Contributions of Brownfield Development to Urban Internal Expansion and Urban Renewal in Practice

Introduction

'Brownfields' refers to sites, or the activity of remediating and developing sites, which are idle, unused, or abandoned after former industrial or commercial use, and which exhibit a legacy of contamination of soil, groundwater, surface water, or streams.

The conversion of Brownfields sites into viable industrial, residential, and recreational sites has evolved from an initial public health protection activity to an urban planning strategy which directly and efficiently reduces urban sprawl while improving social and economic amenity. It is an activity which has been most actively developed and evolved in countries such as the United States, the European Union, and Australia. Evidence is emerging that Brownfields policy is being developed and applied in cities planning in Asia and in other global locations. Those applications include both the public health protection and strategic urban consolidation components of Brownfields activity which have been evident in the West.

Most towns and communities have historically enjoyed prosperity as a result of industrial activities. Large manufacturing facilities were commonly located in inner urban areas, particularly on valuable foreshore land where waterways were used as key transport routes. Some health problems associated with the 'legacy' sites of polluting industries has caused public concern. The decline of heavy industries near populated residential areas has frequently led to abandoned and underutilized facilities, sometimes resulting in increased local crime and unemployment (IEDC 2008).

Because of the typical location of historic industry activities adjacent high density urban areas, Brownfields are often located within active and renewing areas of cities. They represent cost-effective opportunities to utilise formerly alienated land areas, improving social wellbeing while enhancing public health protection through redevelopment and renewal. Reuse of idle industrial facilities also has a positive benefit through minimising loss of urban commerce and of jobs.

Brownfields activity directly contributes to reducing urban sprawl through:

- reducing migration of urban populations to suburban and peri-urban communities, thereby reducing pressure on peri-urban natural landscapes
- keeping infill development within the city's existing boundaries thus preserving open space and decreasing urban expansion

Governments internationally are recognizing the benefits of innovative Brownfields redevelopment strategies for addressing environmental and public health protection while contributing to economic development and community revitalisation. In light of the importance of land value to re-use of land and urban renewal, the planning and science of Brownfields development affect Brownfield site economic viability. Liability concerns may reduce the private sector's willingness to tackle Brownfield properties. Accordingly, and in light of the major benefits of Brownfields to urban growth, governments in many nations are increasingly taking steps to facilitate the reuse of Brownfield sites.

International Approaches to Brownfields

Brownfields planning and development was initially directed towards cleaning up contaminated sites for protection of the public and the environment. Between the inception

of the so-called 'Superfund' legislation in the United States in 1980, which addressed major contaminated sites, and a 2003 report by the International City/County Management Association (ICMA 2003a) over 2000 properties had appeared on a national priorities list of the most severely contaminated properties in the United States. Approximately half of these had been remediated or were underway. The use of Brownfields to address legacy sites which represent a risk to public health continues today in most countries and at all levels of government.

The US EPA has estimated that there are currently some 450,000 Brownfields sites identified in the United States, and recognises that there are benefits resulting from cleaning up and reinvesting in such properties including increases in local tax bases and jobs growth. Brownfields development also utilises existing infrastructure by reducing development pressures on undeveloped urban land, and improves and protects the environment through reducing pressure on biodiverse habitats, waterways and air quality (USEPA 2007).

In the United States the governance and regulatory approach to Brownfields is based on well established real estate markets and on experience in suburban development, decentralized government and strong private property protections. From an environmental remediation perspective, state environmental agencies now lie at the heart of U.S. site cleanup decisions. Furthermore, state and federal efforts to address landowner and lender liability issues have established a system for private sector-led redevelopment efforts. Tax and financial incentives, as well as streamlined regulatory procedures, further support that approach (USEPA 2007).

In Europe the national approaches to Brownfields have been influenced by the scale and number of contaminated properties, as well as by land availability, population density, historic preservation objectives and other governmental priorities. The U.K., Netherlands, and Germany are examples of countries which are prominent 'recyclers' of older industrial areas, have limited undeveloped land and a strong desire to preserve their remaining green space (IEDC 2008).

Countries such as the United States, Canada and Australia are less restricted by availability of land, but recognise the importance of Brownfields to economic efficiency and urban renewal and, particularly in the United States, have established integrated environment protection and land use planning approaches to facilitate Brownfields activities (USEPA 2007).

More recently, particularly where national and state-approved programmes have been developed, Brownfields activity is being directed towards urban renewal and regeneration. In the United States the signing of the so-called Brownfield Law in 2001 (USEPA 2001) confirmed ongoing public and private national interest in cleanup and redevelopment of former industrial, commercial and military sites. A strong national effort is being made in the United States to blend environmental cleanup, public health protection, and site reclamation, and to realise opportunities for economic development and community revitalisation. For example, Table 1, derived from the 2005 'Brownfields Federal Programs Guide' published by the United States Environmental Protection Agency (USEPA 2005) illustrates just some of the multiple government agencies in the USA which contribute to urban renewal through Brownfields financial and other support.

Federal Programs	Dept. of Agriculture	Appalachian Regional Commission	Army Corps of Engineers- Dept. of Defense	Office of Economic Adjustment- Dept. of Defense	Economic Development Administration- Dept. of Commerce	Dept. of Energy	EPA	Federal Housing Finance Board	General Services Administration
OVERALL COMMUNITY AND ECONOMIC DEVELOPMENT									
Brightfields/Sustainability						•			
Community Engagement/ Education		•					• $		
Public Health		•					• $		
Smart Growth							• $		
SPECIFIC COMMUNITY / ECONOMIC DEVELOPMENT									
Commercial/Industrial		• $			$		• $		•
DoD/BRAC				• $		•	•		•
Historic/Cultural Preservation			•				• $		•
Job Training		$			$		• $		
Low-income Housing							• $	$	
Mine-scarred Lands		• $	•				• $		
Ports/Waterfront			•				$		
Railfields							$		
Residential							• $	$	
Rural	• $	• $					• $		
Tribal							• $		
QUALITY OF LIFE / REDEVELOPMENT ENHANCEMENTS									
Bike Paths							• $		
Greenspace	• $					•	• $		
Parks/Recreation							• $		
Species/Habitats							• $		
Urban Forest	• $						• $		
SITE PREPARATION FOR REDEVELOPMENT									
Assessment		•			$		• $		
Cleanup			•		$		• $		
Demolition			•		$				
Project Financing Development	$				$		$		
Planning	•	•		• $			•		
Structural Rehabilitation				• $					
Transportation Infrastructure									
Water Infrastructure	•		•				$		
Other Infrastructure	•	$	•	• $					

Table 1: Some US Agencies and Programmes Contributing to Brownfields Policy Implementation. Source: United States Environmental Protection Agency (2005)

In the United Kingdom government programs focus on multiple, integrated goals and not simply on environmental cleanup. There is reportedly less government involvement in specific Brownfield sites. One study estimated that private developers initiate some 75 percent of all redevelopment projects in the UK. To help spur additional private sector investment, developers can take advantage of tax credits for remediation costs (IEDC 2008). This approach is similar to that undertaken recently in Australia.

The high industrial concentration, dense population, and well established planning tradition in the Netherlands has resulted in a well defined approach to the reuse of Brownfield sites. It is no coincidence that the 'Dutch B' remediation criteria specifying soil contaminant concentrations suitable for residential land were developed in the Netherlands in the early 1990s and used widely throughout the world. The Netherlands central government, recognising the importance of Dutch competitiveness in the European market, administers programs that direct funding and support to priority Brownfields sites, coordinated with local land use and planning processes. These initiatives, in addition to providing a strategic approach to reuse of contaminated sites, utilise Brownfields redevelopment to contribute to further urban planning goals, such as improved housing, transportation, and quality of life (IECD 2008).

Germany's experience with post-Cold War reunification efforts has had a significant influence on its Brownfields approach. Following the unification of East and West Germany, the new federal government found itself regulating military facilities and formerly state-owned industrial properties. At the same time, the general decline in the coal, steel, and textile industries led to the abandonment of heavy industrial facilities (IECD 2008). Local governments reportedly view Brownfields as opportunities to foster economic development.

Their planning efforts increasingly encourage development and remediation goals regulated by the prospective land use.

Canada and Australia are examples of countries which currently continue to focus on those contaminated sites principally where the benefits of potential future economic activity outweigh the remediation costs (IEDC 2008, Smith 2003). The private sector commonly identifies opportunities due to strong market forces, notably in conversion of relatively inexpensive industrial land on foreshores into multi-unit residential developments with high value water views. The real estate development industry undertakes the cleanup and reuse of former industrial properties, often with appropriate regulatory assistance from state or local government. In order to minimise the time delays and planning impediments which may affect market viability, state and local governments may use their planning powers in land use zoning, infrastructure development, and public health regulation to improve the market conditions necessary to attract the private sector (IEDC 2008).

In Asia there is an increasingly active approach evident in Hong Kong with respect to Brownfields planning (HKEPD 2007a) both to address sites which pose a risk to public health and to leverage the value of Brownfields remediation in public infrastucture, such as the Disneyland Theme park at Penny's Bay. This coincides with an increase in coastal development in recent years. For example, the revitalization of the Yau Tong Bay Brownfield site has been encouraged by Government through planning studies and zoning plans. Public benefits from remediation and regeneration of the Bay area include community needs for schooling, open space, and housing, and utilise formerly contaminated land for more environmentally sustainable and non-polluting productive uses. Brownfields sites, such as Kai Tak Airport, represent opportunity, with appropriate planning regulation and public inclusion, for the Hong Kong Special Administrative Region to secure additional land for development and to facilitate urban renewal through remediation of former industrial sites. Based on international successes and the strategic improvement in Brownfields planning to date, such projects may be expected to become increasingly attractive as a means of increasing the land supply in urban areas and alleviating pressures for development of natural areas.

Brownfields Practice

Practical implementation of Brownfields development requires consideration of a range of factors including the science of public health protection, the economic drivers of real estate development, and the land use regulation skills of urban planning. The ability today to carefully plan land uses and redevelopment options for affected properties allows for planning of viable risk-based remediation projects while providing liability protection for environmental regulatory requirements. However, most countries which have utilised Brownfields methodologies have been required to establish cooperation between the activities of their planning and their environment protection agencies, and frame specific legislation to facilitate such cooperation and shared control. Fortunately, and notwithstanding the different national jurisdictional examples of Brownfields development, scientific and planning methodologies are readily available which may be adapted and applied in most countries.

Land Uses

Internationally a number of industries are associated with the potential for causing land contamination. These include:

- oil installations (e.g. oil depots, petrol filling stations);
- gas works;
- power plants;

- shipyards/boatyards;
- chemical manufacturing/processing plants;
- steel mills/metal workshops;
- car repairing/dismantling workshops; and
- scrapyards.

This list illustrates the number and diversity of land use activities which may affect environmental quality in both small local activities and in larger industrial regions. Similarly it illustrates the locational opportunities which Brownfields sites offer, from smaller residential suburban location to larger foreshore or inner city industrial estate sites.

European countries have traditionally placed a high value on spatial planning, with local governments exercising strong planning and land use authority, and Brownfield sites have been addressed as part of an integrated planning and redevelopment framework (IEDC 2008). Large-scale planning policies that seek to harmonize land use and remediation requirements may enhance economic goals. For example, the Netherlands environmental agency recognises that contamination can be found across large areas, and utilises a large-scale approach to local land use and zoning decisions. Such an approach supports local government urban regeneration projects. Uniformity of cleanup protocols, in turn, enhances the feasibility of remediation efforts at these sites.

UK national government goals in Brownfields redevelopment are supported by a strong local government role in environmental cleanup and urban planning. Local government identifies contaminated lands, determining responsibility for site cleanup, establishing remediation requirements and maintaining records. Through planning and permitting powers, local government coordinates cleanup with land use, controlling the suitability of remediation and site condition with proposed further site use. Similarly in the Netherlands the provinces and municipalities take the lead in identifying contaminated properties within their jurisdictions. Local governments prioritize sites based upon threats to human health and the environment (IEDC 2008). In Germany local governments are supporting land remediation goals earmarked for appropriate proposed land uses. However project profitability reportedly remains a decisive factor that will drive a project forward.

Land use controls are an important aspect of Brownfields urban regeneration and renewal. Local and state governments are important participants in planning these developments, and in ensuring communities involvement in decision-making. Local government planning and economic development offices contribute substantially to the success in bringing Brownfield projects to fruition. One account of German activities (IEDC 2008) indicated that of some 150 medium and large cities the lead entity in Brownfield project management was the local planning office in some 50 percent of cases; the economic development office in some 25 percent; a local development corporation or an independent development entity in some 25 percent; and the relevant environmental agency in only some 5 percent of German cities.

Whether the goal of a Brownfields policy approach is public health protection, or realisation of urban renewal potential, or both of these, two planning methods, called ‘institutional controls’, and direct physical methods, called ‘engineering controls’, are likely to play a part in a Brownfields development.

Institutional and Engineering Controls

Examples of institutional controls for contaminated sites may include:

- zoning regulations, banning certain uses from sensitive areas
- Site restrictions limiting land use in areas that are prone to natural hazards such as flood or earthquake

- Proprietary controls including deeds of restriction on current land usage and easements whereby the site owner transfers only limited ownership of a property area.

Engineering controls are physical mechanisms that contain, mitigate, or monitor residual contamination and which may prohibit access to property or specific areas.

As Brownfields development becomes a central component of urban planning and renewal, one approach which is increasingly attractive is 'co-location' of Brownfields sites (ICMA 2003b). Co-location links the redevelopment of Brownfields sites with nearby adjacent properties which, like Brownfields, may be proving challenging for redevelopment. The approach considers how adjacent sites and vacant properties may be revitalised together with Brownfields sites, through local government planning processes, and in partnership with communities and national governments. Co-location has advantages in 'leveraging' the value of Brownfields development through, for example (ICMA 2003b):

- enabling assessment, remediation, and redevelopment of Brownfields and other adjacent sites so that the condition of one property does not negatively impact on the potential of another
- combining resources to create a package of planning and remediation tools and programmes to revitalise areas with distressed properties
- improving cost effectiveness of area-based planning
- improving funding for infrastructure improvement such as new roads or public transport
- creating a critical mass of people or activities to make transport access effective

Many localities are accepting Brownfields sites as important reuse projects for government facilities including public parks and recreational areas. There are growing examples of environmentally responsible reuse of Brownfields sites through green building, low impact develop practices, smart growth (urban consolidation), preservation of parks and open, transit-oriented development, and pollution prevention.

Economics and Communication

In the United States in 1996 an inaugural Brownfield's National Conference was informed that the US Government proposed a US$ 2 billion tax incentive for Brownfield's redevelopment to promote private sector cleanup. The US Department of Housing and Urban Development and the Environmental Protection Agency currently expedite Brownfields redevelopment, reducing agency overlap, developing joint programs and more effectively combining their expertise (USEPA 1997).

As a local example, the Commonwealth of Massachusetts in the United States reported that by the early 2000s some 20,000 Brownfields sites in that state had been addressed, creating some 8000 jobs, an increasing tax revenues by approximately $1 billion through to urban revitalisation (NALG 2004).

Maintaining effective land-use controls, which sometimes may exhibit multiple layering of controls on a given property, requires steps including:

- Design and implementation
- stakeholder coordination
- information management
- enforcement
- funding

Essential components of successful Brownfields development include:

- Finding financing
- Accurate cleanup estimates
- Effective community involvement
- Successful negotiation with regulators
- Cost-effective and efficient cleanup

The Science

A critical question regarding Brownfields remediations, which routinely leave some residual contamination at a property, is whether the planning and remediation processes have ensured that human health and ecological risks are adequately controlled. There has always therefore been a strong scientific and engineering component in Brownfields planning.

Risk assessment is an important tool for evaluation of site contamination in public health protection, and for protecting the ecology, through estimation of hypothetical health risks for present and potential future land uses. Risk communication has also proven to be an important part of planning by engaging government and local communities during complex land remediation projects in Australia and internationally.

With respect to the emerging Brownfields approach in parts of Asia, Hong Kong until recently had no locally-derived land contaminant standards. The Netherlands 'Dutch B levels' soil contamination criteria were used between 1994 and 2007. Risk-based contaminated land standards specifically derived for Hong Kong are being developed to replace the Dutch B levels in light of the benefits of developing standards suitable for addressing environmental issues for local regions such as Hong Kong; the world-wide practice for countries to develop country-specific standards based on a risk assessment to suit their local environmental conditions, community needs, and legislative jurisdictions; and the Dutch government itself developing a new set of risk-based standards to replace the Dutch B levels.

A risk-based approach means that decisions on defining a site as contaminated, and hence the level of remediation required, are based on the potential contaminant risks to receptors and on exposures which may occur for the intended land use. In the case of Hong Kong a set of locally-derived contaminated land standards, the Risk-based Remediation Goals (RBRG) has been published for four types of land uses to protect local populations ('receptors'). Part of the RBRG criteria list is illustrated in Table 2. The Guidance Manual (HKEPD 2007b) explains the risk-based approach and guides users in applying the RBRGs to contaminated sites.

Chemical	Risk-Based Remediation Goals for Soil			
	Urban Residential (mg/kg)	Rural Residential (mg/kg)	Industrial (mg/kg)	Public Parks (mg/kg)
VOCs				
Acetone	9.59E+03	4.26E+03	1.00E+04*	1.00E+04*
Benzene	7.04E-01	2.79E-01	9.21E+00	4.22E+01
Bromodichloromethane	3.17E-01	1.29E-01	2.85E+00	1.34E+01
2-Butanone	1.00E+04*	1.00E+04*	1.00E+04*	1.00E+04*
Chloroform	1.32E-01	5.29E-02	1.54E+00	2.53E+02
Ethylbenzene	7.09E+02	2.98E+02	8.24E+03	1.00E+04*
Methyl tert-Butyl Ether	6.88E+00	2.80E+00	7.01E+01	5.05E+02
Methylene Chloride	1.30E+00	5.29E-01	1.39E+01	1.28E+02
Styrene	3.22E+03	1.54E+03	1.00E+04*	1.00E+04*
Tetrachloroethene	1.01E-01	4.44E-02	7.77E-01	1.84E+00
Toluene	1.44E+03	7.05E+02	1.00E+04*	1.00E+04*
Trichloroethene	5.23E-01	2.11E-01	5.68E+00	6.94E+01
Xylenes (Total)	9.50E+01	3.68E+01	1.23E+03	1.00E+04*

Table 2: Hong Kong Special Administration Region Volatile Organic Compound Risk Remediation Goals. Source: Hong Kong Environment Protection Department

Decisions on contaminated soil and groundwater remediation are to be based on the nature and extent of the potential risks posed to human receptors as a result of exposure to chemicals in the soil or groundwater. The approach acknowledges that there are some low levels of exposure to contaminants that will pose minimal risks to the receptors. RBRGs have been developed as threshold contaminant concentrations, below which hazards or risks to human health arising from exposure to soil and groundwater are considered minimal (HKEPD 2007b).

Contaminant Treatment Techniques and Technologies

As noted earlier, the emergence of Brownfields as a strategic planning approach has meant that traditional planning approaches must recognise and adjust to a sometimes complex scientific consensus and must include science-based considerations in both public health protection and identification of appropriate land uses.

Remediation of land requires storage or treatment of a range of chemical contaminants which require removal from the site. The regulatory considerations associated with contaminant treatment also require careful planning considerations. In early remediation work (Smith 2003) excavation and containment of contaminated soil in storage sites below parkland or in other inaccessible locations was not uncommon. In some instances, incineration or chemical destruction technologies have been applied. Through a process of technological improvement, regulatory approval, and community consultation, a spectrum of technologies has now emerged to treat Brownfield's contaminants. These technologies are utilised with risk-based corrective actions to determine appropriate cleanup levels for hazardous waste and to inform future land use decisions.

An increasingly popular and effective technology for contaminant treatment is thermal desorption whereby chemicals are released from contaminated soil through a controlled heating process and the chemicals are destroyed by a subsequent controlled high-temperature heating step. Pollution control devices are important components of such technologies. An advantage of such thermal desorption technologies is the ability to reuse the cleaned soil in landscaping activities as part of the development.

Case Studies

The historic development of Brownfields activities in Australia was initiated largely through government enterprise and the Olympic Games, and more recently has been transferred to the private sector, resulting in continuing practice improvement.

Two Australian case studies illustrate the value of Brownfields development and the application of planning and risk assessment tools:

1. Olympics 2000 site, Homebush Bay, Sydney and
2. Rhodes foreshore residential sites, Homebush Bay, Sydney

The use of Brownfields methods to improve urban fabric is a common feature of Australian urban planning and has emerged as a strategy in urban consolidation and real estate development. In addition to extensive urban centre redevelopment, small infill regional releases utilise Brownfields sites for expansion of urban fringe lands contributing to housing supply.

The Olympics 2000 site was developed on a large area of derelict land in Sydney which had formerly hosted a munitions storage facility, a major regional abattoir, and a poorly regulated metropolitan and industrial waste landfill in the geographic centre of a sprawling city. The State, Commonwealth and Olympics funding contributed to the remediation of the site to host the 2000 Olympics events, to develop a new medium density urban residential area (Fig 1), and to provide major sporting facilities and environmental parkland for the city (Smith 2003). An important initial 'driver' for this early example of Australian Brownfields development was protection of worker and public health during the development. This was an example of Brownfields development driven by attention to public health protection through cleanup of contaminated sites, linked in this case to preparation of international quality sporting facilities.

Figure 1: The Residential Suburb of Newington Developed on the Brownfields Site of the 2000 Olympics Games at Homebush Bay in Sydney. Source: Waste Services NSW

The application of Brownfields planning to urban consolidation is occurring through transfer of the approach to government and private sector development planning in Australia. At Rhodes in Sydney, a foreshore residential area adjacent the Homebush Bay Olympics 2000 site, private development is remediating heavily chemically contaminated industrial land to residential standard using a risk-based approach. This is being undertaken through legislative and regulatory processes and requires high-quality science, regulatory auditing and ongoing air quality and local waterways protection. A measure of the relative sophistication of Brownfields methods which have evolved to date is evident in the development of private residential dwellings directly adjacent the Brownfields site while remediation of contaminants is being undertaken (Figure 2).

Figure 2: The Renewing Residential Suburb of Rhodes on Former Chemical Industry Brownfields Sites at Rhodes Peninsula in Sydney. Source: Thiess Services

Emerging Themes

Current and emerging themes with respect to Brownfields development include:

- The effectiveness of land use controls and regulation for protection of adjacent neighbour human health and the environment at contaminated sites during remediation
- The suitability of 'unrestricted use' approvals for any possible future property such as housing and schools following site remediation
- The appropriate form of land use controls to generate economic development and community revitalisation while protecting public health and the environment
- Transferring the costs of those government actions which benefits privately held land to site owners who benefit most directly

Conclusions

The earth at present is experiencing rapid urban development. Over half the global population is now urbanised. Industrial relocation is resulting in a preponderance of derelict urban land. Brownfields has evolved from an initial public health protection measure to now represent a strategic planning approach which rapidly and effectively addresses urban sprawl, providing government and the private sector with direct control over the mixture of environmental, social and economic factors which affect urban growth. The urgent and effective application of Brownfields policies to growing Asian and other cities, consistent with specific local national needs and policies, will contribute to minimising urban sprawl globally.

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Reference Endnotes

ICMA (2003a) *Striking a Balance: Local Government Implementation of Land Use Controls*, Strategies from the 2003 Brownfields Exchange, Washington D.C., International City/County Management Association

ICMA (2003b) *Co-location: Facilitating Revitalisation Beyond Brownfields*, Washington D.C., International City/County Management Association

IEDC (2008) *International Brownfields Redevelopment*, Washington D.C., International Economic Development Council http://www.iedconline.org/?p=Brownfields_Publications (accessed 28.6.08)

HKEPD (2007a) *Environmental Protection Department Guidance Note for Contaminated Land Assessment and Remediation*, Hong Kong, Government of Hong Kong Special Administrative Region, Hong Kong, Government of Hong Kong Special Administrative Region

HKEPD (2007b) *Guidance Manual for Use of Risk-based Remediation Goals for Contaminated land management, Hong Kong*, Government of Hong Kong Special Administrative Region, Hong Kong, Government of Hong Kong Special Administrative Region

NALGEP (2004) *Unlocking Brownfields, Keys to Community Revitalization, Washington D.C.*, National Association of Local Government of Environmental Professionals and the Northeast-Midwest Institute

Smith, Garry (2003) *Development and Application of Environmental Risk Assessment Methods for Planning and Delivery of City and Suburban Development*, in E. Beriatos and J. Colman (eds), The Pulsar Effect, Volos, University of Thessaly Press

Smith Garry and Scott Jennifer (2006) *Living Cities: An Urban Myth? Government and Sustainability in Australia*, Dural, Rosenberg Publishing

USEPA (1997) *Brownfields '96 National Conference*, Washington D.C. United States Environmental Protection Agency

USEPA (2001) *Small Business Liability Relief and Brownfields Revitalization Act*, Washington D.C., United States Environmental Protection Agency

USEPA (2005) *Brownfields Federal Programme Guide*, Washington D.C. United States Environmental Protection Agency

USEPA (2007) *About Brownfields*, Washington D.C. United States Environmental Protection Agency, www.epa.gov.gov/brownfields/about.htm (accessed 28.6.08)