1. INTRODUCTION

Historically, contamination of land and groundwater has principally resulted from the manufacture, use and disposal of chemicals.

In the late 1970's a number of discoveries of contaminated soil in Europe and the USA resulted in legislative action and major clean-up programs being implemented [1]. Consequently a number of European countries and American and Canadian states or provinces already have some ten years experience in dealing with contaminated sites.

The three main concerns associated with site contamination in these countries are:

Groundwater contamination;

Residential development of former industrial, commercial or agricultural land; and

Abandoned industrial land and waste disposal sites [1].

In Europe, the scale of the problem is large. For example, in the Netherlands, over 100,000 sites have been identified as being potentially contaminated with 10,000 sites confirmed as being contaminated. Likewise, in West Germany over 50,000 potentially contaminated industrial sites have been identified. In the United States there are an estimated 100,000 sites nominated as contaminated with some 10,000 of these designated as priority sites.

Recognition of the problems of soil and groundwater pollution is a relatively recent development in Australia, although isolated incidents of soil pollution have been the subject of local and state government investigations since the 1950's.

The actual scale of this problem in Australia and New Zealand, however, is yet to be determined. On current estimates, there are up to ten thousand potentially contaminated sites around Australia. Many of these potential sites are being re-developed for residential or parkland use. In addition, there are hundreds of former waste disposal and mining sites which have the potential to be major sources of soil or groundwater pollution.

Chemical contamination of land is not solely limited to former or current industrial sites. Agricultural land can also be chemically contaminated. The recent experience in Australia with organochlorine residues in meat has highlighted the potential impact of contaminated soil on agricultural produce for export. The use of certain chemicals on agricultural land can leave residues in soil affecting the future development of such land for residential purposes and may pose an off-site hazard to aquatic ecosystems.

The main concern with contaminated soil is that the presence of some contaminants can pose immediate or, more likely, long term threats to human health, plants and animals and to the amenity of the land. Certain contaminants can also have a detrimental impact on the integrity of building and service structures [2]. The problems differ from site to site both in nature, hazard and importance.

Public awareness of the problems associated with contaminated soil has been heightened and it is now recognized that site assessment prior to land rezoning or redevelopment of industrial land in particular is essential as is the need for guidelines to address the full range of issues.

The publishing of these guidelines at this time, reflects the two Councils' awareness of the need for a national co-ordinated approach to contaminated sites. There is already significant activity throughout Australia and New Zealand on the remediation of contaminated sites as a result of business decision making and decisions taken under existing legislation. There is a need therefore, for an operational set of guidelines for those people who are currently required to make decisions on the need for remediation, the procedures that should be followed and the standards that should apply. In the absence of agreed guidelines there is a natural tendency to adopt a conservative approach to rehabilitation.

It is the aim of these guidelines to provide a systematic framework for the prevention, assessment, clean-up and management of existing and future contaminated sites.

The goals of contaminated site assessment and clean-up should be to:

render a site acceptable and safe for the long term continuation of its existing use;

minimise environmental and health risks both on and off site;

maximise to the extent practicable, the potential future uses of a site.

A full clean-up may not always be technically achievable and the benefits of full or partial clean-up may be outweighed by the costs to society. In some cases containing contaminants on a site or using planning controls to limit site use may be the preferred options.

The New Zealand Authorities have opted for a slightly different approach in relation to the third goal: where site clean-up is required, the goal should be to achieve a standard that minimises risks to human health and the environment, consistent with the existing and likely future use of the site, and in accordance with a system to inform future landowners that the clean-up has been conducted to an extent consistent with particular land uses.

2. DEFINITION AND SCOPE

A contaminated site is broadly defined as a site at which hazardous substances occur at concentrations above background levels [3] and where assessment indicates it poses, or is likely to pose an immediate or long term hazard to human health or the environment [4]. Background levels in this paper refer to ambient levels of a contaminant in the local area of the site under consideration.

Impacts on public health from contaminated soil can occur as a result of exposure via a number of routes including: pollution of surface and groundwaters; inhalation and ingestion of soil; and via uptake and subsequent bioaccumulation by plants and animals. These and other exposure routes are discussed in section 5.3. Impacts on the environment can occur from a number of routes including: direct uptake of contaminants by plants and animals and migration of contaminants to ground or surface waters.

Materials which can cause contamination include:

metals,

inorganic compounds containing anions such as cyanide,

organic chemicals,

oils and tars,

toxic, explosive and asphyxiant gases (including gases from the decomposition of wastes in landfills),

combustible substances,

putrescible material, and

hazardous wastes.

Contamination can occur as a result of past or current industrial, agricultural and commercial activities. These include:

disposal of wastes (controlled or uncontrolled),

accidental spillage,

leakage during plant operation,

storage or transportation of raw materials, finished products or wastes,

spreading of sewage sludge,

deposition from the atmosphere from an industrial site,

migration of contaminants into a site from neighbouring land, either as vapour, leachate or movement of liquids through the soil, and

use of agricultural chemicals [2].

Naturally occurring materials, such as mineralised rock and soils may also be a source of health and environmental concern in certain localities depending on the intended use of the land [2].

While many different types of sites may be potentially contaminated, experience has shown that some industrial activities have a higher probability of contaminating a site, including activities such as oil production and storage and chemicals manufacture and formulation.

Specific industries and land uses which have been associated with site contamination include:

acid/alkali plant and formulation,
agricultural/horticultural activities,
airports,
asbestos production, and disposal,
chemicals manufacture and formulation,
defence works,
drum re-conditioning works,
dry cleaning establishments,
electrical manufacturing (transformers),
electroplating and heat treatment premises,
engine works,
explosives industry,
gas works,
iron and steel works,
landfill sites,
metal treatment,
mining and extractive industries,
oil production and storage,
paint formulation and manufacture,
pesticide manufacture and formulation,
pharmaceutical manufacture and formulation,
power stations,
railway yards,
scrap yards,
service stations,
sheep and cattle dips,
smelting and refining,
tanning and associated trades,
waste storage and treatment, and
wood preservation.

The exact level of risk of site contamination associated with any particular industrial, commercial or agricultural practice will depend upon the standard of management, including the past regulatory framework and of safety procedures employed at individual sites.

3. STRATEGIC FRAMEWORK

Even though each identified contaminated site is unique and generally requires the development of a site specific solution, there is a need to establish a set of common fundamental principles which should be reflected in policy, legislation, assessment, clean-up procedures and mechanisms for community involvement.

3.1 Policy Basis

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

3.1.3 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 also been recognised to have the potential to contaminate soil and surface waters at a distance from the source of the original contamination. Transmedia movement of contaminants needs to be prevented and properly managed.

3.1.4 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 as previously described in Chapter 1.

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. Considerations 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.

3.1.8 The preferred order of options for site clean-up 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, and

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, and

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.

3.1.9 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.

3.2 Implementation Strategies

It is recognised that the legislative responsibility for the assessment and management of contaminated sites rests, in the case of New Zealand, with the New Zealand authorities and, in the case of Australia, with individual State and Territory authorities, (excluding sites on Commonwealth Territory) and that each authority may implement the necessary controls in a different manner. However, they should do so in as consistent a manner as practicable. In establishing strategies for the assessment and management of contaminated sites, including legislative controls, all governments should ensure that the following matters

are addressed. (In the case of 3.2.2 and 3.2.4 below it should be noted that there are no requirements at present in New Zealand legislation equivalent to these two aspects.)

Reporting to the relevant authorities of the existence of contaminated sites and of pollution incidents which are likely to lead to contamination is essential. This notification requirement could also encompass those sites which, on the basis of past use and management, are likely to be contaminated.

Site owners should be required to advise prospective buyers or developers that a site is contaminated (contamination being determined on the basis of standards established in the relevant jurisdiction).

Consideration needs to be given to amending legislation to require clean-up actions to be recorded on land titles or some other data base, along with the need for further clean-up action if land use is to be changed.

Assessment and if necessary, clean-up of contaminated sites should occur prior to a change in land use being authorised by the appropriate agency.

Regulatory authorities need the ability to require, control and enforce the assessment, clean-up and long term management of contaminated sites. These controls need to take into account public health and environmental concerns.

3.2.6 Development of financial incentives to assist the owners of contaminated sites in remediation works should be considered where appropriate. Such incentives include tax concessions in areas such as customs on the import of remediation technology and sales tax on equipment which is essential for the successful remediation of the contamination.

3.2.7 Development of inventories or registers of contaminated sites should be considered in order to:

- establish priorities for clean-up,
- establish the resources necessary to approach this problem,
- [illegible],
- assess suitable development on a site specific basis with due recognition of economic and resource considerations,
- establish the market for clean-up technologies in Australia and New Zealand, and
- inform potential purchasers.

Such registers will provide governments with important information to assist in the development of policies and legislation and will provide planning authorities and potential purchasers of land with an authoritative source of site specific information.

The separation of those sites judged to pose some threat to human health (either on or off-site), and/or to the off-site environment from those sites which are judged to pose no such threat should be considered. In the latter case, the listing would be for information purposes only, since the on site environmental impairment would not preclude the continuation of the present land use. Clean up action would only need to be considered if a change to a more sensitive land use were to be proposed.

Such registers may also be used to encourage the development of innovative remedial technologies. For instance, one way to facilitate research and development is to estimate the possible extent of the problem of soil and groundwater pollution in Australia, thus establishing a market for technologies in this area.

Planning Issues

Planning issues are important to consider when dealing with contaminated sites. In Australia, the identification of contaminated sites is commonly associated with changes in land use, for example where industrial land is rezoned for residential development. In urban areas the rezoning of industrial land for residential development is becoming increasingly common.

At present planning controls often fail to take contamination of soil into account in the rezoning process. This issue requires the attention of municipal councils and planning authorities.

3.2.8 Consideration should be given to clauses in planning systems indicating that any proposed re-development of sites for specified uses requires a permit or certificate to indicate either that a site is not contaminated or that the nature and extent of any contamination does not render it unsuitable for its intended use. It may also be appropriate for a caveat to be put on land which has been used for specified purposes. The caveat could not be removed unless appropriate Planning or Environmental authorities are satisfied the land is not contaminated.

Planning controls should effectively restrict future land uses to those which will not be adversely affected by the residual contamination. This may be appropriate where a site has been cleaned up to either to the best level possible with existing technology or to a lesser standard with agreement of the relevant authorities, and where the residual levels of contamination will not adversely impact upon certain sensitive land uses.

A mechanism is needed for planning and other relevant authorities to ensure that land with a history of use indicative of potential contamination and being considered for re-zoning, sale or transfer is suitable for its intended future use. Some assessment may be appropriate for the transfer process.

Such a mechanism will need to draw on mandatory reporting of site contamination and some form of register of contaminated sites where available.

3.2.11 The use of appropriate buffer zones to prevent potential contamination of residential or agricultural areas should be utilised.

3.2.12 Tighter planning controls should be introduced to ensure appropriate separation of incompatible land uses.

3.3 Community Involvement

Community involvement is necessary from the earliest stages of contaminated site management.

The principles underlying this statement are the public's right to know and the necessity for their involvement in the decision making process. Obviously at a site where no community groups are potentially affected or concerned, involvement in the decision making process may not be appropriate.

3.3.2 Education programs need to be instigated to increase the awareness of the public, industry, unions, planning and local authorities and government agencies about the need to prevent site contamination and about issues affecting the assessment and management of contaminated sites.

3.3.3 Persons making use of these guidelines should have regard to the cultural and spiritual significance that indigenous people attach to land in general, and sites of particular significance. In New Zealand, the principles of the Treaty of Waitangi, as noted in Part II of the Resources Management Act 1991, should be noted and active consultation and participation of Iwi should be incorporated as well. In Australia, relevant State, Territory and Commonwealth legislation dealing with Aboriginal and Torres Strait Islanders' land and heritage issues will apply where appropriate

3.4 Future Directions

Research and Development

Research and development of appropriate technology for the treatment, handling and disposal of contaminated soil should be encouraged and supported by both government and industry.

A survey of background levels of chemicals in Australian and New Zealand soils needs to be undertaken to assist in the development of investigation thresholds for contaminants and Australian and New Zealand soil criteria.

Further work is required to assess the bioavailability of chemical contaminants in soil.

Standards and Protocols

Uniform sampling and analysis protocols and standards should be adopted by regulatory agencies.

This is particularly pertinent with the application of criteria. Analytical methods should be stipulated for specific acceptance criteria for contaminants in soil.

3.4.5 Protocols, exposure transport models and risk assessment techniques need to be researched and developed for Australian and New Zealand conditions to assist in the development of site specific criteria and guidelines to protect human health and the environment from contaminated soil and groundwater.

Review and Up-date

3.4.6 Further development and periodic update of these guidelines will be essential to reflect improvements in our understanding of the nature and impacts of various contaminants and to take advantage of any proven new technologies and strategies for clean-up and management which may become available.

Of immediate importance in this context is the development of Australian and New Zealand soil quality criteria and development of soil sampling and analysis guidelines.

Continuing consultation with industry, unions, health community and environmental groups will be undertaken to ensure the maintenance of broadly based national support for the standards and the processes set out in the Guidelines.

There are a number of issues related to these guidelines that are not addressed in existing New Zealand Government policy. These issues are the subject of further consideration, currently being co-ordinated by the Ministry for the Environment.

4. ASSESSMENT AND CLEAN-UP

Australia and New Zealand are in the fortunate position of being able to learn from overseas experience in the assessment and management of contaminated sites. During the past ten to twenty years countries in Europe and North America have trialled a number of strategies and mechanisms to deal with the clean-up of contaminated sites, with mixed results.

Broadly speaking, there appear to be two basic approaches to dealing with contaminated sites. The first approach involves a fairly rigid adherence to a set of predetermined soil criteria. The criteria are used both to define a condition of contamination and to serve as the standard which sites must meet in order to be considered to have been decontaminated. In some cases, as in the UK, minor variations are made to the standard criteria when applied to different land uses.

The second approach involves a more flexible use of pre-determined soil criteria. The criteria are used chiefly to provide guidance as to whether a detailed investigation is required, confirm no further action is needed or provide guidance for clean-up in appropriate circumstances.

The second approach recognises that the environmental consequences of the soil chemical concentration identified in any standard list may vary from site to site. Therefore, the second approach does not advocate any universal standard (or criteria) to which contaminated sites must be cleaned up. Rather, this approach relies on careful consideration of site specific data to derive acceptance criteria which will ensure that public health, local amenity and soil, air and water quality are protected. This is the approach favoured by New Zealand authorities. Commonly, the development of site specific criteria involves the use of modelling techniques (geochemical and hydrogeological transport models, exposure assessment, risk estimation) in conjunction with physico-chemical, toxicological, demographic and geographic data. Often, this information is difficult, expensive and time consuming to obtain.

Given the experience of individual Australian States and Territories and that of other countries, it has been concluded that the most appropriate approach for Australia to adopt is to combine the above two approaches. This approach incorporates, at a national level, a general set of management principles and soil quality guidelines which guide site assessment and may guide site clean-up action, obviating, where appropriate, the need to develop costly site specific criteria. However, this approach also recognises that every site is different and that in many cases, site specific acceptance criteria and clean-up technologies will need to be developed which reflect local conditions.

Soil quality criteria can be used as guidance values for assessing the extent of effort needed to investigate a contaminated site. Contaminant migration models, exposure assessment models and risk models can help take account of the physical, demographic or geographic conditions specific to a particular site. This approach provides for flexibility in the decision making process and allows the consideration of site specific factors such as land use, extent of contamination and the social costs and benefits derived from clean-up.

The ultimate goal of such an approach is to select a socially acceptable and cost effective management strategy which mitigates threats to and provides protection for public health and the environment as well as allowing flexibility in the future use of the land.

There is a demonstrated requirement for community consultation and participation during the investigation and clean-up of contaminated sites. Overseas experience has shown that heightened public concern, mistrust of agencies involved, as well as delays to major developments may result when there is inadequate community involvement.

In addition to community consultation there is a fundamental requirement to address occupational health and safety concerns.

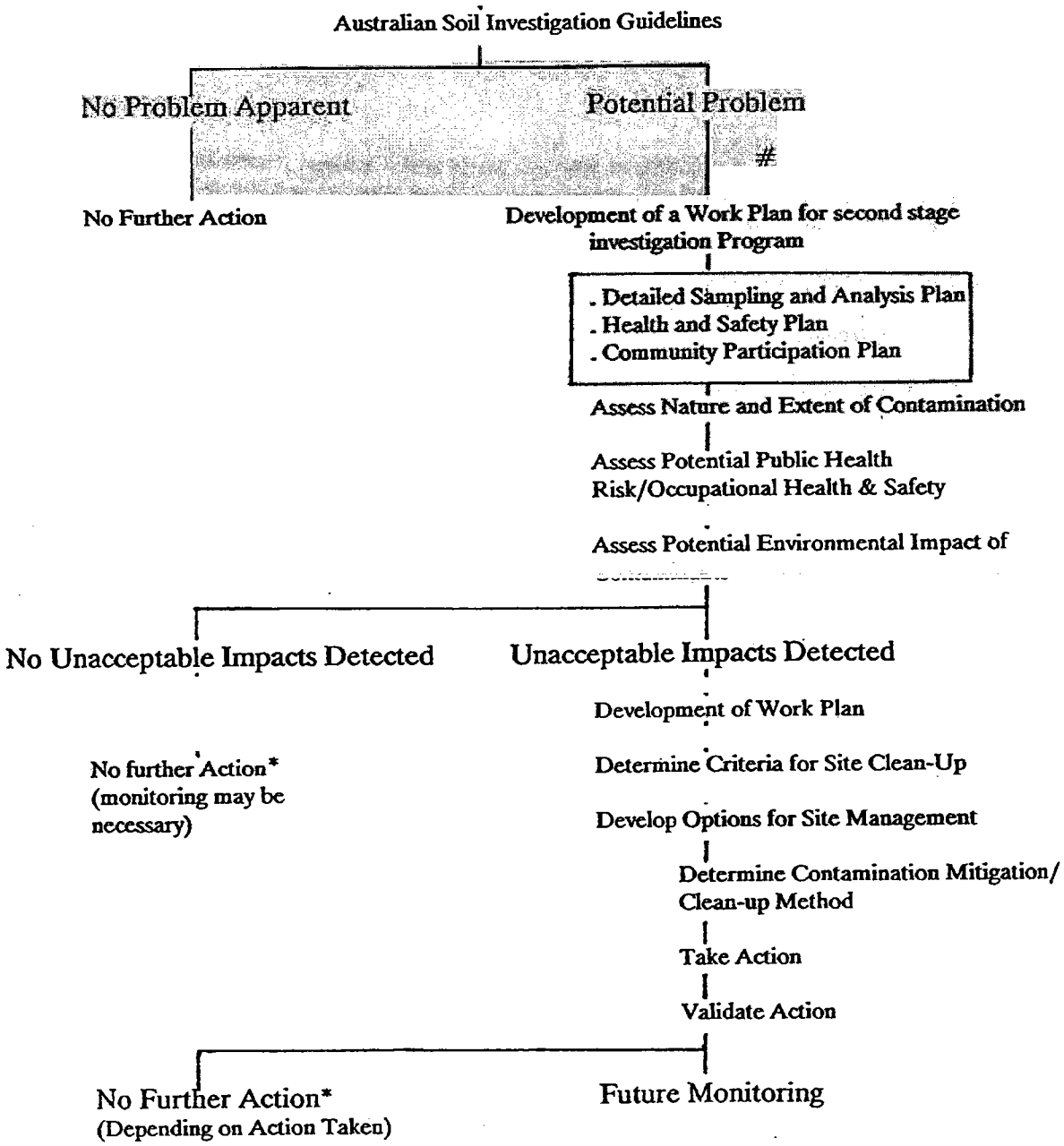
The recommended Australian approach is intended to apply to both large scale and small scale clean-up operations. It is unrealistic to expect that small contamination incidents will be subject to the same level of investigation and treatment as larger incidents. The recommended approach makes allowance for some simplification of the assessment and clean-up procedures in the case of minor incidents, provided the general systematic approach outlined in Figure 4.1 is considered and each stage of the investigation adopted is completely and accurately documented. Proper documentation is required to assist in the evaluation of the effectiveness of the clean-up program employed.

The following diagram represents the recommended approach to the assessment and management of a contaminated site. Overlaid on this diagram, but not stipulated is the need for progressive and final review, with reporting to and acceptance by participants.

As previously suggested, not every site will require exhaustive investigation in order to develop responsible management options. The degree of effort will vary from site to site.

Figure 4.1

Recommended Approach to the Assessment and Management of a Potentially Contaminated Site



decision to proceed directly to clean-up according to guidelines may be taken at a number of points in the following process sequence

provided land use remains as originally proposed

4.1 Preventive Measures

In many instances site contamination could have been prevented had appropriate procedures and standards been put into place.

While governments have an important role to play in the establishment of guidelines, standards and controls, the primary responsibility for minimising or eliminating soil contamination must be with individual firms and operators in industry, commerce and agriculture. In essence this means an acceptance by industry of the need to follow environmentally sound siting procedures for facilities and to adopt exemplary chemical and waste management practices during operation.

The following list is a guide to the sorts of measures which should be considered.

Site selection:

When selecting a site which will be used wholly or partly for the storage, processing or disposal of potentially contaminating materials, consideration should be given to the vulnerability of the local environment to contamination.

Good house keeping, including:

staff training,

infrastructural measures to ensure satisfactory removal of residual substances,

layout of work site; the designation of areas for certain types of high risk activities,

regular internal checks and inspection of the protection systems,

material/waste audits to detect losses,

maintain drainage system in good condition, and

immediate clean-up of spills.

Equipment features, including:

equipment safety features such as overfill protection for tanks and leak detection systems,

enclosed structures and secondary containment such as liquid-tight floors, drip trays and double liners,

protective coatings and cathodic protection for underground tanks and pipes so as to minimise corrosion,

installation of aboveground tanks and pipes so leaks can be traced quickly, and

installation of low leakage pumps, valves and flanges.

Process-related measures such as:

the use of alternative raw and ancillary materials, production of alternative substances, and

incorporation of pollution control equipment and processes.

Other issues which need to be considered are appropriate buffer zones to prevent migration of pollution to residential or agricultural areas and tighter planning controls to ensure appropriate separation of incompatible land uses.

By choosing a number of prevention measures, the risks of contamination of soil and groundwater at a site can be greatly reduced in an efficient and cost effective fashion, thus reducing the number and scale of future clean-up actions.

4.2 Decommissioning Considerations

By adopting the types of measures outlined above, industry can avoid excessive costs and liabilities in the future when decommissioning [5].

When an industrial site or part thereof is to be closed down and decommissioned, the owner/s should begin to plan an evaluation of the site to determine the following [5]:

whether risks to public health and safety and/or the environment are issues,

whether the potential costs of any impacts are of concern,

if the proposed decommissioning procedure is in compliance with all applicable laws and regulations,

whether the land may be a liability to current and future owners due to contamination, and

whether the premises and land are aesthetically acceptable.

The following measures can be utilised to achieve the above:

review records of the types of materials handled and processes carried out to assess the likelihood of contamination,

review records of any accidental spills and clean-up action taken, and

the site assessed.

An effective decommissioning program should involve [5]:

site information/assessment,
initial testing program,
comprehensive investigation,
preparation of decommissioning plans,
implementation of decommissioning and clean-up, and
confirmatory sampling/completion reporting.

It is important to recognise that some companies may not have the financial resources to properly decommission a site in an environmentally acceptable way. Others may avoid appropriate decommissioning practices or in some extreme cases may attempt simply to abandon a site.

Financial and legal mechanisms relating to decommissioning need to be examined on a national basis to establish a consistent approach towards preventing the huge sums of public money being required to clean-up contaminated sites and to ensure that the true costs of environmental protection are applied equitably to industry.

Some potential mechanisms are as follows [5]:

a decommissioning and clean-up bond deposit refunded only when government is satisfied that the site has been properly decommissioned (the level of the bond being based on an assessment of risk associated with the operation),

an annual decommissioning and clean-up surcharge assessed against each industrial facility based on operating and waste management practices, and

industrial sector specific decommissioning and clean-up contingency funds to which all industries in that sector contribute on an annual basis to address clean-ups at bankrupt or abandoned sites.

A spectrum of issues needs to be addressed if any of these funding mechanisms are adopted. For example, industries that have supported and practised ecosystem protection would take strong objection to having to contribute to the remediation costs of less responsible industries.

4.3 Identification of a Potentially Contaminated Site

Early identification of potential contamination is fundamental to achieving the optimum design of a more detailed site investigation. This can be facilitated through information provided by the site's present and previous owner/occupier, knowledge of past and present land uses, historical records, local government and community submissions.

Identification of contamination may also arise from the discovery of foreign materials during any demolition or construction activity on site.

A number of methods can be employed to identify a potentially contaminated site such as:

routine surveillance of industrial premises and those generating industrial waste,

appraisal of premises which have been used by particular industries and/or for specific land uses,

appraisal of premises which have notified the relevant authority of any accidents or spills or who are subject to periodic audit,

appraisal of land which is to be re-developed,

appraisal of land where localised environmental effects are noted with no apparent cause, and

environmental assessment on change of ownership.

Once a potentially contaminated site has been identified, an initial evaluation is required to determine whether a problem exists and whether a detailed investigation of the site is warranted.

4.4 Initial Evaluation

An initial evaluation should include a review of the site's history and a description of the site's condition. It may also involve an initial sampling and analysis program for a limited range of chemicals to ascertain whether contamination exists. Without sampling and subsequent analysis from a given site, there is no sure way of determining whether a site is contaminated or not.

Public health, environmental issues, community participation and occupational health and safety considerations should be taken into account at this early stage. Comprehensive plans to address these matters, however, may be developed at a later stage. Discussion of health considerations, environmental considerations, community involvement and occupational health and safety plans can be found in sections 5.3, 5.4, 5.5 and 5.6 respectively.

Site History

A site history should be compiled, taking into account relevant items from the following checklist. Obviously, not all these factors will be appropriate for a particular site.

They include:

- past and current owners of the site,
- air and ground photographs,
- past involvement with government authorities, consultants,
- trade and street directories,
- local literature, including newspapers,

technical literature, including building and related permits,
local knowledge of residents,
complaint history,
previous land uses,
previous industries supported,
products manufactured,
raw materials used,
wastes produced,
chemical storage and transfer areas,
disposal locations,
discharges to land,
product spills and losses,
geological survey maps, and
sewer and underground service plans.

Information gained from former site owners and employees will be useful in compiling a history of the site.

Site Condition

A description of the condition of the land should be included in the site assessment report, in an attempt to identify any obvious pollution problems.

Some useful indicators are

disturbed or affected vegetation,
unpaved areas where no vegetation is apparent,
discoloured, oily or disturbed soil,
presence of chemical or waste containers,
odour,
quality of surface water, and
condition of buildings and roads.

Initial Sampling and Analysis Effort

An initial sampling and analysis program should be aimed at assessing whether contaminated soil is present It should be based on information arising from the site history and condition reports described in the previous sections.

Samples should be taken where contamination is suspected as well as where it would not be expected in the locality of the contaminated site. Initial samples should be located on a coarse grid pattern within the area of suspected contamination. However, if there is good information arising from the site history and condition reports, judgemental sampling may be more appropriate than coarse grid sampling. Stratified random sampling can provide further useful information.
Additional samples may be taken at off-site locations to provide an indication of the `local' background levels of suspected contaminants. Where possible local background samples should be of similar soil type to those taken on site.

Analyses should be performed using approved standard methods and should be performed by a laboratory registered for those analyses with the National Association of Testing Authorities, Australia (NATA) or the New Zealand Testing Laboratory Registration Advisory Council (TELARC).

Once this information is collated, a decision can be made as to whether further investigation of a site is required.

It should be re-iterated at this point that an initial assessment of occupational health and safety and public health concerns will need to be addressed to ensure the protection of investigators/workers and the general public.