

The Australian and New Zealand Approach to Manufactured Gas Plants (MGP) – Assessment, Regulation and Remediation

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An overview of MGP assessment, regulation and remediation in Australia and New Zealand is presented including a brief discussion of the history of MGP and a summary of the numbers of sites known, assessed and remediated. The general approach to assessment and management of contaminated sites in terms of the policy and regulatory framework that exists in Australia is outlined including some of the differences in approach between Australian states. Case studies from different parts of Australia and New Zealand are briefly described and general comments on remediation technologies, successes and failures are provided.

INTRODUCTION

MGP sites are broadly distributed throughout Australia and New Zealand in many cities and towns. The density of sites is roughly related to population density and climate. Most Australian sites are located around the more populated eastern states and particularly the south eastern area. Based on the information made available for this paper, it would appear that many MGP sites in Australia and New Zealand were commissioned between about 1850 and 1920 and were coal to gas plants. In the mid-1900s, some were converted to oil gas production and most of these probably continued until around the 1970s when natural gas became available. Others were decommissioned as refinery gas became available and were redeveloped for various land uses. Some were used by the gas supply authorities for the storage and distribution of natural gas whilst others were redeveloped for parklands, schools, kindergartens, road widening, residential use or industrial use.

Table 1. Estimated number of notified, assessed and remediated MGP sites in Australia and New Zealand

Area	Estimated number of former MGP sites	Sites assessed at least to field investigation stage	Sites that have been managed/ remediated
South Australia	10	2	0
Queensland	17	1	0
Victoria	55	12	7
New South Wales	47	22	12
Western Australia	?	1	0
Tasmania	3	2	1
Northern Territory	0	–	–
ACT	0	–	–
Australian Total	132 +	40 +	20 +
New Zealand Total	51	9 +	2 +

THE ESTIMATED NUMBERS OF SITES KNOWN, ASSESSED AND REMEDIATED

Current estimates of the number of MGP sites based on information recently supplied by state and federal environmental authorities are summarised in Table 1. The picture presented in Table 1 is approximate, particularly with respect to the number of sites assessed as some sites have been assessed without the knowledge of the government authorities.

POLICY AND REGULATIONS IN THE ASSESSMENT OF MGP SITES IN AUSTRALIA

As explained by Lambert (1994), Australia is a federation of six states and two territories which were largely settled separately. Consequently, environmental protection including contaminated land, rests principally with the individual states and territories. Nevertheless, initiatives have been implemented to develop a consistent national approach to contaminated sites, particularly in the development of guidelines which are generally endorsed by the states and territories. The principal national policy documents endorsed by the state environmental authorities in Australia are:

Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC/NHMRC, January, 1992); and

Financial Liability for Contaminated Site Remediation; A Position Paper (ANZECC, April, 1994).

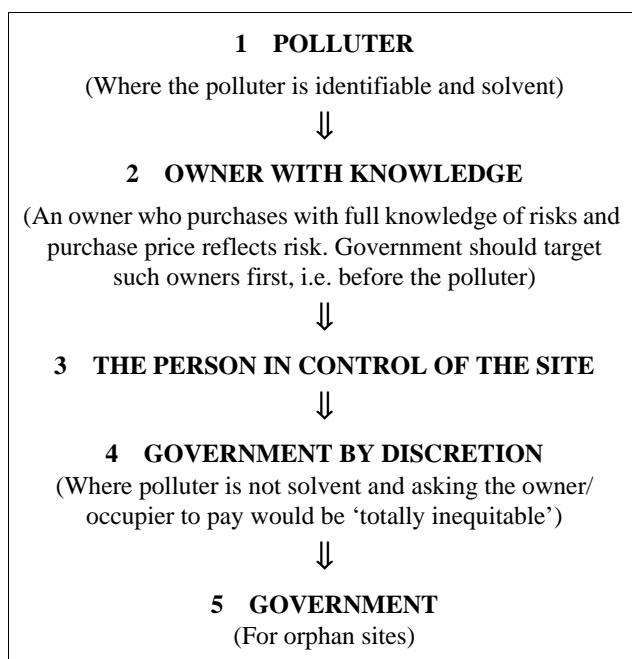
The ANZECC/NHMRC guidelines provide a suggested approach for investigation and management of contaminated sites and include health and environmental investigation criteria for some soil contaminants. These guidelines are currently being updated and a longer list of soil investigation guidelines are anticipated. Where Australian soil investiga-

tion guidelines do not exist, both the old and new Dutch levels are commonly used, typically the old Dutch B levels or the new Dutch guidelines where:

$$\frac{TV + IV}{2}$$

(intervention level plus target value divided by two) are being used as investigation guidelines. Where the Australian investigation guidelines are exceeded, ANZECC/NHMRC recommend a site specific, risk based approach.

The ANZECC 1994 position paper on financial liability for contaminated sites has not yet been developed as policy. It provides a position on the hierarchy, standard and apportionment of liability and discusses such issues as lender liability and government liability. For example, it proposes a hierarchy of liability as follows:



As regulations for environmental issues are almost wholly vested in the states in Australia, different sets of acts are used in each state to regulate contaminated sites. In most cases, these acts were formulated to deal with issues other than site contamination, such as occupational health and safety, release of hazardous chemicals and protection of waters from pollution. More recently, some states have put in place specific legislation to deal with contaminated sites. Most states also have a policy to protect water resources, including groundwater. No states have a specific soil protection policy. Some examples of the regulatory frameworks in different Australian States are given below.

SOME EXAMPLES OF STATE REGULATORY APPROACHES TO MANAGING CONTAMINATED SITES IN AUSTRALIA

NSW

Anderson and Symonds (1995) explain the regulatory framework that is in place in Australia's most populated state, NSW.

Victoria

In Victoria, the issue of contaminated sites is integrated into the overall system of legislative and regulatory provisions for environmental management. The Environmental Protection Act, 1970 is administered by the Victorian Environment Protection Authority. There are several regulations which are promulgated under this act, including those which address pollution to land, notifications for clean-up and certification of environmental audits.

The Victorian EPA is empowered to appoint individuals as 'environmental auditors' for contaminated land. These auditors must consider issues such as the beneficial uses that may be made of the land, guidelines issued by the authority and any other relevant state environment protection policy. Audit reports should reflect the recommended approach to assessing contaminated sites outlined by ANZECC/NHMRC (1992). At the end of an audit, an auditor may issue a 'Certificate of Environmental Audit' which states that in the auditor's opinion, the land is suitable for unrestricted use. Alternatively, the auditor may refuse to issue a certificate, but issue a 'Statement of Environmental Audit' which indicates that the land is suitable for a particular use.

At the time of writing this paper, of the 55 identified municipal based MGP sites in the state of Victoria, desktop assessments had been carried out on all sites and approximately twelve sites had been subjected to sampling and analysis. Seven sites had been subjected to audit by an approved auditor. Six of these sites had received Statements of Environmental Audit, stating that the land was suitable for a specific land use. One of these sites had been remediated to the extent that a Certificate of Environmental Audit was issued.

South Australia

In South Australia, the EPA has responsibility for assessment and clearance of contaminated land; risk assessment is conducted by the Health Commission. There is some legislative support for dealing with contaminated land however the process has deficiencies and this will be improved by amendments to the Environment Protection Act. In addition, in order to mitigate resource constraints and defer liability, site assessment will be delegated to accredited auditors.

CASE STUDIES IN REMEDIATION AND MANAGEMENT OF MGP SITES IN AUSTRALIA

General

Remediation of MGP sites in Australia and New Zealand has principally been driven by the commercial viability of remediating the site to the extent that redevelopment can take place and the land can be used for another use such as residential or commercial. In some cases, remedial efforts have been aimed at dealing with the problem of off-site migration of contamination, particularly in groundwater. The companion paper in these *Proceedings* by Anderson and Symonds (1995) provides some specific examples for the Australian State of NSW. Some examples from other states and New Zealand are given below.

The occurrence of such problems appears to be mainly related to site specific hydrogeology and historical waste management practices.

Case studies

Country town, Victoria

This was a former municipal MGP, located in Victoria, and the site was being used as a kindergarten, elderly citizens centre and a general residence. Assessment identified the presence of contamination, particularly polyaromatic hydrocarbons (PAHs). A contamination management strategy was adopted, with near surface contaminated soils being removed from the more sensitive use areas of the site (e.g. kindergarten areas) and replaced with clean fill. In other areas, a separation layer of clean fill was brought onto the site. A management plan was instituted to deal with future events such as gardening activities, trenching activities, and possible demolition/construction work. The site was listed as a confirmed contaminated site but not one requiring immediate action.

Major city, Victoria

This was a former MGP located in an un-named major city, which had been acquired and developed for public housing. An assessment was conducted, involving testing shallow soils collected from each housing unit yard, and also testing deeper soils and groundwaters beneath the site. Residual contamination by PAH and cyanide was identified, distributed mostly in fill on the site. The levels of these contaminants were considered not to pose a threat to the health of residents on the site or environment. Some clean-up works were conducted on the grounds of aesthetic and odour impacts.

Major city, South Australia

The site was a former MGP located within a partly industrial, partly residential area of an un-named major city. A clay quarry approximately 13m deep underlain by sand and gravel lenses had been filled with a variety of waste including MGP wastes, and old brick and concrete tar and liquor wells were left containing tar. Free tar was observed in two monitoring wells. Stormwater which had traditionally been directed to the quarry was directed to a soakage pond above the filled quarry which served to recharge groundwater and elevate the groundwater head within the quarry. Extensive site assessment was undertaken over a period of approximately three years including installation of off-site groundwater monitoring wells and three deep wells (to 125m) to assess the quality of groundwater in a limestone aquifer beneath the site. Contamination was found to be principally present in the shallow, unconfined and semi-confined aquifers connected to the former quarry. Nearby residents were potential users of the shallow groundwater for garden watering. Assessment and management options have yet to be completed.

Country town, South Australia

This site was a former MGP located in an un-named country town. Groundwater in karstic limestone formations was found to be contaminated to a depth of at least 70m, principally through the past practice of storage and disposal of tar and

liquor in wells. The groundwater is connected at some distance to a lake which is used as a local drinking water supply. Assessment of off-site contamination is in progress. This will be followed by an assessment of risk and remediation requirements.

New Zealand

A number of sites (>9) in New Zealand are being actively investigated prior to remediation. Two have been capped for reuse at one site. Other sites are currently being assessed for redevelopment. Recent investigations at one site have shown that an MGP site operating in the early 1900s is now overlain by up to 50 residences. Contamination is primarily by PAH, cyanide, spent uranium, and iron oxides.

Remediation technologies, successes and failures

Based on the information made available for this paper, it would appear that most MGP sites in Australia and New Zealand that have been remediated have used capping and containment and/or off-site disposal. Anderson and Symonds (1995) report on some of the remediation methods trialed and used in NSW, including bioremediation and thermal desorption. At one site in New Zealand over 2000 m³ of sludges have been treated by bioremediation to reduce phenol concentrations from 2000ppm to <100ppm.

It would appear that generally bioremediation of the heavy PAHs is a particular problem. Also, the low cost of landfilling and the acceptability of capping and containment create a climate where most treatment methods are relatively expensive alternatives.

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