Investigation Levels (EILs) aim to protect the ecological values of a site.

CSIRO has developed a framework and methodology for deriving soil EILs and will be developing values for selected contaminants.

Groundwater Investigation Levels (GILs) aim to protect groundwater. Existing GILs are based on Australian and New Zealand Environment and Conservation Council guidelines for water quality and drinking water, current when the NEPM was originally developed. They will be updated taking into account the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (2004) and the *Australian Drinking Water Guidelines* (2004).

The NEPM is the principal guidance document in Australia for the assessment of contamination of land and has been in place since 1999. There is provision in the NEPM for periodic reviews to accommodate new knowledge. The proposed enhancements to the NEPM were to improve its effectiveness and efficiency by addressing technological, scientific and health risk issues raised by site assessors, consultants, land developers, auditors, the public and state and territory governments.

The NEPM adopts a 'fit for purpose' approach to contamination assessment based on risk assessment methodology. The remediation (and therefore assessment) of contaminated land should be commensurate with the scale of contamination and its likely impacts on human health and the environment, including the proposed future use of the site. It is important to do what is necessary, and not do more than is necessary to assess, remediate and manage the site in order to safeguard human health and the environment.

## The variation process

Given the sheer number of issues being addressed, the variation process is complex. The variation is being developed by a NEPC project team, which is chaired by the Western Australian government member of the NEPC committee. The project team includes officers from several jurisdictions as well as a health sector representative. The project team is undertaking much of the work involved

in the variation, although (as indicated above), some major elements are being facilitated by third parties such as:

- NHMRC – Health investigation levels (HILs) review and development
- CRC CARE – Total petroleum hydrocarbon health screening levels, bioavailability and leachability, fuel additives
- CSIRO/NSW Department of Environment, Climate Change and Water – EIL framework and methodology development
- CSIRO/CRC CARE/Western Australia Department of Environment and Conservation – Review of model for volatiles, and
- Monash University – Mixtures guidance.

The project team is managed by the NEPC Service Corporation. The variation process commenced in mid-2007 and will be complete in mid-2010, when the NEPM is expected to make the variation. The time taken to carry out the work reflects the complexity of the issues being considered. Even though the process is complex, the results will ensure that the Assessment of Site Contamination NEPM will continue to provide the high level of guidance required by the site assessment and remediation industry. Whilst outside the scope of the NEPM, the *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites* (published in 1992) will be updated. ■

# Themes and issues

The review focused on three themes, which are reflected in the development of the variation:

- Investigation levels
- Contaminating substances
- Provision of guidance.

## 1. Investigation levels

Investigation levels act as a trigger for further investigation if exceeded and are important in the assessment process. HILs aim to protect human health. The National Health and Medical Research Council (NHMRC) on behalf of NEPC is carrying out:

- review of HIL development methodology
- revision of existing HILs
- development of HILs for substances which were identified in the review as a high priority, and
- clarification of the guidance for HIL use to minimise inappropriate applications.

## 2. Contaminating substances

Guidance is being developed for several categories of substances due to their prevalence as contaminants. They include:

- Total petroleum hydrocarbons, for which screening levels are being developed.
- Persistent organic pollutants – extending HILs to some persistent organic pollutants not covered in the NEPM
- Asbestos – development of assessment guidance to assist in managing uncertainties such as the condition of asbestos-containing material in products, mixtures of asbestos types and products and soil types.
- Fuel additives – a scoping exercise to determine whether guidance regarding fuel additives is required.
- Assessment of mixtures of substances commonly encountered on contaminated sites.

## 3. Provision of guidance

The NEPM provides guidance in the following areas, each will be updated in the development of the variation:

### (i) Clarification of the proper use of investigation levels

### (ii) Guidance for data collection and analysis to serve the following needs:

- establishing the lateral and vertical extent of contamination
- appropriate sampling methodologies and data quality objectives
- stockpile sampling
- development of conceptual site models, fate and transport models
- risk assessments on which management decisions are based
- a review of data quality objectives
- transparent and verifiable quality assurance/quality control procedures, and
- review of analytical procedures for particular analytes (an analyte is a substance or chemical constituent that is determined in an analytical procedure)

### (iii) Bioavailability and leachability

- Update bioavailability values used in developing HILs and site-specific assessments.

### (iv) Risk communication

- Update guideline to reflect current practice to assist in the appropriate management of site clean-up.

### (v) Professional competencies

- A system of independent third party auditing of site assessments is used throughout Australia. The NEPM outlines the competencies, experience, and ethical behaviours required of auditors, thus providing the basis for their accreditation. These requirements will be updated to reflect current practice.

### (vi) Management and remediation principles

- Whilst outside the scope of the NEPM, the *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites* (published in 1992) will be updated.

# Evaluating sustainable remedial strategies and techniques

Richard Boyle, Homes & Communities Agency  
David Ellis, DuPont  
Paul Bardos, r3 environmental  
Brian Bone, Environment Agency  
Frank Evans, National Grid  
Nicola Harries, CL:AIRE and  
Jonathan Smith, Shell Global Solutions

Management approaches for land and groundwater contamination have evolved in recent decades. From an initial recognition of the issues in the 1960s and 70s, through attempts to remediate for multifunctional end-use (1980s), and technical risk-based criteria (1990s - 2000s), the industry is now entering a period where sustainable development criteria are becoming more dominant.

It has often been assumed that remediation is a beneficial activity, almost regardless of how it is undertaken. It is now apparent that remediation activities are not necessarily sustainable per se, and that poorly considered

or operated schemes may cause more detriment than they remedy. As a consequence, interest in remediation that can be shown to contribute to sustainable development goals – ‘sustainable remediation’ – is growing around the world.

Sustainable development was defined by the United Nations World Commission on Environment and Development (commonly referred to as the ‘Brundtland Report’) as: *development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. This is commonly interpreted as meaning those actions which maximise the overall benefit, having regard to social, environmental and economic factors, and to short- and long-term issues.*

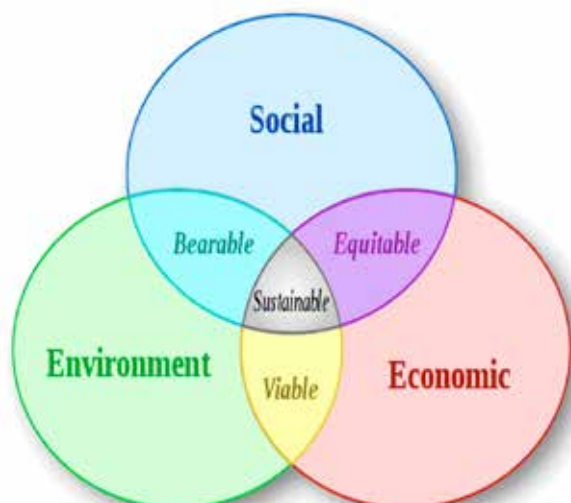
Consideration of the three components of sustainability – society, environment, economy (or people, planet, profit) can be used within the remediation industry to develop strategies and to select remedial techniques that directly contribute to achieving sustainable development. This is increasingly important for the following reasons:

- corporate and government policies contributing to sustainable development
- climate change issues and CO<sub>2</sub> emission reduction strategies
- energy consumption
- resource consumption (e.g. water, aggregate)
- public sentiment
- investor sentiment
- safety risks
- many remediation projects failing to achieve initial non risk-based objectives and continuing expenditure and environmental emissions for minimal additional risk reduction, and
- many remediation technologies trade one kind of pollution for another.

In response, a number of initiatives have been established to develop an understanding and capability in sustainable remediation.

The Sustainable Remediation Forum (SuRF) was established in the USA in 2006. In Europe SuRF UK, the United Kingdom’s Sustainable Remediation Forum, was established shortly afterwards followed by a Network for Contaminated Land in Europe (NICOLE) working group on sustainable remediation.

The three components of sustainable development (after Linder 2009)





# SuRF UK's tiered approach to sustainable remediation

## Environmental

1. Impact on air
2. Impact on water
3. Impact on soil
4. Impact on ecology
5. Natural resource use and waste generation
6. Intrusiveness

## Social

1. Impacts on human health and safety
2. Ethical and equity considerations
3. Impacts on neighbourhoods or regions
4. Community involvement and satisfaction
5. Compliance with policy objectives and strategies
6. Uncertainty and evidence

## Economic

1. Direct economic costs and benefits
2. Indirect economic costs and benefits
3. Employment and capital gain
4. Gearing
5. Life-span and 'project risks'
6. Project flexibility

Created in 2007, SuRF UK has active involvement and support from industry, service providers, government agencies and academia. It has recently issued a framework for assessing sustainable land and groundwater remediation for public consultation, and a review of sustainable development indicator sets that might be applied to sustainable remediation assessments.

SuRF UK has defined sustainable remediation as *the practice of demonstrating, in terms of environmental, economic and social indicators, that an acceptable balance exists between the effects of undertaking remediation activities and the benefits the same activities will deliver.*

SuRF UK recognises that a wide range of management decisions affect the scope of remediation work and its sustainability assessment, which will determine the possible remediation approaches chosen in two ways:

- Firstly, in terms of the regulatory and planning controls on environmental risks, say to human health, water and the wider environment (i.e. the needs are those that relate to the desired end use of the site).
- Secondly, by setting practical boundaries such as the time and space available to carry out remediation, but also limiting the range of possible interventions.

The decision points recognised by SuRF UK as impacting on contaminated land management for a particular site are:

- high level decision making

for policy and regional spatial planning by national government/regional agencies

- local level land-use planning and policy by local authorities
- project-based decision making that sets remedial objectives (e.g. related to risk management/development needs) for land owners and developers, and
- remedy selection and implementation including monitoring and verification implications.

SuRF UK has proposed a tiered approach to sustainable remediation assessment starting with simple qualitative methods, progressing through to approaches such as multi-criteria analysis (MCA), and ultimately to cost-benefit analysis (CBA). At each tier a set of environmental, social and economic factors are considered as outlined in the box on the right. However, the level of detail considered at each tier may also vary. For example, at the simplest tier an assessment of the impacts and benefits associated with 'environment', 'society' and 'economy' may be adequate. In an MCA assessment the 18 categories may be initially considered, and during a CBA the monetised impacts and benefits associated with detailed sustainability metrics (e.g. impacts on air: CO<sub>2</sub> and NO<sub>x</sub> emissions, impacts on water: consumptive water abstraction) are used. The assessment tier used should then reflect the project complexity and be the minimum assessment required to make a robust and reasonable management decision.

The first phase of SuRF UK activity, consultation and publication of a framework, is drawing to an end. Future work is likely to concentrate on the development of sustainability indicators and metrics to supplement or replace those in the box (above) and collation of data on the performance of a range of remediation techniques against those metrics. Further detail will be posted on the SuRF UK website. It is hoped that with the publication of the framework it will help the remediation industry in the UK (and elsewhere) to more directly contribute to achieving sustainable development. ■



# Government, community and remediator perspectives

Catherine Fletcher, Thies Services, John Coffey, Department of Environment, Climate Change and Water and  
Kate Hughes, Adviser to Rhodes Community Consultative Committee

The former Lednez/Union Carbide site in Sydney was home to chemical manufacturing plants for 60 years until the late 1980s. It became contaminated with dioxins, organochlorines and other chemicals when lime and ash wastes from the manufacturing process were used to reclaim land. When the neighbouring Allied Feeds grain mill site accepted the wastes for the same purpose, it too became contaminated.

Thies Services has been remediating the 16-hectare land sites as well as sediment from the adjacent Homebush Bay in projects valued at \$140 million. The presence of the known dioxin carcinogen 2378 TCDD on the sites was the principal reason for the remediation. The projects are collectively known as the Rhodes Remediation Projects after the inner western Sydney suburb where the sites are located.

In 1999, the NSW Government acquired the Lednez/Union Carbide site and in 2001, Thies Services was contracted to remediate the land and portions of the bay. A Parliamentary Commission of Inquiry into the remediation proposal was held in 2003 and remediation activities commenced in late 2005.

The remediation of the former Allied Feeds site for its owner, Meriton Apartments, is essentially complete and all other remediation works will conclude next year. Remediated lots on both sites are certified as suitable for residential zoning by an independent auditor who represents the NSW Department of Environment, Climate Change and Water (DECCW). The DECCW has also



regulated the remediation projects since their inception.

Thies Services' work has included the staged excavation and classification of soil and sediment, on-site treatment of contaminated material by directly heated thermal desorption, and the re-instatement of material that meets each site's re-use criteria. Throughout the remediation, Thies Services has liaised with members of the Rhodes Community Consultative Committee (RCCC).

## Products manufactured on the Lednez/Union Carbide site

- 1928 to 1986: Coal tar
- 1933 to 1986: Xanthates
- 1948 to 1983: Chlorobenzenes
- 1949 to 1976: Herbicides (chlorine gas plant established)
- 1955 to 1968: Insecticides such as DDT (dichlorodiphenyltrichloroethane) and DDD (a compound created by the natural breakdown of DDT).



### A challenging environment

The situation of the Rhodes Remediation Projects within a high-density urban area has provided challenges for the remediator, the government regulatory authority and the community group. Each organisation respectfully engages with other project stakeholders to deliver the Rhodes Remediation Projects efficiently and with a minimum of disruption to the wider community. Much has been learnt about how to successfully engage with community stakeholders during the high-profile, high-impact projects. ■

# Publications Update

The following CRC CARE titles have been published in the last six months. In future editions it will be for the previous three months – the period between editions of *Remediation Australasia*. The publications may originate from research institutions, regulators or industry groups. Please let us know if you have any appropriate publications (no promotional material) to be included by sending details to [aric@crccare.com](mailto:aric@crccare.com).



### CRC CARE Technical Reports

TR 12: *Biodegradation of petroleum hydrocarbon vapours*

TR 11: *Characterisation of sites impacted by petroleum hydrocarbons: National guideline document*

TR 8: *Review of current international approaches for total petroleum hydrocarbon assessment*

TR 6: *Technical impracticability of further remediation for LNAPL-impacted soils and aquifers*

TR 5: *The development of a modular, constructed wetland system for salt, organic and nutrients removal from dairy wastewaters*

TR 4: *The development of HSLs for petroleum hydrocarbons - an issues paper*



TR 3: *Natural attenuation: A scoping review*

TR 2: *Protocols and techniques for characterising sites with subsurface petroleum hydrocarbons - A review*

TR 1: *Petroleum vapour model comparison (interim report superseded by TR9)*

Visit [www.crccare.com](http://www.crccare.com) to see our full suite of Technical Reports.

### CRC CARE Fact Sheets

Acid sulfate soils (ASS)

Indoor air quality

Pesticide residues

Toxic metals

VOCs and POPs

Visit [www.crccare.com](http://www.crccare.com) to see our full suite of Fact Sheets.



### Sustainable Remediation Forum (SURF - US)

Sustainable Remediation White Paper - Integrating Sustainable Principles, Practices, and Metrics into Remediation Projects. ■

# Towards bioavailability as a basis for risk assessment and remediation

---

Ilia Rostami, FMG Engineering

The last 10 years has seen bioavailability emerge as an alternative indicator for determining the potential risk that chemical substances pose to environmental or human health. As such it is being increasingly accepted as a tool for decision making in risk assessment and site remediation, and is now regarded as a significant research area.





Worldwide, the framework used to assess potentially contaminated sites tends to be based on threshold contaminant concentration.

This process typically involves a preliminary investigation followed by an assessment of contamination against the nationally legislated (or recognised) threshold values or criteria. Where the concentration of the chemical substance exceeds the threshold value, site-specific risk assessment and/or remediation is normally recommended.

These thresholds values are not necessarily 'clean-up' goals and yet they are sometimes used that way, resulting in ongoing remediation of contamination and hundreds of millions of dollars being spent each year on satisfying unnecessary clean-up criteria.

Another drawback of using the criteria in isolation has been the failure to consider what fraction of the chemical substance in question is present in a form which may pose a significant risk to people or other organisms. Clearly, if the chemical form or some other factor prevents the contaminant from being taken up by organisms (i.e. there is low or no bioavailability), then this should be taken into account in developing a management strategy for a contaminated site.

### The bioavailability option

Bioavailability is most likely to influence site decision-making where:

- the assumptions made during risk assessment are conservative (e.g. they presume 100% bioavailability)

- the remediation goal will drive significant decisions (e.g. when large quantities of contaminated materials are involved)
- conditions at the site after remediation are unlikely to change substantially over time, and
- regulators and the public accept the process of bioavailability assessment.

Nevertheless, at this stage there is a degree of uncertainty associated with bioavailability as a tool, arising from the complexity of contamination, limits to our understanding of the factors that may be involved and difficulties measuring the indicators of bioavailability.

These uncertainties may be further exacerbated by the limited amount



# Ecological risk

Whilst bioavailability adjustments are scientifically justified in terms of human health risk assessment, such adjustments are yet to be determined for ecological risk assessment.

This is due to the variability in bioavailability responses for different ecological receptors.

A conservative approach tends to be adopted in these situations in order to protect ecological health.

of data on bioavailability relating to ecological systems and human health, and issues associated with residual contamination and how this should be managed in perpetuity.

## Bioavailability and soil legislation

Environment protection guidelines were enacted in the 1990s in most industrialised countries where the focus was initially placed on the total chemical concentration in soils relative to trigger values. For example, the *Soil Remediation Decree of 1995* is the legal framework for soil protection and soil remediation policy in the Flemish Region of Belgium, Switzerland has *Legislation on Prevention of Soil Pollution*, and *National Environment Protection (Assessment of Site Contamination) Measure 1999* is the guideline document in Australia.

At present, the possibility of including bioavailability and bioaccessibility in the current

NEPM measure in Australia is being considered.

Trigger values vary amongst the countries, but are pathway specific and defined as a threshold to a possible but not yet confirmed hazard. They are generally determined on the basis of the reasonable worst case scenario. Until late 1990s, exceeding a trigger value generally led to remediation, regardless of bioavailability. If bioavailability is taken into account, one could argue that only those sites that pose a risk to a particular life form (the 'exposed receptor') need attention, a decision that could substantially reduce remediation costs. This realisation is leading to a gradual shift towards a risk-based approach using bioavailability as a basis for assessment and setting remediation goals.

In Belgium, bioavailability is now included in legislation. The VITO (Flemish Institute for Technological Research) has developed a standard risk evaluation guideline, which is similar to the Dutch guidelines and has been translated into a model (Vlier-Humaan). This guideline presents a holistic setting for evaluation of the potential risks, and contains model codes to calculate the potential transfer of contaminants from soil to the receptors. A number of standard parameters have been set into the model, based on 'best-guess estimates' of a standard Flemish situation. The site owner can opt either to run this model, or to adapt it better to his situation by using site-specific data or contaminant data. It is evident that data on bioavailability can have a profound influence on the outcomes of such an exercise.

In the US, bioavailability assessment has been used to adjust clean-up targets for some inorganic contaminants, such as arsenic, cadmium and lead (Table 1).

The inclusion of bioavailability data from in-vivo (rat, monkey or swine) and in-vitro assays has led to a raising of clean-up targets at a number of sites.

TABLE 1 Examples where arsenic, cadmium and lead bioavailability adjustments have been included in remediation targets for contaminated sites in the US.

Site	Contaminant	Test	Bioavailability (%)	Clean up Target (ug g <sup>-1</sup> )	Regulator Agency
National Zn Co. Bartlesville, OK	Pb	In-vivo, rat	40	9251 (500) <sup>2</sup>	Oklahoma DEQ
	Cd	In-vivo, rat	33	1001 (30) <sup>2</sup>	
	As	In-vitro, PBET	25	601 (20) <sup>2</sup>	
Anaconda, MT	As (soil)	In-vivo, monkey	18	2502	USEPA Region VIII
	As (dust)	In-vivo, monkey	26		
Crego Park, MI	As	In-vitro, PBET	10	681 (6.8) <sup>2</sup>	Michigan DEQ
Union Pacific Railroad Yard, Sacramento, CA	As	In-vivo, pig	< 0.1	No clean up (up to 1,800 ug g <sup>-1</sup> As in slag) <sup>1</sup>	Cal-EPA

1 Cleanup target after site-specific bioavailability assessment.

2 Cleanup target prior to bioavailability adjustment.

# Health screening levels training DVD AVAILABLE NOW



Following the national series of HSL workshops in November 2011, and in response to positive feedback from industry, CRC CARE has made the HSL workshop and materials available on DVD.

This three-disc set features:

- the presentation materials and audio from a live workshop
- a CD containing CRC CARE Technical Report no. 10, and
- all presentation slides.

The training materials will be of relevance to all regulators and practitioners dealing with petroleum hydrocarbon-impacted sites. To provide your staff with these training resources, visit the CRC CARE website to purchase your copy of the DVD.

**purchase your copy at [www.crccare.com](http://www.crccare.com)**

## Work at CRC CARE

CRC CARE is currently working in partnership with legislators in Australia to help establish bioavailability-based criteria in site contamination legislation. Current research by CRC CARE focuses on:

- the fate and behaviour of inorganic and organic contaminants in long-term contaminated soil representing major soil types
- modelling bioavailability of contaminants in varying soil types
- the effect of ageing on contaminant bioavailability and in particular the tightly bound contaminant fraction and their bioavailability under varying soil and environmental conditions
- in-vitro and in-vivo methods for the assessment of contaminant bioavailability,

including the development/calibration of a rapid, reliable and cost-effective tool

- the effect of weathering of PAHs on long-term contaminant bioavailability
- factors influencing contaminant bioavailability and how these could be manipulated to reduce the risk posed by contaminants in the environment, and
- bioavailability reduction as a tool for managing contaminated soils.

## Conclusions

Bioavailability is an intrinsic part of risk assessment. It has an important role in soil remediation policy in Belgium and the UK, and is gaining acceptance in Australia. It may also play a major role in the new European Soil Strategy, and already has a strong legal basis in

the new Environmental Liability Directive which came into force in EU member states in March 2009.

However, despite the EU directive, there is still some reluctance on the part of policy makers, authorities and the public to accept the results of risk evaluation, rather than relying on 'numbers' (total concentration) alone. Nevertheless, in Australia, bioavailability is now recognised as a key measure for risk characterisation and is increasingly included in risk assessment and in decision making for remediation.

---

Note: this article was prepared for *Remediation Australasia* based on the draft paper, '*Towards bioavailability-based soil criteria: past, present and future perspectives*', by Naidu, R, Pruszinski, A, Chaney, R, McConnell, S, Johnston, N and Dries, V.



# Contaminated Sites Law and Policy Directory

The new law and policy website provides access to information about the legislation, guidelines and other information related to contaminated site management.

Initially the site has focused on the states and territories of Australia. Work is currently underway to broaden its focus to include Europe, North America and the Asian region.

Using a standard format for the different jurisdictions the site makes it easier to source the information you need quickly. Visit [www.cslawpolicy.com](http://www.cslawpolicy.com) to browse through the freely available resources. ■

## Regulatory Process

- Introduction
- Responsibility for Remediation
- The Role of Private Professionals
- Identification, Investigation and Assessment
- The Remediation Process
- Voluntary Remediation ("Brownfields" Measures)
- Remediation Under the Land-use Planning Process
- Post-Remediation Controls
- Public Participation
- Liability in Tort and Contract
- Select All



## The importance of ARIC to industry

**Marc Andrews, Coffey Environments**

Coffey Environments is pleased to be a part of this exciting initiative, given our leading role in the commercialisation of innovative soil and groundwater remediation technologies in Australia since the late 1980s.

There is a real and urgent need to create practical and cost-effective alternatives to current remediation and

management practices. CRC CARE and its partners are undertaking work that will potentially alter the ways in which contaminated land issues are managed in Australia and internationally. We see ARIC as an excellent vehicle to collaborate and engage with government, research bodies and key industry players to achieve these significant contamination and remediation goals. ■

# ALGA Update

Peter Nadebaum, ALGA

Sustainable development is very important to our communities, particularly in this time of global warming and financial crisis. It is important that we do not use resources unnecessarily, and we gain the greatest return from the resources that we do use.

The Australian Land and Groundwater Association (ALGA) encourages businesses to apply the principles of sustainable remediation for the management and cleanup of contaminated land and groundwater. This involves remediating land and water in the most efficient manner possible.

## Reducing unnecessary fuel use through better planning

Sustainable remediation is being introduced in North America and Europe, and in April 2009 ALGA drew together leaders in the field to share experiences at the Ecoforum conference in Sydney. This is being followed up with seminars in various states to encourage people to think about the role of sustainable remediation in Australia, drawing on international experiences and thinking.

SuRF – a ‘Sustainable Remediation Forum’ involving environmental agencies, industry and consultants has been established in the UK and US. SuRF is developing white papers and providing guidance on sustainable remediation and its benefits.

ALGA is supporting the establishment of SuRF Australia, and its launch at CleanUp 09 will commence the debate on what might form an appropriate framework for sustainable remediation in Australia.

In addition to championing sustainable remediation, ALGA is also running state seminars on a range of other important topics of interest to the industry. These include:

- debate on issues surrounding managing and cleaning up contaminated groundwater and where improvements can be made
- recent changes to contaminated land management legislation
- issues involving the audit system and where improvements are possible, and
- promoting the application of advanced technologies for land and groundwater remediation.

The continuing mission of ALGA is to provide a forum for the contaminated land and groundwater industry in which topical issues can be discussed, and advances encouraged.

Visit [www.landandgroundwater.com](http://www.landandgroundwater.com) for more information about ALGA. ■

## Engaging the Community handbook AVAILABLE NOW

*‘Engaging the community: a handbook for professionals managing contaminated land’* presents a framework for community consultation on contaminated site projects.

The handbook provides readers with the principles of community engagement, national and international perspectives on best practice in risk communication, Australasian case studies, and a structural framework for involving the public in environmental decision making.

The handbook is a useful tool for state and local authority officers, site planners and environment agencies, and land owners, environmental consultants, contractors, and others involved in the management of contaminated sites.



purchase your copy at [www.crccare.com](http://www.crccare.com)



# ALCLCA Update

## Ross McFarland, ACLCA

The Australian Contaminated Land Consultants Association Inc. (ACLCA) was formed in late 1995 to provide a voice to decision makers in Australia and internationally on matters associated with contaminated land management. The association represents the major environmental consulting firms involved in the assessment and management of contaminated sites in Australia. It currently has representation in New South Wales, Victoria, South Australia, Queensland and Western Australia. The goals of ACLCA are:

- to provide a forum for consultant member companies to develop, discuss and respond to issues that affect us in our responsible management of contaminated lands
- to establish and maintain a strong working relationship with regulatory authorities and other related agencies that have an interest in the management of contaminated lands
- to encourage others to accept ACLCA as the consulting industry's peak representative group on contaminated land issues
- to assist in the development and maintenance of appropriate industry practices and encourage members to adopt these practices
- to promote and encourage the open exchange of information between members and other interested bodies, and
- to promote an awareness and provide information to outside parties on the professional skills in the area of contaminated land management.

Over the last decade, ACLCA has established itself as the peak industry representative body for contaminated land management consultants when dealing with regulators, contractors, laboratories, private sector, the legal fraternity and all tiers of government.

### Structure

Each branch (state) consists of a voluntary organisational structure of subcommittees, supported by part-time executive officers. For example in Victoria there are the following subcommittees with associated aims:

### Laboratory

- To improve the quality of relationships between ACLCA member companies and their preferred laboratories.

- To promote training and awareness in best practice techniques for both field staff and laboratory technicians.

### Membership and ethics

- To develop criteria and monitoring procedures for maintaining a high standard of integrity for ACLCA as the peak representative association.
- To deliver a quality service to member companies.

### Continuing professional development

- To facilitate education and training opportunities for member companies and to seek alliances and opportunities for ACLCA with quality training and education providers.

### Regulatory affairs

- To coordinate ACLCA feedback to EPA and other regulatory authorities.

### Asbestos sub-committee

- To have a voice in legislation and practice related to asbestos in soils.

### Occupational health and safety

- To coordinate all health and safety issues on behalf of ACLCA.

### Professional indemnity insurances

- To coordinate ACLCA feed-back on issues related to Professional Indemnity insurances for members.

### Young professionals

- To coordinate social and professional development opportunities for the younger members of ACLCA.

### Further information

For further information about branch activities visit their websites:

NSW – [www.aclca.asn.au](http://www.aclca.asn.au)

Queensland – [www.aclcaqld.asn.au](http://www.aclcaqld.asn.au)

South Australia – [www.aclca-sa.org.au](http://www.aclca-sa.org.au)

Victoria – [www.aclca.org.au](http://www.aclca.org.au)

Western Australia – [www.aclca-wa.org.au](http://www.aclca-wa.org.au) ■

# Subscribe today to *Remediation Australasia*



*Remediation Australasia* is a quarterly magazine produced by the Australian Remediation Industry Cluster (ARIC) for the Australasian remediation industry.

The publication is currently distributed to ARIC members and contributors throughout Australasia, free of charge.

Each edition of *Remediation Australasia* includes a range of full technical articles, regulator updates, case studies, training events, publications, and news relating to new technologies and research developments, keeping the reader ahead of the public debates and scientific advances within the industry.

It informs people working in the Australasian remediation industry about new research and outcomes that may impact on their business, and helps them to better respond to the challenges of dealing with contamination.

## Subscribe to *Remediation Australasia* today

Name .....

Occupation .....

Organisation .....

Address .....

Town/City .....

State .....

Postcode .....

Country .....

Phone .....

Email .....

EMAIL [aric@crccare.com](mailto:aric@crccare.com)

POST P.O. Box 486, Salisbury South, SA, 5106

FAX +61 (0) 8 8302 3124

# Regulator RoundUp

## Tasmania

**Kylie Bull, Department of Primary Industries, Parks, Water and Environment**

Proposed regulations for the environmental management of underground petroleum storage systems (UPSS) in Tasmania have been drafted. The main requirements in the proposed regulations are the need to:

- register all UPSS
- install mandatory equipment in new systems or where a tank is replaced (e.g. double-walled, non-corrodible tanks and lines)
- undertake loss monitoring procedures
- install groundwater monitoring wells if the UPSS is in a groundwater protection zone (as defined by the director of the EPA)
- permanently or temporarily decommission UPSS in accordance with guidelines
- undertake an assessment when an UPSS is decommissioned or an UPSS, bowser, fill point and/or piping are replaced, to determine if surrounding soil and/or groundwater are contaminated by petroleum, and
- keep records relating to the UPSS and its environmental management.

It is intended that the commencement of some of these requirements will be staged.

The draft regulations and a regulatory impact statement, which considers costs and benefits of the regulations, were released for public comment for five weeks in August.

Visit [www.environment.tas.gov.au](http://www.environment.tas.gov.au) for further information. ■

## Victoria

**Jo Stokes, Environment Protection Authority**

### HazWaste Fund

The Victorian Government has established the HazWaste Fund to help industry reduce hazardous waste, recover energy and resources and save money.

Funding is available for industry, site owners and technology providers to invest in new technologies for the remediation of contaminated soils and for the reuse, recycling, reprocessing and recovery of hazardous waste. Funding is targeted at projects to reduce the volume of hazardous waste and soils disposed to landfill, such as:

- developing low cost contaminated site remediation solutions
- upgrading existing plant or equipment to reduce waste volumes
- installing new technology to minimise or recover hazardous waste
- trialling novel soil remediation technology
- undertaking R&D to investigate hazardous waste reduction solutions, and
- researching innovative remediation options for 'difficult' soil contaminants.

Visit [www.epa.vic.gov.au/HazWasteFund](http://www.epa.vic.gov.au/HazWasteFund) or contact EPA Victoria for information about how to apply to the HazWaste Fund on (03) 9695 2722.

### HazWaste Expo November 2009

The first HazWaste Expo was held in November 2008. Over 300 people from industry, government and the waste consultant sector attended the event in search of

innovative solutions to reduce industrial hazardous waste and remediate contaminated soil.

The event is now recognised as one of the key hazardous waste events in Australia. EPA Victoria is conducting the second HazWaste Expo in Melbourne on 10 November 2009. Through creating this networking forum, EPA hopes to encourage industries to implement innovative solutions for waste avoidance, reuse and recycling.

Visit [www.epa.vic.gov.au/projects/PIW\\_Reduction/hazwaste\\_expo.asp](http://www.epa.vic.gov.au/projects/PIW_Reduction/hazwaste_expo.asp) for further information about the 2009 HazWaste Expo.

### New Environment Protection (Industrial Waste Resource) Regulations 2009

New hazardous waste regulations have been announced by the Victorian State Government – the *Environment Protection (Industrial Waste Resource) Regulations 2009*.

Under the new regulations, hazardous waste will be more easily transformed into a safe product that can be sold or reused rather than sent to landfill.

The intent of the new regulations, which replace the *Environment Protection (Prescribed Waste) Regulations 1998* and the *Industrial Waste Management Policy (Prescribed Industrial Waste) 2000*, is to drive resource efficiency and facilitate the reuse and recycling of industrial waste resources within a risk-based regulatory framework.

Visit [www.epa.vic.gov.au/waste/](http://www.epa.vic.gov.au/waste/) for further information about the new regulations. ■



## ACT

**Daniel Walters, Department of the Environment, Climate Change, Energy and Water**

The most common cause of soil and groundwater contamination in the ACT is from the leakage of underground fuel storage facilities.

Following a leak from one of the main underground fuel tanks at a suburban petrol station in 2005, which resulted in the loss of over 65,000 litres of fuel into the surrounding soil and perched groundwater, the ACT Environment Protection Authority (EPA) amended the *Environment Protection Act 1997*. This required that all service stations or facilities designed to contain more than 50,000 litres of petroleum products be licensed.

Previously this was only a requirement for fuel depots storing greater than 500,000 litres of petroleum products. The EPA has also taken this approach based on its past experience with underground storage tank assessments, the complex nature of the underlying geology (i.e. fractured rock) in the ACT and a coronial inquiry into a death in the ACT which was a result of hydrocarbon-polluted groundwater in 1977.

To complement these licensing requirements, the EPA has released the *Environmental Guidelines for Service Station Sites and Hydrocarbon Storage*. These guidelines specify the design, management, monitoring and assessment requirements for fuel storage facilities in the ACT, and require that all decommissioned tanks be removed and the site assessed unless there are specific operational or structural reasons as to why they should remain. ■

## NSW

**Niall Johnston, Department of Environment, Climate Change and Water**

### **New legislative and policy tools for dealing with contaminated land in NSW**

The NSW government is building on 20 years of experience in regulating contaminated land in NSW by improving the regulatory tools for managing contaminated land and shifting the focus to the prevention of contamination. These changes are supported by significant changes to the management and regulation of waste in NSW, which will in turn support more sustainable management of these closely aligned areas.

On 1 July 2009 a number of amendments to the *Contaminated Land Management Act (CLM Act)* came into force to allow sites to be cleaned up more efficiently. The amendments come 10 years after the commencement of the CLM Act. At the time the CLM Act overhauled the way contaminated sites were managed and ensured that where possible the polluter, not the community, bears the cost of the clean-up.

Under the CLM Act amendments these powers were expanded with the Department of Environment, Climate Change and Water (DECCW) now able to order a broader range of persons to investigate or remediate a site to allow a timely clean-up. Preliminary investigation orders can now be issued to obtain a snap-shot of contamination to determine whether regulation is needed and streamlining the investigation and remediation stages into one contaminated site management stage. The minister can also enter into offset arrangements where remediation will take a long time to complete, providing additional flexibility to manage complex contaminated sites.

Supporting documents including updated *Guidelines on the Duty to Report* have recently been released; visit [www.environment.nsw.gov.au/clm/](http://www.environment.nsw.gov.au/clm/) for more information.

The amendments are part of an overall shift towards more innovative ways of managing and preventing land contamination in NSW. DECCW has a preventative approaches program which seeks to reduce the number of contaminated sites in the long term by providing guidance to industries about best environmental management practices.

One such example of a preventative approach is the *Underground Petroleum Storage Systems (UPSS) Regulation 2008*. This regulation introduces measures to protect the environment and human health, and minimise time-consuming and costly remediation by preventing hydrocarbon leaks or dealing with them early. Over 30% of contaminated sites in NSW are caused by leaking UPSS.

The regulation requires that operators implement industry best practice to manage UPSS. It requires appropriate monitoring, validation and decommissioning of systems and sites based on Australian Standards. DECCW has been progressively implementing the regulation by working cooperatively with industry stakeholders to ensure UPSS operators meet their obligations. Guidelines to support the regulation are available on the DECCW website.

Other industry sectors where preventative programs are being rolled out include marinas and ship repair facilities, galvanisers and electroplaters and dry cleaners. ■



## South Australia

Andrew Pruszynski, Environment Protection Authority

On Wednesday 1 July 2009, the *Environment Protection Act* (the EP Act) was amended to include all of the remaining site contamination provisions. This change was a great step forward for the management of site contamination in the state.

The South Australian Environment Protection Authority (EPA) has for many years advocated risk-based decision making, especially with respect to assessment and remediation. These concepts are reflected in the legislation. For example, the definition of site contamination is linked to land use.

Remediation for many people means clean-up, remove or 'dig and dump'. Such an approach is generally far from risk-based, and is generally not consistent with the waste management hierarchy. The legislative definition (Section 3(1) of the EP Act) for remediation is risk based:

*'remediate a site means treat, contain, remove or manage chemical substances on or below the surface of the site so as to—*

*(a) eliminate or prevent actual or potential harm to the health or safety of human beings that is not trivial, taking into account current or proposed land uses; and*

*(b) eliminate or prevent, as far as reasonably practicable—*

*(i) actual or potential harm to water that is not trivial; and*

*ii) any other actual or potential environmental harm that is not trivial, taking into account current or proposed land uses, and remediation has a corresponding meaning'.*

This definition allows for considerable flexibility when making decisions in relation to remediation.

For the remediation of underground water, the EPA has developed a unique concept, being 'remediate to the extent necessary' (RTEN). This concept is explained in detail in the EPA guideline. RTEN allows a person to treat, contain, manage or remove the site contamination to the point of necessity, based on risk assessment.

Only a site contamination auditor can submit a RTEN opinion to the EPA. This is done in the form of an audit report.

For soils, remediation is generally difficult to undertake without some environmental impact. For this reason, the EPA has prepared and published a guideline titled *Environmental management of onsite remediation*. The guideline is available on the EPA website ([www.epa.sa.gov.au](http://www.epa.sa.gov.au)). This unique document provides guidance to owners, consultants, contractors, the community and planning authorities. Nine key aspects are considered:

- air quality (volatiles, particulates, asbestos)
- noise
- surface water
- soil quality
- groundwater quality
- flora
- heritage
- consultation and involvement
- vibration, dewatering and groundwater pumping, and
- health and safety (occupational health and safety, security, visitors, dangerous/hazardous substances)

For each aspect, the following is discussed:

- significance – why each aspect is important
- items that must be considered – key issues for each aspect
- potential mitigation measures – a list of potential measures that are likely to remove or reduce the risk, and
- further information – a list of references that provide more detailed information.

For both soil and groundwater remediation, the EPA expects clear and well-documented remediation management plans that demonstrate how the remediation will be undertaken. The EPA welcomes written comments on and suggestions for improvements to any of its site contamination publications. ■

## New Zealand

James Court and Howard Ellis, NZ Ministry for the Environment

The New Zealand Ministry for the Environment has determined the need for a more comprehensive policy framework for managing contaminated land in New Zealand. After extensive public consultation, the ministry published a position paper in September 2007 that set out a prioritised work program designed to improve how contaminated land is managed in New Zealand. The Ministry is currently developing: tools to improve planning controls for land affected by contaminants, and methods for deriving soil contaminant thresholds to define an adequate level of protection for human health. These tools and methods are expected to facilitate an economic use of contaminated land by ensuring that:

- District planning controls are adequate and consistent – the tools will address a present deficiency in planning controls. Very few district planning controls ensure that contamination issues are assessed and managed (if necessary).
- Councils gather the information needed for efficient decision making on contaminated or potentially contaminated land. The collection of verified information about contaminants on land underpins responsible decision making concerning its use.
- The appropriate soil contaminant value is used – the standard will normalise the way soil guidelines are applied by practitioners and councils.

The tools and methods will be supported by soil contaminant values that will define the concentration of contaminants under which the risk to human health are considered acceptable, and policies, principles, and a framework for applying the soil contaminant values.

Visit [www.mfe.govt.nz/issues/hazardous/contaminated/](http://www.mfe.govt.nz/issues/hazardous/contaminated/) to find out more about the ministry's contaminated land work program. ■

# Shorts

Our goal is to present items of interest to the remediation industry. The items will be from industry, government or research groups. The items below span the last six months, but in future, news will cover the period between editions of *Remediation Australasia*. Please let us know about any news items (no promotional items) you would like considered by sending details to [aric@crccare.com](mailto:aric@crccare.com). ■



## Environmental Sciences Building officially opened

The Environmental Sciences Building at Mawson Lakes in South Australia was officially opened on Wednesday 26 August 2009. The building is home to CRC CARE and the Centre for Environmental Risk Assessment and Remediation (CERAR). The new state of the art facility further highlights the strong commitment by governments, universities and industry to supporting environmental research in Australia. ■

## Petroleum LNAPL Forum

A new Petroleum LNAPL Forum has formed to help address the challenges faced in remediating sites contaminated with petroleum light non-aqueous phase liquids (LNAPLs). The inaugural meeting of the forum was facilitated by CRC CARE in Melbourne on 27 August 2009.

The aim of the forum is to share knowledge on LNAPL remediation technologies – what works and, importantly, what doesn't, and to develop cost effective technologies through its research partners.

The meeting participants were also keen in the future to provide input into policy development and training. Participation in the forum will be based on organisations having a significant problem, technical knowledge they are willing to share and resources for developing solutions. ■



## ChemCentre on the move

After more than 60 years at its current location, ChemCentre will relocate this September to the Resources and Chemistry Precinct, a \$116 million facility located at Curtin University of Technology in Bentley, Perth. This is a significant step for ChemCentre, enhancing operations and bringing greater opportunities for new collaborations. Most services will remain operational during relocation. ■

## Planning and Environment Act in Victoria under review

The *Planning and Environment Act* in Victoria is currently being reviewed, with a draft bill being produced for consideration in late November 2009. ■



## WA experts play key role in Boston subway 'attack'

Western Australia's ChemCentre will have a team on the ground when a simulated chemical and biological attack is launched in the Boston subway later this year. ■



## AECOM to merge

From 4 May ENSR Australia, Bassett, EDAW AECOM and Maunsell AECOM came together as one company: AECOM. AECOM is a Fortune 500 company with more than 43,000 people located in over 100 countries delivering advanced environmental, planning, design, engineering, management and advisory services to a broad range of markets. ■

## Electronic noses – sniffing out toxins and competing against the house fly

Imagine a polka-dotted postage stamp-sized sensor that can sniff out some known poisonous gases and toxins, and can show the results simply by changing colours. While physicists have radiation badges to protect them in the workplace, chemists and workers who handle chemicals do not have equivalent devices to monitor their exposure to potentially toxic chemicals. In future, this sensor might be used to detect high exposures to toxic industrial chemicals that pose serious health risks.

The researchers involved in this project have created an 'optoelectronic nose'; an artificial nose for the detection of toxic industrial chemicals that is simple, fast, inexpensive, and works by visualising colours. A 36-dye sensor array changes colours when exposed to different chemicals. The pattern of the colour change is a unique molecular fingerprint for any toxic gas and also communicates the concentration. By comparing the pattern to a library of colour fingerprints, the toxic chemicals can be identified and quantified in seconds. To test the application of their colour sensor array, the researchers chose 19 representative examples of toxic industrial chemicals. The arrays were exposed to the chemicals for two minutes. Most of the chemicals were identified from the array colour change in a number of seconds, and almost 90% of them were detected within two minutes.

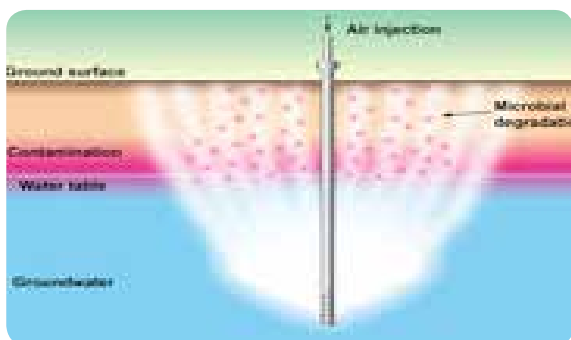
Visit [www.nih.gov/news/health/sep2009/niehs-13.htm](http://www.nih.gov/news/health/sep2009/niehs-13.htm) for more information. ■

Scientists from CSIRO's Food Futures Flagship have made a breakthrough in efforts to extend the sensory range of 'electronic noses' (e-noses) by developing a system for comparing their performance against the much-superior nose of the vinegar fly (*Drosophila*). The comparisons between the *Drosophila's* receptors and those of the e-nose were made possible by recent descriptions of how the fly's odorant receptors function. *Drosophila* was the first insect to have its genome described, and it was this new genomic knowledge that made the fly odorant receptor work possible.

E-noses are not as discriminating as biological noses, but a new system compares technical sensors with biological sensors. The project researchers considered how the most common type of e-nose sensors – metal oxide or 'MOx' receptors – sample the air around them (this is critical in the performance of all noses), and compared it with the performance of *Drosophila's* odorant receptors. *Drosophila* outperformed the MOx sensors in independent levels, with its range of broadly tuned receptors that are independent of each other. Scientists and engineers haven't yet worked out how to engineer this feature, but the information will help to increase the understanding of how biological systems work.

This research is part of a larger project for developing a Cybernose® for use in the wine industry. Using insect receptors, the Cybernose will detect volatiles and contaminants in grapes and wine, thus allowing winemakers to improve their wines. The Cybernose is hoped to be used for detecting ripeness and spoilage in a range of foods, and even detecting explosives.

Visit [www.csiro.au/Portals/Media/E-noses.aspx](http://www.csiro.au/Portals/Media/E-noses.aspx) for more information. ■



Schematic showing how biosparging enhances the microbial degradation of contaminants.

## Hot microbes cause groundwater cleanup rethink

CSIRO researchers have discovered that micro-organisms that help break down contaminants under the soil can actually get too hot for their own good. While investigating ways of cleaning up groundwater contamination, scientists examined how microbes break down contaminants under the soil's surface, and found that subsurface temperatures associated with microbial degradation can become too hot for the microbes to grow and consume the groundwater contaminants. Visit [www.csiro.au/news/Groundwater-cleanup-rethink](http://www.csiro.au/news/Groundwater-cleanup-rethink) for more information. ■

## Name changes for DECC NSW and DEPHA Tasmania

As of late July, the Department of Environment and Climate Change in NSW has become the Department of Environment, Climate Change and Water. As of July this year, the Department of Environment, Parks, Heritage and the Arts in Tasmania has become the Department of Primary Industries, Parks, Water and Environment. Website and email addresses have not changed. ■

# Advertise with *Remediation Australasia*...

*Remediation Australasia* gives advertisers access to an emerging market of clients and product users each time we publish a new issue.

*Remediation Australasia* is now distributed to more than 2,000 recipients, not only exclusive to the Australasian region (Australia, New Zealand, Papua New Guinea, western Pacific Islands), but also from the United States, Canada, India, Germany and Russia.

Visits to the publication online come from more than 80 countries, resulting in an even wider readership of the magazine.

See our advertising packages at [www.remediationaustralasia.com.au](http://www.remediationaustralasia.com.au) for more information.



Want more information  
about advertising in  
*Remediation Australasia*?

## CONTACT ARIC

[aric@crccare.com](mailto:aric@crccare.com)

[www.remediationaustralasia.com.au](http://www.remediationaustralasia.com.au)

## ...Australia's only dedicated environmental remediation magazine.

The *Remediation Australasia* magazine is distributed quarterly to all ARIC members by post and email notification. The magazine features a range of material of relevance and interest to members, including:

- Case studies
- Regulator updates
- Reports from industry groups
- Technical articles
- News relating to new technologies and developments in the industry, and
- Training, international conferences or events in Australasia.

The editorial team welcome your suggestions for content, as well as article submissions.

Articles should clearly explain the topic of discussion (technology or research, for example), implications for industry, and how this information can be used to facilitate change or greater understanding of important issues.

Get in touch with the editorial team if you are interested in contributing any content - whether it be an article or simply a photo. You won't have to sweat over the editorial details; we can edit and format your article ready for publication.

**Just flick an email to [aric@crccare.com](mailto:aric@crccare.com), and we'll take care of the rest.**

