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ABSTRACT

INSTITUTIONAL CONTROLS AND BROWNFIELD REDEVELOPMENT

Ronnachai Tiyarattanachai

Institutional controls (ICs) are used to reduce risks to human health and environment from exposure to contaminants at Brownfield sites. Regulators approve use of ICs in Brownfield redevelopment with the expectation that ICs will remain effective over the long-term under proper oversight mechanisms. However, a recent review of compliance statuses of Brownfield sites with ICs implemented in Massachusetts and New Jersey indicated a significant percentage of the sites are out of compliance status.

Implementation of ICs depends on compliance efforts by humans. Thus, consistency of implementation over the long-term is questionable because there are several potential problems due to human errors or omissions related to record keeping of ICs and maintenance of engineering controls (ECs). Many Brownfield sites have relatively short redevelopment histories (less than 20 years) and thus potential gaps, if any, in oversight mechanisms of ICs may not be evident now. In light of the potential concerns on implementation effectiveness of ICs, there is a need for a methodology to evaluate implementation effectiveness of ICs as well as an analysis of available data to determine the rate of success or failure of IC implementation.

This study evaluated implementation effectiveness of ICs through 1) an assessment of oversight mechanisms for remediated sites with ICs implemented under state cleanup programs and 2) a survey of state regulators and Licensed Site Professionals (LSPs) on effectiveness of IC implementation.

Assessment of oversight mechanisms suggested that ICs are not properly implemented as stipulated by regulation. The study identified three potential gaps in oversight mechanisms of New Jersey Department of Environmental Protection (NJDEP) including: 1) work force size and work load; 2) information management system; and 3) enforcement of IC-related requirements.

Survey results indicated that Massachusetts Department of Environmental Protection (MADEP) environmental professionals and Massachusetts LSPs would be concerned if restrictions and requirements associated with IC implementation are not strictly enforced. These findings along with the fact that a sizable percentage of sites in Massachusetts and New Jersey are still out of compliance status suggest that effectiveness of ICs is not optimal and the situation could be worse over the long-term. Based on the findings of the study, a set of policy recommendations for improving implementation and enforcement of ICs is proposed.

INSTITUTIONAL CONTROLS AND BROWNFIELD REDEVELOPMENT

by
Ronnachai Tiyarattanachai

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To my dad, my mom, my sister, and my brother. I'm doing this for them. To my grandma who saved me from living on the street. I wish she had a chance to see my success. To my beloved country, Thailand, the land of smile.

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LIST OF ACRONYMS

ACE	Agricultural Conservation Easement
AICs	Active Institutional Controls
AOC	Area of Concern
ARARs	Applicable Relevant and Appropriate Requirements
AUL	Activity and Use Limitations
BCM	Bureau of Case Management
BFO-N	Bureau of Northern Field Operations
BFO-S	Bureau of Southern Field Operations
BNCM	Bureau of Northern Case Management
BSCM	Bureau of Southern Case Management
BOMM	Bureau of Operation, Monitoring and Maintenance
BRMINCA	Bureau of Risk Management, Initial Notice & Case Assignment
CCA	Compliance Certification Application
CEA	Classification Exception Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CADTSC	California Department of Toxic Substances Control
DN	Deed Notice
ECs	Engineering Controls
ECA	Energy Communities Alliance
EDB	Ethylene dibromide

LIST OF ACRONYMS
(Continued)

ELI	Environmental Law Institute
FEMA	Federal Emergency Management Agency
GAO	General Accounting Office
IEC	Immediate Environmental Concern
ICs	Institutional Controls
ICTS	Institutional Controls Tracking System
ISRA	Industrial Site Recovery Act
ITRC	Interstate Technology and Regulatory Council
LCA	Local Cooperative Agreements
LSP	Licensed Site Professional
LSPA	Licensed Site Professional Association
LSRP	Licensed Site Remediation Professional
MCP	Massachusetts Contingency Plan
MGL	Massachusetts General Laws
NCP	National Contingency Plan
NFA	No Further Action
NHPA	National Historic Preservation Act
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NRC	National Research Council
NPL	National Priority List

LIST OF ACRONYMS
(Continued)

NWPA	Nuclear Waste Policy Act
OPRA	Open Public Records Act
PA	Preliminary Assessment
PICs	Passive Institutional Controls
PDR	Purchase of Development Rights
RA	Remedial Action
RAO	Response Action Outcome
RAPS	Response Action Performance Standard
RAWP	Remedial Action Workplan
RBCA	Risk-Based Corrective Action
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SI	Site Investigation
SDWA	Safe Drinking Water Act
SRP	Site Remediation Program
SRRA	Site Remediation Reform Act
Tech Reqs	Technical Requirements for Site Remediation
TSCA	Toxic Substances Control Act
TSDFs	Treatment, Storage, and Disposal Facilities
UECA	Uniform Environmental Covenants Act

LIST OF ACRONYMS
(Continued)

UMTRCA	Uranium Mill Tailings Radiation Control Act
USACE	United States Army Corps of Engineers
USDOE	United States Department of Energy
USDOT	United States Department of Transportation
USUSEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VAP	Voluntary Action Program
VCP	Voluntary Cleanup Program

CHAPTER 1

INTRODUCTION

1.1 General Background

A Brownfield site is defined by the United States Environmental Protection Agency (USEPA) as "*real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.*" (USEPA, 2004a). It is estimated that there are between 500,000 and 1,000,000 Brownfield sites in the United States (US) (USEPA, 2009a). The levels of contamination and toxicity vary by site (McCarthy, 2002). Brownfield redevelopment was first initiated by the USEPA in 1994 through the Economic Redevelopment Initiative. Brownfield redevelopment is an effort to turn an abandoned site to some beneficial use (e.g., new commercial activities, recreational areas, apartments, etc.). In 2001, the US enacted the Small Business Liability Relief and Brownfields Revitalization Act (herein after referred to as the "Federal Brownfields Act") to promote Brownfield redevelopment by providing financial assistance for cleanup of Brownfield sites (USEPA, 2009a).

Brownfield redevelopment requires a site remedy as part of redevelopment. Developers and regulators are required to comply with federal laws such as the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as well as state laws, to remediate a site. RCRA and CERCLA, enacted in 1978 and 1980 respectively, were established to authorize USEPA to oversee cleanup of contaminated sites throughout the

country. Although they have similar goals, RCRA was enacted to address contamination at current operating facilities while CERCLA was established to address contamination at abandoned sites (USEPA, 2006a). Therefore, for Brownfield redevelopment, CERCLA is the key legislation for site remediation. CERCLA authorizes the use of Institutional Controls (ICs) at Brownfield sites.

The USEPA defines ICs as "*actions, such as legal controls, that help minimize the potential for human exposure to contamination by ensuring appropriate land or resource use*" (USEPA, 2006b). ICs are used when residual contamination is to remain on-site. USEPA does not allow the use of ICs without Engineering Controls (ECs) incorporated into the remedy (USEPA, 1997). ECs are any mechanisms designed to contain or stabilize contamination or ensure the effectiveness of a remedial action. ECs may include, without limitation, caps, covers, dikes, trenches, leachate collection systems, signs, fences and physical access controls (NJDEP, 1998a). ECs are usually used to support ICs to prevent exposure to the remaining contamination.

The use of ICs and ECs by federal and state environmental agencies increased when the attitude on site remediation changed in the early 1990s. Government agencies once had a mindset that contamination at a site has to be completely cleaned up or removed. By using a complete remediation, budgets set for site cleanups (e.g., Superfund monies authorized under CERCLA) were quickly exhausted. As a result, regulators decided to use Risk-Based Corrective Action (RBCA) to allocate cleanup funds. Sites with high risks to human health and the environment received priority for CERCLA cleanup funds. For sites with lower risks, ICs and ECs were used depending on site-specific factors such as intended use and level of contamination (Ehlers, 1999; Swickard,

2008). It is widely-recognized that a vast number of contaminants can last in the subsurface for a very long time if not degraded by some active remediation technology (e.g., chemical reaction, enhanced biodegradation, physical treatment) (Weidemeier, et al., 1999). Implementing ICs solely would only rely on natural attenuation to reduce contamination level. Depending on the level of contamination and geological conditions at the site, it may take decades for the natural processes to degrade contamination to the applicable cleanup standards. Therefore, ICs should remain effective over the long-term and at least as long as the lifespan of remaining contaminants (ELI, 1995).

1.2 Statement of the Problem

This study investigated implementation effectiveness of ICs for reducing risks to human health and the environment from exposure to contaminants present at Brownfield sites. Failure of ICs may lead to a sudden exposure to the remaining contamination (NRC, 2003a). Regulators, who permit redevelopment on Brownfield sites, may have granted approvals for the use of ICs with the expectation that ICs will remain effective over the long-term under proper oversight mechanisms[1]. However, a recent review of compliance status of Brownfield sites with ICs implemented in Massachusetts and New Jersey indicated a significant percentage of the sites were still out of compliance status. Based on the most available up-to-date data, approximately 20% of Brownfield sites with ICs implemented in both Massachusetts (as of 2007) and New Jersey (as of 2008) did not comply with IC-related requirements (Munie et al., 2007; NJDEP, 2007a).

[1] "Oversight mechanism" in the context of this study means the monitoring and reporting requirements and enforcement methods of regulatory agencies used to oversee the implementation of ICs for sites under their jurisdictions. The mechanisms may include, but not limited to, rules and regulations established under related legislations that require the agencies and responsible parties to follow as part of implementation of ICs.

Implementation of ICs depends on compliance efforts by humans. Thus, consistency of implementation over the long-term is questionable because there are several potential problems due to human errors or omissions (e.g., the lack of efficient record keeping and tracking, the lack of maintenance effort to keep ECs effective). Without proper maintenance, ECs may fail simply because of normal wear and tear over long periods of time. Natural disasters such as hurricanes and earthquakes could also drastically impair the functions of these controls (ELI, 1995).

Pendergrass (1999) stated that long-term effectiveness of ICs is uncertain due to several reasons. First, most Brownfield sites have relatively short redevelopment histories (less than 20 years) and thus, potential gaps, if any, in oversight mechanisms of ICs may have not surfaced. Moreover, regulatory agencies responsible for overseeing implementation of ICs may not be able to effectively review the conditions of ICs due to budget limitation. Funding for inspection and monitoring may not be available especially if budgetary priorities are changed in the future (USEPA, 2005a). Also, some monitoring and reporting requirements rely on entities that have little or no knowledge of the remaining contamination. Current land users may totally ignore the designated functions of ICs and misuse the property (USEPA, 2005a). One of the emerging questions about Brownfield redevelopment is the implementation effectiveness of ICs, particularly over an extended period of time (ELI, 1999). Without an effective enforcement strategy, ICs may not achieve the desired outcome and may lead to more problems (ELI, 1995).

ICs may also "fall through the regulatory cracks" when there is shared responsibility among several parties (e.g., government agencies and private parties). This situation may be caused by the absence of land use databases or historical records, the

lack of institutional coordination, and differences in interpretations of restrictive requirements (ELI, 1995). Also, when contamination (e.g., contaminant plume) extends off-site onto adjacent properties, the impacted property owners may not be willing to have such record of restrictions on the deed of their properties (USEPA, 2005b).

A review of the peer-review literature and government agency databases revealed little attention has been paid to the assessment of implementation effectiveness of ICs for Brownfield redevelopment. No assessment of available data on the performance of enforcement efforts to ensure effectiveness of ICs has been conducted. Failure to comply with regulatory requirements associated with implementation of ICs could limit the effectiveness of the tool to protect human health and the environment. In light of the potential concerns on implementation effectiveness of ICs, there is a need for a design methodology to evaluate implementation effectiveness of ICs as well as analysis of available data to determine the rate of success or failure of IC implementation. Understanding current effectiveness of IC implementation can help identify any potential problems that may occur in the future.

1.3 Objective of the Study

The objective of this study is to evaluate implementation effectiveness of ICs through an assessment of current oversight mechanisms for IC sites under state cleanup programs and a survey with state regulators and environmental professionals. It is expected that the findings of the study can be used to assess long-term effectiveness of ICs and also identify potential gaps in the oversight mechanisms, if any, that may impact the effectiveness of ICs over the long-term.

1.4 Scope of the Study

The study consists of two components: 1) an assessment of oversight mechanisms for remediated sites with ICs implemented under state cleanup programs and 2) a survey of state regulators and Licensed Site Professionals (LSPs).

The first major component of the study will investigate the current status of IC implementation (e.g., percentage of compliance status of IC sites) and to project any potential problems of oversight mechanisms. This study focused on IC implementation for soil contamination because, compared to groundwater problem, remaining contamination in soil is more related to Brownfield redevelopment. ICs for soil contamination allows certain types of use (e.g., industrial, commercial, or residential uses) depending on the levels of remaining contamination, thus are directly related to the types of Brownfield redevelopment projects (Washburn and Edelmann, 1998). This study investigated oversight mechanisms of the New Jersey Department of Environmental Protection (NJDEP) and the Massachusetts Department of Environmental Projection (MADEP) for overseeing implementation of ICs for Brownfield redevelopment. These two state environmental agencies manage a large number of contaminated sites under their jurisdictions. To date, there are over 23,000 and 6,000 contaminated sites under NJDEP and MADEP site cleanup programs, respectively (MADEP, 2007a; NJDEP, 2009a).

The two agencies are widely recognized for their advanced Brownfield redevelopment initiatives. In fact their Brownfield programs were included in legislation before the national initiative (Federal Brownfields Act) began in 2001. In New Jersey,

the Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B (NJ Brownfields Act) was passed in 1998 (NJDEP, 2009a). The Massachusetts Brownfields Act, Chapter 206 of the Acts of 1998 (MA Brownfields Act) was also passed in the same year (MADEP, 1998).

MADEP is also the pioneer agency to use the Licensed Site Professional Program (LSP Program) in their site cleanup work. A Licensed Site Professional (LSP) is a licensed individual, who must meet minimum education and relevant professional experience requirements and must pass a comprehensive exam. The LSP's role is to direct the assessment, characterization, and, to the extent necessary, cleanup process in a manner consistent with the requirements of the Massachusetts Contingency Plan (MCP) and other relevant regulations. The LSP program was designed to help relieve excessive work load on MADEP staff members in managing site cleanups in Massachusetts (LSPA, 2008). It should be noted that NJDEP was in the process of adopting a similar LSP Program when this study was conducted in late 2008. The Site Remediation Reform Act (SRRA), N.J.S.A. 58:10C-1, which establishes a program for licensing of Licensed Site Remediation Professionals (LSRPs), was later signed by Governor Jon Corzine on May 7, 2009 (NJDEP, 2009b).

The second major component of the study is considered to be another source of information to project long-term effectiveness of ICs. State regulators, targeted as survey respondents, have direct experiences in making remedy decisions and overseeing site cleanups that may have ICs implemented as part of the remedy. They are expected to be able to provide opinions regarding current status of implementation and enforcement of ICs. In this study, a survey was conducted with the MADEP environmental professionals

in the Bureau of Waste Site Cleanup, the core bureau overseeing site remediation for the agency. Additionally, the Massachusetts LSPs are also considered part of the target study population because they are highly-experienced environmental professionals, who have a significant role in decision making for a remedy. It should be noted that the study was initially designed to conduct the survey with NJDEP as well. Unfortunately, the agency could not participate in the survey due to their "limited resources" as a result of reorganization and staff reduction.

Comparison of how regulators expect ICs to be implemented and actual compliance rate of sites with ICs implemented reveal the level of effectiveness of the oversight mechanisms. Interpretation of the information obtained from these two data sources was used to qualitatively project long-term effectiveness of ICs. A set of policy recommendations for improving implementation and enforcement of ICs is also proposed based on the results of the study.

CHAPTER 2

LITERATURE REVIEW

2.1 Brownfield Redevelopment

A great number of abandoned contaminated sites were created in the past couple of decades when the US and Western European countries restructured their economies and land use practices by moving away from many types of manufacturing. Many plants were relocated to less developed countries (e.g., countries in Asia and Africa). This new business strategy resulted in plant closings and a large number of vacant, industrial lots in many major cities. These sites are often called "Brownfields" (McCarthy, 2002).

Brownfield redevelopment was initiated in the early 1990s during the Clinton administration when the USEPA Administrator, Carol Browner, introduced the Economic Redevelopment Initiative and awarded the first Brownfield Pilot Project Grant. The USEPA provided $200,000 grants to cities to plan for cleaning up and redevelopment of former industrial sites (USEPA, 1998). Browner also removed about half of the CERCLA sites from the CERCLA list in 1995 to decrease regulatory burden related to site remediation, thus encouraging redevelopment on contaminated sites. In 2001, the Federal Brownfields Act was enacted to provide relief for small businesses from liability under CERCLA (USEPA, 2009a). These initiatives and incentives have greatly promoted redevelopment on Brownfield sites; some of the sites have ICs and ECs implemented as part of their remedies (Lange and McNeil, 2004).

Level of interest in Brownfield redevelopment in Europe was reviewed to find if the continent, which has old developed countries clustered in, has experienced similar

issues related to Brownfield redevelopment discussed in this study. Compared to the US, Brownfield redevelopment is relatively new in Europe. The European Environmental Agency (EEA) estimates that there are between 900,000 and 1.5 million contaminated sites (Thornton et al., 2007). Several members of the European Union (EU) have only recently introduced legislation on soil remediation inspired by US legislation (i.e., RCRA and CERCLA).

Definitions of Brownfields vary among countries in Europe. For example, the Environmental Agency for England and Wales defines Brownfields as *"Previously developed land – land which is or was occupied by a permanent structure (excluding agricultural or forestry buildings), and associated fixed surface infrastructure"*. In Germany, Brownfields are defined as *"Inner city buildings not under use or inner city areas for redevelopment and refurbishment"* (Oliver et al., 2005). Some countries in Europe (e.g., Austria, Finland, Netherlands, and Sweden) do not have official definitions of Brownfields. The Concerted Action on Brownfield and Economic Regeneration Network (CABERNET), the European expert network addressing the complex multi-stakeholder issues that are raised by Brownfield regeneration, defines Brownfields as sites that (CABERNET, 2005):

- have been affected by former uses of the site or surrounding land;
- are derelict or underused;
- are mainly in fully or partly developed urban areas;
- require intervention to bring them back to beneficial use; and
- may have real or perceived contamination problems

Brownfield redevelopment can be viewed as a type of sustainable development because it helps save some "fresh" green areas for the next generation while turning underutilized lands to some benefit (Thornton et al., 2007). Brownfield redevelopment also can be viewed as a smart growth option because most of the sites are clustered in urban areas, where public transportation and utilities already exist (Greenberg et al., 2001). Smart growth is defined as "*an urban planning and transportation theory that concentrates growth in the center of a city to avoid urban sprawl; and advocates compact, transit-oriented, walkable, bicycle-friendly land use, including neighborhood schools, complete streets, mixed-use development with a range of housing choices*" (Talen and Gerrit, 2003). Smart growth values long-range, regional considerations of sustainability to achieve a unique sense of community and place; expand the range of transportation, employment, and housing choices; equitably distribute the costs and benefits of development; preserve and enhance natural and cultural resources; and promote public health (McCarthy, 2002).

Studies on how to promote Brownfield redevelopment programs have focused on problems faced by developers. For example, McCarthy (2002) stated that government agencies should reduce barriers to private sector involvement in Brownfield redevelopment by addressing four major areas of uncertainties including: 1) legal liability; 2) cleanup standards; 3) availability of funding; and 4) complicated regulatory requirements. Alberini et al. (2005) conducted a survey with real estate developers in Europe to examine the significance of incentives on Brownfield redevelopment. They found that, generally, developers value market-based incentives and liability relief.

However, developers with prior experience using Brownfield sites are more responsive to government subsidies (e.g., tax relief).

De Sousa (2000) interviewed stakeholders from private sector (i.e., developers, landowners, and consultants) in the Great Toronto Area (Ontario, Canada) about their perspectives on the costs and risks associated with Brownfield redevelopment compared to development projects on uncontaminated lands. Interview results indicated industrial redevelopment projects would involve greater risks and be potentially less cost-effective compared to less complex residential projects. Therefore, residential projects seem more feasible for Brownfield sites.

Lange and McNeil (2004) developed a predictive model as a tool to measure the level of successfulness and outcomes of Brownfield redevelopment. They concluded that a successful Brownfield redevelopment project should incorporate more green space into the development plan, take advantage of available financial incentives, benefit existing businesses in the area, and have future use considered when establishing environmental cleanup levels.

Tedd et al. (2001) described that risk assessment and risk management are the vital factors to create sustainable Brownfield redevelopment. Page and Berger (2006) characterized contaminated properties in voluntary cleanup programs by comparing sites in an older industrial region (New York) and a newer industrial region (Texas) with regard to their land use data and contamination profiles before and after they entered the voluntary cleanup programs (VCPs).

2.2 Site Remediation

One of the most important challenges in Brownfield redevelopment is to address site contamination. According to a USEPA guidance document entitled "Rules of Thumb for Superfund Remedy Selection" (1997), there are five requirements for remedial action selection for Superfund sites. The selected remedial approach must: 1) protect human health and the environment; 2) comply with Applicable or Relevant and Appropriate Requirements (ARARs[2]) unless a waiver is justified; 3) be cost-effective; 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and 5) satisfy a preference for treatment as a principal element, or provide an explanation in the Record of Decision (ROD[3]) as to why this preference was not selected. The document also states that USEPA shall consider the following expectations when selecting a remedial approach:

- Treat or address the "principal threat waste" whenever practicable;
- Use ECs to address contaminants where they provide a low long-term threat reduction when treatment is impracticable;
- Use a combination of the above methods if appropriate;
- Use ICs to prevent or limit exposure to contaminants remaining on-site;
- Consider using innovative technology if more practicable and suitable than demonstrated technologies;
- Return groundwater to its usable condition in a reasonable timeframe.

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[2] Section 121(d) of CERCLA requires that on-site remedial actions attain or waive Federal environmental Applicable or Relevant and Appropriate Requirements (ARARs), or more stringent State environmental ARARs, upon completion of the remedial action. ARARs are identified on a site-by-site basis for all on-site response actions where CERCLA authority is the basis for cleanup (USEPA, 2007a).

[3] The Record of Decision (ROD) is a public document that explains which cleanup alternatives will be used to clean up a Superfund site (USEPA, 2007b).

"Principal threat wastes" are those source materials considered to be highly toxic or highly mobile that generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Conversely, "low-level threat wastes" are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. While USEPA expects to use treatment to address the principal threat wastes, containment may be used when treatment is not feasible. USEPA expects ICs to be used when long-term waste management is associated with the remedy (USEPA, 1997).

In general, site cleanup programs can be categorized into three groups: 1) voluntary cleanup programs (VCPs); 2) Brownfield programs; and 3) enforcement programs. The VCPs allow property owners to voluntarily contact and cooperate with the responsible regulatory agency to clean up their sites. Site cleanup is conducted in a more flexible manner and usually results in an increase in property value. Brownfield programs encourage cleanup of unused sites in urban areas that can indirectly reduce expansion of development projects into suburban areas. As for the enforcement programs, a regulatory agency enforces applicable laws and regulations to respond to immediate environmental concern at a contaminated site. The enforcement may, for example, be triggered by a complaint received from an impacted community residing in the vicinity of a contaminated site.

Generally, regulators use VCPs to address smaller sites with lower levels of contamination (Broetzman, 1997). At least 47 states have established VCPs. Some states name the program in different ways (e.g., Voluntary Action Program [VAP] in Ohio). Thousands of sites have been successfully remediated under the programs (Broetzman,

1997). Sites entering VCP generally have to meet state requirements by selecting one of the following alternative cleanup approaches: 1) cleanup to the natural level of contaminants of concern; 2) cleanup up to a level appropriate for a containment method; and 3) cleanup to a level necessary to control risks particular for a site (GAO, 1997). The containment method entails remaining contaminants on-site while using ICs to control associated risks of the remaining contamination. Remaining contamination would be degraded by natural processes. The containment method is used to save cleanup costs and time. Cleanup managers in three states (IL, MN, and NJ) stated that the containment method was used in more than half of VCP sites (GAO, 1998).

2.3 Risk-Based Remediation

As discussed earlier, the use of ICs is a mean for controlling risk of exposure to contaminants remaining on-site through use restrictions. The following paragraphs discuss the fundamentals of risk-based remediation to clarify the role of ICs in site remediation.

Risk is defined as "*the probability of a specific hazard occurrence*"; and the hazard is "*a potential threat to humans and their welfare*" (Smith, 1996). Risk-based remediation usually entails a remedy that allows contamination to remain on-site. Remaining contamination may pose a risk to human health and the environment. Risk is determined based on the level of toxicity of the contamination present on-site as well as the degree of exposure to workers, site operators, and future users. Different types of use incur different levels of risk. For example, site cleanup for industrial and commercial uses can be allowed higher levels of residual contamination because the exposure period

of the users is expected to be shorter than that of users of residential sites (Washburn and Edelmann, 1998). Because risk cannot be eliminated, the only option is to manage it (Smith, 1996).

Risk assessment is *"the method used to determine the magnitude and probability of actual or potential harm that a hazardous situation poses to human health and the environment"* (Asante-Duah, 2002). Risk assessment was formally introduced as a part of the remedy to address environmental contamination with the enactment of CERCLA in 1980. There are two primary types of risk assessment associated with environmental contamination: 1) human health risk assessment and 2) ecological risk assessment or environmental risk assessment. Under CERCLA, USEPA is authorized to require a human health risk assessment and an environmental risk assessment be conducted at Superfund sites as part of the remedial investigation. Risk assessments were designed to ensure that remedial approaches selected at the sites were adequate to protect human health and the environment.

Site characterization is "*the method used by cleanup programs to establish the nature and extent of contamination and subsequently any risks potentially posed by contamination at a site*" (ITRC, 2008). During site characterization, field data are collected and analyzed to determine the nature and extent of threats to human health and the environment. Therefore, site characterization activities are ideally designed to support risk assessment that eventually provides information used in decision making for risk management.

Risk management refers to *"the approaches to reduce threats to human health and the environment posed by known hazards"* (Smith, 1996). People may accept

unmanageable risks and maximize any benefits associated with it. Risk management, especially in term of Brownfield redevelopment, should consist of well-balanced economic, legal, and technological tasks (Smith, 1996). ICs are the tools used to manage the risks associated with remaining contamination. ICs are used to ensure that the site will not be used in a manner contrary to the basic assumptions on which the risk assessment was made. Cleanup approach entailing risk assessment and risk management provides a scientifically defensible method for establishing cleanup goals that are economically sound and still protective to human health and the environment (Griffin et al., 2003).

Excerpted from Environmental Hazards: Assessing Risk and Reducing Disaster (Smith, 1996), *"There are great difficulties in deciding what an acceptable level of risk is, who benefits from risk management, who pays and what constitutes success or failure"*. Implementing risk-based remediation has to be carefully considered. Environmental and safety benefits may be compromised for short-term economic savings, but these savings may be insufficient to fund activities associated with long-term monitoring of the remaining contamination. Thus, any remediation plan should ensure that the selected remedy does not pose an unacceptable level of long-term risks to human health and the environment.

Risk-based remediation, so-called Risk-Based Corrective Action (RBCA), is used by several entities to remediate their sites (Ehlers, 1999; Swickard, 2008). For example, Consolidated Edison Company of New York (Con Edison) has entered into a voluntary cleanup agreement with the New York State Department of Environmental Conservation (NYSDEC) to investigate and complete remediation at 50 former manufactured gas

plants (MGPs) in the New York City metropolitan area. A fast-track cleanup approach has been used at many of these sites due to three major challenges: negotiating and achieving NYSDEC-approved cleanup objectives, aggressive redevelopment schedules, and supporting intended future uses. The cleanup approach generally consists of source removal, containment or extended recovery of contaminant, and use of ICs to manage risks associated with residual contamination (Miller, 2006).

A similar cleanup approach that incorporates implementation of ICs was also used by USEPA to address contamination at the Industri-plex site in Woburn, Massachusetts. The site is the fifth-most contaminated site in the US. The remedy relied on ICs such as deed restriction, restrictive covenant, and easement to restrict land use. USEPA also issued a Covenant Not to Sue (CNS) to minimize risk and liability for the developer. The site is now successfully redeveloped and includes a 900,000 ft^2 high-end office park and hotel campus, a 200,000 ft^2 retail center, and a regional public transportation hub (Brooks, 2006).

Though not totally similar to the approach used in the US, a risk-based remediation is also used in the United Kingdom (UK). The UK Environmental Protection Act of 1990, Part IIA – Contaminated Land (amended in 1995) established remediation standards based on the "suitable for use" approach that uses risk management to address contamination on a site by site basis (Luo et al., 2009). However, a review of the regulations in the European Union does not indicate the use of tools, which are similar to ICs in the US (Thornton, 2007; OPSI, 2009). Cushman (2001) stated that the use of risk assessment in site remediation in Canada remains well behind the US although it has gained more acceptances lately. To promote the use of risk assessment in

site remediation in Canada, more training of stakeholders, public awareness enhancement, and adaptation of risk assessment methodologies being applied in the US should be included in Canada's regulations (Cushman, 2001).

2.4 Institutional Controls for Brownfield Redevelopment

Besides the application of ICs for Brownfield redevelopment, ICs are also used in three other general contexts: 1) to limit land uses in order to protect particular values of land (e.g., aquifer protection programs); 2) to limit land uses because of risks from natural hazards (e.g., land development in floodplains); and 3) to limit land uses because of risks from human-created hazards (e.g., former nuclear waste disposal sites) (ELI, 1995).

Ones of the most common types of ICs generally recognized by the public are an easement and a covenant. An easement is "*a non-possessory interest to use real property in possession of another person for a stated purpose. An easement is considered as a property right in itself at common law and is still treated as a type of property in most jurisdictions. In some jurisdictions, another term for easement is equitable servitude, although easements do not have their origin in equity*". The concept of easement has been around since almost from the time the concept of private property was created. A right is not granted to the easement holder to possess the property. The easement provides the holder a personal privilege to use the land owned by others for a limited purpose. For example, an easement may be attached to a property to allow a utility company to access its utility lines buried within the property boundary (ELI, 1995).

In an environmental context, a conservation easement[4] restricts the property owner to uses that are compatible with conservation of environmental values. A conservation easement acquisition is usually a voluntary, incentive-based approach that relies on continued private ownership and management of land used to meet conservation goals. Approximately, 1.8 million acres of agricultural land in the US have been preserved through agricultural conservation easements (ACEs). The mechanism behind it is called purchase of development rights (PDR). With this mechanism, the ACE is placed on the deed to the property that permanently restricts the amount and type of development that can occur on the property (Stoms at el., 2009).

A covenant is a one-way agreement, which may have some terms that bind the covenanter or property owner to some specific conditions. For example, a restrictive covenant or deed restriction may be used by developers or government entities to determine future land use of a property. A restrictive covenant has often been included in the deed sometimes before zoning laws were in place. Both conservation easements and restrictive covenants are usually governed by state property laws, and thus vary from state to state (ELI, 1995).

Based on a review of federal and state legislation pertaining to site remediation and Brownfield redevelopment (e.g., CERCLA, NJ Brownfields Act, MA Brownfields Act), it appears that the basic concepts of easement and covenant were adopted by the legislation. The following sections describe the use of ICs in the context of site

[4] The conservation easement is defined by the Uniform Conservation Easement Act of 1982 as "*non-possessory interest of a holder in real property imposing limitations or affirmative obligations the purposes of which include retaining or protecting natural, scenic, or open-space values of real property, assuring its availability for agricultural, forest, recreational, or open-space use, protecting natural resources, maintaining or enhancing air or water quality, or preserving the historical, architectural, archaeological, or cultural aspects of real property*".

remediation and Brownfield redevelopment. Key components, restrictions, and requirements associated with implementation of ICs are also discussed.

2.4.1 Institutional Controls in Federal Cleanup Programs

ICs are among the remedial tools allowed under CERCLA. Under CERCLA, USEPA is authorized to acquire real property interests (e.g., easements) needed to conduct a remedial action provided that the state in which the interest is to be acquired is willing to accept the transfer of the interest following remedial action. Transfers of contaminated federal property are subject to special deed requirements under CERCLA sections 120(h)(3)(A)(iii) and 120(h)(3)(C)(ii)(I) and (II). USEPA can enforce the implementation of ICs, but may not serve as responsible agent to carry out designed long-term monitoring and maintenance (USEPA, 2000). The USEPA recognizes four types of ICs including (USEPA, 2004b):

- **Governmental Controls:** Controls using the regulatory authority to impose restrictions on property under its jurisdiction (e.g., a local jurisdiction may zone a site to disallow uses that are incompatible with the remedy. Examples of this type of ICs are zoning, local permits, groundwater use restrictions, etc.
- **Proprietary Controls:** Tools based on private property law used to restrict or affect the use of property. Examples of this type of ICs are easements and covenants.
- **Enforcement Tools:** Enforcement authority is used to prohibit a party from using land in certain ways or to require a party to put in place some other form of controls. This tool is enforceable by USEPA under CERCLA and RCRA or by a state. Examples of this type of ICs are administrative orders and consent decrees.

- **Informational Devices:** Tools which rely on property record systems such as deed notices to provide public information about risks from contamination. USEPA noted that this type of IC is not legally enforceable. It is easy to implement however, it has very little effect on a property owner's legal rights regarding the future use of the property. Also, if it is not well written, the device may even discourage use of the land.

2.4.2 Institutional Controls in State Cleanup Programs – New Jersey

NJDEP regulates site cleanup through the Technical Requirements for Site Remediation, N.J.A.C. 7:26E (Tech Reqs) and the Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B (NJ Brownfields Act). The NJ Brownfields Act defines ICs as "*a mechanism used to limit human activities at or near a contaminated site, or to ensure the effectiveness of the remedial action over time, when contaminants remain at a contaminated site at levels or concentrations above the applicable remediation standard that would allow unrestricted use of that property. Institutional controls may include, without limitation, structure, land, and natural resource use restrictions, well restriction areas, and deed notices*" (NJDEP, 1998a). Per the Technical Requirements for Site Remediation (Tech Reqs), N.J.A.C. 7:26E, ICs may be used when "Limited Restricted Use Remedial Action[5]" or "Restricted Use Remedial Action[6]" is used as a remedy at a site (NJDEP, 2008a).

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[5] "Limited Restricted Use Remedial Action" means remedial action for soil that requires the continued use of ICs but does not require the use of ECs in order to meet the established health risk or environmental standards (NJDEP, 2008a).

[6] "Restricted Use Remedial Action" means any remedial action for soil that requires the continued use of ICs and ECs in order to meet the established health risk or environmental standards (NJDEP, 2008a).

NJDEP employs two major types of ICs: 1) Deed Notice (DN) is the IC for soil contamination; and 2) Classification Exception Area (CEA) is the IC for groundwater contamination. The agency oversees site cleanups through its Site Remediation Program (SRP). The SRP has used DN on a case-by-case basis since at least 1991. The New Jersey Site Remediation Act (NJSA) legislation in 1993 required the use of DNs as part of certain remedial actions (NJDEP, 1998b). As defined by the Tech Reqs, DN means "*a document which is identical in wording to N.J.A.C. 7:26E, Appendix D and which provides notice of the following for a specific real property* (NJDEP, 2008a)*:*

1. *That the contamination on the real property exists at a level above the applicable unrestricted use soil remediation standards;*
2. *The restrictions to the applicable property due to contamination; and*
3. *The engineering controls applicable to the property."*

Although regulated under the Tech Reqs, CEA was established as part of the New Jersey Groundwater Quality Standards (GWQS, N.J.A.C. 7:9-6) (NJDEP, 2008b). Per the agency's guidance on CEA, a CEA is established in order to provide notice that the constituent standards for a given aquifer classification are not or will not be met in a localized area due to natural water quality or anthropogenic influences, and that designated aquifer uses are suspended in the affected area for the term of the CEA (NJDEP, 1998c). In general, the CEA has similar requirements as the DN. However, the key difference between these ICs is that, due to the nature of contaminants in soil, DNs are usually considered to be permanent with no specific expiration date. Occasionally, DNs can be lifted if the contamination is removed. The CEA, on the other hand, has a

specific expiration date, so it is expected to be removed someday; although it can be extended in some circumstances.

To ensure the effectiveness of ICs, NJDEP requires responsible parties[7] of a site to submit certification every two years indicating that the ICs and its associated ECs are still in place and functional as designed. This certification is called "Biennial Certification". The responsible parties shall submit the Biennial Certification until they receive notice from NJDEP authorizing removal of the ICs. Additionally, NJ Brownfields Act (N.J.S.A. 58:10B-13(g)) also requires NJDEP to inspect remediated sites, with ICs implemented, every five years (hereinafter referred to as "5-yr Inspection"). During the intervening period, the responsible parties are required to develop a detailed log of how ICs are maintained and evaluated. There are no specific requirements about the frequency and detail of the self-monitoring for the detailed log report. The detailed log must be available at the site for the NJDEP inspector during the 5-yr Inspection (NJDEP, 1998a).

The NJ Brownfields Act states that whenever a "No Further Action (NFA) letter[8]" is issued after remediation is complete, NJDEP shall also issue a "Covenant Not to Sue" to the person performing the remediation (NJDEP, 1998a). Though the NFA letter is

[7] Under the N.J.S.A., there are three groups of persons who may have the responsibility to maintain any ICs and/or ECs that are part of the remedy at a contaminated site: 1) the person responsible for conducting the remediation; 2) a person in any way responsible for the hazardous substances causing the contamination; and 3) subsequent owners and operators of the site.

[8] A no further action letter means "a written determination by the department that, based upon an evaluation of the historical use of the industrial establishment and the property, or of an area of concern or areas of concern, as applicable, and any other investigation or action the department deems necessary, there are no discharged hazardous substances or hazardous wastes present at the site of the industrial establishment, at the area of concern or areas of concern, or at any other site to which discharged hazardous substances or hazardous wastes originating at the industrial establishment have migrated, and that any discharged hazardous substances or hazardous wastes present at the industrial establishment or that have migrated from the site have been remediated in accordance with applicable remediation regulations" (NJDEP, 2008a).

granted for the site, a Restricted Use Remedial Action or Limited Restricted Use Remedial Action may be used at a site where contamination remains. The legislation, therefore, indicates that the Covenant Not to Sue (CNS)[9] may be revoked if a responsible party does not comply with any limitations or requirements associated with the ICs implemented at the site.

Based on a review of NJ Brownfields Act and related regulations (e.g., Tech Reqs), the legislation does not indicate why DN and CEA are chosen over other approaches. It appears that DN and CEA were developed based on more traditional types of ICs (e.g., easement and covenant) as discussed in the earlier section. DN and CEA not only intend to inform the public about the contamination, but they also require the property owner and responsible parties to give up some right to NJDEP to restrict the types of land use and groundwater use, respectively. Examples of DN and CEA are presented as Appendix A and Appendix B, respectively.

2.4.3 Institutional Controls in State Cleanup Programs – Massachusetts

MADEP uses the Activity and Use Limitation (AUL) as its main IC for site remediation. By definition, an AUL is "*a legal document that identifies site conditions that are the basis for maintaining a condition of No Significant Risk at a property where contamination remains after a cleanup*". Per the Massachusetts Contingency Plan (MCP) (310 CMR 40.0000), an AUL can be used at a site to achieve a level of No Significant Risk of harm to health safety, public welfare, and the environment. MCP provides a risk

[9] A Covenant Not To Sue (CNS) (NJSA 58:10B-13.1) accompanies all letters of No Further Action (NFA). The CNS is a finality document; it is NJDEP's own commitment that it will not institute civil actions to require more clean up or funds for cleanups against those who conducted the remediation that resulted in the NFA or against and subsequent owners, lessees, or operators who come onto the site after the NFA/CNS is issued (NJDEP, 2008a).

characterization process to determine whether an AUL is needed to eliminate future potential exposure pathways. An AUL is also required to alert future owners or interested parties that certain uses may not be appropriate for the property given the level of cleanup achieved. An AUL is necessary to ensure that the site presents No Significant Risk[10] over time (MADEP, 2007b).

The MCP and the Massachusetts General Laws (MGL) Chapter 21E authorize MADEP to acquire interests in or to restrict use of real property (through the use of AUL) as a tool to ensure that oil and hazardous materials are cleaned up adequately. The MA Brownfields Act directs MADEP to ensure that AULs are prepared and recorded in the same manner and with the same professional standards as other similar real estate instruments. The major purposes of an AUL are (MADEP, 1999):

- To provide a notice of the presence and location of contamination;
- To identify permitted uses, which may be allowed to occur in the future, consistent with maintaining a condition of No Significant Risk, and;
- To notify property owners' obligations (e.g., maintenance of caps, fences, etc. and monitoring of the area subject to the AUL) which ensure that the objectives of the AUL continue to be met.

AUL is somewhat flexible. When new uses and activities not consistent with the uses permitted by the AUL are planned, MCP requires an evaluation by a LSP before the uses and activities can take place. After completion of the evaluation, the AUL can be amended for the new use. When a remedy is considered to be complete, a LSP submits a Response Action Outcome (RAO) Statement to the MADEP for approval. The RAO

[10] No Significant Risk means a level of control of each identified substance of concern at a site or in the surrounding environment such that no such substance of concern shall present a significant risk of harm to health, safety, public welfare or the environment during any foreseeable period of time (MADEP, 1999).

Statement is an LSP's opinion on classification applied to a remediated site where there is No Significant Risk.

It should be noted that the AUL is primarily used for sites with soil contamination. Occasionally, an AUL is only required for groundwater and may be applied to restrict the ongoing use of an existing private well for use as a drinking water supply where the groundwater standards will not be met. The rationales behind this policy decision are explained in the Guidance in Implementing AULs (MADEP, 1999). First, because groundwater contamination migrates over time, providing an accurate description of the affected area as part of an AUL is difficult. Second, because groundwater migration may extend beyond the legal boundaries of a property, AULs for groundwater can entail obtaining agreement from owners of neighboring properties to restrict exposure to contamination. Implementing an AUL in this case may be impractical because it is unlikely that parties engaging in a remedy could easily obtain such agreement. Finally, in the case of ensuring that new private wells are not installed in and are not drawing upon contaminated groundwater, local Boards of Health have the authority to ensure that such supplies are potable. Therefore, MCP does not need to provide a separate regulatory check on potential exposure to groundwater contamination via new private water supply wells. An example of an AUL is presented as Appendix C.

2.5 Improvement of IC Implementation for Brownfield Redevelopment

Effectiveness of ICs at a site depends on several factors including level of experience of the cleanup party, type of party affected by the ICs, type of enforcement mechanism,

enforcement authority, type of future use, and level of cooperation among stakeholders (USEPA, 2000).

ELI (2005) reported that, in order to make ICs most effective, the controls need to be actively monitored and maintained. The required monitoring and maintenance activities would incur some significant costs to accomplish, but these costs rarely have been included in the budgets set for the remediation. Lacking sufficient funds to support monitoring and maintenance activities would likely result in failure of ICs over the long-run (Pendergrass and Probst, 2005).

To improve implementation effectiveness of ICs, USEPA issued a guidance document for identifying, evaluating, and selecting ICs in 2000. The guidance document stated that the use of ICs would be required if a site cannot provide unrestricted use; however, the guidance document does not specify "what" type of ICs and "when" implementation of ICs are necessary. Instead, the guidance uses vague language like "generally required" and "likely appropriate" (GAO, 2005). The guidance document states that ICs should consist of four major components including: 1) objectives of ICs; 2) mechanisms of ICs; 3) timing or duration of IC implementation; and 4) designation of the responsible party for monitoring and enforcing the ICs (USEPA, 2000). The GAO (2005) found that the remedy decision documents for sites with ICs implemented usually have no more than two of the four components identified in the guidance document (GAO, 2005). Based on a total of 93 remedy decision documents reviewed, more than 80% of the documents clearly identify objectives and mechanisms of ICs, but less than half of them discuss timing issues (e.g., duration of implementation) and the responsible parties for monitoring and enforcement. GAO (2005) also noted that, for some sites,

USEPA site managers believed ICs were being implemented, but document review revealed ICs had never been implemented at those sites (GAO, 2005).

The USEPA responded to the GAO (2005) report that, although the consideration of all key components should be done at remedy selection, all of the key components do not need to be included in the remedy decision document as recommended in the guidance document. This flexibility in developing a remedy decision document was an USEPA policy decision designed to allow the agency to present an "enforcement neutral" remedy description. Also, it is sometimes not clear whether a remedy will be led by USEPA or by other authorities (e.g., state regulatory agencies). Different leads have significantly different enforcement and monitoring responsibilities. Therefore, the remedy decision document should be somewhat flexible (GAO, 2005).

The mechanism to ensure long-term protectiveness of ICs may have some gaps in its requirements. One of requirements designed by USEPA is the "5-yr Review[11]" (USEPA, 2008a). An official at USEPA stated that the review, which occurs every five years, may not be frequent enough to ensure the protectiveness of the controls (GAO, 2005). At some sites, the 5-yr Reviews revealed failure of the controls meaning that the violations (and presumably increased risks) had occurred during the 5-yr gap. With more frequent monitoring and review, the violations could have been avoided before they actually happened. Some site managers may not check whether ICs are in place during the 5-yr Review. Some site managers do not even know if the continued presence of ICs

[11] Five-Year Reviews generally are required by CERCLA or program policy when hazardous substances remain on site above levels which permit unrestricted use and unlimited exposure. Five-year reviews provide an opportunity to evaluate the implementation and performance of a remedy to determine whether it remains protective of human health and the environment. Generally, reviews are performed five years following the initiation of a CERCLA response action, and are repeated every succeeding five years so long as future uses remain restricted. Five-year reviews can be performed by EPA or the lead agency for a site, but EPA retains responsibility for determining the protectiveness of the remedy (USEPA, 2008a).

is included in the 5-yr Review checklist (GAO, 2005). USEPA simply responded to GAO regarding these potential failures of IC implementation that the majority of the sites not only have ICs, but also have ECs. Therefore, negative conclusions about the protectiveness of the sites should not be drawn based solely on the absence of ICs (GAO, 2005).

The GAO listed its recommendations in 2006 for the USEPA to improve the effectiveness of ICs as follows (GAO, 2006):

- Ensure that adequate consideration is given in the selection of ICs to be implemented;
- Implement a mandatory financial assurance system for businesses/developers handling hazardous substances;
- Enhance USEPA oversight and enforcement capability;
- Ensure that the frequency and scope of monitoring is proper to maintain IC effectiveness;
- Ensure that the information put in the Institutional Controls Tracking System (ICTS) accurately reflects actual conditions of the sites.

The USEPA established another guidance document entitled "The Strategy to Ensure IC Implementation at Superfund Sites" in 2004 (USEPA, 2004b). The guidance document was designed to serve as a roadmap for USEPA case managers in preparing action plans and tasks to ensure proper implementation of ICs at Superfund sites. The tasks include gathering and inputting information into the ICTS, evaluating the data, conducting follow-up activities for the selected sites, building capability to manage and review IC-related information, and coordinating with other stakeholders. With regard to

enforceability of ICs, ICs are generally established by environmental regulatory agencies. Because many states have no specific laws concerning the enforcement of ICs, the controls sometimes fail because related requirements cannot be properly implemented by the responsible parties in the states. To help mitigate this issue, the Uniform Environmental Covenants Act (UECA) was established to standardize enforceability of ICs throughout the states. The law was drafted in 2003 by the National Conference of Commissioners on Uniform State Laws, with the participation of state and federal regulators, land owners, investors, financial institutes, environmentalists and other related experts (Uniform Laws Conference Drafting Committee, 2009).

UECA creates a specific type of use restriction (i.e., environmental covenant) and authorizes regulatory agencies (e.g., state environmental agencies or local governments) to enforce the restrictions (Pendergrass and Probst, 2005). UECA is expected to remove legal impediments to the use of ICs and to lessen concerns of developers of the Brownfield sites. UECA provides the legal infrastructure needed for creating, modifying, and recording environmental covenants. It is expected that stakeholders in Brownfield redevelopment and site cleanup should be in favor of the law because of several benefits it provides. Some of the key benefits of the act are as follows (Miller, 2006):

- UECA will help ensure reliability and enforceability of the land use controls;
- UECA does not set up a new set of cleanup standards; instead, it entails the use of standards determined by existing state or federal laws.
- UECA encourages voluntary agreement with existing property owners to agree to long-term use controls on their properties. Subsequent purchasers of the

properties would buy the properties with actual knowledge regarding the use restrictions.

- UECA protects environmental covenants from being inadvertently extinguished by application of various common law doctrines, adverse possession, tax lien foreclosures, less-restrictive zoning changes, and marketable title statutes.

As of March 2009, UECA has been enacted in 24 states and districts including Alabama, Delaware, District of Columbia, Georgia, Hawaii, Idaho, Illinois, Iowa, Kentucky, Maine, Maryland, Minnesota, Mississippi, Missouri, Nebraska, Nevada, Ohio, Oklahoma, Pennsylvania, South Dakota, Utah, U.S. Virgin Islands, Washington, and West Virginia (Uniform Laws Conference Drafting Committee, 2009).

There are some initiatives created to improve information management systems for implementation of ICs. Mapping sites with ICs and ECs implemented using publicly available online applications (e.g., Google Earth) has become a promising supplemental tool to help get public and related stakeholders informed (Wenzlau, 2007). A company called Terradex provides commercial services to integrate electronic data and information and provide maps online. Terradex offers monitoring and alerting solutions for responsible parties, land owners, and government sectors to help ensure that ICs and ECs are properly maintained at the designated sites (Terradex, 2008).

Terradex stores a copy of the site's deed restriction in Adobe® PDF format. The company also collects and updates land use data, which include real estate transactions, building permitting, excavation notices, well permits, and sensitive occupancy permits. In the event that there is an indicator of activity at or near the boundary of a site with ICs implemented, Terradex will evaluate the activity found in relation to the site's

restrictions. If a potential conflict is found, Terradex will initiate an alert mechanism in advance. The alert will be sent to designated contacts (e.g., environmental professional or responsible party) via email. Customized reports can also be provided to parties requesting proof of monitoring and maintenance activities (Terradex, 2008). Not only could this tool be a promising solution for the IC tracking issue, but it also shows that the private sector sees some business opportunities for ensuring effectiveness of ICs and ECs. This kind of initiative would draw more attention from stakeholders to the implementation effectiveness of the ICs and ECs and definitely be a win-win solution for stakeholders involved in this issue.

Some state environmental agencies also have established similar efforts to improve effectiveness of ICs implemented at sites under their jurisdiction. NJDEP created a database called "Data Miner". This database allows the public to obtain reports containing a list of sites with DNs and/or CEAs implemented (NJDEP, 2007b). A GIS database, "i-Map", was also established in parallel with Data Miner to link geographic information about the sites with the data retrieved from the database (NJDEP, 2008c). Similarly, the California Department of Toxic Substances Control (CADTSC) has developed an institutional control database called "EnviroStor" that allows users to browse and search for sites by specific site characteristics (e.g., location, type of contaminants, etc.). The database links its information with Google Map and also offers reports available for public review including land use restrictions. The agency plans to link the database with a geographical information system by providing a data layer indicating where ICs are in place (USEPA, 2008b).

2.6 Institutional Controls for Nuclear Waste Sites

This section discusses application of ICs for nuclear waste sites. Due to extremely long lifespan and high hazard of nuclear waste, ICs designed for this application are probably the most stringent ICs to be adopted in the US. Some concerns regarding implementation effectiveness of ICs for this application have been documented in many studies. These concerns are similar to the concerns of IC implementation for Brownfield redevelopment.

The United States Department of Energy (USDOE) is responsible for cleanup of radioactive and chemical contamination from the production of nuclear weapons. Few USDOE waste sites will be cleaned up to the point where developers are allowed unrestricted use. USDOE employs Long-Term Stewardship (LTS), defined as *"activities to protect human health and the environment from hazards that may remain at sites after cessation of remediation"*, to manage remaining contamination on-site. LTS will be required for over 100 of the 144 USDOE sites. Use of ICs is usually required to accomplish a successful LTS (Probst and McGovern, 1998; Wells and Spitz, 2003).

The Environmental Law Institute (ELI) and the Energy Communities Alliance (ECA) examined how stakeholders, local governments, state environmental agencies, and real property professionals implement LTS. They used two USDOE facilities, Los Alamos National Laboratory, New Mexico, and Oak Ridge Reservation, Tennessee, as case studies. The study found that ICs used at the sites consist of internal permits for excavation and construction, internal databases of potential release sites, geographic information systems (GIS), site planning, state permitting, signs, zoning, and land use restrictions imposed in deeds. It was noted in the report that although properly recorded land use restrictions may satisfy legal requirements, they are not necessarily adequate to

provide actual notice of such restrictions to subsequent purchasers of the land. The study concludes that there is substantial need for improvement in the implementation of LTS at these two sites. Stakeholders involved in the LTS should improve their use of the existing tools and also create new tools to more effectively implement LTS at the sites (ELI, 2003).

Another example of using LTS at radioactive waste sites is the Hanford site in Washington. Similar to many other USDOE sites, regulators believe that it is more economical and friendly to the environment to utilize ICs rather than to pursue cleanup options. However, due to waste remaining in perpetuity near the land surface and the Columbia River, the Hanford site is believed to be one of the most complex in the US. Local communities and tribes expressed their concern on reliability of the ICs, funding and information management system associated with the cleanup program (Power, 2006; Poston et al., 2007).

In 2003, a NRC committee analyzed and evaluated long-term institutional management plans and practices at USDOE sites that have LTS implemented. Findings of the study were based on committee visits at three USDOE sites, review of relevant documents of other sites, and discussion with USDOE staff. Unfortunately, the committee found no evidence indicating that USDOE considered long-term effectiveness of LTS when establishing cleanup goals and approaches. USDOE appeared to have no practical measures to ensure protectiveness of the sites over the long-term. Additionally, the committee also indicated that LTS seemed to be an afterthought solution for the remediation (NRC, 2003a).

Long-term effectiveness of a remedy is a criterion in remedy selection under CERCLA, which is the legislation that frames decision making for USDOE site cleanup program. However, the committee found that environmental regulators agree to remediate USDOE sites with only minimal provisions for LTS assuming that ICs are self-enforcing. This finding raised some concern to the committee. They stated that simply complying with regulations is not enough because such action does not necessarily ensure protectiveness to human health and the environment over the long-term. Natural and social conditions (e.g., environmental awareness of communities) set forth in the regulations may not endure in the future and may eventually jeopardize effectiveness of ICs (NRC, 2003a).

The situation could be even more unpredictable for high-level waste sites that pose even greater risks over a longer period of time. The Waste Isolation Pilot Plant (WIPP) is the USDOE's first operational repository for radioactive waste located in Carlsbad, New Mexico. The USEPA is responsible for the regulatory oversight and certification of the WIPP as per the WIPP Land Withdrawal Act of 1992 (amended in 1996). In 1996, USDOE submitted the Compliance Certification Application (CCA) to the USEPA for the disposal facility to demonstrate its compliance status per the USEPA's radioactive waste disposal standards (Subparts B and C of 40 CFR Part 191). As part of the CCA, USDOE submitted assessment results of projected performance of the WIPP over the next 10,000 years in terms of radioactive release control and human safety protection. ICs are included as part of the six assurance requirements to comply with the USEPA's radioactive waste disposal standards. The six assurance requirements are: (1) use of active ICs for radioactive waste; (2) monitoring of performance after

disposal; (3) implementation of passive ICs for radioactive waste; (4) use of both engineered and natural barriers; (5) avoidance of areas exploited for natural resources; and (6) feasibility of waste retrieval for a reasonable period of time after disposal. The USEPA approved the CCA in 1998 (Rechard, 2000; Howard et al., 2000).

Active Institutional Controls (AICs) are defined in 40 CFR 191.12 as "*controlling access to a disposal site by any means other than passive institutional controls, performing maintenance operations or remedial actions at a site, controlling or cleaning up releases from a site, or monitoring parameters related to disposal system performance*" (USDOE, 2009). However, a review of the IC measures planned for the WIPP indicated that USDOE plans to mainly focus on the use of Passive Institutional Controls (PICs) to warn and inform future generations and civilizations about the location and purpose of the WIPP. PICs are defined as *"(1) Permanent markers placed at a disposal site, (2) public records and archives, (3) government ownership and regulations regarding land or resource use, and (4) other methods of preserving knowledge about the location design, and contents of a disposal system.*" (USDOE, 2007).

The federal government is in the process of establishing the nation's first permanent nuclear waste repository site. The Nuclear Waste Policy Act of 1982 (NWPA) amended in 1987 designated Yucca Mountain in Nevada as the repository site. The site was planned to be operational in 2017, which was postponed from its original proposed opening in 2010. The site is expected to be able to handle approximately 77,000 tons of nuclear waste (Eureka County, 2009). Unfortunately, after over 20 years and $9 billion spent in studies, the site may not even see its launch date.

The project is opposed by some critics including the residents of Nevada. The USDOE originally demonstrated that the site was safe for 10,000 years, yet the agency acknowledged that the peak radiation release would come after about 300,000 years. In 2004, the US Court of Appeals ruled that USDOE had to demonstrate that the waste could be stored safely for one million years (Wald, 2009). The big question is what kind of ICs or warnings would remain effective in that period of time that is much longer than human history (Erikson, 1994).

President Obama promised Nevada residents to halt the project during his election campaign in 2008 (Goode, 2009). In 2009, with support from Harry Reid, the senior Democratic Senator from Nevada serving as the US Senate Majority Leader, funding for the project was decreased. The budget was reduced to the level that would not allow sufficient dollars needed for construction and operation of the site.

Delay of site opening is probably not a bad decision. Sillen et al. (2001) analyzes scenarios of human intrusion into a deep disposal repository storing nuclear wastes from fusion reactions in Belgium. The study assumed that the fusion wastes are to be disposed of in a repository located in a boom clay layer. The study predicted that ICs would fail prior to human intrusion into the repository. The main intrusion scenario would be direct drilling of a borehole from the surface into the boom clay and would occur approximately 50 years after repository site closure. They noted that the radioactive level of the fusion wastes in the repository would remain above the background level for as long as 60,000 years.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter describes research methodology conducted to complete the two major components of the study including: 1) an assessment of oversight mechanisms for remediated sites with ICs implemented under state cleanup programs (Section 3.1) and 2) a survey with state regulators and LSPs (Section 3.2).

3.1 Study on NJDEP and MADEP Oversight Mechanisms

NJDEP and MADEP oversight mechanisms were first reviewed through peer-review literature and technical reports available from government agency databases (e.g., Interstate Technology and Regulatory Council [ITRC]). The NJ Brownfields Act and the MA Brownfields Act were reviewed to understand how legislatures expected ICs to perform in a remedy. These laws were reviewed in detail to understand the rationale behind the authorization of ICs to be used in site remediation and Brownfield redevelopment. A separate review was also conducted on CERCLA, the federal law authorizing cleanup of Brownfield sites.

State regulations (Tech Reqs of NJDEP and MCP of MADEP) were reviewed to identify the responsibilities of the states and responsible parties associated with IC implementation. Tech Reqs and MCP are the guidance documents listing responsibilities of the regulatory agency (NJDEP and MADEP) and responsible parties to ensure effectiveness of ICs. The responsibilities include, but not limited to, inspection by the agencies; self-inspection by responsible parties; frequency of inspection by the agencies

and self-inspection by responsible parties; reporting; and actions and penalties to be applied in the event that responsible parties fail to comply with the requirements.

Compliance data on 439 sites in Post-No Further Action (Post-NFA) phase were gathered from NJDEP records during an internship held by the author with the agency from July 2005 through March 2006. The internship was with the Bureau of Monitoring and Maintenance (BOMM), which is responsible for enforcing post-NFA sites that have DN implemented. Post-NFA sites are sites that have active remedial actions completed and receive the NFA letter from NJDEP. Post-NFA sites include sites that implement the limited restricted use remedial action and still rely on DN to control risks associated with remaining contamination. It should be noted that a DN may also be implemented at an active site, which has ongoing remedial action. Requirements regarding DN of these sites are not overseen by BOMM. However, the majority of sites with DNs are in post-NFA phase. For example, as of April 2009, there were 881 sites with DNs attached; 726 of these sites were in post-NFA phase (NJDEP, 2009c).

Compliance data of the 439 sites were selected because the responsible parties were required to submit at least one Biennial Certification before the end of 2004. This set of information was the most up-to-date information available during the internship period. The data were accessed through the agency's internal database, the New Jersey Environmental Management System (NJEMS). The database is designed to store information of sites overseen by NJDEP. The database stores compliance status and record enforcement activities of DN sites. The database was reviewed to understand the structure of the database and compliance percentage of remediated sites with ICs implemented.

Data fields related to compliance status of sites were extracted from NJEMS as presented in Appendix D. Extracted data fields include: 1) Site Name; 2) Municipality; 3) Brownfield Site Status; 4) DN Filed Date; 5) Biennial Certification Due Date; 6) Biennial Certification Filing Date; 7) 5-yr Inspection Date; 8) 5-yr Inspection Report Date; 9) Entire Site Restriction; 10) and EC Description.

It should be noted that IC-related requirements per the Tech Reqs are equally applied to all contaminated sites with a DN implemented regardless sites entering Brownfield program or not. Sites in the Brownfield program are referred to as "Brownfield sites" in NJEMS. Brownfield differ from other sites (e.g., VCP and Immediate Environmental Concern [IEC] sites) in that Brownfield sites usually receive some financial incentives from the Brownfield redevelopment programs, while others do not.

The internship also provided opportunity for direct discussion with NJDEP's case managers to learn their perspectives on IC-related issues. Informal interviews were conducted with key persons in BOMM. The interviewees were asked to reveal the actual performance of enforcement efforts that are not available to the public. Interviewees included:

- Mr. Robert Soboleski, the Bureau Chief of the Bureau of Operation, Monitoring and Maintenance (BOMM)
- Mr. Thomas O'Neill, Section Chief, BOMM
- Mr. Robert Hoch, Case Manager (responsible for collecting the biennial certifications for DN), BOMM

A second internship held by the author with the Louis Berger Group, one of the top 20 Design Firms (worldwide) (ENR, 2008), was carried from May 2006 through August 2007. The consulting company, based in Morristown, New Jersey, works closely with NJDEP to assist both private clients and government agencies (e.g., New Jersey Department of Property Management and Construction [DPMC] and New Jersey Department of Transportation [NJDOT]) to oversee remedies of several sites in New Jersey. Consultants play an important role in selection and recommendation of remedial alternatives. Through the internship, cooperation of remediation work between consultants and regulators (i.e., NJDEP and USEPA case managers) in site remediation process was explored.

3.2 Survey with State Regulators and LSPs

A survey was conducted to obtain opinions of state regulators and LSPs on some aspects related to implementation of ICs (e.g., importance of complying with IC-related requirements). Results of the study are used to compare with actual compliance record to assess for implementation effectiveness of ICs.

3.2.1 Study Population

NJDEP and MADEP were initially contacted for cooperation in administering the survey to environmental professionals in their site cleanup programs. As stated earlier, the agencies are widely recognized for the advanced level of their Brownfield redevelopment initiatives. Environmental professionals (e.g., engineers, geologists, scientists) including administrative-level staff of these agencies were selected as the study population. However, NJDEP was not able to participate in the survey due to their "limited

resources" as a result of reorganization and staff reduction. The survey was administered to MADEP environmental professionals and administrative-level staff in cooperation with Mr. Paul Locke, Director, Response & Remediation, Bureau of Waste Site Cleanup. Bureau of Waste Site Cleanup is responsible for overseeing site cleanups in the state. The bureau staff consists of approximately 100 environmental professionals.

MADEP uses LSPs to oversee site cleanup in Massachusetts. LSPs work closely with MADEP environmental professionals in assessing, characterizing, and cleaning up contaminated sites in Massachusetts. Their opinions on the effectiveness of ICs are considered relevant to the objectives of the study. LSPs perform key remedial functions including site assessment, investigation, and remediation. They also provide certification to the state that applicable remediation standards and requirements have been met at the site.

The Licensed Site Professional Association (LSPA) is the core organization for registered LSPs in Massachusetts. As of October 2008, when the survey was conducted, there were a total of 472 LSPs registered with the agency. The survey was administered to LSPs in cooperation with Mr. Wesley Stimpson, the director of the LSPA. Therefore, the study population consisted of approximately 570 environmental professionals from the two agencies.

A total of 80 respondents visited the web-based survey form. Two of the respondents declined to agree with the consent form, thus discontinuing their participation in the survey. Ten respondents did not respond to the question regarding agreement with the consent form, thus terminating their participation in completing the

survey. Therefore, the sample population accounts for approximately 12% of the study population (68 out of 572).

3.2.2 Questionnaire Design and Distribution

The survey is presented as Appendix E. The survey consists of three major sections with 20 questions in total. The first group of questions (Section A: Personal Work Experience and Background Information) is designed to explore level of experience and affiliated organization of the respondents. The second group of questions is designed to explore opinions of respondents on implementation effectiveness of ICs. This group of questions is designated as Section B: Long-term Effectiveness of ICs and ECs. The last group of questions (Section C: Respondent's Profile) was included to learn about characteristics (e.g., gender and educational background) of respondents.

A web-based survey tool (SurveyMonkey.com) was used to administer the survey. The survey was uploaded and formatted following guidelines provided by the website. Invitation emails were sent to the main contact persons of each organization as follows: 1) Mr. Paul Locke: Director, Response & Remediation, Bureau of Waste Site Cleanup, MADEP; and 2) Mr. Wesley Stimpson: Director, LSPA. Paul Locke and Wesley Stimpson then forwarded the emails to their internal email lists. The email lists contain email addresses of all MADEP environmental professionals and LSPs targeted as the study population.

3.2.3 Survey Pretest and Approval

Under a federal-wide assurance with the United States Department of Health and Human Services, all research involving human subjects performed by NJIT faculty, staff, and

students either on-campus or off-campus, including at other institutions, must be reviewed and approved by the NJIT Institutional Review Board (IRB) prior to survey initiation. The application and consent form for this research were submitted to the IRB for approval. The purpose of the consent form is to inform the survey participants about any risks and confidentiality associated with the survey. IRB granted the Notice of Approval in July 2008 (presented as Appendix F).

To ensure that the survey instrument is well-designed and can be clearly understood by the respondents, the instrument should be pre-tested with a small number of respondents with similar profiles to the targeted study population. The survey was pre-tested by five environmental professionals in New Jersey, who are representatives from NJDEP (to represent MADEP staff members) or consultants (to represent LSPs because the LSP program was not operational in New Jersey at the time the survey was administered in October 2008). The survey was revised based on comments received during the pretest.

3.2.4 Data Processing and Interpretation

Survey responses were automatically collected by the web-based survey tool. The raw survey results are presented as Appendix G. The survey results are presented in Section 4.3.

MADEP environmental professionals and LSPs may hold different opinions on the implementation and effectiveness of ICs. MADEP environmental professionals may have better access to the actual enforcement performance and percentage of sites in compliance status, while LSPs take the first hand in proposing ICs as part of selected remedy for Brownfield redevelopment. Comparison of responses from these two groups

of respondents would reveal a difference in the opinions of environmental professionals from two different sectors (i.e., government sector and private sector for MADEP environmental professionals and LSPs, respectively) that both have great impacts on selection and implementation of ICs.

Variation of the responses by levels of experience of respondents is another key attribute to be assessed in the survey. As per the requirements of the USEPA, NJDEP, and MADEP, the first regulatory audit would happen within the first five years after implementation of ICs (MADEP, 1998, USEPA, 2000, and NJDEP, 2008a). Any matters that may indicate level of effectiveness of ICs and the impacts of failed ICs could be detected during the site audit. Environmental professionals, who have worked in this field for more than five years, are expected to have more experience in these audits and may have different opinions on any related issues when compared to less experienced respondents.

The relationship between survey responses and attributes of respondents described above were analyzed using "Chi-square (λ^2) analysis". Chi-square analysis is a statistical tool used to compare if responses of two groups to a question are significantly different (Stephan and Berenson, 2008). Results of the survey and Chi-square analysis are discussed in Section 4.3.

CHAPTER 4

STUDY RESULTS

4.1 NJDEP and MADEP Oversight Mechanisms

4.1.1 NJDEP Oversight Mechanism

The general site remediation management process as detailed in the Tech Reqs is presented in Figure 4.1 (NJDEP 2008a).

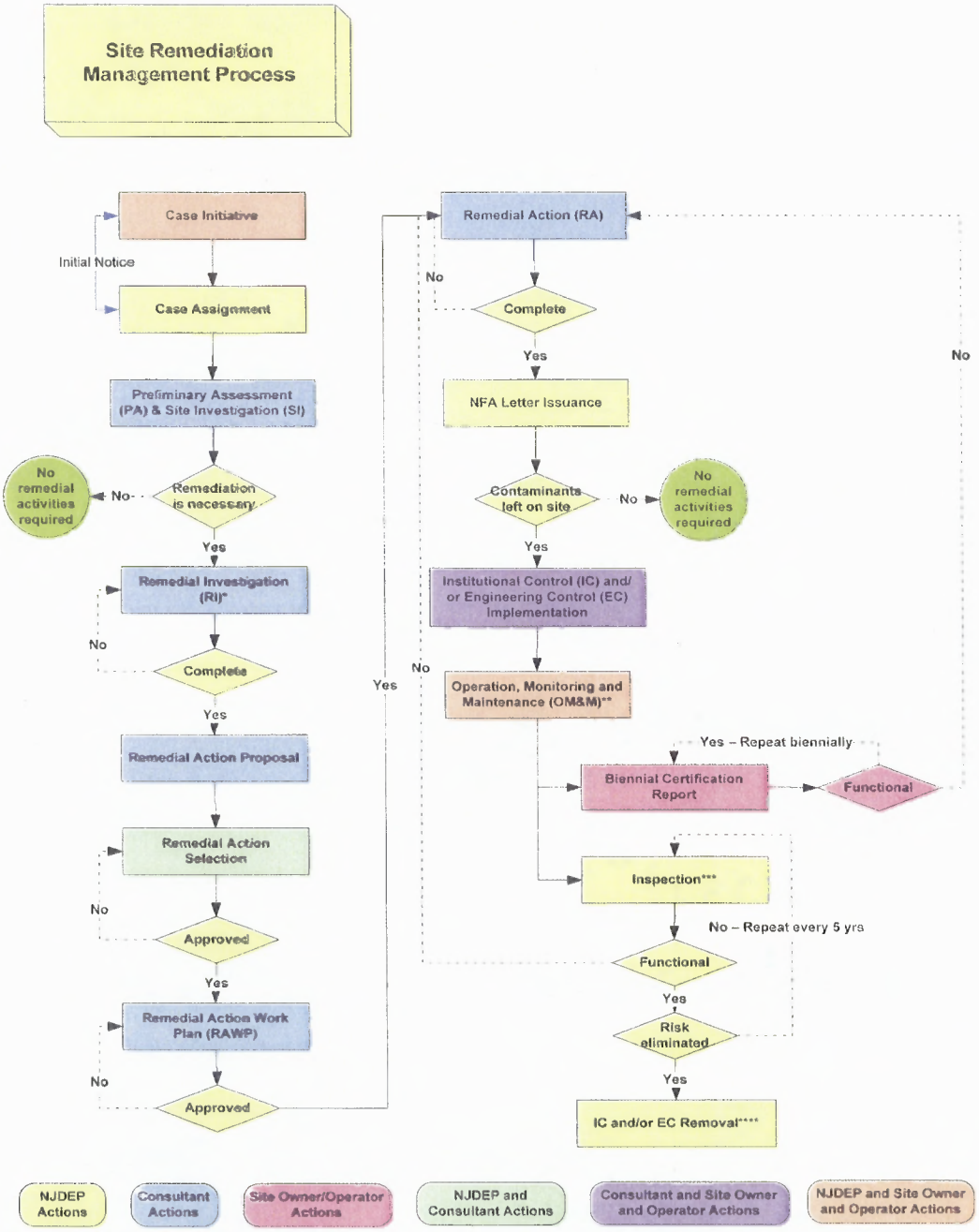

Figure 4.1 Site remediation management process at the NJDEP.

* For the Underground Storage Tank (UST) cases, Remedial Action Proposal will be submitted along with the RI report.

** An evaluation with regard to the "10X rule" will be required if the standard is changed.

*** The New Jersey Brownfield and Contaminated Site Remediation Act (NJ Brownfields Act), requires NJDEP to inspect remediated sites with ICs implemented at least once every five years (5-yr Inspection)

**** DN, ICs of soil contamination case, is considered to be permanent, only be lifted occasionally, while IC of groundwater contamination case has a fixed removal date; although it may be extended.

4.1.1.1 Case Initiative and Case Assignment. Site remediation cases are assigned by the Bureau of Risk Management, Initial Notice & Case Assignment (BRMINCA). Each case is assigned to the appropriate bureau depending on how the case is originally filed. This step is called the Initial Notice. For example, if industrial sites are about to be purchased, the cases will be tied to the Industrial Site Recovery Act (ISRA) and then transferred to the Bureau of Northern Case Management (BNCM). Cases that are initiated due to Underground Storage Tank (UST) issues will be taken care of by the Bureau of Southern Case Management (BSCM). Although the bureaus have geographic place titles, the cases are not assigned based on locations of Brownfield sites. According to Mark Pedersen, the Bureau Chief of the BRMINCA, assigning cases by geographic location is not cost-effective because contaminated sites are not equally distributed throughout the state.

If the cases are not bound to specific conditions as described above, they will be assigned to a bureau according to the remedial level and level of contamination (Table 4.1). Level of contamination is determined based on professional judgment of responsible NJDEP staff in the Bureau of Risk Management, Initial Notice & Case Assignment; there are no specific criteria to classify the level of contamination.

Table 4.1 Remedial Level of Site Remediation

Remedial Level of Site Remediation	Contamination Profile	Potential Remedial Action	Responsible Bureau/ Cleanup Program
Low	Low contamination level	Not specific	VCP
High	High contamination level	Emergency Action	IEC
A	Stabilization		
B	Single contamination affecting only soil	Single phase remedial action	Bureau of Northern Field Operations (BFO-N) and Bureau of Southern Field Operations (BFO-N)
C1	Source known or identified-potential groundwater contamination	No Formal Design	
C2	Known source or release with groundwater contamination	Formal design	
C3	Unknown or uncontrolled discharge to soil or groundwater	Multi-phased remedial action	Bureau of Case Management (BCM)
D	Multi source/release to multi-media including groundwater	Multi-phased remedial action	

4.1.1.2 Preliminary Assessment and Site Investigation. A preliminary assessment (PA) is the first step in the process to determine whether or not a site is actually contaminated. The purpose of the PA is to identify the presence of any potentially contaminated areas of concern. If any potential contaminated areas of concern (AOCs) are identified, then there is a need for a site investigation pursuant to N.J.A.C. 7:26E-3.3. If no potentially contaminated AOCs are identified, then no further remedial activities are required for the site.

Site Investigation (SI) will be conducted based on the information collected during the PA activities. The purpose of the SI is to determine if any contaminants are present at a site. If such contaminants are present at the site, then a remedy is required. Usually, consultants on behalf of responsible parties will submit PA and SI reports to NJDEP for approval before considering other actions.

4.1.1.3 Remedial Investigation. The purpose of a Remedial Investigation (RI) is to characterize the contaminants, identify site characteristics, determine potential extension of the contamination, and collect all data necessary to evaluate remedial action alternatives.

4.1.1.4 Remedial Action Selection. Generally, remedial alternatives are proposed by the consultant. NJDEP case managers will work cooperatively with the consultants to finalize the most appropriate remedial alternatives for the sites. A selected remedy is chosen to reduce or eliminate exposure to contaminants that are present above the applicable remediation standards. The applicable remediation standards are determined based on the current and future land use of a site.

4.1.1.5 Remedial Action. Remedial Action (RA) means actions taken at a contaminated site including contaminant removal, treatment measures, containment, transportation, securing, or ICs, designed to ensure that any discharged contaminant is remediated in compliance with applicable remediation standards. A Remedial Investigation Report (RIR) and a Remedial Action Workplan (RAWP) must be submitted to the department before remedial actions can take place.

Particularly for sites with ICs implemented, the RAWP is required to contain a plan for the maintenance and evaluation of all ICs. The responsible parties should also demonstrate in the RAWP that the controls selected will remain protective for human health and the environment for as long as the contamination exists above a concentration that would allow for the unrestricted use of the property.

4.1.1.6 Monitoring and Maintenance. In this phase, if ICs are implemented as part of the remedial action, the responsible parties monitor the controls until such time that the agency approves, in writing, for the removal of the controls. Monitoring requirements associated with IC implementation have been discussed in Section 2.4.2.

4.1.2 MADEP Oversight Mechanism

MADEP regulates site cleanup under the Massachusetts Contingency Plan (MCP). The MCP was established in 1993 to provide incentives for private parties to respond to contamination at Brownfield sites with new reporting, assessment, and contamination cleanup initiatives. The MCP authorized MADEP to initiate the LSP Program. MADEP implements the AUL as its major IC tool for sites with contamination remaining on-site.

4.1.2.1 LSP Program. The LSP Program is regulated by the Massachusetts Board of Registration of Hazardous Waste Site Cleanup Professionals. Professional licensure of consultants was the first of its kind in the US (LSPA, 2008). The role of the Licensed Site Professional (LSP) is to direct the assessment, characterization, and, to the extent necessary, the cleanup process in a manner consistent with the requirements of the MCP and other relevant regulations and laws. In doing this, the LSP renders professional opinions at specific phases of the process, often referred to as LSP Opinions. Under the MCP, LSPs are required to maintain a Response Action Performance Standard (RAPS). The RAPS is defined in the MCP as: *"...the level of diligence reasonably necessary to obtain the quantity and quality of information adequate to assess a site, to evaluate remedial action alternatives and to design and implement appropriate remedial action..."* (MADEP, 2007b).

Similar licensing programs have been adopted in California, Connecticut, North Carolina, Ohio, Tennessee, and Washington. By allowing LSPs to oversee and certify remediation at sites with lower risks and levels of contamination, state regulators can spend more time and attention on sites with higher levels of contamination (Frazier and Steinway, 1997). In Massachusetts, higher-risk sites are classified as Tier IA and require direct MADEP oversight and approval for all response actions. The lower-risk sites, Tier IB, Tier IC, and Tier II sites, can by managed by LSPs.

Johnson et al. (1997) stated that one of the benefits of the LSP Program is that it provides more realistic risk evaluation in the cleanup process. Real-estate developers can predict the cost of site cleanup more accurately without too much delay in the regulatory approval process. The flexibility and consistency in site cleanup provided by the LSP

Program opened up redevelopment opportunities on Brownfield sites. Remedies were completed at more than 3,000 hazardous-waste sites within the first few years after the LSP Program kicked off in 1993, compared to MADEP's ability to complete only about 50 sites per year (Johnson et al., 1997).

4.1.2.2 Activity and Use Limitation. MCP allows using "Activity and Use Limitation (AUL)" for sites remediated with contamination remaining on-site. The use of AUL is designed for sites with soil contamination. AUL is rarely used for groundwater contamination. The rationale behind this policy decision is described earlier in Section 2.3.3. The MCP requires AULs to be recorded at the Registry of Deeds or Land Registration Office. At the end of the cleanup, the responsible party will have to document "Response Action Outcomes (RAO)"; the document will let future owners/purchasers of the sites know what has been done and what type of solution (permanent/temporary) was reached (MADEP, 1999).

The MA Brownfields Act requires MADEP to audit remedial actions at 20% of all Brownfield sites each year. Although not specified in MA Brownfields Act, MADEP's goal is to conduct a random audit at AUL sites "within" two years after the RAO Statement is first filed or when there is evidence of a potential problem. The agency also inspects each AUL site every five years by focusing on highly-concerned sites. Sites failing to meet conditions set in the AUL are subject to a maximum penalty of $25,000 per violation per day (MADEP, 2007b). It is noticeable that MADEP uses more flexible language for the requirement on targeted audit timeframe allowing the agency to audit sites with AUL at any time (Soboleski and Potter, 2007).

The inspection results (as of 2007) indicate that more than 80% of the AUL sites are in compliance with AUL-related requirements. However, approximately 24% of re-inspected sites have violations identified. Most identified are related to: 1) failure to maintain an engineering cap or 2) excavation in AUL areas. The agency usually uses low level enforcement such as fine collection or warning for these violations (Munie et al., 2007).

4.2 Potential Gaps in Oversight Mechanism: An Analysis of NJDEP Oversight Mechanism

4.2.1 Work Force Size and Work Load

According to Mark Pedersen, the Bureau Chief of the BRMINCA, as of July 2005, there were approximately 8,000 cases managed by SRP. SRP had approximately 230 case managers. The case load has increased to 23,000 cases in 2009, but the number of case managers remains roughly the same. NJDEP now has backlog of over 20,000 cases Berkowitz and Abrams, 2009).

As of July 2005, there were 439 post-NFA sites with DNs. The number of post-NFA sites quickly increased to 575 in 2007 and 726 in 2009. The total number of sites with DNs (including both active sites and post-NFA sites) increased to 855 in 2008 and 881 in 2009 (Soboleski and Potter, 2007; NJDEP, 2009c).

According to Thomas O'Neill, Section Chief of the BOMM, as of 2005, all of the 439 post-NFA sites with DNs were under the care of only one case manager. This case manager was internally referred to as "Cap Cop" and was responsible for collecting the Biennial Certifications and conducting the 5-yr Reviews. BOMM recently assigned one

additional case manager to oversee the post-NFA sites. There are now two case managers overseeing over 700 post-NFA sites. One case manager is responsible for collecting the Biennial Certifications, while the other case manager is responsible for conducting the 5-yr Reviews. It should be noted that not all of the post-NFA sites are active in any given year. Based on data from 2009, there were approximately 360 sites due for filing of the Biennial Certification and approximately 145 sites due for the 5-yr Inspection.

4.2.2 Information Management System

NJEMS is the main database of NJDEP designed to store site-related information that is used to assist NJDEP's oversight. The information includes DN-related information for post-NFA sites under BOMM. Examples of NJEMS screens are presented as Figures 4.2 and 4.3. Based on the review of DN-related information on NJEMS of 439 sites (Appendix D), there were some data fields left unfilled as summarized below:

- DN filed dates are not identified for 16 sites (3.6%);
- Biennial Certification due dates are not identified for 82 sites (18.7%);
- 80 sites (18.2%) are not identified if the use restrictions are for the entire site or some portions of the sites;
- EC descriptions are not identified for 63 sites (14.4%).

The database also was not up-to-date. In 2005, there were 349 sites (79.5%) that lack of up-to-date information. Figure 4.2 presents an example of the deed notice screen for a post-NFA site. Compliance status of the site was reviewed in May 2005. However, the Biennial Certification due date of the site was still shown as February 1996; while the most current due date at the time should be in 2006. Moreover, the compliance status is

checked as "In compliance" when in fact the Biennial Certification due date indicates that the site was out of compliance. The default option of the database software is for the "In compliance" box to be checked unless modified by the case managers.

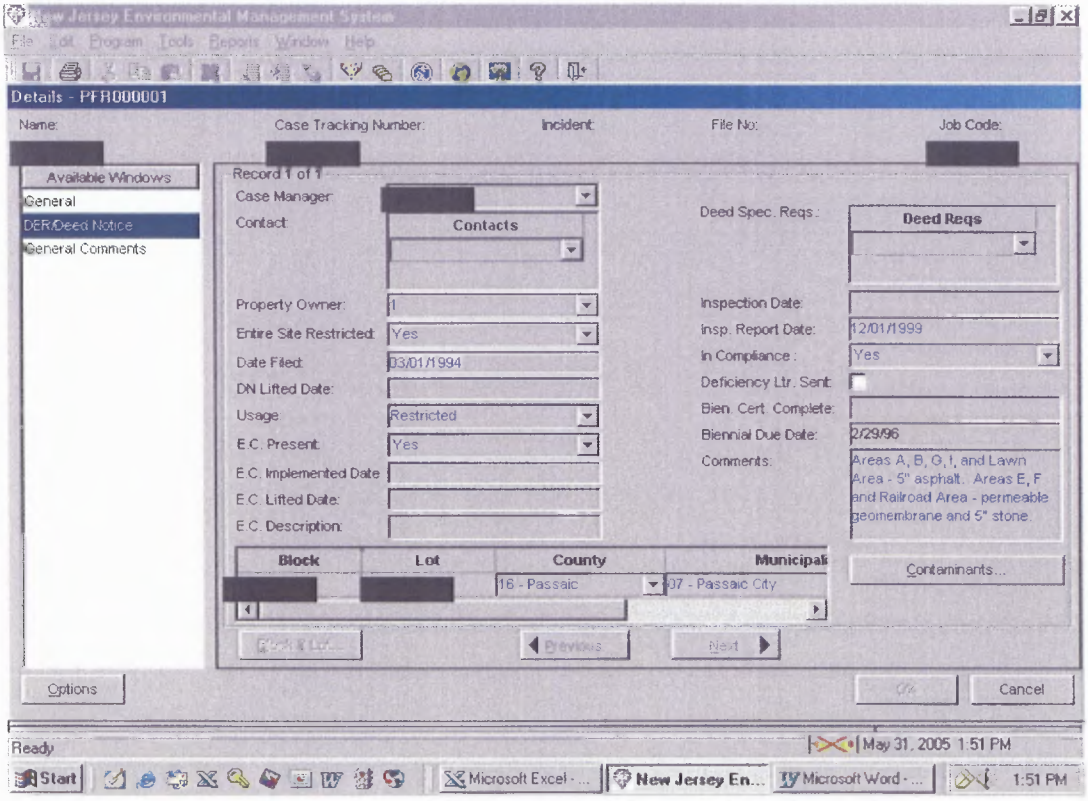

Figure 4.2 Deed Notice screen on NJEMS.

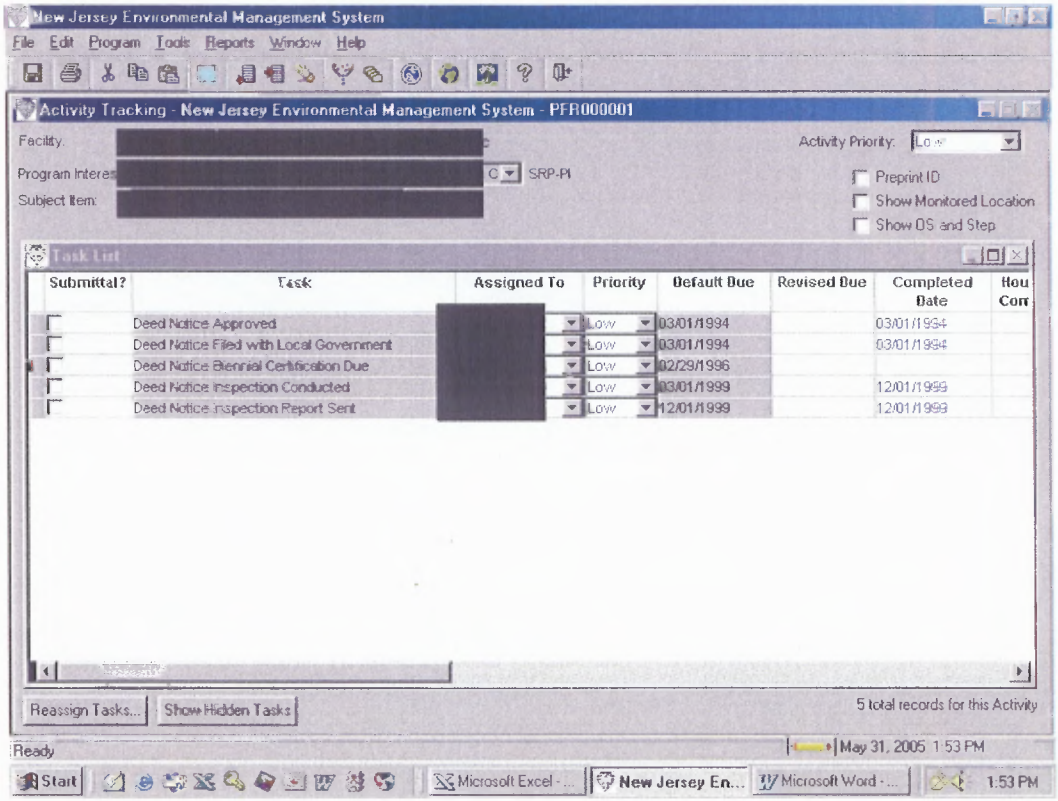

Figure 4.3 Enforcement activity tracking screen on NJEMS.

4.2.3 Enforcement of the IC-related Requirements

Based on the data files of 439 sites on NJEMS, there were 42 sites (9.6%) that the date of Biennial Certification filing was identified. Only 22 of the 439 sites (5.0%) had filed the most recent due version of the certification. The level of compliance of sites that were required to submit multiple Biennial Certifications over the history of the sites was even lower. For sites with DNs filed at the County Court House before December 2000 (352 sites), only two (2) of these sites (0.6%) had filed all of the Biennial Certifications required as of 2005. Deficiency letters are required to be sent out to sites that fail to submit the Biennial Certification. Due to insufficient work force, only 10 "deficiency letters" were sent to the out-of-compliance sites.

Regarding the 5-yr Inspection requirement, there were 298 sites where the DNs were filed before December 1999 and were required to be inspected before the end of 2004. Only 132 of these sites (44.3%) had been inspected as of the NJEMS review conducted in 2005.

It should be noted the data presented in this section were based on information gathered in 2005. Since then, NJDEP has put a tremendous amount of effort to improve its enforcement effectiveness. According to Thomas O'Neill, NJDEP has focused on the importance of compliance status on monitoring and reporting requirements of sites with ICs implemented. Under Assistant Commissioner Irene Kropp in 2007, SRP launched the Enforcement Initiative focusing on the enforcement of monitoring and reporting requirements. The initiative allowed an amnesty period for the responsible party to submit required certifications and avoid a penalty, which can be as high as $8,000 per day for each out-of-compliance day (NJDEP, 2007). The compliance percentage has significantly improved since the Enforcement Initiative was launched. The compliance percentage before the Enforcement Initiative began was less than 20%. As of April 2009, the compliance percentage was approximately 80% (NJDEP, 2009c).

4.3 Survey Results

Table 4.2 presents respondents' profiles including affiliated organization, gender, age, and level of education. Approximately 88% of the respondents are older than 40 years

Table 4.2 Survey Results: Respondents' Profile

Question	Question No.	Answer Options	Answer Option ID	Response Percent	Response Count
Organization	Q1	MADEP	1	44.1%	30
		LSPA	2	55.9%	38
Gender	Q18	Male	1	68.8%	44
		Female	2	31.3%	20
Age	Q19	<20 Yr	1	0.0%	0
		21-30 Yr	2	1.6%	1
		31-40 Yr	3	10.9%	7
		41-50 Yr	4	48.4%	31
		51-60 Yr	5	32.8%	21
		>60 Yr	6	6.3%	4
Level of Education	Q20	Some High School	1	0.0%	0
		High School Diploma	2	0.0%	0
		Bachelors	3	31.3%	20
		Graduate Study (In Progress)	4	6.3%	4
		Masters	5	60.9%	39
		Doctoral	6	1.6%	1

Table 4.3 Survey Results: Level of Familiarity in Brownfield Redevelopment and Its Components

Questions 2-1 through 2-5: What is your level of familiarity with:	Not Familiar (1)*	Somewhat Familiar (2)	Familiar (3)	Very Familiar (4)	Exceedingly Familiar (5)	Response Count
Brownfield Redevelopment	0	12	22	25	11	70
Site Remediation	0	2	8	27	34	71
ICs for Contamination in Soil	0	1	10	37	23	71
ECs for Contamination in Soil	0	4	13	33	21	71
Remedial Alternative Selection	0	3	12	27	29	71

Notes: * Number in ( ) indicates the identification number assigned for the answer option.

Table 4.4 Survey Results: Level of Experience

Question	Question No.	Answer Options	Answer Option ID	Response Percent	Response Count
Approximately how long have your worked in site remediation?	Q3	<1 Yr	1	0.0%	0
		1-5 Yr	2	1.4%	1
		6-10 Yr	3	5.6%	4
		>10 Yr	4	93.0%	66
How many remedial alternative selection cases have you worked on?	Q4	Never	1	4.3%	3
		1-5 Cases	2	7.1%	5
		6-20 Cases	3	18.6%	13
		>20 Cases	4	70.0%	49
How long have you worked on Brownfield redevelopment?	Q5	<1 Yr	1	14.5%	10
		1-5 Yr	2	24.6%	17
		6-10 Yr	3	17.4%	12
		>10 Yr	4	43.5%	30

old. Approximately 69% of the respondents have or are working on advanced degrees (e.g., Masters and Doctoral degrees). All of the respondents indicated that, although not at the same level, they are familiar with site remediation and Brownfield redevelopment. A greater percentage of the respondents identified themselves as "exceedingly familiar" with site remediation (approximately 48%) versus Brownfield redevelopment (approximately 16%) (Table 4.3). It should be noted that, although Brownfield redevelopment generally involves site cleanup or some kind of remedy to address contamination at the site, it is most likely that the project may be initiated by a development plan, which would involve a planned future use. Brownfield sites may also involve a process to obtain an incentive grant for the redevelopment from a state or federal agency to support the site cleanup. Site remediation, on the other hand, can easily be initiated when a complaint is sent to a regulatory agency (e.g., MADEP). With all of these potential components, Brownfield redevelopment tends to be a more complicated task to accomplish.

Approximately 79% of the respondents identified themselves as "very familiar" or "exceedingly familiar" with remedial alternative selection, ICs and ECs for contamination in soil. Approximately 70% of the respondents have worked on remedial alternative selection on more than 20 cases (Table 4.4). However, a much greater percentage (93%) of the respondents has a long history of experience in site remediation (>10 years) compared to those who have long experience in Brownfield redevelopment (44%). This result is in agreement with the fact that site remediation was practiced by regulatory agencies before the Brownfield redevelopment concept was first initiated in the 1990s.

The survey asked respondents about the major groups of contaminants that exist on the sites that they managed. Over 70% of the respondents indicated that the major groups of contaminants at sites where they have worked include heavy metals, chlorinated solvents, and aromatic hydrocarbons. These groups of contaminants either have a long lifespan in soil (e.g., heavy metals) or have a tendency to pose high risk to occupants at the site (e.g., vapor intrusion from chlorinated solvents, and aromatic hydrocarbons).

Respondents mostly agree (with approximately 68% "strongly agree") that implementation of ICs is necessary for a site which has contamination remaining at a concentration that may not be appropriate for all future uses. However, when asked whether ECs need to be incorporated along with ICs (for remedial action without other active remedial technologies), approximately 55% of the respondents "agree" and approximately 29% "disagree".

It should be noted that these varied perspectives are probably due to the fact that different groups and concentrations of site contaminants may pose different levels of risk to the site occupants. ECs are viewed as the supplemental measures to ICs, which would help reduce the level of risk posed by such contaminants. This issue was considered when the question was originally designed. The question was included in the survey to gather perspectives in general regardless of the type of contaminants or level of contamination at a site.

Table 4.5 Survey Results: Effectiveness of ICs and ECs

Question	Question No.	Answer Options	Answer Option ID	Response Percent	Response Count
It is necessary to incorporate ECs with ICs (for remedial action without other active remedial technologies) in order to make ICs effective in the long-term	Q8	Strongly Disagree	1	12.3%	8
		Somewhat Disagree	2	16.9%	11
		Neither Agree nor	3	13.8%	9
		Somewhat Agree	4	23.1%	15
		Strongly Agree	5	32.3%	21
		n/a	6	1.5%	1
Implementation of ICs is necessary for a site which has contamination remaining at a concentration that may not be appropriate for all future uses.	Q9	Strongly Disagree	1	4.6%	3
		Somewhat Disagree	2	9.2%	6
		Neither Agree nor	3	4.6%	3
		Somewhat Agree	4	13.8%	9
		Strongly Agree	5	67.7%	44
		n/a	6	0.0%	0
On average, how long do you think property owners/site responsible parties will remain in compliancewith requirements associated with AUL attached to their sites (e.g., restrictions on certain types of use due to the level of contamination remaining at their remediated site)?	Q10	Less than 6 months	1	0.0%	0
		1-2 Years	2	9.2%	6
		3-5 Years	3	32.3%	21
		6-20 Years	4	32.3%	21
		More than 20 Years	5	20.0%	13
		n/a	6	6.2%	4
Should a responsible regulatory agency monitor remediated sites that have AUL attached to make sure that required restrictions are not violated and to ensure protectiveness of the sites?	Q11	Yes	1	89.1%	57
		No	2	10.9%	7
		n/a	3	0.0%	0
How long should the responsible regulatory agency monitor remediated sites that have ICs (e.g., AUL) implemented?	Q12	Less than 6 months	1	0.0%	0
		1-2 Years	2	0.0%	0
		3-5 Years	3	1.7%	1
		6-20 Years	4	20.3%	12
		More than 20 Years	5	74.6%	44
		n/a	6	3.4%	2

Notes: 'n/a' indicates that the respondent does not have an answer for the question.

Table 4.5 Survey Results: Effectiveness of ICs and ECs (Cont.)

Question	Question No.	Answer Options	Answer Option ID	Response Percent	Response Count
How often should the responsible regulatory agency monitor remediated sites that have ICs (e.g., AUL) implemented?	Q13	Not Necessary	1	0.0%	0
		Every 3 Months	2	0.0%	0
		Every Half Year	3	0.0%	0
		Every Year	4	15.2%	7
		Every 2 Years	5	32.6%	15
		Every 5 Years	6	52.2%	24
		n/a	7	0.0%	0
		Other*	-	-	17
You would be worried if you learn, in fact, that property owners/site responsible parties do not comply with requirements/restrictions associated with the AUL attached with their property.	Q14	Strongly Disagree	1	1.6%	1
		Somewhat Disagree	2	1.6%	1
		Neither Agree nor	3	9.4%	6
		Somewhat Agree	4	28.1%	18
		Strongly Agree	5	57.8%	37
		n/a	6	1.6%	1
You would be worried if you learn that sites with AUL attached are not to be monitor/audited by a regulatory agency to ensure that the property owners/site responsible parties remain in compliance with requirements/restrictions associated with the AUL.	Q15	Strongly Disagree	1	3.1%	2
		Somewhat Disagree	2	4.7%	3
		Neither Agree nor	3	7.8%	5
		Somewhat Agree	4	37.5%	24
		Strongly Agree	5	45.3%	29
		n/a	6	1.6%	1
To make ICs protective and efficient, should responsible parties submit self-monitoring reports to clarify the status of environmental restrictions at their remediated sites to a responsible regulatory agency?	Q16	Yes	1	80.0%	52
		No	2	18.5%	12
		n/a	3	1.5%	1
If your answer on Question #9 is "Yes", how often should responsible parties submit the documents clarifying the status of environmental restrictions at their remediated sites to the responsible regulatory agency?	Q17	Not Necessary	1	0.0%	0
		Every 3 Months	2	0.0%	0
		Every Half Year	3	1.9%	1
		Every Year	4	29.6%	16
		Every 2 Years	5	33.3%	18
		Every 5 Years	6	25.9%	14
		n/a	7	9.3%	5
		Other*	-	-	8

Notes: * See Appendix G for specific responses under 'Other'.

Approximately 83% of the respondents agree that they would be worried if sites with AUL attached are not monitored by a regulatory agency to ensure that site responsible parties remain in compliance with requirements associated with the AUL. As for monitoring frequency, 52% of the respondents think that the regulatory agency should monitor a site with ICs implemented every five years. Smaller numbers of the respondents indicate that the site should be audit every two years (33%) and one year (15%), respectively. It should be noted that responses received as "other" (17 of 63 responses) were not included in the percentage calculation. Specific responses listed under "other" by the respondents are presented in Appendix G.

Approximately 89% of the respondents agree that a regulatory agency should monitor remediated sites that have ICs implemented (e.g., AUL). Approximately 75% of the respondents believed that monitoring efforts should be implemented for more than 20 years. Approximately 20% of the respondents believed that the responsible parties will comply with the requirements for more than 20 years. Approximately 86% of respondents agree that they would be worried if responsible parties do not comply with requirements/restrictions associated with the AUL attached with the property.

Approximately 80% of respondents indicated that responsible parties should submit self-monitoring reports to clarify the status of environmental restrictions at their remediated sites to a responsible regulatory agency. The opinions on frequency of submitting self-monitoring documents are varied with the highest percentage of responses (33%) as "every two years". It should be noted that responses received as "other" (8 of 62 responses) were not included in the percentage calculation. Specific responses listed under "other" by the respondents are presented in Appendix G.

An additional question (Question 18) designed to obtain recommendations from the respondents regarding how to improve or ascertain the effectiveness of ICs was also included, but the ranked data were discarded due to lack of clear instructions for response by respondents.

Open-ended responses for suggested recommendations were provided by respondents. These recommendations are considered very valuable and legitimate as they are given based on their direct experiences from their remediation activities. The responses were collected in text format and presented as follows (direct quotes):

- *"If a responsible party remediates a property to the point where a condition of no significant risk exists with the implementation of an AUL, I feel that the burden of compliance with the AUL requirements (which usually tend to be maintenance of pavement and/or building footprints) rests with future property owners. Future property owners have a responsibility to both negotiate compensation at the time of sale from the PRP with regards to maintaining the AUL requirements and they have a duty to comply with the requirements placed on the deed at the time of sale. (This comment assumes the most common scenario - that the PRP sells the AUL deed restricted property at some time in the relatively near future).";*
- *"I have recommended to MADEP that notice of an AUL be part of the information required when there is a "Dig Safe" request, and that the existence of an AUL be placed in the property file in Assessor's offices. This would alert both contractors as to the presence of an AUL as well as providing notice to purchasers prior to their conducting a title search.;*

- *"Local control by building/zoning/health authorities may be more effective than state-level control (may depend on nature of AUL filing, records, and enforcement mechanisms)";*
- *"In Massachusetts, enforce the statutory requirement that sites be cleaned up to those levels that would be present in the absence of the release.";*
- *"Maintain public data bases of sites with IC"*
- *"Often new owners are not aware of institutional controls at a property."*
- *"Prior assumptions are unrealistic. Broad brush of institutional controls and engineering controls are constructs therefore; like computer "virtual" not real. any endeavor succeeds when leadership is from the front and delegation- and institutional control are delegated- read "woosey" until environmental issues are addressed from the point of contact by agents with "real power and authority" all endeavors in this arena are if at best! LSP should have been the ones who put the issues to bed, but instead a set of Draconian rule and third party oversight have rendered them very ineffective. Paperwork is and always will be a poor substitute for results in the tangible- real- world whether paper follows or not something good has been accomplished and does Government exist for itself or the good of the people?";*
- *"AULs are overused and in some cases inappropriately used. I think we should have stricter requirements for implementing and maintaining AULs and definitely agency oversight including inspections. And strict penalties for not staying in compliance.";*

- *"Require notification to enforcing agency (DEP) of transfer of property to new owner, at time of transfer, with appropriate new owner contact information and a copy of the new deed.";*
- *"Significant penalties if RP breaks IC";*
- *"People do what gets checked. Owners will understand the importance of the IC if its compliance is verified within an appropriate interval without the inspection program turning into revenue enhancement/harvesting opportunities for the bureaucrat. I know several bureaucrats whose advanced degrees did not results in higher edification.";*
- *"I disagree with Q7 & Q8 because in MA, ICs are NOT REQUIRED under the MCP until the site is closed as a PERMANENT SOLUTION (filing of a Class A RAO), therefore my job is done & I can't be held responsible or liable. I have learned of IC violations on site that I have placed ICs - but there is no vehicle to report this to DEP, and my job is complete ie I'm no longer involved because the site is closed under the regulations.*

  RE: Q10 - remember most of these sites are sold immediately after regulatory closure so the original RP goes away and is decoupled from the site- any new owner should be required to ensure that the EC/IC are maintained. Implicit in brownfields in my experience is that someone else made the mess and someone new buys and uses the property. Sometimes new tenents of a site with a preexisting IC violate the conditions, but the landlord corporation (that didn't make the mess) is off in Dallas or Atlanta....Remember LSP could care less because AULs are not required until a permanent solution is reached - once an

AUL is filed our job usually ends there. I have filed over a dozen ICs and I have no idea what the statuses of any of them are, since a consultant is no longer needed once closure is achieved.

An AUL is also not required at the time a Class C RAO is filed. So a site with a temporary solution could go for years without the IC in place, as long as no substantial hazard exists. Huge loophole here";

- *"I find it difficult to rank the above statements , all are important in maintaining the effectiveness of the AUL, though the financial assurance item is really site specific";*
- *"you really should have both. self=reporting/monitoring and periodic (random interval) inspections. either one alone isn't really that useful. if we have reports on file, the public, etc., can also review them.".*

Although responses to this question cannot be quantitatively assessed, three major recommendations can be made. First, the respondents recommended that a proper information management system should be maintained. Such system should be updatable and publicly available. The enforcement agency (e.g., MADEP) should also require a notification when a transfer of property is made to a new owner. Second, the agency should have a mechanism ensuring that the new property owner will be aware of existing ICs implemented at the site. This is especially important because ICs are usually established during the old ownership; however the property will often be sold immediately after the issuance of regulatory closure (e.g. RAOs). At that time, the original responsible party and the LSP conducting the site remediation will be decoupled from the site. Therefore, the ICs will not be effective at all without the new property

owner being aware of the existence of the ICs. Last, a strict enforcement and penalty should be established to improve effectiveness of ICs. Property owners are likely to understand the importance of the ICs if their compliance is monitored.

Chi-square analysis was performed to determine if there were significant differences between opinions of MADEP environmental professionals and LSPs (Questions 8, 9, 11, 14, 15, and 16) (Appendix E). Survey responses were grouped prior to the analysis because sample size was small (Table 4.6).

For example, Question 8 provided six answer options for the respondents to demonstrate their levels of agreement on the statement that "*It is necessary to incorporate ECs with ICs (for remedial action without other active remedial technologies)*". The answer options included: (1) strongly disagree; (2) somewhat disagree; (3) neither agree nor disagree; (4) somewhat agree; (5) strongly agree; and (6) n/a. To group the responses, answer options (3) and (6) were omitted from analysis. Responses (1) and (2) were grouped together to reflect that the respondents "agree" with the statement. Responses (4) and (5) were combined as another group to reflect that the respondents "disagree" with the statement. The same procedure was then repeated for Questions 9, 11, 14, 15, and 16.

Results reveal that:

- The respondents agree that it is necessary to incorporate ECs with ICs (for remedial action without other active remedial technologies) in order to make ICs effective in the long-term;

- The respondents agree that implementation of ICs is necessary for a site which has contamination remaining at a concentration that may not be appropriate for all future uses;
- The respondents agree that responsible regulatory agency should monitor remediated sites that have AUL attached to make sure that required restrictions are not violated and to ensure protectiveness of the sites;
- The respondents agree that they would be worried if you learn, in fact, that site responsible parties do not comply with requirements/restrictions associated with the AUL attached with their property.
- The respondents agree that they would be worried if you learn that sites with AUL attached are not to be monitor/audited by a regulatory agency to ensure that site responsible parties remain in compliance with requirements/restrictions associated with the AUL.
- The respondents agree that, to make ICs protective and efficient, responsible parties should submit self-monitoring reports to clarify the status of environmental restrictions at their remediated sites to a responsible regulatory agency.

Table 4.6 Data Preparation for Statistical Analysis – Issues regarding Effectiveness of ICs

Question	Question No.	Answer Options	Answer Option ID	Grouped Answer Option	Grouped Answer Option ID
It is necessary to incorporate ECs with ICs (for remedial action without other active remedial technologies) in order to make ICs effective in the long-term	Q8	Strongly Disagree	1	Disagree	1
		Somewhat Disagree	2		
		Somewhat Agree	4	Agree	2
		Strongly Agree	5		
Implementation of ICs is necessary for a site which has contamination remaining at a concentration that may not be appropriate for all future uses.	Q9	Strongly Disagree	1	Disagree	1
		Somewhat Disagree	2		
		Somewhat Agree	4	Agree	2
		Strongly Agree	5		
Should a responsible regulatory agency monitor remediated sites that have AUL attached to make sure that required restrictions are not violated and to ensure protectiveness of the sites?	Q11	Yes	1	Yes	1
		No	2	No	2
You would be worried if you learn, in fact, that property owners/site responsible parties do not comply with requirements/restrictions associated with the AUL attached with their property.	Q14	Strongly Disagree	1	Disagree	1
		Somewhat Disagree	2		
		Somewhat Agree	4	Agree	2
		Strongly Agree	5		
You would be worried if you learn that sites with AUL attached are not to be monitor/audited by a regulatory agency to ensure that the property owners/site responsible parties remain in compliance with requirements/restrictions associated with the AUL.	Q15	Strongly Disagree	1	Disagree	1
		Somewhat Disagree	2		
		Somewhat Agree	4	Agree	2
		Strongly Agree	5		
To make ICs protective and efficient, should responsible parties submit self-monitoring reports to clarify the status of environmental restrictions at their remediated sites to a responsible regulatory agency?	Q16	Yes	1	Yes	1
		No	2	No	2

Table 4.7 Opinions of MADEP Environmental Professionals and LSPs on Issues Regarding Effectiveness of ICs

Question	Quesiton No.	Answer Option						N_T	DF	λ^2	p-value
		Definition	N_1	P	Definition	N_2	Q				
It is necessary to incorporate ECs with ICs (for remedial action without other active remedial technologies) in order to make ICs effective in the long-term	Q8	Agree	36	0.5	Disagree	19	0.5	55	1	5.25	0.022
Implementation of ICs is necessary for a site which has contamination remaining at a concentration that may not be appropriate for all future uses.	Q9	Agree	53	0.5	Disagree	9	0.5	62	1	31.23	0
Should a responsible regulatory agency monitor remediated sites that have AUL attached to make sure that required restrictions are not violated and to ensure protectiveness of the sites?	Q11	Yes	57	0.5	No	7	0.5	64	1	39.06	0
You would be worried if you learn, in fact, that property owners/site responsible parties do not comply with requirements/restrictions associated with the AUL attached with their property.	Q14	Agree	55	0.5	Disagree	2	0.5	57	1	49.28	0
You would be worried if you learn that sites with AUL attached are not to be monitor/audited by a regulatory agency to ensure that the property owners/site responsible parties remain in compliance with requirements/restrictions associated with the AUL.	Q15	Agree	53	0.5	Disagree	5	0.5	58	1	39.72	0
To make ICs protective and efficient, should responsible parties submit self-monitoring reports to clarify the status of environmental restrictions at their remediated sites to a responsible regulatory agency?	Q16	Yes	53	0.5	No	12	0.5	65	1	25.86	0

Notes: N_1 = Response count of grouped answer option 1; N_2 = Response count of grouped answer option 2; N_T = Total response count; DF = Degree of Freedom; P = Test proportion of grouped answer option 1; and Q = Test proportion of grouped answer option 2.

As stated in Section 3.2.4, opinions on the issues regarding effectiveness of ICs may be varied by affiliated organizations and levels of experience of the respondents. To conduct the analysis, survey responses regarding affiliated organization and level of experience in Brownfield redevelopment were grouped as presented in Table 4.8.

Table 4.8 Data Preparation for Statistical Analysis – Respondents' Profile

Question	Question No.	Answer Options	Answer Option ID	Grouped Answer Option	Grouped Answer Option ID
Organization	Q1	MADEP	1	MADEP	1
		LSPA	2	LSPA	2
How long have you worked on Brownfield redevelopment?	Q1	<1 Yr	1	<5 Yr	1
		1-5 Yr	2		
		6-10 Yr	3	>5 Yr	2
		>10 Yr	4		

As presented in Table 4.9, null hypothesis (H_0) assumes that the proportion of affirmative ("Agree" or "Yes") is not significantly different from the proportion of responses received in negative responses ("Disagree" or "No"); while the alternative hypothesis (H_1) assumes that the proportions are significantly different. The confidence level is set at 95% ($\alpha = 0.05$).

Based on the Chi-square analysis, it can be interpreted that there is no evidence suggesting that proportions of the responses received from different groups are different on the statement that implementation of ICs is necessary for a site that has contamination remaining at a concentration that may not be appropriate for all future uses. The respondents agree with the statement regardless of their affiliated organizations and level of experience. They also agree that it is necessary to incorporate ECs with ICs (for remedial action without other active remedial technologies) in order to make ICs effective over the long-term. However, the proportions of LSPA respondents that

disagree with the statement (13 Disagrees Vs 16 Agrees) are much higher compared to the proportions of responses from MADEP respondents (5 Disagrees Vs 18 Agrees).

Table 4.9 Comparison of Proportions of Responses on Issues Regarding Effectiveness of ICs

Definition/Question	Variance	Answer Option						λ^2	DF	p-value
		Category 1			Category 2					
		Definition	N_1	N_2	Definition	N_1	N_2			
It is necessary to incorporate ECs with ICs (for remedial action without other active remedial technologies) in order to make ICs effective in the long-term	Organization	MADEP	18	5	LSPA	16	13	3.02	1	0.08
	Experience with BF redevelopment	<5 yrs	14	6	>5 yrs	21	12	0.23	1	0.64
Implementation of ICs is necessary for a site which has contamination remaining at a concentration that may not be appropriate for all future uses.	Organization	MADEP	22	3	LSPA	28	5	0.12	1	0.73
	Experience with BF redevelopment	<5 yrs	20	2	>5 yrs	32	6	0.54	1	0.46
Should a responsible regulatory agency monitor remediated sites that have AUL attached to make sure that required restrictions are not violated and to ensure protectiveness of the sites?	Organization	MADEP	26	2	LSPA	28	4	0.48	1	0.49
	Experience with BF redevelopment	<5 yrs	22	2	>5 yrs	34	4	0.08	1	0.78
You would be worried if you learn, in fact, that property owners/site responsible parties do not comply with requirements/restrictions associated with the AUL attached with their property.	Organization	MADEP	22	0	LSPA	29	2	n/a*	1	n/a
	Experience with BF redevelopment	<5 yrs	20	0	>5 yrs	34	2	n/a*	1	n/a
You would be worried if you learn that sites with AUL attached are not to be monitor/audited by a regulatory agency to ensure that the property owners/site responsible parties remain in compliance with requirements/restrictions associated with the AUL.	Organization	MADEP	25	0	LSPA	24	5	4.75*	1	0.03
	Experience with BF redevelopment	<5 yrs	22	0	>5 yrs	30	5	3.45*	1	0.06
To make ICs protective and efficient, should responsible parties submit self-monitoring reports to clarify the status of environmental restrictions at their remediated sites to a responsible regulatory agency?	Organization	MADEP	22	3	LSPA	25	8	1.39	1	0.24
	Experience with BF redevelopment	<5 yrs	19	4	>5 yrs	32	7	0	1	0.96

Notes: N_1 = Response count of Agree or Yes responses; N_2 = Response count of Disagree or No responses; DF = Degree of Freedom; * indicates that computed λ^2 is not valid because too less expected counts within a category are detected.

Also, there is no evidence that proportions of the respondents with different organizations and different levels of experience are different on the statement that responsible regulatory agency should monitor remediated sites that have AUL attached to make sure that required restrictions are not violated and to ensure protectiveness of the sites. The respondents seemed to all agree with the statement at the same level. They also agree that, to make ICs protective and efficient, responsible parties should submit self-monitoring reports to clarify the status of environmental restrictions at their sites to a responsible regulatory agency.

It can be seen from the number of responses counted that the respondents seemed to all agree that they would be worried either 1) if property owners/site responsible parties do not comply with requirements/restrictions associated with the AUL attached with their property or 2) sites with AUL attached are not to be monitor/audited by a regulatory agency to ensure that the property owners/site responsible parties remain in compliance with the requirements/restrictions associated with the AUL. However, the Chi-square values computed are considered invalid because the expected counts in a category of answer option are too less. Therefore, Chi-square analysis cannot be used to conclude if proportions of responses to these statements are different between these groups of sample population.

Additionally, proportions of agreement of respondents on Question 9 (*Implementation of ICs is necessary for a site which has contamination remaining at a concentration that may not be appropriate for all future uses.*) versus Question 14 (*The respondents would be worried if you learn, in fact, that property owners/site responsible parties do not comply with requirements/restrictions associated with the AUL attached*

with their property.) and Question 15 (*The respondents agree that they would be worried if you learn that sites with AUL attached are not to be monitor/audited by a regulatory agency to ensure that the property owners/site responsible parties remain in compliance with requirements/restrictions associated with the AUL.*) were also observed.

The purpose of this observation is to assess the concern of respondents on the necessity of monitoring and reporting requirements that may impact the effectiveness of ICs. Survey results previously presented in Table 4.7 clearly showed that approximately 85.5% of the respondents believed that implementation of ICs are necessary for a site that has contamination remaining on-site above remediation standards for unrestricted uses. However, as presented in Table 4.10, a large percentage of the respondents, who agree with the statement in Question 9, also seemed to agree with the statements in Question 14 (51 out of 60) and Question 15 (45 out of 57) as well.

These results indicated that, although the respondents agree that implementation of ICs is a good tool for site remedy, they still would be worried either: 1) if the responsible parties do not comply with related requirements or 2) if the regulatory agencies do not enforce the requirements properly. Therefore, it could be concluded from this observation that the monitoring and reporting requirements need to be properly implemented in conjunction with the implementation of ICs to make ICs effective.

Table 4.10 Importance of Compliance Status on the Effectiveness of ICs

Definition/Question	Variance	Answer Option					
		Category 1			Category 2		
		Definition	N_1	N_2	Definition	N_1	N_2
Implementation of ICs is necessary for a site which has contamination remaining at a concentration that may not be appropriate for all future uses.	Q14	Agree	51	2	Disagree	7	0
	Q15	Agree	45	4	Disagree	6	1

Notes: N_1 = Response count of Agree responses; N_2 = Response count of Disagree responses; DF = Degree of Freedom; * indicates that computed λ^2 is not valid because too less expected counts within a category are detected.

Q14 = The respondents agree that they would be worried if you learn, in fact, that property owners/site responsible parties do not comply with requirements/restrictions associated with the AUL attached with their property.

Q15 = The respondents agree that they would be worried if you learn that sites with AUL attached are not to be monitor/audited by a regulatory agency to ensure that the property owners/site responsible parties remain in compliance with requirements/restrictions associated with the AUL.

CHAPTER 5

DISCUSSION

5.1 Potential Gaps in Oversight Mechanism

Three (3) major potential gaps have been identified in NJDEP oversight mechanism including: 1) work force size and work load; 2) information management system; and 3) enforcement of IC-related requirements.

It appears that NJDEP currently has insufficient work force to oversee the large (and growing) number of sites under its jurisdiction. This situation is indicated by the growing number of over 20,000 cases in the agency's backlog (Berkowitz and Abrams, 2009). Ideally, NJDEP case managers assigned to oversee site remediation should have the capability and level of technical expertise to work cooperatively and with equal competence with the consulting company to finalize the most appropriate remedial alternative. Due to current limits on the size of the work force, NJDEP may not always be able to assign its cases to the most appropriate case mangers that have the highest levels of expertise on remedial issues at particular sites. If this situation happens, the selected remedies may not necessarily be the most appropriate alternative for the sites.

The agency did not assign enough case managers to follow up compliance status of sites with ICs implemented. Due to the fact that enforcement of over 400 sites in post-NFA phase was in the care of only one case manager in the BOMM in 2005, NJDEP was able to conduct the 5-yr Inspection of only approximately 44% of the sites that required the inspection. Only approximately 5% of the sites complied with the requirement on

Biennial Certification filing. NJDEP only sent the deficiency letters to a fraction of these out-of-compliance sites.

In 2009, however, the percentage of sites that complied with the Biennial Certification requirement increased to approximately 80%. The increase of compliance percentage was mainly due to priority given by NJDEP Assistant Commissioner to the enforcement of monitoring and reporting requirements starting in 2007. The BOMM also assigned an additional case manager to help enforce the requirements. These findings support the concerns stated in the study developed by USEPA in 2005 and GAO in 2006 that sufficient budget and priority should be given to the enforcement of ICs to ensure effectiveness of the controls. Without proper budget allocation, responsible regulatory agencies may not be able to effectively enforce IC-related requirements (USEPA, 2005b; GAO, 2006).

As stated in the USEPA guidance document in 2000, effectiveness of ICs depends on enforcement mechanism (USEPA, 2000). Requirement on Biennial Certification filing may not be the best tool to encourage responsible parties to conduct self-inspections. If there is something wrong with the ICs and/or ECs at their sites, there may be very minimal incentive for them to report the flaw to NJDEP. Also, the time interval between each Biennial Certification filing is long. The time between each 5-yr Inspection by NJDEP is even longer. If there is something interfering with the effectiveness of the ICs (e.g., excavation in a non-permitted area) during the time between Biennial Certification filing and the 5-yr Inspection, site users may already be exposed to the contaminants for a considerably long time (ELI, 1995). The situation could be worse in cases where responsible parties do not have sufficient technical

knowledge to recognize malfunctions of the controls (Pendergrass, 1999). Furthermore, the responsible parties also would likely be reluctant to report the failure of ICs considering the fact that breaking of the use restrictions on their sites could not have easily happened without their permission.

NJDEP's information management system, NJEMS, contains some functions designed to track compliance status and the history of sites with ICs implemented. The agency also provides a searchable public database (Data Miner) and a GIS-based database (i-Map) that share the same background information with NJEMS. The databases are good tools for the public to retrieve information about the existence of ICs on sites of interest. With more information made available to the public, NJDEP and other regulatory agencies could rely, at least in part, on public oversight of ICs (ELI, 1999). This effort by NJDEP is in line with a recommendation by Pendergrass and Probst (2005) that computer-based record keeping systems, ideally with GIS application, can facilitate oversight of ICs over the long-term. Such databases should accurately reflect actual conditions of the sites. The databases would solve the problem that the ICs might outlast the government staff over the long-term (GAO, 2006).

However, NJEMS has not been fully updated and utilized. This lack of recorded information may result from the shift of case managers from case to case resulting from attrition within the department or reassignment to other environmental programs. Such changes, coupled with excessive workload may leave case managers with too little time to update information. The lack of a good information management system could lead to ineffectiveness of IC information tracking. The situation will be worse if the cases are passed over to other regulators. Because of the absence of information in the database,

the only way for regulators or other responsible parties to check out compliance status would be to review from the hardcopy-formatted site reports, which are not easy-to-access or long-lasting. Without tracked compliance record, effectiveness of ICs is questionable over an extended period of time (ELI, 1999).

5.2 Survey with MADEP Environmental Professionals and LSPs

The survey results indicate that individuals actively working in remediation agree that implementation of ICs is necessary for a site that has contamination left in place at a concentration that may not be appropriate for unrestricted uses. However, it is inconclusive whether ECs should be incorporated with ICs or not. Respondents agree that site responsible parties should submit a self-monitoring document to a regulatory agency.

Only one-fifth of respondents believed that the responsible parties will remain in compliance with the requirements associated with ICs for more than 20 years. Similar to a recommendation by ELI that ICs need to be monitored (ELI, 1999), a majority of respondents agree that responsible regulatory agencies should monitor sites with ICs implemented. The monitoring efforts should remain in effect for at least 20 years. This set of opinions supports a recommendation by ELI that ICs need to be actively monitored to be effective (ELI, 2005).

A majority of respondents believed that responsible regulatory agencies should monitor remediated sites with ICs implemented every 5 years, which is in line with the requirements of federal and some state cleanup programs presented earlier. However, some respondents would prefer a more frequent site audit from the regulatory agencies.

This opinion is similar to what GAO found in its study in 2005. The report stated that some USEPA officials believed that the 5-yr Review for Superfund sites may not be frequent enough to ensure the protectiveness of ICs (GAO, 2005). ELI also stated that the frequency of 5-yr Review may not be sufficient to avoid failures (ELI, 2000). Some respondents also indicated that the frequency of site reviews should be based on a case by case basis. Frequency of the site reviews should be designed based on a site's key characteristics (e.g., level of risk and contamination at the site, type of future use). Proper frequency and scope of monitoring is necessary to maintain effectiveness of ICs (GAO, 2006).

The respondents expressed that they would be worried if they learned that a site's responsible parties are not in compliance with requirements and restrictions associated with ICs. They also would be worried if the sites with ICs implemented are not monitored by a regulatory agency as they are required. These findings along with the fact that a sizable percentage of sites in NJ and MA are still out of compliance status suggest that effectiveness of ICs is not optimal and the situation could be even worse over the long-term.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This study investigated implementation effectiveness of ICs for Brownfield redevelopment. A large number of sites in NJ and MA still remain out of compliance status. NJDEP oversees a large number of Brownfield sites and has come a long way to improve its site cleanup program. Findings of the study indicated that NJDEP has had insufficient work force to oversee sites under its jurisdiction and may not be able to assign site remediation cases to the most appropriate case managers. The agency did not have enough case managers assigned to enforce IC-related requirements. NJEMS was not fully updated and utilized at the time of the study in 2005 and percentage of sites that complied with the IC-related requirements was very low. In the past few years, more attention has been paid to enforcement of IC-related requirements. The result was a significantly improved percentage of sites in compliance status, but approximately 20% of sites still remained out of compliance status (as of 2008). These findings suggest that ICs are not being properly implemented as they are expected by the legislatures. The survey results indicated that MADEP environmental professionals and Massachusetts LSPs would be concerned if restrictions and requirements associated with IC implementation are not strictly enforced.

6.2 Policy Recommendations

Based on the findings and results of the study, a set of policy recommendations is proposed to improve implementation effectiveness of ICs and, thereby, ensure protectiveness of Brownfield sites to human health and the environment as presented in this section.

6.2.1 Improve Enforcement of Related Regulations and Requirements

Regulations and requirements are established with the expectation that people would obey them in order to achieve their objectives. The same expectation goes to the regulations and requirements for the ICs used in site remediation.

Regulatory agencies should use available tools (e.g., penalties) and amenities (e.g., information management system) to accommodate enforcement and oversight of their sites. The agencies should strictly enforce applicable laws and regulations that would eventually result in increased percentage of compliance status. Improved percentage of compliance status of sites in NJ is the evidence indicating that strict enforcement is needed to bring more sites into compliance status.

6.2.2 Utilize Flexibility in Site Audit and Certification

Some state and federal regulations indicate a certain gap between each mandatory site audit by responsible regulatory agencies and the self-inspection and reporting by responsible parties. Using specific gap between each inspection and reporting period may not be appropriate for every site. For example, a more sensitive site (e.g., a site with a high level of contamination and more sensitive use) would require more frequent monitoring activities than a site with lower level of risk. Therefore, the designated

frequency of site inspection should be based on case by case basis. The use flexible frequency of site inspection has been adopted by MADEP as the state use a more flexible language in their regulation that allows the agency to randomly inspect the site with AULs at any time.

6.2.3 Improve Information Management System

An interactive database system that provides necessary information related to the ICs (e.g., existence of ICs and ECs at a property, required monitoring and maintenance activities, etc.) should be handily available. The database should be sustainable, user-friendly, and up-to-date. Regulatory agencies, responsible parties and the public should have accessibility to the database at appropriate security levels to become informed about the presence of ICs and ECs implemented at their interested sites.

Nevertheless, a good database system cannot run by itself. Responsible personnel should maintain and keep the database up-to-date as it is designed to be. Regulators should understand the value of the database and utilize it in their oversight work. The management of regulatory agencies should educate their personnel on the importance of the database and encourage them to use and work with the database.

6.2.4 Provide Sufficient Budget and Work Force Allocation

Proper allocation of budget and labor force in regulatory agencies overseeing remediation cases is crucial to making oversight mechanism effective. The level of work force is closely related to the budget allocation. Environmental agencies should set an appropriate priority for its remediation group. The budget should not only be planned for the cleanup work, but also for the post-cleanup period for sites that have ICs

implemented. Long-term plans for budget allocation should be considered since ICs require extended period of monitoring and maintenance activities.

The management of regulatory agencies should start considering a long-term strategy to make certain that the budget and work force allocation for overseeing sites with ICs implemented would not be neglected in the future, when the agencies' budget priorities may change. More attention should be paid to the budget allocation issue when the federal or state budgets need to be adjusted due to bad economic climate. The already insufficient resources assigned to this segment of the agencies should not be further cut during the economic downturn.

6.2.5 Plan for the Failure of ICs

Sites with ICs and ECs implemented may be protective if nothing alters their conditions. However, in reality, conditions of the site may be changed. A site located in a moderate area may turn out to be a dense-commercial area in the future. Pressure from urbanization may force the change on types of use at the sites. Natural disaster could cause a sudden failure on ECs. Regulators should consider for a plan to respond to any failure of the controls when first selecting them as part of the remedy.

At policy level, legislatures should include consideration on a plan for responding to failed ICs and ECs as one of the remedial selection criteria. The plan should include both response actions and associated costs necessary for responding to the worst case scenario. These costs should be taken into account as part of the total costs of the remedial alternatives during remedy selection. Responsible parties should also find a way to make sure that funding would be available at the time when the failure actually happens.

6.2.6 Improve Public Awareness and Educate Responsible Parties

Public participation is important even in the early stages of remedial selection. Roles and responsibilities of parties conducting remediation at a site should be clarified as early as possible in the remedy process. Regulators should develop working relationships and understanding among community and other stakeholders on implementation of ICs. Good communication in the early stage of remediation would ensure that the most effective and appropriate ICs are used at the site.

Regulatory agencies should educate responsible parties and the public about the importance and functions of ICs and ECs implemented at their sites. With good understanding and realization about the importance and functions of the ICs and ECs, they should be more willing to inform or consult the responsible regulatory agencies as soon as they notice any malfunction of the ICs and ECs.

6.3 Future Work

This section summarizes a list of future work recommended to expand the outcomes of the study as presented below:

6.3.1 Expand the Scope of the Study

The regulations, requirements, and oversight mechanism associated with implementation of ICs may vary by state and level of authorities, which could result in different degrees of effectiveness of the ICs and ECs (ELI, 1999). Therefore, similar studies should be conducted with other regulatory agencies in other states and different levels of regulatory agency (e.g., local and federal levels). Such studies would reveal any potential gaps and problems other agencies may be encountering.

6.3.2 Direct Interview with Respondents

It is realized that respondent's opinions collected through a survey may be constrained by several limitations (e.g., range of given alternative answers, given space). A direct interview with some respondents would reveal even deeper perspectives that cannot be obtained through a questionnaire form. Selected respondents for the interview should be varied by the groups of the typical stakeholders of ICs including governments and agencies at federal, state, and local levels, property owners, responsible parties, neighbors, and prospective purchasers. A set of questions should be prepared separately for each group of the stakeholders. The questions can be designed, in part, based on the results and findings of this study.

6.3.3 Monitoring Study on Sites with Failed ICs

A monitoring study focusing on the failure of ICs implemented at Brownfield sites would be an appropriate response to the fact that there are still a large number of Brownfield sites with failed ICs. Such a study would be useful to reveal the actual causes of the failure. The study can also be used to determine the actual risks and impacts to human health and the environments due to the failure of the controls.

6.3.4 A Study on the Impacts from Implementation of LSP Program

As presented earlier, NJDEP recently adopted a LSP Program similar to what has been implemented by the MADEP. LSP Programs are expected to resolve excessive workload issue and accelerate remediation work at the agencies. It is predictable that similar kind of program would be implemented at other state regulatory agencies if its success continues to be recognized. Implementation of a LSP Program may impact decision-

making process on site remediation and would likely help unload excessive work for the regulatory agencies. Regulators may be able to focus more on the monitoring and enforcement efforts, which may result in improvement of the effectiveness of ICs over the long-term. Therefore, a study on the impacts of implementation of LSP Program on the implementation effectiveness of ICs would help confirm the benefits of LSP Program to other state regulatory agencies.

APPENDIX A

MODEL DEED NOTICE

Model Deed Notice

The model document in this appendix contains blanks and matter in brackets [ ]. These blanks shall be replaced with the appropriate information prior to submission to the Department for approval. The model document in this appendix is not subject to the variance provisions of N.J.A.C. 7:26E-1.6.

Matter bracketed [ ] is not intended for deletion, but rather is intended to be descriptive of the variable information that may be contained in the final document.

IN ACCORDANCE WITH N.J.S.A. 58:10B-13, THIS DOCUMENT IS TO BE RECORDED IN THE SAME MANNER AS ARE DEEDS AND OTHER INTERESTS IN REAL PROPERTY.

Prepared by: _____
[Signature]

_____
[Print name below signature]

Recorded by:

_____
[Signature, Officer of County Recording Office]

_____
[Print name below signature]

DEED NOTICE

This Deed Notice is made as of the _____ day of _____, ____, by *[Insert the full legal name and address of each current property owner]* (together with his/her/its/their successors and assigns, collectively "Owner").

1. THE PROPERTY. [*Insert the full legal name and address of each current property owner*] [*Insert as appropriate: "is", or "are"*] the owner in fee simple of certain real property designated as Block(s) _____ Lot(s) _____, on the tax map of the [*Insert, as appropriate: City/Borough/Township/Town*] of [*Insert the name of municipality*], [*Insert the name of county*] County; the New Jersey Department of Environmental Protection Program Interest Number (Preferred ID) for the contaminated site which includes this property is [*Insert the Program*

Interest Number (Preferred ID)]; and the property is more particularly described in Exhibit A, which is attached hereto and made a part hereof (the "Property").

2. DEPARTMENT'S ASSIGNED BUREAU. The [*insert name of Bureau*] was the New Jersey Department of Environmental Protection program that was responsible for the oversight of the remediation of the Property. The matter was Case No. [*insert Program Interest Number (Preferred ID)*].

3. SOIL CONTAMINATION. [*Insert the full legal name of the person that was responsible for conducting the remediation*] has remediated contaminated soil at the Property, and the New Jersey Department of Environmental Protection approved a remedial action on [*Insert date of Department's approval*], such that soil contamination remains in certain areas of the Property which contains contaminants in concentrations that do not allow for the unrestricted use of the Property; this soil contamination is described, including the type, concentration and specific location of such contaminants, in Exhibit B, which is attached hereto and made a part hereof. As a result, there is a statutory requirement for this Deed Notice [*include if appropriate:* and engineering controls] in accordance with N.J.S.A. 58:10B-13.

4. CONSIDERATION. In accordance with the New Jersey Department of Environmental Protection's approval of the remedial action work plan for the remediation of the site which included the Property, and in consideration of the terms and conditions of that approval, and other good and valuable consideration, Owner has agreed to subject the Property to certain statutory and regulatory requirements which impose restrictions upon the use of the Property, to restrict certain uses of the Property, and to provide notice to subsequent owners, lessees and operators of the restrictions and the monitoring, maintenance, and biennial certification requirements outlined in this Deed Notice and required by law, as set forth herein.

5A. RESTRICTED AREAS. Due to the presence of these contaminants, the Owner has agreed, as part of the remedial action for the Property, to restrict the use of certain parts of the Property (the "Restricted Areas"); a narrative description of these restrictions, along with the associated monitoring and maintenance activities and the biennial certification requirements are provided in Exhibit C, which is attached hereto and made a part hereof. The Owner has also agreed to maintain a list of these restrictions on site for inspection by governmental enforcement officials.

[Insert *the following paragraph when engineering controls are also implemented at the site:*

5B. ENGINEERING CONTROLS. Due to the presence and concentration of these contaminants, the Owner has also agreed, as part of the remedial action for the Property, to the placement of certain engineering controls on the Property; a narrative description of these engineering controls, along with the associated monitoring and maintenance activities and the biennial certification requirements are provided in Exhibit C.]

6A. ALTERATIONS, IMPROVEMENTS, AND DISTURBANCES.

i. Except as provided in Paragraph 6B, below, no person shall make, or allow to be made, any alteration, improvement, or disturbance in, to, or about the Property which disturbs any engineering control at the Property without first obtaining the express written consent of the Department of Environmental Protection. Nothing herein shall constitute a waiver of the obligation of any person to comply with all applicable laws and regulations including, without limitation, the applicable rules of the Occupational Safety and Health Administration. To request the consent of the Department of Environmental Protection, contact:

Department of Environmental Protection
Division of Remediation Management and Response
Bureau of Operation, Maintenance, and Monitoring
Deed Notice Inspection Program
P.O. Box 413
401 E. State Street
Trenton, NJ 08625-0413

ii. Notwithstanding subparagraph 6A.i., above, the Department of Environmental Protection's express written consent is not required for any alteration, improvement, or disturbance provided that the owner, lessee or operator:

(A) Notifies the Department of Environmental Protection of the activity by calling the DEP Hotline, at 1-877-WARN-DEP or 1-877-927-6337, within twenty-four (24) hours after the beginning of each alteration, improvement, or disturbance;

(B) Restores any disturbance of an engineering control to pre-disturbance conditions within sixty (60) calendar days after the initiation of the alteration, improvement or disturbance;

(C) Ensures that all applicable worker health and safety laws and regulations are followed during the alteration, improvement, or disturbance, and during the restoration;

(D) Ensures that exposure to contamination in excess of the applicable remediation standards does not occur;

(E) Submits a written report, describing the alteration, improvement, or disturbance, to the Department of Environmental Protection within sixty (60) calendar days after the end of each alteration, improvement, or disturbance. The owner, lessee or operator shall include in the report the nature of the alteration, improvement, or disturbance, the dates and duration of the alteration, improvement, or disturbance, the name of key individuals and their affiliations conducting the alteration, improvement, or disturbance, a description of the notice the Owner gave to those persons prior to the disturbance, the amounts of soil generated for disposal, if any, the final disposition and any precautions taken to prevent exposure. The owner, lessee, or operator shall submit the report to:

Department of Environmental Protection

Division of Remediation Management and Response
Bureau of Operation, Maintenance, and Monitoring
Deed Notice Inspection Program
P.O. Box 413
401 E. State Street
Trenton, NJ 08625-0413

[Insert *the following paragraph when engineering controls are also implemented at the site:*

6B. EMERGENCIES. In the event of an emergency which presents, or may present, an unacceptable risk to the public health and safety, or to the environment, any person may temporarily breach any engineering control provided that that person complies with each of the following:

i. Immediately notifies the Department of Environmental Protection of the emergency, by calling the DEP Hotline at 1-877-WARNDEP or 1-877-927-6337;

ii. Limits both the actual disturbance and the time needed for the disturbance to the minimum reasonably necessary to adequately respond to the emergency;

iii. Implements all measures necessary to limit actual or potential, present or future risk of exposure to humans or the environment to the contamination;

iv. Notifies the Department of Environmental Protection when the emergency has ended by calling the DEP Hotline at 1-877-WARNDEP or 1-877-927-6337;

v. Restores the engineering control to the pre-emergency conditions as soon as possible, and provides a written report to the Department of Environmental Protection of such emergency and restoration efforts within sixty (60) calendar days after completion of the restoration of the engineering control. The report must include all information pertinent to the emergency, potential discharges of contaminants, and restoration measures that were implemented, which, at a minimum, should specify: (a) the nature and likely cause of the emergency, (b) the potential discharges of or exposures to contaminants, if any, that may have occurred, (c) the measures that have been taken to mitigate the effects of the emergency on human health and the environment, (d) the measures completed or implemented to restore the engineering control, and (e) the changes to the engineering control or site operation and maintenance plan to prevent reoccurrence of such conditions in the future. The owner, lessee, or operator shall submit the report to:

Department of Environmental Protection
Division of Remediation Management and Response
Bureau of Operation, Maintenance, and Monitoring
Deed Notice Inspection Program
P.O. Box 413
401 E. State Street
Trenton, NJ 08625-0413]

7A. MONITORING AND MAINTENANCE OF DEED NOTICE, AND PROTECTIVENESS CERTIFICATION. The persons in any way responsible, pursuant to the Spill Compensation and Control Act, N.J.S.A. 58:10-23.11a et seq., for the hazardous substances that remain at the Property, the persons responsible for conducting the remediation, the Owner, and the subsequent owners, lessees, and operators, shall monitor and maintain this Deed Notice, and certify to the Department on a biennial basis that the remedial action that includes this Deed Notice remains protective of the public health and safety and of the environment. The subsequent owners, lessees and operators have this obligation only during their ownership, tenancy, or operation. The specific obligations to monitor and maintain the deed notice shall include all of the following:

i. Monitoring and maintaining this Deed Notice according to the requirements in Exhibit C, to ensure that the remedial action that includes the Deed Notice continues to be protective of the public health and safety and of the environment;

ii. Conducting any additional remedial investigations and implement any additional remedial actions, that are necessary to correct, mitigate, or abate each problem related to the protectiveness of the remedial action for the site prior to the date that the certification is due to the Department pursuant to iii, below, in order to ensure that the remedial action that includes this Deed Notice remains protective of the public health and safety and of the environment.

iii. Certify to the Department of Environmental Protection as to the continued protectiveness of the remedial action that includes this Deed Notice, on a form provided by the Department and consistent with N.J.A.C. 7:26C-1.2 (a)1, every two years on the anniversary of the <u>date stamped on the deed notice that indicates when the deed notice was recorded;</u>

[*Insert the following paragraph if the soil remedial action included any engineering controls at the site:*

7B. MONITORING AND MAINTENANCE OF ENGINEERING CONTROLS, AND PROTECTIVENESS CERTIFICATION. The persons in any way responsible, pursuant to the Spill Compensation and Control Act, N.J.S.A. 58:10-23.11a et seq., for the hazardous substances that remain at the Property, the person responsible for conducting the remediation, and, the Owner, and the subsequent owners, lessees, and operators, shall maintain all engineering controls at the Property and certify to the Department on a biennial basis that the remedial action of which each engineering control is a part remains protective of the public health and safety and of the environment. The subsequent owners, lessees and operators have this obligation only during their ownership, tenancy, or operation. The specific obligations to monitor and maintain the engineering controls shall include the following:

i. Monitoring and maintaining each engineering control according to the requirements in Exhibit C, to ensure that the remedial action that includes the engineering control continues to be protective of the public health and safety and of the environment;

ii. Conducting any additional remedial investigations and implement any additional remedial actions, that are necessary to correct, mitigate, or abate each problem related to the protectiveness of the remedial action for the Property prior to the date that the certification is due to the Department pursuant to iii, below, in order to ensure that the remedial action that includes the engineering control remains protective of the public health and safety and of the environment.

iii. Certify to the Department of Environmental Protection as to the continued protectiveness of the remedial action that includes the engineering control, on a form provided by the Department and consistent with N.J.A.C. 7:26C-1.2 (a)1, every two years on the anniversary of the date stamped on the deed notice that indicates when the deed notice was recorded.

8. ACCESS. The Owner and the subsequent owners, lessees and operators agree to allow the Department, its agents and representatives access to the Property to inspect and evaluate the continued protectiveness of the remedial action that includes this Deed Notice and to conduct additional remediation to ensure the protection of the public health and safety and of the environment if persons responsible for monitoring the protectiveness of the remedial action, as described in Paragraph 7, above, fail to conduct such remediation pursuant to this Deed Notice as required by law. The Owner, and the subsequent owners and lessees, shall also cause all leases, subleases, grants, and other written transfers of an interest in the Restricted Areas to contain a provision expressly requiring that all holders thereof provide such access to the Department.

9. NOTICES.

i. The Owner and the subsequent owners and lessees, shall cause all leases, grants, and other written transfers of an interest in the Restricted Areas to contain a provision expressly requiring all holders thereof to take the Property subject to the restrictions contained herein and to comply with all, and not to violate any of the conditions of this Deed Notice. Nothing contained in this Paragraph shall be construed as limiting any obligation of any person to provide any notice required by any law, regulation, or order of any governmental authority.

ii. Owner and all subsequent owners and lessees shall notify any person intending to conduct invasive work or excavate within the Restricted Areas at the Property, including, without limitation, tenants, employees of tenants, and contractors of the nature and location of contamination in the Restricted Areas, and, of the precautions necessary to minimize potential human exposure to contaminants.

iii. The Owner and the subsequent owners shall provide written notice to the Department of Environmental Protection at least thirty (30) calendar days before the effective date of any conveyance, grant, gift, or other transfer, in whole or in part, of the owner's interest in the Restricted Area.

iv. The Owner and the subsequent owners shall provide written notice to the Department within thirty (30) calendar days following the owner's petition for or filing of any document

initiating a rezoning of the Property. The Owner and the subsequent owners shall submit the written notice to:

Department of Environmental Protection
Division of Remediation Management and Response
Bureau of Operation, Maintenance, and Monitoring
Deed Notice Inspection Program
P.O. Box 413
401 E. State Street
Trenton, NJ 08625-0413.

10. ENFORCEMENT OF VIOLATIONS.

i. This Deed Notice itself is not intended to create any interest in real estate in favor of the Department of Environmental Protection, nor to create a lien against the Property, but merely is intended to provide notice of certain conditions and restrictions on the Property and to reflect the regulatory and statutory obligations imposed as a conditional remedial action for this site.

ii. The restrictions provided herein may be enforceable solely by the Department against any person who violates this Deed Notice. To enforce violations of this Deed Notice, the Department may initiate one or more enforcement actions pursuant to N.J.S.A. 58:10-23.11u and require additional remediation and assess damages pursuant to N.J.S.A. 58:10-23.11g.

11. SEVERABILITY. If any court of competent jurisdiction determines that any provision of this Deed Notice requires modification, such provision shall be deemed to have been modified automatically to conform to such requirements. If a court of competent jurisdiction determines that any provision of this Deed Notice is invalid or unenforceable and the provision is of such a nature that it cannot be modified, the provision shall be deemed deleted from this instrument as though the provision had never been included herein. In either case, the remaining provisions of this Deed Notice shall remain in full force and effect.

12. SUCCESSORS AND ASSIGNS. This Deed Notice shall be binding upon Owner and upon Owner's successors and assigns, and subsequent owners, lessees and operators while each is an owner, lessee, or operator of the Property.

13. MODIFICATION AND TERMINATION.

i. Any person may request in writing, at any time, that the Department modify this Deed Notice where performance of subsequent remedial actions, a change of conditions at the Property, or the adoption of revised remediation standards suggest that modification of the Deed Notice would be appropriate.

ii. Any person may request in writing, at any time, that the Department terminate this Deed Notice because the conditions which triggered the need for this Deed Notice are no longer applicable.

iii. This Deed Notice may be revised or terminated only upon filing of an instrument, executed by the Department, in the office of the [*Insert as appropriate the County Clerk/Register of Deeds and Mortgages*] of [*Insert the name of the County*] County, New Jersey, expressly modifying or terminating this Deed Notice.

14A. EXHIBIT A. Exhibit A includes the following maps of the Property and the vicinity:

i. Exhibit A-1: Vicinity Map - A map that identifies by name the roads, and other important geographical features in the vicinity of the Property (for example, Hagstrom County Maps);

ii. Exhibit A-2: Metes and Bounds Description - A metes and bounds description of the Property, including reference to tax lot and block numbers for the Property;

iii. Exhibit A-3: Property Map - A scaled map of the Property, scaled at one inch to 200 feet or less, and if more than one map is submitted, the maps shall be presented as overlays, keyed to a base map; and the Property Map shall include diagrams of major surface topographical features such as buildings, roads, and parking lots.

14B. EXHIBIT B. Exhibit B includes the following descriptions of the Restricted Areas:

i. Exhibit B-1: Restricted Area Map - A separate map for each restricted area that includes:

(A) As-built diagrams of each engineering control, including caps, fences, slurry walls, ground water monitoring wells, and ground water pumping system;

(B) As-built diagrams of any buildings, roads, parking lots and other structures that function as engineering controls; and

(C) Designation of all soil and sediment sample locations within the restricted areas that exceed any soil or sediment standard that are keyed into one of the tables described in the following paragraph.

ii. Exhibit B-2: Restricted Area Data Table - A separate table for each restricted area that includes:

(A) Sample location designation from Restricted Area map (Exhibit B-1);

(B) Sample elevation based upon mean sea level;

(C) Name and chemical abstract service registry number of each contaminant with a concentration that exceeds the unrestricted use standard;

(D) The restricted and unrestricted use standards for each contaminant in the table; and

(E) The remaining concentration of each contaminant at each sample location at each elevation (or if historic fill, include data from the Department's default concentrations at N.J.A.C. 7:26E-4.6, Table 4-2).

14C. EXHIBIT C. Exhibit C includes narrative descriptions of the institutional controls [*Insert as appropriate:* and engineering controls] as follows:

i. Exhibit C-1: Deed Notice as Institutional Control: Exhibit C-1 includes a narrative description of the restriction and obligations of this Deed Notice that are in addition to those describe above, as follows:

(A) General Description of this Deed Notice:

(1) Description and estimated size of the Restricted Areas as described above;

(2) Description of the restrictions on the Property by operation of this Deed Notice; and

(3) The objective of the restrictions.

(B) Description of the monitoring necessary to determine whether:

(1) Any disturbances of the soil in the Restricted Areas did not result in the unacceptable exposure to the soil contamination;

(2) There have been any land use changes subsequent to the filing of this Deed Notice or the most recent biennial certification, whichever is more recent;

(3) The current land use on the Property is consistent with the restrictions in this Deed Notice;

(4) Any newly promulgated or modified requirements of applicable regulations or laws apply to the site; and

(5) Any new standards, regulations, or laws apply to the site that might necessitate additional sampling in order to evaluate the protectiveness of the remedial action which includes this Deed Notice, and conduct the necessary sampling.

(C) Description of the following items that will be included in the biennial certification:

(1) A monitoring report that describes the specific activities, pursuant to (A) and (B), above, conducted in support of the biennial certification of the protectiveness of the remedial action that includes this Deed Notice;

(2) Land use at the Property is consistent with the restrictions in this Deed Notice; and

(3) The remedial action that includes this Deed Notice continues to be protective of the public health and safety and of the environment.

[*Insert the following if engineering controls are part of the remedial action for the site:*

ii. Exhibit C-2: [*Insert the name of the first engineering control*]: Exhibit C-2 includes a narrative description of [*Insert the name of the first engineering control*] as follows:

(A) General Description of the engineering control:

(1) Description of the engineering control;

(2) The objective of the engineering control; and

(3) How the engineering control is intended to function.

(B) Description of the operation and maintenance necessary to ensure that:

(1) Periodic inspections of each engineering control are performed in order to determine its integrity, operability, and effectiveness;

(2) Each engineering control continues as designed and intended to protect the public health and safety and the environment;

(3) Each alteration, excavation or disturbance of any engineering control is timely and appropriately addressed to maintain the integrity of the engineering control;

(4) This engineering control is being inspected and maintained and its integrity remains so that the remedial action continues to be protective of the public health and safety and of the environment;

(5) A record of the self-inspection dates, name of the inspector, results of the inspection and condition(s) of this engineering control. Sampling, for example, may be necessary if it is not possible to visually evaluate the integrity/ performance of this engineering control; and

(6) Any new standards, regulations, or laws apply to the site that might necessitate additional sampling in order to evaluate the protectiveness of the remedial action which includes this Deed Notice, and conduct the necessary sampling.

(C) Description of the following items that will be included in the biennial certification:

(1) A monitoring report that describes the specific activities, pursuant to (A) and (B), above, conducted in support of the biennial certification of the protectiveness of the remedial action that includes this Deed Notice;

(2) The engineering controls continue to operate as designed; and

(3) The remedial action that includes the engineering control continues to be protective of the public health and safety and of the environment.

Repeat the contents of Exhibit C-2, renumbering accordingly, for each separate engineering control that is part of the remedial action for the site.]

15. SIGNATURES. IN WITNESS WHEREOF, Owner has executed this Deed Notice as of the date first written above.

[If Owner is an individual]

WITNESS:

_____ _____

[Signature] [Print name below signature]

[If Owner is a corporation]

ATTEST: [Name of corporation]

_____ By_____

_____ _____

[Print name and title] [Signature]

[If Owner is a general or limited partnership]

WITNESS: [Name of partnership]

_____

_____ By_____, General
[Signature] [Print name] Partner

[If Owner is an individual]

STATE OF [State where document is executed] SS.:
COUNTY OF [County where document is executed]

I certify that on _____, 20__, [Name of Owner] personally came before me, and this person acknowledged under oath, to my satisfaction, that this person [or if more than one person, each person]

(a) is named in and personally signed this document; and

(b) signed, sealed and delivered this document as his or her act and deed.

_____

_____, Notary Public
[Print Name and Title]

[If Owner is a corporation]

STATE OF [State where document is executed] SS.:
COUNTY OF [County where document is executed]

I certify that on _____, 20__, [Name of person executing document on behalf of Owner] personally came before me, and this person acknowledged under oath, to my satisfaction, that:

(a) this person is the [secretary/assistant secretary] of [Owner], the corporation named in this document;

(b) this person is the attesting witness to the signing of this document by the proper corporate officer who is the [president/vice president] of the corporation;

(c) this document was signed and delivered by the corporation as its voluntary act and was duly authorized;

(d) this person knows the proper seal of the corporation which was affixed to this document; and

(e) this person signed this proof to attest to the truth of these facts.

_____
[Signature]

_____
[Print name and title of attesting witness]

Signed and sworn before me on _____, 20__

_____, Notary Public

_____
[Print name and title]

[If Owner is a partnership]

STATE OF [State where document is executed] SS.:
COUNTY OF [County where document is executed]

I certify that on _____, 20__, [Name of person executing document on behalf of Owner] personally came before me, and this person acknowledged under oath, to my satisfaction, that this person:

(a) is a general partner of [Owner], the partnership named in this document;

(b) signed, sealed and delivered this document as his or her act and deed in his capacity as a general partner of [owner]; and

(c) this document was signed and delivered by such partnership as its voluntary act, duly authorized.

_____
[Signature]

_____, General Partner
[Print Name]

_____, Notary Public

_____
[Print name and title]

New Jersey Department of Environmental Protection
Division of Remediation, Management and Response
Bureau of Operations, Maintenance & Monitoring
PO Box 413
401 East State Street
Trenton, NJ 08625-0413
609-984-2990

DEED NOTICE SITE INSPECTION REPORT

Site Name		Page Of	Date:
Municipality	County		
PI #	Program		
Inspector			
Section Chief			
Contact Person on site:	Relationship:	Phone:	
Address:			
Municipality:	County:	Zip Code:	

ENGINEERING CONTROL PRESENT:

.

WERE ANY MODIFICATIONS NOTED TO THE EC?	Yes	No
If yes,describe modifications.		

DEED NOTICE ON SITE ? Yes _____ No _____ Comment: _____

Date Prepared By:

SAMPLE

APPENDIX B

MODEL GROUNDWATER CLASSIFICATION EXCEPTION AREA

Ground Water Classification Exception Area Fact Sheet

A. SITE INFORMATION

1. Program's Site Identification Number: _____

2. Program Interest Number (Preferred ID): _____

3. Program Interest Name: _____

4. Street address: _____

5. City: _____

6. County: _____

7. Block and Lots of the site (duplicate if the site is located in more than one municipality):

   a. Name of the municipality in which the site is located: _____

   b. Block and Lots: _____

   c. Year of tax map: _____

8. United States Geological Survey Quadrangle map, indicating the location of the site, presented as Exhibit A.

9. Site Contact:

   a. Name of contact person: _____

   b. Company name: _____

   c. Mailing address: _____

   d. Phone number: (__ __ __) __ __ __ - __ __ __ __

B. PROPOSED CLASSIFICATION EXCEPTION AREA INFORMATION

1. Narrative description of proposed classification exception area:

2. Location of proposed classification exception area (duplicate if the site is located in more than one municipality):

   a. Name of the municipality in which the site is located: _____

   b. Block and Lots: _____

   c. Year of tax map: _____

3. Affected aquifer(s):

Aquifer Name	Vertical Depth	Ground Water Classification

4. Contaminant concentrations:

Contaminant	Concentration[1]	GWQS[2]	SWQS[3]

5. Proposed classification exception area boundaries:

Horizontal: Scaled map indicating projected areal extent of proposed classification exception area, as well as location of site, presented as Exhibit B.

Vertical: As stated in B.3., above.

Locational coordinates of boundary of proposed classification exception area as New Jersey State Plane Coordinates. A minimum of four coordinates shall be submitted, in a format compatible with Department's geographic information system:

Northing Easting (New Jersey State Plane Coordinates)

Latitude Longitude

6. Estimated size of the proposed ground water classification exception area:

_____

7. Projected duration and expiration date of the proposed classification exception area:

   a. Duration (in years and or days): _____

   b. Expiration date (as calendar date): _____

Footnotes

1 Maximum concentration detected at the time Classification Exception Area information submitted to the Department.

2 New Jersey Ground Water Quality Standards, N.J.A.C. 7:9C.

3 New Jersey Surface Water Quality Standards, N.J.A.C. 7:9B.

APPENDIX C

ACTIVITY AND USE LIMITATIONS FORM

NOTICE OF ACTIVITY AND USE LIMITATION
M.G.L. c. 21E, §6 and 310 CMR 40.0000

Disposal Site Name: Titan Tool Company
DEP Release Tracking No.(s): 3-0000

This Notice of Activity and Use Limitation ("Notice") is made as of this 3rd day of July, 19 97, by Titan Tool Company, Inc., a Massachusetts corporation having a principal place of business at 345 Main Street, Siteville, Massachusetts 99999, together with its successors and assigns (collectively, "Owner").

W I T N E S S E T H:

WHEREAS, Titan Tool Company, Inc., of Siteville, Essex County, Massachusetts, is the owner in fee simple of that certain parcel of land located in Siteville, Essex County, Massachusetts, with the buildings and improvements thereon ("Property");

WHEREAS, said parcel of land, which is more particularly bounded and described in Exhibit A, attached hereto and made a part hereof ("Property") is subject to this Notice of Activity and Use Limitation. The property is shown on a plan recorded with Essex County Registry of Deeds (Southern District) in Plan Book 150, Plan 10.

WHEREAS, a portion of the Property ("Portion of the Property") is subject to this Notice of Activity and Use Limitation. The Portion of the Property is more particularly bounded and described in Exhibit A-1, attached hereto and made a part hereof. The Portion of the Property is shown as the "AUL Area" on the aforementioned plan recorded with said Deeds in Plan Book 150, Plan 10;

WHEREAS, the Portion of the Property comprises part of a disposal site as the result of a release of oil and/or hazardous material. Exhibit B is a sketch plan showing the relationship of the Portion of the Property subject to this Notice of Activity and Use Limitation to the boundaries of said disposal site (to the extent such boundaries have been established). Exhibit B is attached hereto and made a part hereof; and

WHEREAS, one or more response actions have been selected for the Portion of the Disposal Site in accordance with M.G.L. c.21E ("Chapter 21E") and the Massachusetts Contingency Plan, 310 CMR 40.0000 ("MCP"). Said response actions are based upon (a) the restriction of human access to and contact with oil and/or hazardous material in soil and/or (b) the restriction of certain activities occurring in, on, through, over or under the Portion of the Property. The basis for such restrictions is set forth in an Activity and Use Limitation Opinion ("AUL Opinion"), dated July 2, 1997, (which is attached hereto as Exhibit C and made a part hereof);

NOW, THEREFORE, notice is hereby given that the activity and use limitations set forth in said AUL Opinion are as follows:

1. Permitted Activities and Uses Set Forth in the AUL Opinion. The AUL Opinion provides that a condition of No Significant Risk to health, safety, public welfare or the environment exists for any foreseeable period of time (pursuant to 310 CMR 40.0000) so long as any of the following activities and uses occur on the Portion of the Property:

(i) Commercial and/or industrial uses and activities associated therewith, including, but not limited to, pedestrian and/or vehicular traffic, landscaping, and routine maintenance of

landscaped areas, which do not cause and/or result in the disturbance and/or the re-location of petroleum-contaminated soil located at 4 to 8 feet below surface grade;

(ii) Short-term (three months or less) underground utility and/or construction activities including, but not limited to, excavation (including emergency repair of underground utility lines), which are likely to disturb petroleum-contaminated soil located at 4 to 8 feet below surface grade, provided that such activities are conducted in accordance with Obligations/Conditions (i) and (ii) in Section 3 of this Activity and Use Limitation Opinion ("Opinion"), the soil management procedures of the MCP cited at 310 CMR 40.0030, and all applicable worker health and safety practices pursuant to 310 CMR 40.0018;

(iii) Activities and uses which are not identified in this Opinion as being inconsistent with maintaining a condition of No Significant Risk; and

(iv) Such other activities and uses which, in the Opinion of an LSP, shall present no greater risk of harm to health, safety, public welfare, or the environment than the activities and uses set forth in this Paragraph.

2. Activities and Uses Inconsistent with the AUL Opinion. Activities and uses which are inconsistent
with the objectives of this Notice, and which, if implemented at the Portion of the Property, may result in a significant risk of harm to health, safety, public welfare or the environment or in a substantial hazard, are as follows:

(i) Use of the portion of the property as a residence, school (with the exception of adult education), daycare, nursery, recreational area (such as a park or athletic fields), and/or any other use at which a child's presence is likely;

(ii) Any activity including, but not limited to, excavation, which is likely to disturb petroleum-contaminated soil located at 4 to 8 feet below surface grade associated with underground utility and/or construction work, without prior development and implementation of a Soil Management Plan and a Health and Safety Plan in accordance with Obligations (I) and (ii) of Section 3 of the AUL;

(iii) Any activity which is likely to disturb petroleum-contaminated soil located at 4 to 8 feet below surface grade for a period of time greater than three months, unless such activity is first evaluated by an LSP who renders an Opinion stating that such activity is consistent with maintaining a condition of No Significant Risk and that such activity is conducted in accordance with Obligations (i) and (ii) of Section 3 of this AUL;and

(iv) Relocation of petroleum-contaminated soil located at 4 to 8 feet below surface grade, unless such relocation is first evaluated by an LSP who renders an Opinion stating that such relocation is consistent with maintaining a condition of No Significant Risk.

3. Obligations and Conditions Set Forth in the AUL Opinion. If applicable, obligations and/or conditions to be undertaken and/or maintained at the Portion of the Property to maintain a condition of No Significant Risk as set forth in the AUL Opinion shall include the following:

(i) A Soil Management Plan must be prepared by a Licensed Site Professional (LSP) prior to the commencement of any activity which is likely to disturb petroleum-contaminated soil located at 4 to 8 feet below surface grade. The Soil Management Plan should describe appropriate soil management, characterization, storage, transport and disposal procedures in accordance with the provisions of the MCP cited at 310 CMR 40.0030 et seq. Workers who may come in contact with the petroleum-contaminated soil should be appropriately trained on the

requirements of the Plan, and the Plan must remain available on-site throughout the course of the project;

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(ii) A Health and Safety Plan must be prepared and implemented prior to the commencement of any activity which may result in the disturbance of petroleum-contaminated soil located at 4 to 8 feet below surface grade. The Health and Safety Plan should be prepared by a Certified Industrial Hygienist or other qualified individual appropriately trained in worker health and safety procedures and requirements. The Plan should specify the type personal protection, engineering controls, and environmental monitoring necessary to prevent worker and other potential receptor exposures to petroleum-contaminated soil through ingestion, dermal contact, and inhalation. Workers who may come in contact with the petroleum-contaminated soil should be appropriately trained on the requirements of the Plan , and the Plan must remain available on-site throughout the course of the project; and

(iii) The petroleum-contaminated soil located at 4 to 8 feet below surface grade must remain at depth and may not be relocated, unless such activity is first evaluated by an LSP who renders an Opinion which states that such activity poses no greater risk of harm to health, safety, public welfare, or the environment and ensures that a condition of No Significant Risk is maintained.

4. Proposed Changes in Activities and Uses. Any proposed changes in activities and uses at the Portion of the Property which may result in higher levels of exposure to oil and/or hazardous material than currently exist shall be evaluated by an LSP who shall render an Opinion, in accordance with 310 CMR 40.1080 *et seq.*, as to whether the proposed changes will present a significant risk of harm to health, safety, public welfare or the environment. Any and all requirements set forth in the Opinion to meet the objective of this Notice shall be satisfied before any such activity or use is commenced.

5. Violation of a Response Action Outcome. The activities, uses and/or exposures upon which this Notice is based shall not change at any time to cause a significant risk of harm to health, safety, public welfare, or the environment or to create substantial hazards due to exposure to oil and/or hazardous material without the prior evaluation by an LSP in accordance with 310 CMR 40.1080 *et seq.*, and without additional response actions, if necessary, to achieve or maintain a condition of No Significant Risk or to eliminate substantial hazards.

If the activities, uses, and/or exposures upon which this Notice is based change without the prior evaluation and additional response actions determined to be necessary by an LSP in accordance with 310 CMR 40.1080 *et seq.*, the owner or operator of the Portion of the Property subject to this Notice at the time that the activities, uses and/or exposures change, shall comply with the requirements set forth in 310 CMR 40.0020.

6. Incorporation Into Deeds, Mortgages, Leases, and Instruments of Transfer. This Notice shall be incorporated either in full or by reference into all deeds, easements, mortgages, leases, licenses, occupancy agreements or any other instrument of transfer, whereby an interest in and/or a right to use the Property or a portion thereof is conveyed.

Owner hereby authorizes and consents to the filing and recordation and/or registration of this Notice, said Notice to become effective when executed under seal by the undersigned LSP, and

recorded and/or registered with the appropriate Registry(ies) of Deeds and/or Land Registration Office(s).

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WITNESS the execution hereof under seal this 3rd day of July , 19 97.

Titan Tool Company, Inc.

Owner
By: Ernest C. Greene
Its: President and Treasurer

COMMONWEALTH OF MASSACHUSETTS

Essex , ss July 3 , 19 97

Then personally appeared the above named Ernest C. Greene in his respective capacities as President and Treasurer of the Titan Tool Company, Inc., and acknowledged the foregoing to be his free act and deed in his aforesaid respective capacities before me,

NOTARY PUBLIC

Notary Public: Marvin Notary
My Commission Expires December 12, 2000

The undersigned LSP hereby certifies that he executed the aforesaid Activity and Use Limitation Opinion attached hereto as Exhibit C and made a part hereof and that in his Opinion this Notice of Activity and Use Limitation is consistent with the terms set forth in said Activity and Use Limitation Opinion.

Date: July 3, 1997

LSP – Sam Geologist

Sam Geologist
No. 461
LSP

COMMONWEALTH OF MASSACHUSETTS

Essex , ss July 3 , 19 97

Then personally appeared the above named Sam Geologist and acknowledged the foregoing to be his free act and deed before me,

NOTARY PUBLIC

Notary Public: Marvin Notary
My Commission Expires December 12, 2000

Upon recording, return to:

Titan Tool Company, Inc.,
345 Main Street,
Siteville, MA 99999
Attn.: Ernest C. Greene

EXHIBIT A

(Description of Parcel of Land Containing Area Subject to AUL)

A certain parcel of land situated in Siteville, Essex County, Massachusetts, shown as Lot 1 on a plan entitled, "Plan of, Lot 1, AUL Area and Disposal Site Land in Siteville, Massachusetts, Owned by Titan Tool Company, Inc., of 345 Main Street, Siteville, Massachusetts 99999", dated March 1, 1981, Scale 1" = 80', prepared by Mass Survey Company, Inc., Boston, Massachusetts, and recorded with Essex County Registry of Deeds (Southern District) in Plan Book 150, Plan 10, and being more particularly bounded and described as follows:

BEGINNING	at a point on the northerly side of New Hope Street at the southwest corner of land now or formerly of Titan Tool Company; and thence running
N 85°23'15"W	along the northerly side line of New Hope Street, one hundred sixty-six and 87/100 (166.87) feet; thence continuing
NORTHWESTERLY	by a curve to the right having a radius of twenty and 00/100 (20.00) feet, a distance of thirty-one and 39/100 (31.39) feet to the easterly side line of Main Street; thence turning and running
N 04° 32' 15" E	along the easterly side line of Main Street, four hundred seventy-four and 85/100 (474.85) feet; thence turning and running
S 78° 53' 59" E	by land now or formerly of City of Siteville two hundred sixty-eight and 75/100 (286.57) feet; thence turning and running
S 16° 29' 15" W	by land now or formerly of Titan Tool Company, four hundred seventy-two and 65/100 (472.56) feet to the point of beginning, containing 113,555 square feet of land, more or less, according to said plan.

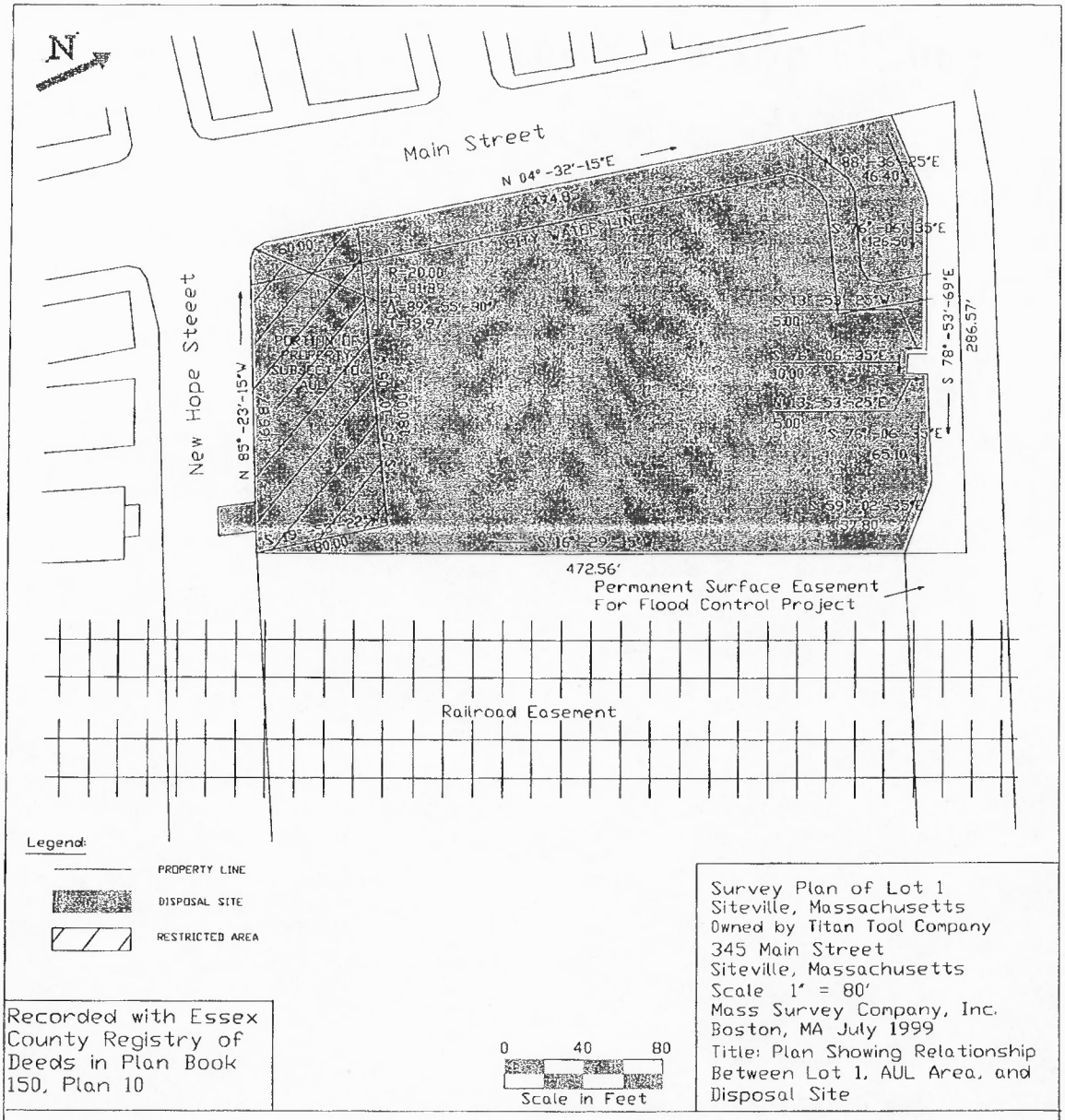
EXHIBIT A-1

(Description of Area Subject to AUL)

That certain portion of a parcel of land, said parcel of land being situated in Siteville, Essex County, Massachusetts, and being shown as Lot 1 on the aforementioned plan recorded with said Deeds in Plan Book 150, Plan 10, said portion being shown as the "AUL Area" on said plan, and being more particularly bounded and described as follows:

BEGINNING	at a point on the northerly side of New Hope Street at the southwest corner of land now or formerly of the Titan Tool Company; thence running
N 85° 23' 15" W	along the northerly side line of New Hope Street, one hundred sixty-six and 87/100 (166.87) feet; thence continuing
NORTHWESTERLY	by a curve to the right having a radius of twenty and 00/100 (20.00) feet, a distance of thirty-one and 39/100 (31.39) feet to the easterly side line of Main Street; thence turning and running
N 04° 32' 15" E	along the easterly side line of Main Street, sixty (60.00) feet; thence turning and running
S 75° 10' 05" W	one hundred eighty and 00/100 (180.00) feet to a point; thence turning and running
S 19° 53' 22"W	eighty and 00/100 (80.00) feet to the point of beginning, containing 12,140.45 square feet of land, more or less, according to said plan.

Exhibit B: Sketch Plan



[Note to the Readers: Exhibit B must provide a sketch plan showing the relationship of the Restricted Area to the boundries of the disposal site. This sample Exhibit uses a copy of a new survey plan for the parcel and the portion of that property subject to the AUL, with the boundries of the disposal site added. Please note that, where a survey plan has already been recorded, it can be used as the base plan for this Exhibit. Also, it is not necessary to use a survey plan as the basis for this Exhibit.]

EXHIBIT C

ACTIVITY AND USE LIMITATION OPINION

In accordance with the requirements of 310 CMR 40.1074, this Activity and Use Limitation Opinion has been prepared for a portion of a parcel of land owned by the Titan Tool Company, Inc., located at 345 Main Street, Siteville, Essex County, Massachusetts 99999. As of the date of this Activity and Use Limitation Opinion, the property is zoned for commercial and industrial use. The property remains unpaved with no buildings or improvements thereon.

Site History

Titan Tool Company, Inc., manufactured tools at the subject property from 1940 through 1980. In 1993, the two-story manufacturing facility was demolished. Four underground storage tanks (USTs) containing #2 fuel oil and a large volume of petroleum-contaminated soil were removed from the southern portion of the property at that time.

In 1994, a 21E site investigation identified elevated levels of lead, arsenic, and petroleum hydrocarbons in soil samples collected from various surficial and subsurficial locations on the property. Titan Tool Company, Inc., notified the Massachusetts Department of Environmental Protection of these findings, as such findings triggered certain notification requirements of the Massachusetts Contingency Plan (the "MCP", 310 CMR 40.0000).

*[**Note:** The "MCP" is the Commonwealth of Massachusetts' code of regulations for the notification, assessment, and cleanup of disposal sites where a release of oil and/or hazardous materials has occurred.]*

A Phase II Comprehensive Site Investigation was conducted at the site in 1997. The results of the investigation indicate that lead and arsenic levels below the MCP Method 1, S-1 Soil Standards are present in surficial and subsurficial soil throughout the property. Concentrations of Extractable Petroleum Hydrocarbons (EPH) which exceed the MCP Method 1, S-1 Standards but meet the Method 1, S-3 Soil Standards exist in soil located at 4 to 8 feet below surface grade at the former location of the fuel oil USTs (*See* Exhibit B, Sketch Plan). EPH concentrations in soil at other locations on the property meet the Method 1, S-1 Soil Standards. Lead, arsenic, and petroleum hydrocarbons were not detected in groundwater samples collected from six on-site monitoring wells during four separate groundwater sampling events.

*[**Note:** The "MCP Method 1 Cleanup Standards" refer to numerical standards for chemical contaminants in soil and groundwater which are published in the MCP. The soil standards are broken into three soil categories: S-1, S-2, and S-3. The S-1 Soil Standards are the most strict, or lowest, numerical values since they were derived to be protective of a residential exposure scenario by considering a receptor's incidental ingestion and dermal contact exposures to soil while gardening and playing. The S-2 and S-3 numerical standards are less strict and therefore higher, having been developed using passive recreational and construction-related exposure scenarios, respectively.]*

Reason for Activity and Use Limitation

A Method 1 Risk Characterization was conducted to evaluate the risk posed by contamination remaining in soil at the site. Using the Method 1 approach, concentrations of lead, arsenic, and extractable petroleum hydrocarbons (EPH) remaining in soil were compared to the MCP Method 1 Soil Standards to determine if the site poses a risk for current and future activities and uses.

The Method 1 Risk Characterization concluded that the site poses No Significant Risk to health, safety, public welfare or the environment for current conditions of commercial and/or industrial uses of the property because contaminant concentrations remaining in soil met the applicable Method 1, S-2 and S-3 Soil Standards for the site. Levels of lead and arsenic measured in soil also met the lower Method 1, S-1 Soil Standards and pose No Significant Risk for unrestricted future site activities and uses.

However, since levels of extractable petroleum hydrocarbons in soil located at 4 to 8 feet below surface grade in the southern portion of the site exceeded their respective Method 1, S-1 Standards, an unacceptable risk exists should future activities and uses of this portion of the property result in unrestricted human exposure to the soil, such as those associated with a child's exposure through direct contact and/or ingestion. Therefore, in order to ensure that such exposures do not occur and that a condition of No Significant Risk be maintained for future activities and uses, an Activity and Use Limitation is required to restrict certain activities and uses of this portion of the property.

Permitted Activities and Uses

(i) Commercial and/or industrial uses and activities associated therewith, including, but not limited to, pedestrian and/or vehicular traffic, landscaping, and routine maintenance of landscaped areas, which do not cause and/or result in the disturbance and/or the re-location of petroleum-contaminated soil located at 4 to 8 feet below surface grade;

(ii) Short-term (three months or less) underground utility and/or construction activities including, but not limited to, excavation (including emergency repair of underground utility lines), which are likely to disturb petroleum-contaminated soil located at 4 to 8 feet below surface grade, provided that such activities are conducted in accordance with Obligations/Conditions (i) and (ii) in Section 3 of this Activity and Use Limitation Opinion ("Opinion"), the soil management procedures of the MCP cited at 310 CMR 40.0030, and all applicable worker health and safety practices pursuant to 310 CMR 40.0018;

(iii) Activities and uses which are not identified in this Opinion as being inconsistent with maintaining a condition of No Significant Risk; and

(iv) Such other activities and uses which, in the Opinion of an LSP, shall present no greater risk of harm to health, safety, public welfare, or the environment than the activities and uses set forth in this Paragraph.

Activities and Uses Inconsistent with AUL Opinion

(i) Use of the portion of the property as a residence, school (with the exception of adult education), daycare, nursery, recreational area (such as a park or athletic fields), and/or any other use at which a child's presence is likely;

(ii) Any activity including, but not limited to, excavation, which is likely to disturb petroleum-contaminated soil located at 4 to 8 feet below surface grade associated with underground utility and/or construction work, without prior development and implementation of a Soil Management Plan and a Health and Safety Plan in accordance with Obligations (I) and (ii) of Section 3 of the AUL;

(iii) Any activity which is likely to disturb petroleum-contaminated soil located at 4 to 8 feet below surface grade for a period of time greater than three months, unless such activity is first evaluated by an LSP who renders an Opinion stating that such activity is consistent with maintaining a condition of No Significant Risk and that such activity is conducted in accordance with Obligations (i) and (ii) of Section 3 of this AUL;and

(iv) Relocation of petroleum-contaminated soil located at 4 to 8 feet below surface grade, unless such relocation is first evaluated by an LSP who renders an Opinion stating that such relocation is consistent with maintaining a condition of No Significant Risk.

Obligations and Conditions

(i) A Soil Management Plan must be prepared by a Licensed Site Professional (LSP) prior to the commencement of any activity which is likely to disturb petroleum-contaminated soil located at 4 to 8 feet below surface grade. The Soil Management Plan should describe appropriate soil management, characterization, storage, transport and disposal procedures in accordance with the provisions of the MCP cited at 310 CMR 40.0030 et seq. Workers who may come in contact with the petroleum-contaminated soil should be appropriately trained on the requirements of the Plan, and the Plan must remain available on-site throughout the course of the project;

(ii) A Health and Safety Plan must be prepared and implemented prior to the commencement of any activity which may result in the disturbance of petroleum-contaminated soil located at 4 to 8 feet below surface grade. The Health and Safety Plan should be prepared by a Certified Industrial Hygienist or other qualified individual appropriately trained in worker health and safety procedures and requirements. The Plan should specify the type personal protection, engineering controls, and environmental monitoring necessary to prevent worker and other potential receptor exposures to petroleum-contaminated soil through ingestion,

dermal contact, and inhalation. Workers who may come in contact with the petroleum-contaminated soil should be appropriately trained on the requirements of the Plan , and the Plan must remain available on-site throughout the course of the project; and

(iii) The petroleum-contaminated soil located at 4 to 8 feet below surface grade must remain at depth and may not be relocated, unless such activity is first evaluated by an LSP who renders an Opinion which states that such activity poses no greater risk of harm to health, safety, public welfare, or the environment and ensures that a condition of No Significant Risk is maintained.

LSP: _____

Sam Geologist, Licensed Site Professional

DATE: _____

Legal Notice of Notice of Activity and Use Limitation

(to be published in a newspaper which circulates in the community in which the property subject to the AUL is located within 30 days of recording the Notice of Activity and Use Limitation with the Registry of Deeds; copy of published Legal Notice to be provided to the appropriate regional office of MADEP within 7 days of publication)

NOTICE OF ACTIVITY AND USE LIMITATION

Site Name: Titan Tool Company
Site Address: 345 Main Street, Siteville, MA 99999
MADEP Release Tracking Number 3-0000

Pursuant to the Massachusetts Contingency Plan (310 CMR 40.1073(7)), a **NOTICE OF ACTIVITY AND USE LIMITATION** on the above disposal site has been recorded with the **ESSEX COUNTY REGISTRY OF DEEDS (Southern District)** on **JULY 3, 1997** in Book 200, Page 20 *[or Instrument Number if Book and Page numbers not yet assigned by Registry]*.

The **NOTICE OF ACTIVITY AND USE LIMITATION ("AUL")** limits the following activities and uses on that portion of the above property as identified in the AUL as the "AUL Area":

(i) Use of the portion of the property as a residence, school, daycare, nursery, recreational area, such as a park, and/or other use at which a child's presence is likely;

(ii) Any activity including but not limited to, excavation, which is likely to disturb of petroleum-contaminated soil located at 4 to 8 feet below surface grade within the AUL Area and which is not conducted in accordance with a Soil Management Plan and a Health and Safety Plan prepared and implemented prior to the commencement of such activity;

(iii) Any activity which is likely to disturb petroleum-contaminated soil located at 4 to 8 feet below surface grade for a period of time greater than three months, unless such activity is first evaluated by an LSP who renders an Opinion stating that such activity is consistent with maintaining a condition of No Significant Risk; and

(iv) Relocation of petroleum-contaminated soil located at 4 to 8 feet below surface grade, unless such activity is first evaluated by an LSP who renders an Opinion stating that such relocation is consistent with maintaining a condition of No Significant Risk.

Any person interested in obtaining additional information or reviewing the **NOTICE OF ACTIVITY AND USE LIMITATION** and the disposal site file may contact Joseph Smith, Senior Environmental Officer of the **TITAN TOOL COMPANY, Inc., 345 MAIN STREET, SITEVILLE, MA 99999** at **(978) 555-1111, extension 151.**

Notice to Public Officials of Recording of Notice of Activity and Use Limitation

(to be provided within 30 days of recording Notice of AUL)

22 July 1997

Chief Municipal Officer
Siteville City Hall
1234 Main Street
Siteville, MA 99999

Ladies and Gentlemen:

The purpose of this letter is to inform you that on July 3, 1997, a Notice of Activity and Use Limitation ("AUL"), a copy of which is enclosed, was recorded with the Essex County Registry of Deeds (Southern District) in Book 200, Page 20. The AUL affects a portion of the Titan Tool Company, Inc. property located at 345 Main Street in Siteville, Massachusetts 99999. It identifies certain activities and uses which are inconsistent with maintaining a condition of No Significant risk at the subject property. Such activities and uses are so identified in order to prevent exposures to residual petroleum-contaminated soil located in the southern portion of the property at 4 to 8 feet below surface grade. The AUL identifies those activities and uses which are consistent with maintaining a condition of No Significant Risk and those obligations and conditions necessary to ensure that a condition of No Significant Risk continues to exist at the property for the foreseeable future.

This public notification is being provided pursuant to the Massachusetts Contingency Plan, 310 CMR 40.1090 and 310 CMR 40.1403(7)(a). If you have any questions, please contact Joseph Smith, Senior Environmental Officer of the Titan Tool Company, Inc. at (978) 555-1111, extension 151.

Very truly yours,

Ernest C. Greene
President
Titan Tool Company, Inc.

CC: DEP
Northeast Regional Office

with Enc.

Note to Readers: The same letter should also be sent to the Siteville Health Officer, Building Code Enforcement Official, and Zoning Official.

CLERK'S CERTIFICATE

I, Mary E. Smith, DO HEREBY CERTIFY:

THAT I am the Clerk of Titan Tool Company, Inc., a Massachusetts corporation having a principal place of business at 345 Main Street, Siteville, Massachusetts ("Corporation") and that at a meeting of the Board of Directors of the Corporation duly called and held at the office of the Corporation at 345 Main Street, Siteville, Massachusetts, on the 5th day of June, 1995, all the directors being present and voting at all times, the following resolution was unanimously adopted:

VOTED: That the President, Treasurer or Clerk be, and any one of them is, hereby authorized and directed in the name and on behalf of the Corporation to purchase real or personal property for the Corporation in his or her discretion; to sell, mortgage or lease any and all real estate owned or which may hereafter be owned by the Corporation, as any one of them shall deem expedient and proper in carrying out the business of the Corporation, and in connection therewith to sign in the name and on behalf of the Corporation, seal with the corporate seal, acknowledge and deliver any mortgages, deeds, promissory notes, and other instruments of every nature, which may be necessary or proper in carrying on the business of the Corporation, and to do any and all acts necessary and proper for imposing restrictive covenants and agreements on any property now or hereafter owned by said Corporation. This vote shall remain in full force and effect until an instrument revoking the same shall have been recorded in the Essex County Registry of Deeds (Southern District).

I DO FURTHER CERTIFY that the above vote has not been altered, amended, rescinded or repealed.

I DO FURTHER CERTIFY THAT the Corporation is a duly organizedcorporation; that the foregoing vote is in accordance with the charter and by-laws of the Corporation; that Ernest C. Greene is the duly elected and qualified President and Treasurer of the Corporation, and that I am the duly elected and qualified Clerk of the Corporation.

Dated this 2nd day of July, 1997.

ATTEST: _____
A true copy
Mary E. Smith, Clerk

ATTEST: _____
Ernest C. Greene
President and Treasurer

APPENDIX D

SUMMARY OF SITES WITH DNS ATTACHED BEFORE DECEMBER 31, 2002

SUMMARY OF SITES WITH DNs ATTACHED BEFORE DECEMBER 31, 2002 (DATA AS OF 2005)

Table D.1 Summary of Sites with DNs Attached before December 31, 2002

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
The Boat Works	Bayonne City	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Mercer Cnty Voc Schools Sypek	Hopewell Twp	N	12/25/1980	n/a	n/a	n/a	n/a	n/a	n/a	Surface Cover
Naval Air Warfare Center	Ewing Twp	Y	12/25/1980	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bomont Industries	Totowa Boro	N	12/25/1980	n/a	n/a	n/a	n/a	n/a	n/a	Fencing and vegetative cover
Interstate Metal Separating Corp	Kearny Town	N	12/25/1980	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Leone Industries	Bridgeton City	N	12/25/1980	n/a	n/a	n/a	n/a	n/a	n/a	Surface Cover
James J Ferris High School	Jersey City	N	12/25/1980	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Thomas Jefferson #92	Elizabeth City	N	12/25/1980	n/a	n/a	n/a	n/a	n/a	n/a	n/a
National Paint Products Co Inc	Irvington Town	N	12/25/1980	9/30/2001	n/a	n/a	n/a	n/a	n/a	Asphalt capping with perimeter fencing; locking gates
Volco Brass And Copper Co	Kenilworth Boro	Y	12/25/1980	n/a	n/a	n/a	n/a	10/5/2000	n/a	Asphalt parking lot and concrete building slab
Millville Rescue Squad	Millville City	N	12/25/1980	n/a	n/a	n/a	n/a	n/a	n/a	Surface Cover
Laramkris Corp	Irvington Town	n/a	12/25/1980	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Amerace Corporation Elastimold Division	Washington Twp	n/a	8/1/2002	7/31/2004	n/a	n/a	n/a	n/a	n/a	Engineering control consists of a portion of the building slab plus a portion of the adjacent alleyway
Liquid Carbonics	Linden City	N	12/25/1980	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bayonne Shopping Center	Bayonne City	N	12/25/1980	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Ppd Corporation	Newark	N	12/25/1980	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Observer Highway Redevelopment Project	Hoboken City	N	12/25/1988	n/a	n/a	n/a	5/28/1996	n/a	n/a	Concrete slab which is part of a high-rise apartment building
N Sumergrade & Sons	Jersey City	Y	1/30/1991	8/29/1992	n/a	n/a	n/a	n/a	n/a	n/a
Algonquin Gas Transmission Co	Bernards Twp	N	10/1/1991	7/30/1997	n/a	n/a	7/28/1999	9/8/1999	n/a	Impervious surface
Custom Alloy Corp	Califon Boro	N	10/25/1991	10/22/1993	n/a	n/a	7/28/1999	9/8/1999	n/a	Concrete floor in building
Route Power Mate Company	Hackensack City	N	6/26/1992	6/26/1994	n/a	n/a	n/a	n/a	n/a	The word cap is in the narrative of the DER but there are no maps or specifications.
Tinmet Corporation	Elizabeth City	Y	7/23/1992	7/20/2006	12/18/2001	2001, 2003	n/a	9/19/2000	n/a	Impermeable and permeable surface cover
Quality Tool & Die Co Inc	Hoboken City	N	12/18/1992	12/18/1994	n/a	n/a	n/a	n/a	n/a	Asphalt and crushed stone
Levolor Corp	Hoboken City	Y	3/17/1993	3/17/1995	n/a	n/a	n/a	n/a	n/a	5" thick layer of asphalt
Technical Oil Products Inc	Carlstadt Boro	N	9/3/1993	4/6/2003	n/a	n/a	n/a	n/a	n/a	Building footprint, walkways and asphalt and vegetated areas
Twp Of Union Dept Of Public Works	Union Twp	N	9/16/1993	9/16/1995	n/a	n/a	n/a	8/30/2000	n/a	Impervious cover
Mac Millan Bloedel	Union Twp	N	10/27/1993	10/27/1995	n/a	n/a	9/26/2000	10/3/2000	n/a	Railroad bed
Blw Associated	Elizabeth City	N	11/1/1993	11/1/1995	n/a	n/a	n/a	n/a	n/a	Asphalt paving
J L Prescott Co Inc	Passaic City	N	12/15/1993	12/15/1995	n/a	n/a	10/20/1999	12/1/1999	n/a	The cap consists of asphalt, concrete and existing building foundations
Rhein Chemie Corp	Ewing Twp	N	1/17/1994	n/a	n/a	n/a	n/a	9/8/1999	n/a	Asphalt
Roebling Steel Company	Trenton City	Y	2/18/1994	2/18/1996	n/a	n/a	6/27/1995	n/a	n/a	Floor building is cap (per inspection report)

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Allied Corp.Dundee Warehouse	Passaic City	N	3/1/1994	2/29/1996	n/a	n/a	6/25/1997	12/1/1999	n/a	Areas A, B, G, I, and Lawn Area - 5" asphalt. Areas E, F, and railroad area - permeable geomembrane and 5" stone.
488 Mulberry St Partnership	Newark	N	4/14/1994	4/13/1996	5/2/2002	n/a	2/29/2000	2/29/2000	n/a	Asphalt cap
Abex Corporation	Mahwah Twp	N	5/2/1994	5/1/1996	n/a	n/a	9/21/1997	n/a	n/a	Soil, vegetative, wooded, and asphalt surface covers
Wilson Color Inc	Branchburg Twp	N	5/9/1994	5/8/1996	n/a	n/a	n/a	11/26/2001	n/a	Permeable surface cover
Scientific Chemical Process	Newark	Y	7/14/1994	7/13/1996	n/a	n/a	2/26/1997	2/29/2000	n/a	Concrete
Asarco Incorporated	South Plainfield Boro	N	8/15/1994	8/14/1996	n/a	n/a	9/22/1997	6/1/2001	n/a	Deed notice states permeable soil cover with no other description or useful map
H Reisman Corp	Orange City	N	8/15/1994	8/14/1996	n/a	n/a	2/28/2000	2/29/2000	n/a	Concrete pad
E Elwood And E Francis Moore	Mahwah Twp	N	8/17/1994	8/16/1996	n/a	n/a	7/10/1997	5/9/2000	n/a	Surface cover asphalt cap
Kramer Industries	Clifton City	N	9/26/1994	9/25/1996	n/a	n/a	10/27/1999	12/1/1999	n/a	Asphalt paving
Block Drug Company Inc	South Brunswick Twp	N	10/4/1994	10/3/1996	5/13/2003	n/a	7/15/1997	10/31/2000	n/a	n/a
Puleos Mfg Co	Elizabeth City	N	11/3/1994	11/2/1996	n/a	n/a	n/a	8/30/2000	n/a	Asphalt
Metropolitan Teletronics Corporation	Jersey City	N	11/9/1994	11/8/1996	n/a	n/a	2/26/1997	n/a	n/a	Building floor
H&B Enterprise Corporation	Ewing Twp	N	12/5/1994	12/4/1996	n/a	n/a	11/12/1996	7/10/2001	n/a	Asphalt cap
Ferrulmatic Corp	Totowa Boro	N	12/16/1994	12/15/1996	n/a	n/a	n/a	n/a	n/a	n/a
Georgia Pacific Corp	Newark	N	12/23/1994	12/22/1996	n/a	n/a	2/24/2000	2/29/2000	n/a	The "soil cap" consists of 10 feet of clean fill material

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Prudential Insurance Co	Newark	N	12/25/1994	n/a	n/a	n/a	3/21/2000	4/5/2000	n/a	n/a
S&I Associates Lp	Jersey City	N	12/25/1994	n/a	n/a	n/a	n/a	n/a	n/a	Concrete paving
Goodall Rubber Co	Trenton City	Y	12/25/1994	n/a	n/a	n/a	n/a	n/a	n/a	Four affected areas: cap with liner, stone and asphalt; cap with asphalt or concrete; cap with stone; cap with soil-veg
Hidalgo Gas Station	Guttenberg Town	N	12/25/1994	n/a	n/a	n/a	n/a	n/a	n/a	EC appears to be a building. Footprint (Pizza Hut) and parking area (asphalt?). DER states impermeable/permeable surface cover
Allied Web Offset Printing Corp @ Zuckerberg	Saddle Brook Twp	N	12/29/1994	12/28/1996	n/a	n/a	n/a	7/3/2000	n/a	n/a
Landtec Incorporated	North Bergen Twp	N	1/1/1995	n/a	n/a	n/a	n/a	n/a	n/a	2' soil/veg cap
Coates Screen Inc	East Rutherford Boro	N	1/4/1995	1/3/1997	n/a	n/a	n/a	9/22/1997	n/a	Impermeable cap and fencing
North America Packing Corp	South Brunswick Twp	N	1/11/1995	1/10/1997	n/a	n/a	8/27/1997	11/26/2001	n/a	n/a
Linde Gases Of The Mid-Atlantic Inc	Newark	N	1/18/1995	1/17/1997	n/a	n/a	2/29/2000	2/29/2000	n/a	Area 1 - 2' of clean gravel. Area 2 (Lime Pond area) - an 8' chainlink fence around this area. Areas 3 and 4 have contamination above residential criteria, but below non-residential criteria. No cap is present in these areas
Plastic Specialties & Technologies	Ridgefield Boro	N	1/23/1995	1/22/1997	n/a	n/a	7/22/1997	12/1/1999	n/a	DER does not require a cap, but the area is concrete covered.
Ppf International	East Hanover Twp	N	1/26/1995	1/25/1997	n/a	n/a	9/13/1999	10/26/1999	n/a	n/a
Hygrade Printing Corp	West Caldwell Twp	N	2/6/1995	2/5/1997	n/a	n/a	n/a	n/a	n/a	n/a

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Connelly Gpm Inc	Elizabeth City	N	2/23/1995	2/22/1997	n/a	n/a	4/23/1997	8/31/2000	n/a	Part 1 covers 80% of the site and consists of a 6" layer of asphalt. Part 2 covers the remaining 20% of the site and consists of a non-woven geotextile fabric on top of which is a 6" layer of 3/4" clean crushed stone.
Ferro Industries Inc	New Brunswick City	N	3/1/1995	2/28/2007	7/13/2001	2001, 2003, 2005	8/13/1997	11/26/2001	Y	Vegetative, concrete, asphalt, and pavement
Rti Inc	Rockaway Twp	N	3/10/1995	3/9/1997	n/a	n/a	9/9/1999	9/28/1999	n/a	n/a
Pse&G Company	Jersey City	N	3/10/1995	3/7/2007	n/a	2004, 2005	n/a	n/a	n/a	Bentomat liner
Nu-Tex Corp	Dunellen Boro	Y	3/22/1995	3/21/1997	n/a	n/a	9/29/1997	6/1/2001	No	A portion of the affected areas lies below a concrete vault and the building floor, the remaining portion is not capped and is located within a fully enclosed courtyard at the center of the building.
Resistol Hats	Newark	N	4/1/1995	3/31/1997	n/a	n/a	2/28/2000	2/29/2000	N	n/a
Specialty Toner Corp	Fairfield Twp	N	4/18/1995	4/17/1997	n/a	n/a	n/a	n/a	N	Asphalt cap
W H Linen Supply Co Inc	Paterson City	N	4/20/1995	4/19/1997	n/a	n/a	10/20/1999	12/1/1999	N	n/a
American Cyanamid Landfill	Carteret Boro	Y	5/4/1995	4/25/2001	n/a	n/a	10/15/1999	n/a	Y	Cover, fence, signs
Mw Jenkins Sons Incorporated	Cedar Grove Twp	N	5/19/1995	5/18/1997	n/a	n/a	3/15/2000	4/5/2000	N	Concrete floor in basement
Backus Machine Works	Carlstadt Boro	N	5/22/1995	5/21/1997	11/26/2001	n/a	n/a	11/26/2001	N	Impermeable concrete floor
Pse&G Company	Sayreville Boro	N	5/22/1995	5/21/1997	n/a	n/a	n/a	n/a	N	n/a
Philips Lighting Co	Hightstown Boro	n/a	5/23/1995	5/22/1997	n/a	n/a	n/a	n/a	N	n/a

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Hoboken City Stp	Hoboken City	Y	6/23/1995	6/22/1997	n/a	n/a	n/a	n/a	Y	Vegetative and paved areas
Cpm Realty	Paterson City	N	6/23/1995	6/22/1997	n/a	n/a	10/18/1999	12/1/1999	N	n/a
Nuodex Incorporated	Piscataway Twp	N	6/28/1995	6/27/1997	n/a	n/a	n/a	n/a	N	Asphalt
Landtec Incorporated	North Bergen Twp	N	7/20/1995	n/a	n/a	n/a	n/a	n/a	Y	2' soil/veg cap
250 Glenwood Ave Associates Llc	Bloomfield Town	N	7/26/1995	7/25/1997	n/a	n/a	3/15/2000	4/13/2000	Y	Could not determine the components which makeup the engineering control, but it appears that an area of asphalt is part of the cap.
Dover Department Of Public Works Garage	Dover Town	N	7/28/1995	7/27/1997	n/a	n/a	9/9/1999	9/28/1999	N	n/a
Algonquin Gas Transmission Co	Bernards Twp	N	7/31/1995	7/30/1997	n/a	n/a	7/28/1999	9/8/1999	N	Impervious surface
Monsanto Co	Kearny Town	Y	8/1/1995	7/31/1997	n/a	n/a	1/15/1997	n/a	N	6" layer of asphalt underlain by 6" sub-base material
Audubon-Cesco Corp	Audubon Boro	N	8/4/1995	8/3/1997	n/a	n/a	9/16/1999	9/28/1999	N	All lead contamination is a depth (~4'). Most of the area is paved. Unpaved area above Pb contamination is covered with crushed rock.
Gaf Building Materials Corp	Gloucester City	Y	8/7/1995	8/6/1997	n/a	n/a	7/21/1997	9/28/1999	Y	Asphalt cap over PCBs, soil cap over asbestos containing materials and a fence
Prospect Industries Corporation	Bridgewater Twp	N	8/21/1995	8/20/1997	n/a	n/a	7/28/1999	9/8/1999	N	Almost entire site capped with soil
Scientific Packaging Corp	East Orange City	N	8/22/1995	8/21/1997	n/a	n/a	3/22/2000	4/11/2000	N	Concrete
Bp Oil Pipeline Co	Linden City	N	8/23/1995	8/22/1997	n/a	n/a	n/a	n/a	N	n/a
Rylco Rubber Products	Hamilton Twp	N	8/24/1995	8/23/1997	n/a	n/a	4/17/1997	8/1/2001	N	Asphalt pavement

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Kester Solder	Newark	n/a	8/25/1995	n/a	n/a	n/a	1/5/1997	4/11/2000	N	Concrete building floor
Theurer Inc Bldg Nos 11 12 14 & 15	Newark	N	9/10/1995	9/9/1997	n/a	n/a	n/a	5/18/2000	Y	Asphalt cap
East Hanover Airport	East Hanover Twp	N	9/14/1995	9/13/1997		n/a	9/13/1999	9/28/1999	N	6-24" top soil
Flemington Bituminous	Raritan Twp	n/a	9/22/1995	n/a	n/a	n/a	n/a	n/a	N	Concrete
Joint Meeting Of Essex & Union Counties	Elizabeth City	N	10/4/1995	10/3/1997	n/a	n/a	8/17/2000	8/17/2000	N	Concrete pad
American Safety Technologies Inc	Irvington Town	n/a	10/6/1995	10/5/1997	n/a	n/a	n/a	n/a	N	2' clean fill, or 2' clean fill overlain by an asphalt cap.
Sherman Industries Inc	Palmyra Boro	N	10/13/1995	10/12/1997	n/a	n/a	2/15/2000	2/29/2000	No	n/a
Art Wave Marketing	Paterson City	N	10/16/1995	10/15/1997	n/a	n/a	10/18/1999	12/1/1999	No	n/a
Comtron Incorporated	Manalapan Twp	N	10/17/1995	10/16/1997	n/a	n/a	n/a	n/a	Y	Asphalt, concrete building floor and grass
Jcl Tool & Die Stamping Co	Paterson City	N	10/26/1995	10/25/1997	n/a	n/a	10/19/1999	12/1/1999	No	3" layer of asphalt
Pressman Toy Corp	New Brunswick City	N	11/1/1995	10/31/1997	n/a	n/a	n/a	n/a	No	Soil surface cover, contaimination found below 8.5'
Monsanto Company	Kenilworth Boro	N	11/2/1995	11/1/1997	n/a	n/a	9/26/2000	10/3/2000	N	Asphalt cap, and vegetative cover
The Wella Corp	Teterboro Boro	N	12/25/1995	n/a	n/a	n/a	7/9/1997	7/10/2001	N	Contaminants enclosed in a slurry wall keyed to clay layer. Area also capped by paved parking area.
Ames Warehouse	Secaucus Town	N	12/25/1995	n/a	n/a	n/a	n/a	n/a	Y	Asphalt and vegetative cover
Kardon Oldsmobile	Lumberton Twp	N	12/31/1995	n/a	n/a	n/a	n/a	2/16/2000	N	Concrete
Federated Metals Corp	Newark	N	1/17/1996	1/16/1998	n/a	n/a	n/a	n/a	Y	Asphalt and concrete floor
Flexwrap Corp	Lodi Boro	N	1/29/1996	1/28/1998	n/a	n/a	5/1/2000	6/29/2000	Y	Asphalt cap, clay cap and building slab

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
General Foam Corp	East Rutherford Boro	N	2/29/1996	2/28/1998	6/25/2002	n/a	n/a	10/1/2001	N	Existing building, asphalt paving, stone/gravel and vegetative cover
C & F Realty Limited	Carlstadt Boro	N	3/7/1996	3/7/1998	n/a	n/a	n/a	6/29/2000	N	Concrete, vegetated soil with synthetic liner and/or vegetated soil caps
New York Daily News Incorporated	Kearny Town	N	3/11/1996	3/11/1998	n/a	n/a	n/a	n/a	Y	5" asphalt layer over 3" crushed stone
Robert Taylor And Sons	Paterson City	N	3/15/1996	3/15/1998	n/a	n/a	10/20/1999	12/1/1999	N	Asphalt or concrete
Magnetic Metals	Camden City	Y	3/18/1996	3/18/1998	n/a	n/a	8/25/1999	9/28/1999	N	Concrete floor of tool crib room
Coca Cola Foods-Citrus Plant	Hightstown Boro	Y	4/2/1996	4/2/1998	n/a	n/a	9/25/1997	n/a	N	Building floor and asphalt cap
Circuit Foil Usa Inc	Bordentown Twp	n/a	4/2/1996	4/2/1998	7/25/2002	n/a	9/2/1999	8/1/2001	N	Several types of controls: dirt, asphalt, stone, and 20 mm liner, concrete pad
Chevron Chemical Moorestown Research Station	Moorestown	N	4/11/1996	4/11/1998	n/a	n/a	1/22/1997	2/29/2000	N	n/a
M Pasaelinsky & Sons Inc	Jersey City	N	4/14/1996	4/14/1998	n/a	n/a	n/a	n/a	N	n/a
Independence Cherubini	Riverside Twp	N	5/3/1996	5/3/1998	n/a	n/a	n/a	n/a	Y	Asphalt or chainlink fence
Accurate Box Company Inc	Paterson City	N	5/14/1996	5/14/1998	n/a	n/a	10/18/1999	12/1/1999	N	The affected area is limited to the interior of an abandoned 70,000 gallon concrete UST, which was filled with fuel-oil contaminated soils in accordance with an approved soil reuse plan issued by the NJDEP
Rellim Properties	Lodi Boro	N	5/28/1996	5/28/1998	n/a	n/a	9/20/2001	9/20/2001	N	Impervious surface cover
Willamette Industries Inc	Holland Twp	N	5/28/1996	5/28/1998	n/a	n/a	n/a	n/a	N	Asphalt cap
Willamette Industries Inc	Holland Twp	N	5/28/1996	5/28/1998	n/a	n/a	9/8/1999	n/a	N	10 different restricted areas with veg and asphalt. Maps in file do not accurately reflect

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
										current site layout
Cefco Div English Electric Corp	North Bergen Twp	N	6/11/1996	6/11/1998	n/a	n/a	n/a	n/a	Y	Six inches of asphalt and/or concrete
New Jersey City University	Jersey City	N	7/2/1996	7/2/1998	n/a	n/a	n/a	n/a	N	n/a
Mbj Realty Company	Union Twp	Y	7/9/1996	7/9/1998	n/a	n/a	9/26/2000	10/4/2000	N	Impervious cover
Pnc Incorporated	Nutley Town	N	7/16/1996	7/16/1998	n/a	n/a	6/25/1997	4/11/2000	N	6" concrete floor
Sayreville Borough Hall	Sayreville Boro	N	7/17/1996	7/17/1998	n/a	n/a	n/a	5/8/2001	N	n/a
Morgan Fire House	Sayreville Boro	N	7/17/1996	7/17/1998	n/a	n/a	n/a	5/8/2001	N	Sidewalk and crushed stone within a wooden fence area - Utility pole within the restricted area.
Garden State Seafood Inc	Point Pleasant Boro	N	7/18/1996	7/18/1998	n/a	n/a	4/23/1997	n/a	N	Asphalt
Transamerica Delaval Condenser	Florence Twp	n/a	7/22/1996	7/22/1998	n/a	n/a	1/31/1997	2/29/2000	N	Fence? Contaminants are metals permap, but inspection report says PAHs
Miller Chemical Pratt Gabriel Division	Washington Twp	n/a	7/26/1996	7/26/1998	n/a	n/a	n/a	9/8/1999	N	Asphalt paving
130 Grand Street	Carlstadt Boro	N	8/9/1996	8/9/1998	n/a	n/a	9/26/1997	5/8/2001	N	Impermeable surface cover
Great Freight Station	Flemington Boro	N	8/15/1996	8/15/1998	n/a	n/a	n/a	9/8/1999	N	Asphalt and vegetated area
Clarion Hotel	Elizabeth City	N	8/28/1996	8/28/1998	n/a	n/a	4/23/1997	8/31/2000	Y	Asphalt and building foundation
Centerless Products Company	Bloomfield Town	N	8/29/1996	8/29/1998	n/a	n/a	3/21/2000	4/5/2000	Y	6"layer of asphalt and building foundation
3m Co-Magnetic Media Div	Freehold Twp	N	9/6/1996	9/6/1998	n/a	n/a	8/15/1999	9/8/1999	N	Restricted area is and old lagoon located at the back of the building and is veg-grass. Site is now occupied by Asbury Park Press

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Mercer Cnty Geriatrics Center	Hamilton Twp	N	9/10/1996	9/10/1998	n/a	n/a	7/19/1999	9/8/1999	N	Surface cover of 10' of soil over former location of 1000 galon. Leaded gas tank and 2000 gal. Unleaded gas tank.
Mass Mutual Live Insurance Co	Secaucus Town	N	9/17/1996	9/17/1998	n/a	n/a	6/20/2000	7/3/2000	Y	Buildings, landscaping and paved areas
American Cyanamid Company	West Windsor Twp	N	10/2/1996	n/a	n/a	n/a	n/a	n/a	N	Landfills were excavated and excavation was replaced with clean fill.
Johnson Matthey Inc Winslow Plant	Winslow Twp	n/a	10/9/1996	10/9/1998	n/a	n/a	n/a	n/a	N	n/a
N C Automated Incorporated	Paterson City	N	10/16/1996	10/16/1998	n/a	n/a	10/20/1999	12/1/1999	Y	5" layer of asphalt
Igoe Brothers Inc	Newark	N	10/17/1996	10/17/1998	n/a	n/a	1/21/1997	4/28/2000	N	Concrete
Monsey Products Co	East Rutherford Boro	N	10/21/1996	10/21/1998	n/a	n/a	8/5/1999	9/30/1999	N	Impermeable surface ocver: 6" of steel reinforce concrete underlaid by six inches of compacted fil and a layer of geotextile.
Renora Incorporated	Edison Twp	N	10/21/1996	n/a	n/a	n/a	n/a	n/a	Y	Fencing surrounding the site and five feet of clean fill over site.
Silicon Technology Corporation	Oakland Boro	N	10/24/1996	10/24/1998	n/a	n/a	n/a	10/1/2001	N	No information in file
Ph Buildings	Passaic City	N	10/30/1996	10/30/1998	n/a	n/a	10/27/1999	12/1/1999	Y	Asphalt (4" layer) or building foundations
Henkel Corp	Hoboken City	N	11/8/1996	11/8/1998	n/a	n/a	n/a	n/a	Y	6" of 1.5" crushed stone blend
Us Steel Corporation American Bridge Div	Trenton City	N	12/24/1996	12/24/1998	n/a	n/a	1/13/1997	n/a	Y	Impermeable and permeable surface cover. At least 2' of clean fill overlies all areas of residual contamination.
Gloucester Twp Mua	Gloucester Twp	N	12/25/1996	n/a	n/a	n/a	n/a	3/14/2001	N	Concrete - note draft DER only
Washington School	Kearny Town	N	12/25/1996	n/a	n/a	n/a	n/a	n/a	N	DER states an impermeable and permeable surface cover but does not specify

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Devon Tape Corporation	North Bergen Twp	N	12/25/1996	n/a	n/a	n/a	6/20/2000	7/3/2000	Y	Asphalt paving and other site improvements
Reldon Enterprises	Camden City	N	12/25/1996	n/a	n/a	n/a	10/28/1999	12/30/1999	N	Asphalt pavment
370 Secaucus Road	Secaucus Town	N	12/25/1996	n/a	n/a	n/a	n/a	n/a	N	An impermeable surface cover but none specified or documented in the DER
Skyport Industrial Park	Newark	N	12/27/1996	12/27/1998	n/a	n/a	n/a	n/a	Y	Asphalt, building footprint, veg and traprock
General Metal & Black Finishers	Bloomfield Town	N	12/30/1996	12/30/1998	n/a	n/a	n/a	n/a	N	EC is a concrete floor. However, exact location of the restricted area is difficult to discern from the map.
Roosevelt School	Weehawken Twp	N	12/31/1996	n/a	n/a	n/a	n/a	n/a	N	Concrete pad
Garden State Converters	Bayonne City	N	1/6/1997	1/6/1999	n/a	n/a	6/19/2000	7/5/2000	Y	Asphalt paving and concrete floor of the building
General Drafting Co	Morris Twp	N	1/29/1997	1/29/1999	n/a	n/a	9/1/1999	9/28/1999	N	Concrete floor
F W Speer	Passaic City	Y	2/2/1997	2/2/1999	n/a	n/a	n/a	n/a	N	n/a
Landtec Incorporated	North Bergen Twp	N	2/4/1997	n/a	n/a	n/a	n/a	n/a	Y	2' soil/veg cap
Obrien Cogeneration Incorporated	Newark	N	2/21/1997	2/21/1999	n/a	n/a	2/29/2000	2/29/2000	n/a	n/a
Cpm Realty	Paterson City	N	2/25/1997	2/25/1999	n/a	n/a	n/a	n/a	n/a	n/a
Barbruce Realty Co	Trenton City	N	2/26/1997	2/26/1999	n/a	n/a	n/a	n/a	n/a	n/a
Shorewood Packaging Corp	Clifton City	N	3/3/1997	3/3/1999	n/a	n/a	10/28/1999	12/1/1999	N	The DN does not specifically state that there is an EC; however, since the contamination is located between 18 and 20 feet below grade, the overlying soils, if clean, could be considered as a cap

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
West Lake Incorporated	Farmingdale Boro	N	3/7/1997	3/7/1999	n/a	n/a	8/19/1999	n/a	N	There is a 3-4" layer of clay then geotextile liner then 4" of 3/4" bluestone then a top coat of asphalt that extends beyonds the restricted area.
Warner-Lambert Of Pfizer Inc	Morris Plains Boro	N	3/12/1997	3/5/1999	n/a	n/a	9/9/1999	9/28/1999	N	As epoxy sealant has been placed over the concrete pad which contain PCBs
Worthington Pump Div Dresser Industries	Harrison Town	N	3/15/1997	n/a	n/a	n/a	n/a	n/a	N	Asphalt cap and buildings
Keystone Camera Corp	Clifton City	N	3/20/1997	3/20/1999	n/a	n/a	10/28/1999	12/1/1999	N	Asphalt, concrete and building slabs
General Foods Corp	Clifton City	N	4/1/1997	4/1/1999	n/a	n/a	n/a	6/1/2001	N	Asphalt and concrete capping
Forge Pond Golf Course	Brick Twp	N	4/8/1997	4/8/1999	n/a	n/a	n/a	n/a	N	Concrete pad
111 Midtown Associates	Hackensack City	N	4/25/1997	4/25/1999	n/a	n/a	n/a	7/10/2001	N	No narrative or map documenting the engineering control specifications except "an impermeable surface cover is in place at the property".
Sun Chemical Corp	Newark	N	4/29/1997	4/27/2007	n/a	2003	n/a	4/11/2000	Y	4" asphalt and building slabs (interior and exterior) which consist of 4-6" reinforced concrete.
Pamarco Inc	Roselle Boro	N	5/1/1997	5/1/1999	n/a	n/a	9/26/2000	10/4/2000	N	Asphalt cap
Paterson Plank Road & Murray Hill Pwy	East Rutherford Boro	N	5/8/1997	5/8/1999	n/a	n/a	n/a	n/a	Y	n/a
Olin Hunt Sub I Corp	Palisades Park Boro	n/a	6/4/1997	6/4/1999	n/a	n/a	n/a	n/a	Y	Existing buildings were razed and site was re-developed. A supermarket was constructed on site. Engineering controls include the new building and the asphalt parking area for the supermarket.

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Hartz Mountain Corp	Bloomfield Town	N	6/12/1997	6/12/1999	n/a	n/a	3/15/2000	4/12/2000	N	Soil and asphalt cover and a portion of a sidewalk
U S Metals Refining Co	Carteret Boro	Y	6/16/1997	6/16/1999	n/a	n/a	n/a	n/a	N	Cap consists of asphalt, concrete, a vegetated area with a bentonite liner, and a rubber liner.
Freehold Cycle Center	Freehold Twp	N	6/18/1997	6/17/2003	4/26/2004	n/a	8/18/1999	9/8/1999	N	Asphalt and building footprint
Camden Lutheran Housing Corp	Camden City	N	6/26/1997	6/26/1999	n/a	n/a	n/a	n/a	Y	Deed notice indicates that there is a "surface cover" in place. Could not determine specific construction details.
Saddle River Texaco	Saddle River Boro	N	6/27/1997	6/27/1999	n/a	n/a	n/a	7/31/2000	N	Three feet of clean soil overlies the contamination. The concrete floor of the building and surrounding bituminous pavement overly the affected area.
Colonial Park Shopping Center	Saddle River Boro	N	6/27/1997	6/27/1999	n/a	n/a	n/a	7/31/2000	Y	3' of soil and building. Footprint consisting of concrete and asphalt
Essex Industrial Chemicals Incorporated	Newark	N	6/27/1997	6/27/1999	n/a	n/a	3/20/2000	4/5/2000	Y	n/a
Thatcher Plastic Packaging	Hawthorne Boro	N	7/2/1997	7/2/1999	n/a	n/a	n/a	6/1/2001	N	A permeable surface cover is stated in the DER but not specified
700 Penhorn Avenue	Secaucus Town	N	7/11/1997	7/11/1999	n/a	n/a	6/20/2000	7/3/2000	Y	The cap consists of three parts: Asphalt paving (6" stone, 3" stabilizing base, 2" asphalt), Vegetative cover (2' of clean fill covered with 6" topsoil) and the Building Slab (12" reinforced concrete)
Pse&G Palisade Avenue Substation	Jersey City	N	7/16/1997	7/16/1999	n/a	n/a	n/a	4/26/2001	N	4" layer of asphalt
Stapling Machines Co	Rockaway Boro	N	7/17/1997	7/17/1999	n/a	n/a	9/1/1999	9/28/1999	Y	3" asphalt or landscaping

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Standard T Chemical Co Inc	Linden City	N	7/18/1997	7/18/1999	n/a	n/a	n/a	10/4/2000	Y	Impervious cover
Melrose Realty	Summit City	N	7/23/1997	n/a	n/a	n/a	n/a	n/a	N	Macadam and concrete pad
Ppd Corporation	Newark	N	7/23/1997	7/23/1999	n/a	n/a	n/a	n/a	Y	n/a
Lowys Express Incorporated	Neptune Twp	Y	8/1/1997	8/1/1999	n/a	n/a	8/19/1999	9/8/1999	Y	Entire site, asphalt and building footprint
Melrose Realty	Summit City	N	8/8/1997	8/8/1999	n/a	n/a	n/a	n/a	Y	Surface cover
Quantun Chemical Corp Usi Div	Newark	N	8/18/1997	8/18/1999	n/a	n/a	3/20/2000	4/5/2000	Y	3" asphalt pavement for outdoor areas, 6" concrete for outdoor areas and spill containment areas, 9" concrete for floors within buildings are in palce on Block 5070, Lot 1. In addition, a 7' chainlink fence and signs are in place on Block 5070, Lot 1A
Toys "R" Us	Newark	N	8/20/1997	8/20/2003	11/25/2002	n/a	2/28/2000	3/9/2000	Y	Existing building and paved parking lot
Pond Road Shopping Center	Freehold Twp	Y	9/10/1997	9/10/1999	n/a	n/a	8/18/1999	9/8/1999	N	Building footprint and asphalt
The West Co	Millville City	N	9/22/1997	9/22/1999	n/a	n/a	n/a	n/a	N	n/a
Merck & Company Incorporated Landfill	Linden City	Y	9/23/1997	9/23/1999	n/a	n/a	10/15/1999	n/a	Y	Cover, Fence, Signs
Crystal Clear Ind Inc Lighting Center	Ridgefield Park Village	N	9/29/1997	9/29/1999	n/a	n/a	11/1/1999	12/1/1999	N	Clean fill (after excavation) and surface cover to a depth of two feet
New Woodbridge Barrel & Drum	Newark	N	10/6/1997	10/6/1999	n/a	n/a	3/21/2000	4/5/2000	N	The cap consists of a 4" layer of asphalt over a 4" stone base or 4" concrete slab.
Palermo Fashions	Hoboken City	N	10/7/1997	10/7/1999	n/a	n/a	6/19/2000	7/10/2001	Y	8" thick layer of reinforced concrete whichcomprises the floor

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
										of the building
Riverside Auto Parts	Woodbridge Twp	N	10/28/1997	10/28/1999	n/a	n/a	10/14/1999	12/1/1999	N	Concrete
Karl's Auto Glass	Phillipsburg Town	N	11/10/1997	11/10/1999	n/a	n/a	n/a	n/a	N	5-6' soil
Zeta Tool & Die Inc	Hillside Twp	N	11/12/1997	11/12/1999	n/a	n/a	n/a	n/a	N	2' layer of soil
Us Pipe And Foundry Co	Burlington City	n/a	11/13/1997	11/13/1999	n/a	n/a	2/15/2000	2/29/2000	Y	Asphalt capped areas, soil/vegetative capped areas. Whole site is fenced.
Inx International Ink Co	Clifton City	n/a	11/20/1997	11/20/1999		n/a	n/a	n/a	N	Building floor or asphalt paving
National Magnetics	Newark	N	12/10/1997	12/10/1999	n/a	n/a	3/22/2000	4/6/2000	Y	Asphalt and concrete
Camden Iron Shredder Division	Camden City	N	12/22/1997	12/22/1999	3/13/2002	n/a	n/a	9/28/1999	N	Asphalt and concrete
Ames Rubber Corp	Hamburg Boro	N	12/25/1997	n/a	n/a	n/a	n/a	n/a	Y	Soil/veg, stone and asphalt caps
Lincoln School	Kearny Town	N	12/25/1997	n/a	n/a	n/a	n/a	n/a	N	Can not determine
Kearny High School	Kearny Town	N	12/25/1997	n/a	n/a	n/a	n/a	n/a	N	Couldn't identify the material which comprises the cap
Gloube Manufacturing Company	Harrison Town	N	12/25/1997	n/a	n/a	n/a	n/a	n/a	Y	Concrete floor slab of existing building, exterior sidewalks, and landscaped areas.
Thomas & Muller Company Incorporated	Camden City	N	12/25/1997	n/a	n/a	n/a	9/15/1999	10/28/1999	Y	Radionuclides. A steel plate and gravel cover over Area1. 6" of gravel over Area 2.
Twin City Auto Wreckers	Bayonne City	N	1/30/1998	1/30/2000	n/a	n/a	n/a	n/a	Y	Bldg. Footprint, asphalt, concrete sidewalks and landscaped areas make up the EC.
J & D Transportation Equipment	Jersey City	N	2/3/1998	2/3/2000	n/a	n/a	n/a	n/a	N	Asphalt and concrete

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
S & W Waste Inc	Kearny Town	n/a	2/4/1998	n/a	n/a	n/a	n/a	n/a		n/a
Bloomfield Twp	Bloomfield Town	N	2/6/1998	4/8/2002	4/8/2002	n/a	n/a	n/a	Y	A 10" surface cover (unspecified) including a low permeability layer of asphalt 3" thick
South Clinton Avenue & Elmer Street	Trenton City	Y	2/19/1998	2/19/2000	n/a	n/a	n/a	n/a	Y	Asphalt and concrete. Also, a new residential building is part of the cap.
Anchor Glass Container Corp	Salem City	N	3/25/1998	3/24/2000	n/a	n/a	n/a	n/a	Y	12" soil cap
Midak Industries Incorporated	Trenton City	N	4/3/1998	4/2/2000	n/a	n/a	n/a	3/14/2001	Y	Concrete and asphalt cap
Federal Refining Company	Newark	N	4/3/1998	4/2/2000	n/a	n/a	3/21/2000	4/11/2000	Y	Fence surrounding entire property; and a 4-6" asphalt layer, or 4-6" concrete layer. Where soil is exposed, there are warning signs.
Public School #4	Fort Lee Boro	N	5/14/1998	5/13/2000	8/9/2000	n/a	n/a	10/1/2001	N	DN states impermeable surface cover = pavement
Alterman Transport Lines Inc	Hackensack City	N	6/4/1998	6/4/2000	n/a	n/a	n/a	7/10/2001	N	DER documents an impermeable surface cover but does not specify
Alterman Transport Lines Inc	Hackensack City	N	6/5/1998	6/4/2000	n/a	n/a	n/a	n/a	Y	Impermeable cap = asphalt and building footprint
300 Lincoln Boulevard	Middlesex Boro	N	6/19/1998	6/18/2000	n/a	n/a	n/a	n/a	Y	Cap consists of dense-grade aggregate (6"), asphalt (4"), rip-rap (8"), grass, and concrete (6"). Also, topsoil material underlies areas covered by asphalt and grass. Generally, topsoil directly overlies the asbestos fill underlying the site.
Clifford W Estes Company	Lyndhurst Twp	N	6/19/1998	6/18/2000	n/a	n/a	n/a	7/10/2001	N	Asphalt
Holland Plaza Building	Jersey City	N	7/7/1998	7/6/2000	n/a	n/a	6/19/2000	6/29/2000	Y	Buildings and existing asphalt pavement

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Port Imperial North	West New York Town	n/a	7/10/1998	7/9/2000	n/a	n/a	n/a	n/a	Y	Foundations, roadways, walkways, parking areas, and landscaped areas which consist of a geotextile fabric overlain with 18 inches of clean fill/topsoil andvegetated cover.
Guttenberg Acquisition Parcel	Guttenberg Town	Y	7/10/1998	7/9/2000	n/a	n/a	n/a	n/a	n	n/a
River Road	West New York Town	Y	7/10/1998	7/9/2000	n/a	n/a	n/a	n/a	Y	Building foundations, roadways, walkways, parking lots and landscaped areas (geotextile fabric overlain with 18" of clean fill-topsoil plus vegetated cover).
E&W Textile Processors Inc	East Newark Boro	N	7/15/1998	7/14/2000	n/a	n/a	n/a	n/a	N	Asphalt/concrete/buildings cover the entire affected area
Duramic Products Incorporated	Palisades Park Boro	N	8/28/1998	8/27/2000	n/a	n/a	5/1/2000	6/29/2000	N	4" concrete cap
Pse&G-Central District Systems	New Brunswick City	N	9/15/1998	9/14/2000	10/2/2000	n/a	10/14/1999	12/1/1999	N	Impermeable asphalt, pavement, building concrete foundations and permeable soils
Michael Carrie Warehouse	Jersey City	N	9/18/1998	9/17/2000	n/a	n/a	n/a	n/a	Y	Concrete slabs/sidewalks, asphalt pavement and 12" of topsoil and building footprint
Solar Compounds Corp	Linden City	N	11/18/1998	11/16/2004	5/27/2005	n/a	n/a	n/a	N	Chain-link fence; concrete - nominal 6" thick
Buena Boro	Buena Boro	N	12/4/1998	12/3/2000	n/a	n/a	n/a	9/4/2001	N	Bldg floor is EC. Removed other soil contamination. But couldn't remeove here without damage to building.
Lectronic Research Labs Inc	Camden City	N	12/8/1998	12/7/2000	n/a	n/a	9/16/1999	9/28/1999	Y	lead in historic fill. Concrete slab or asphalt parking lot over lead contamination. Fence.

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Dreher Inc	Newark	Y	12/10/1998	12/9/2000	n/a	n/a	n/a	n/a	Y	4" concrete (sidewalks, driveway, and building foudnations), of 2' of clean fill material with grass.
Mercer Detention Center	Trenton City	N	12/15/1998	12/14/2000	n/a	n/a	n/a	n/a	N	Asphalt
745 Associates	Carlstadt Boro	N	12/24/1998	12/23/2000	n/a	n/a	5/1/2000	7/13/2000	N	50'x80' fence
Cj Osborn Co	Pennsauken Twp	N	12/25/1998	12/23/2004	12/29/2003	n/a	n/a	n/a	N	Concrete slab, or clean soil, or fence
27 To 33 Fisk Street	Jersey City	N	12/25/1998	n/a	n/a	n/a	n/a	n/a	N	Geotextile membrane at two separate locations
Sosangelis Property	Medford Twp	Y	1/11/1999	1/10/2001	n/a	n/a	n/a	n/a	N	n/a
South Brunswick Asphalt Company	South Brunswick Twp	N	2/3/1999	2/2/2001	2/2/2001	n/a	n/a	11/14/2000	N	Some of the contamination lies under a concrete foundation. A sign is present which indicates that the contamination is present.
180 Raritan Center Parkway	Edison Twp	Y	2/11/1999	2/10/2001	n/a	n/a	n/a	n/a	Y	Building is cap for contaminated soils
Scott Paper Company	Buena Boro	N	2/22/1999	2/21/2001	4/3/2003	n/a	8/30/2001	9/4/2001	N	AOC-B: 6" concrete walls of railroad siding and roof of building. AOC-L (Large): 5' of clean fill material and 12" thick concrete bottom/6" thick concrete wall of surface impoundment. AOC-L (Small): 2' of clean fill and concrete walls.
Faber-Castell Corporation	Newark	N	2/22/1999	n/a	n/a	n/a	n/a	n/a	N	NO EC. PHC contamination at 9'
Dallas Airmotive Inc	Millville City	n/a	2/23/1999	7/12/2002	n/a	n/a	n/a	n/a	N	8" concrete floor of the building
Canrad Hanovia Inc	Newark	n/a	3/5/1999	3/4/2001	n/a	n/a	n/a	n/a	Y	Building foundations, sidewalks and driveways or 2' of clean fill
Public School #3	Fort Lee Boro	N	3/19/1999	3/18/2001	n/a	n/a	n/a	n/a	N	Asphalt

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Wheaton Aviation	Millville City	N	3/22/1999	3/21/2001	n/a	n/a	n/a	n/a	N	n/a
Gloucester City Titanium Co Inc	Gloucester City	Y	3/26/1999	3/25/2003	7/25/2003	2000	n/a	3/14/2001	N	8 soil caps with vegatative cover, 2 of the caps have Rip-Rap protection, a fence and warning signs
Melard Manufacturing Corp	Passaic City	N	4/7/1999	4/6/2001	n/a	n/a	n/a	n/a	N	4' layer of clean soil
Jh Pantheon Iv Site	Secaucus Town	N	4/20/1999	4/19/2001	n/a	n/a	n/a	n/a	N	Asphalt paving and building structures, plus a landscaped area capped by at least 2 ' of clean fill and topsoil.
Trans America Delaval Inc-Delroy	Hamilton Twp	N	4/27/1999	4/26/2001	n/a	n/a	n/a	n/a	N	24" soil layer or 4" asphalt
Classic Marble & Tile	Little Ferry Boro	N	5/11/1999	5/10/2001	n/a	n/a	n/a	n/a	N	Asphalt cap
Sillcocks-Miller Co	Berkeley Heights Twp	N	5/12/1999	5/11/2001	n/a	n/a	n/a	n/a	N	6" layer of stone
Artistic Identification Systems	Pompton Lakes Boro	N	5/21/1999	5/20/2001	n/a	n/a	n/a	n/a	N	The restricted area is paved with asphalt
Oceanville Pump Station	Galloway Twp	N	5/21/1999	5/20/2001	10/11/2001	n/a	n/a	9/4/2001	N	4' layer of soil
Therma Plate Corporation	South Plainfield Boro	N	5/21/1999	5/20/2001	n/a	n/a	n/a	5/4/2001	N	AOC #3-3" concrete floor slab. AOC#4-4" asphalt
Henie Realty Co	East Orange City	N	5/28/1999	5/27/2001	n/a	n/a	n/a	n/a	Y	Asphalt cap
Cp Chemicals Inc	Woodbridge Twp	Y	6/2/1999	6/1/2001	n/a	n/a	n/a	n/a	N	Asphalt capping and fencing
Port Imperial North	West New York Town	n/a	6/4/1999	7/9/2000	n/a	n/a	n/a	n/a	Y	Foundations, roadways, walkways, parking areas, and landscaped areas which consist of a geotextile fabric overlain with 18 inches of clean fill/topsoil andvegetated cover.
Ocean Cnty Park Complex	Lakewood Twp	N	6/9/1999	6/7/2005	7/25/2005	2001	n/a	n/a	N	6" asphalt cap over 30'x30' diesel UST removal

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Lincoln Harbor	Weehawken Twp	Y	6/21/1999	6/20/2001	n/a	n/a	n/a	n/a	Y	Asphalt, pavers, clean fill
Hopatcong Muncipal Building	Hopatcong Boro	N	6/24/1999	6/23/2001	n/a	n/a	n/a	n/a	N	12" layer of topsoil
American Tube Inc	Somerville Boro	N	6/28/1999	n/a	n/a	n/a	n/a	n/a	Y	Building and landscaping tiles
Givaudan Roure Corporation	Clifton City	N	6/29/1999	6/28/2001	n/a	n/a	n/a	6/1/2001	Y	Building foundatin, parking area, vegetative cover and fencing
Virtua Memorial Hospital Of Burlington County	Mount Holly Twp	N	7/15/1999	n/a	n/a	n/a	5/15/1996	8/1/2001	N	Soil/grass area
Cleaning Corp	Kenilworth Boro	N	7/22/1999	7/21/2001	n/a	n/a	n/a	n/a	N	2' layer of soil
Compac Corp	Netcong Boro	N	7/27/1999	7/26/2003	6/17/2003	n/a	n/a	n/a	N	Asphalt cover, retaining wall and 18' of backfill
Newark Bay Cogeneration Facility	Newark	N	7/28/1999	7/27/2001	n/a	n/a	n/a	n/a	N	Assumed that this area is historic fill (site along Doremus and Ave. P.) but DN does not specify EC construction or limits
Litton Systems Incorporated	Passaic City	N	7/30/1999	4/2/2005	n/a	n/a	n/a	n/a	Y	Asphalt cap and fence
Sinski Welding Company (Former)	Clifton City	N	8/4/1999	8/3/2001	n/a	n/a	n/a	7/10/2001	Y	Existing top 2' of soil
Bianca Procaczani	Hopewell Boro	Y	8/17/1999	8/16/2003	8/16/2003	n/a	n/a	n/a	N	Bottom layer - plastic layer over the original basement surface. Top layer - 4" concrete cap which was coated with a water - proofing sealant.
At&T	Hanover Twp	N	8/19/1999	8/18/2001	n/a	n/a	n/a	n/a	N	6' high fence with warning signs
420 N Broad St Corp	Elizabeth City	N	8/30/1999	8/29/2001	n/a	n/a	n/a	n/a	N	4" layer of concrete
Sgm Armtek Incorporated	South Plainfield Boro	N	8/30/1999	8/29/2001	n/a	n/a	n/a	5/4/2001	N	Gravel cap
Betz Brewery Property	Jersey City	Y	9/23/1999	9/22/2001	12/3/2001	n/a	n/a	n/a	Y	Concrete slabs, asphalt and 12" soil layer

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Transamerica Delaval Condenser	Florence Twp	N	9/24/1999	9/23/2001	n/a	n/a	n/a	2/29/2000	N	Fence? Contaminants are metals per map, but inspection report says PAHs
Bjb Financial Partners	West New York Town	N	9/29/1999	9/28/2001	n/a	n/a	n/a	n/a	N	A liner was placed in a crawlspace below the building floor
Haband Company Inc	Prospect Park Boro	Y	10/6/1999	10/5/2001	n/a	n/a	n/a	6/1/2001	N	Wood floor of building and membrane liner
Imperial Realty Corp	Passaic City	Y	10/8/1999	10/7/2001	n/a	n/a	n/a	n/a	N	8' clean fill
Baxter Healthcare Corp	Edison Twp	N	10/13/1999	10/12/2003	5/5/2004	2001	n/a	n/a	N	Existing building and asphalt paving
17-17 To 17-71 River Road	Fair Lawn Boro	Y	10/18/1999	10/17/2001	5/7/2002	n/a	n/a	10/1/2001	N	Building foundation, asphalt paving, landscaping and geotextile liner
750 Kenilworth Boulevard	Kenilworth Boro	N	10/20/1999	10/11/2001	n/a	n/a	n/a	n/a	N	2' clean fill or asphalt
Industrial Metal Cleaners	Trenton City	N	10/22/1999	10/21/2001	n/a	n/a	n/a	n/a	Y	4" asphalt and building foundations
Haband Company Inc	Prospect Park Boro	Y	10/26/1999	10/25/2001	n/a	n/a	n/a	n/a	N	Wood floor of building and membrane liner
Rhein Chemie Corp	Ewing Twp	N	10/28/1999	10/27/2001	7/31/2002	n/a	7/19/1999	9/8/1999	N	Existing building and asphalt
Neptune Swimsuit Corp	Neptune Twp	N	10/28/1999	10/26/2005	5/17/2005	n/a	n/a	n/a	N	Asphalt pavement and building structures, or 2' clean soil
Federal Storage Warehouses	Newark	Y	10/29/1999	10/28/2001	7/12/2002	n/a	n/a	n/a	N	12' soil layer
Shulton Inc	Clifton City	N	11/1/1999	10/31/2001	n/a	n/a	n/a	n/a	N	Fence, Asphalt, and Veg
Weasel Brook Drainage Basin	Clifton City	N	11/1/1999	10/31/2001	n/a	n/a	n/a	n/a	N	DN states a fence, two paved roadways transecting the affected area and natural vegetation
Rongene Mold & Plastics Corp	Wharton Boro	N	11/5/1999	11/4/2001	n/a	n/a	n/a	n/a	Y	Asphalt, bldg footprint, concrete sidewalks and veg

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Chem-Fleur Inc	Newark	n/a	11/11/1999	11/10/2001	n/a	n/a	n/a	n/a	N	Concrete and asphalt cap
Lebanon Twp Municipal Complex	Lebanon Twp	N	11/23/1999	11/22/2001	n/a	n/a	n/a	n/a	N	n/a
Prudential Parcel C	Hanover Twp	Y	12/6/1999	12/5/2001	n/a	n/a	n/a	n/a	N	Soil cap
Novo Motors	Bernardsville Boro	N	12/14/1999	12/13/2001	6/25/2002	n/a	n/a	11/26/2001	N	Clean fill and an asphalt or concrete cover
Curtiss Wright Corp	Wood-Ridge Boro	n/a	12/15/1999	12/14/2001	n/a	n/a	n/a		N	4" layer of concrete over a 20" layer of crushed concrete
Petroluem Products Co	Ewing Twp	Y	12/21/1999	12/11/2001	n/a	n/a	n/a		N	Concrete flooring and/or paved parking area
I 295 & Black Horse Pike Mount Ephraim Llc	Mount Ephraim Boro	N	12/25/1999	n/a	n/a	n/a	n/a	3/14/2001	N	Asphalt and concrete = pump island
American Tube Inc	Somerville Boro	N	12/25/1999	n/a	n/a	n/a	n/a		Y	Building and landscaping tiles
Galloway Township Municipal Garage	Galloway Twp	Y	12/25/1999	n/a	n/a	n/a	n/a	n/a	N	60 mm HDPE membrane, heat bonded drainage composite, 14" thick cap constructed of clean fill and 4" layer of soil with grass and landscaping
Farchers Grove	Union Twp	N	12/25/1999	n/a	n/a	n/a	n/a	n/a	N	Building footprint, asphalt, pavers, with veg
111 To 135 Thomas Mcgovern Dr	Jersey City	Y	1/4/2000	1/3/2004	11/18/2003	n/a	n/a	n/a	N	Permeable/impermeable = building footprint, asphalt and landscaped areas
College Of Saint Elizabeth	Morris Twp	N	1/14/2000	1/13/2002	n/a	n/a	n/a	n/a	N	n/a
Colgate Palmolive Co	Jersey City	N	1/31/2000	1/30/2002	n/a	n/a	n/a	n/a	Y	Impermeable = asphalt and concrete sidewalks and permable = soil
Jersey Machine & Tool Co	Kenilworth Boro	N	2/24/2000	7/21/2001	n/a	n/a	n/a	n/a	N	2' layer of soil
Geo Specialty Chemicals Inc	Harrison Town	N	2/25/2000	2/24/2004	8/4/2003	n/a	1/13/2000	n/a	Y	The cap covers the entire and consists of concrete floors, the asphalt parking lot, a bentonite cap, and railroad containments

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
										pans.
General Ceramics National Beryllia Div	Wanaque Boro	n/a	2/28/2000	2/27/2002	n/a	n/a	n/a	n/a	N	Existing floor/foundation of the building
South Brunswick Board Of Education	South Brunswick Twp	n/a	3/6/2000	3/6/2002	n/a	n/a	n/a	n/a	N	Four inches of asphalt and five feet permeable soil layer
Polarome Mfg Co Inc	Newark	Y	3/7/2000	3/6/2004	3/6/2004	n/a	n/a	n/a	Y	Combination of building, asphalt, concrete, gravel and/or landscaped areas and security fencing.
Modern Hydraulics Incorporated	Clifton City	Y	3/7/2000	3/7/2002	n/a	n/a	n/a	n/a	Y	Asphalt cap (parking lot) and building foundation
Colloids Inc	Newark	n/a	3/14/2000	3/15/2002	n/a	n/a	n/a	n/a	Y	Asphalt pavement on groud surface and concrete foundation of buildings
Paulsboro Travel Centers	Paulsboro Boro	N	3/15/2000	3/15/2002	n/a	n/a	n/a	n/a	N	n/a
Goodall Rubber Co	Trenton City	Y	3/21/2000	3/21/2002	n/a	n/a	n/a	n/a	N	Four affected areas: Cap with liner, stone and asphalt; Cap with asphalt or concrete; Cap with Stone; Cap with soil/veg
Basf Corp	Clifton City	Y	3/24/2000	3/24/2002	n/a	n/a	n/a	n/a	N	2' of clean soil graded and seeded. Monuments placed within cap to monitor soil thickness.
916 Garden Street	Hoboken City	N	3/28/2000	n/a	n/a	n/a	n/a	n/a	N	State/cement and 12" clean backfill
Ferguson Propeller Inc	Hoboken City	Y	3/31/2000	n/a	n/a	n/a	n/a	n/a	Y	Entire site covered by EC: 1. 4" concrete over geotextile membrane for sidewalks and coutyard areas 2. 3" bituminous concrete over a 4" layer of gravel sub-base over a geotextile membrane for the parking areas
Norland Products Incorporated	New Brunswick City	N	4/7/2000	n/a	n/a	n/a	n/a	11/26/2001	N	4' of clean fill and building structure

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Benjamin Eastwood Company	Paterson City	N	4/13/2000	4/13/2002	n/a	n/a	1/6/2000	n/a	Y	EC consists of vegitation, asphalt, concrete, and the building. Site is heavily vegitated aroud the perimeter.
Paulsboro Travel Centers	Paulsboro Boro	N	4/26/2000	n/a	n/a	n/a	n/a	n/a	N	n/a
S Goldberg & Co Inc	Hackensack City	N	4/28/2000	4/28/2002	n/a	n/a	n/a	n/a	Y	Building and asphalt parking area = 100% of site is capped
Universal Folding Box Co Inc	Hoboken City	N	4/28/2000	10/21/2002	10/21/2002	n/a	4/13/2000	n/a	Y	Asphalt and concrete floor
Universal Folding Box Co Inc	Hoboken City	N	4/28/2000	n/a	n/a	n/a	n/a	n/a	Y	Asphalt cap on the parking area to the north of the building
Tarney Excavating	Livingston Twp	N	4/28/2000	4/28/2002	n/a	n/a	n/a	n/a	N	No concstruction details or location of EC
Synthatron	Parsippany Troy-Hills	Y	5/5/2000	5/5/2002	n/a	n/a	n/a	n/a	N	Area is paved including 2" F.A.B.C., 3" stabilized base course, &4" Dense grated aggregate over fill material
W Y Industries	Jersey City	Y	5/5/2000	5/4/2004	2/6/2004	n/a	1/18/2000	n/a	Y	A 6' high fence surrounds the eastern soil margin. A sign has been posted on the fence stating "No admittance -- contaminated soil area".
Koznick's Automotive	Paterson City	n/a	5/9/2000	n/a	n/a	n/a	n/a	n/a	N	A portion of the building - - concrete floor is EC
Isolantite Manufacturing Company Inc	Long Hill Twp	N	5/10/2000	5/10/2002	n/a	n/a	n/a	n/a	N	Curbing at a height of 6" installed on the north side of the concrete dumpster pad and along the walkway connecting the bag houses. Additional housekeeping to be performed to prevent additional discharges of barium laden dust from bag house and dumpster

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Estey Metal Products Incorporated	Tinton Falls Boro	N	5/23/2000	5/23/2002	n/a	n/a	12/2/1998	n/a	N	Contaminated sediments and soils were stabilized and a soil/bentonite slurry wall was installed to encapsulate the stabilized soils. The stabilized soil was covered with a layer of 40 mm PVC and clean soil (@20-25')
Maxon Chev - Olds Inc	Washington Twp	n/a	5/25/2000	n/a	n/a	n/a	n/a	n/a	N	4-6" of asphalt
Old Police Radio Building	Freehold Twp	N	5/25/2000	5/25/2002	n/a	n/a	n/a	n/a	N	Asphalt and building footprint near "old police radio building"
I P Container Corp	Paterson City	N	6/1/2000	6/1/2002	n/a	n/a	6/26/2000	n/a	Y	Pavement and sidewalk are the Ecs
Andarn Electro Service	Paterson City	N	6/5/2000	4/10/2002	n/a	n/a	n/a	n/a	N	6" concrete floor slab
Guaranteed Overnight Delivery	Newark	N	6/12/2000	6/12/2002	3/13/2003	n/a	n/a	n/a	Y	Building footprint and surrounding asphatl. Historic fill is probably the contaminants based on previous filing. This DN is incomplete on all exhibits. Lot 60.01 is formerly 60A.
Newark Wire Cloth Co	Newark	N	6/13/2000	6/13/2002	n/a	n/a	n/a	n/a	N	Asphalt cap and soil cover
Monsanto Chemical Co	Camden City	Y	6/16/2000	6/15/2004	9/15/2004	2002	2/17/2000	n/a	Y	6" soil cover with a native plant material. 6' security fence
Mercury Foam Corp	Hackensack City	N	6/19/2000	6/19/2002	n/a	n/a	n/a	n/a	Y	No construction detail in DN
Equipment Erectors Inc	Franklin Twp	N	6/27/2000	6/27/2002	n/a	n/a	n/a	n/a	N	Asphalt, gravel, grass, concrete building floor and fencing
Fords Exxon	Woodbridge Twp	N	7/1/2000	7/1/2002	n/a	n/a	n/a	n/a	Y	Bituminous concrete and asphalt cap approximately 6" in depth
Dynair Services Inc	Wrightstown Boro	N	7/10/2000	3/20/2003	3/20/2003	n/a	6/23/2000	n/a	N	consists of cap provided by existing building structureon east side of the restricted use area and by

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
										a minimum of 6' of fill cover within the excavations on the western side of the restricted use area restricted area totals approx. 1820 square feet.
I P Container Corp	Paterson City	N	7/27/2000	n/a	n/a	n/a	n/a	n/a	Y	Pavement and sidewalk are the Ecs
Tom's Danforth Service Inc	Jersey City	N	8/2/2000	8/2/2002	6/17/2003	n/a	n/a	n/a	N	Site wide concrete pavement
Millville Municipal Airport	Millville City	N	8/2/2000	8/2/2002	n/a	n/a	n/a	n/a	N	Building floor = 8" concrete
Brownstone Company 1	Hoboken City	Y	8/2/2000	8/2/2002	n/a	n/a	n/a	n/a	Y	Entire site restricted -- capped with asphalt, concrete and pavers. DN cover page documents block 27 lot 15. However, bloct 27 lots 14-19 are identified in exhibit A.
Molecular Rearrangement Incorporated	Newton Town	N	8/16/2000	n/a	n/a	n/a	3/9/2000	n/a	Y	Concrete, asphalt, restricted area signs
Jersey Truck Center Inc	Kearny Town	N	8/22/2000	8/22/2002	n/a	n/a	n/a	n/a	N	Unknown -- DN missing most info
Diamond Communication Products	Garwood Boro	N	8/29/2000	8/29/2002	n/a	n/a	n/a	n/a	N	EC consists of the filing in of two trenches located inside the building with concrete
Daewoo Heavy Industry America Corp	Carlstadt Boro	N	9/11/2000	9/11/2002	n/a	n/a	n/a	n/a	Y	Existing site conditions are the EC = grass, asphalt and building footprint
Sier Bath Deck Gear Corp	North Bergen Twp	n/a	9/28/2000	9/28/2002	n/a	n/a	6/19/2000	6/19/2000	N	Building is the cap
361 River Rd	Edgewater Boro	N	10/2/2000	10/2/2002	n/a	n/a	n/a	n/a	Y	Building footprint, asphalt and 1.5 feet soil at landscaped areas
Fulton Landing	Jersey City	N	10/24/2000	10/24/2002	n/a	n/a	n/a	n/a	Y	The building footprint, asphalt and concrete areas and 2' clean soil in vegetated areas.

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Amerifilm Corp	Kearny Town	N	11/3/2000	n/a	n/a	n/a	n/a	n/a	Y	3" asphalt over 3" crushed stone
1101 To 1105 Grand Street	Hoboken City	N	12/18/2000	12/18/2002	n/a	n/a	n/a	n/a	Y	Building footprint, asphalt, landscaped ares and sidewalk
Riegel Products Corporation	Pohatcong Twp	Y	12/25/2000	n/a	n/a	n/a	n/a	n/a	N	Ecs vary depending on AOC. Soil cap with compacted backfill followed by vegetated topsoil surface cover and/or stone, ranging from 1 to 18'.
Sango Building	Secaucus Town	N	1/4/2001	11/22/2002	n/a	n/a	n/a	n/a	N	Asphalt and builidng footprint
High Point Fasteners	Montague Twp	N	1/8/2001	1/8/2003	n/a	n/a	n/a	n/a	N	Clean topsoil has been placed over the contaminated soil. The topsoil has been seeded with a hardy crownvetch groundcover.
Molecu Wire Corp	Wall Twp	n/a	1/9/2001	1/9/2003	n/a	n/a	n/a	n/a	N	2' of soil is the EC as stated by Ben Barnes
Bayer Corporation	Newark	N	1/11/2001	1/11/2003	n/a	n/a	n/a	n/a	Y	The cap consists of concrete sidewalks and building foundations, asphalt parking areas, grass and landscpaing areas and gravel-covered areas. Signs also posted in fenced area.
1126 To 1132 Dickinson Street	Elizabeth City	N	2/16/2001	2/16/2003	n/a	n/a	n/a	n/a	N	Under a sidewalk
Mckays Landfill	Secaucus Town	N	2/20/2001	n/a	n/a	n/a	n/a	n/a	Y	n/a
Former Ehrlich Trucking	Hoboken City	N	2/28/2001	2/28/2003	n/a	n/a	n/a	n/a	N	Asphalt, concrete, structural foundations and on-site structures = impervious surface entire site
Cherry Hill Repair Center	Cherry Hill Twp	N	3/8/2001	3/8/2003	n/a	n/a	n/a	n/a	N	Coverage w/an impervious surface (asphalt)

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Camden Amphitheater	Camden City	Y	3/27/2001	3/26/2003	n/a	n/a	n/a	n/a	Y	Capping provided by the Amphitheater, parking lots and other buildings. Landscaped areas are capped with at least 1 ' of clean fill over the original soils. NFA was issued on 10/30/02
Lapayette Gas	Paterson City	N	4/2/2001	4/2/2003	n/a	n/a	n/a	n/a	N	8' tall chain link locking access gate along Lafayette Ave., cap over the abandoned-in-place 10,000 gal UST consistitng of combination of 6" macadam or 6" concrete or silt & clay.
Chemical Sealing Corporation	Trenton City	N	4/2/2001	4/2/2003	n/a	n/a	n/a	n/a	N	EC consists of permeable cap of clean fill 8-14 ft bldgs.
Tug & Barge Dry Dock Incorporated	Jersey City	Y	4/3/2001	4/3/2003	n/a	n/a	n/a	n/a	N	Not specified in DN
Pedro Varela	Irvington Town	N	4/3/2001	n/a	n/a	n/a	n/a	n/a	Y	8" soil cement and additional 3" asphalt cap
Truck Renting Corp	Newark	N	4/11/2001	n/a	n/a	n/a	n/a	n/a	Y	Asphalt and building footprint.
Industrial Associates Of Clifton	Clifton City	n/a	4/20/2001	4/20/2003	n/a	n/a	n/a	n/a	Y	Building foundations, roadways, sidewalks, geotextile liner under clean fill
99 Grand St	Moonachie Boro	N	4/20/2001	4/20/2003	n/a	n/a	n/a	n/a	Y	4" asphalt cap and 6" stone base - parking area. 4" thick concrete flooring with 4" thick stone base in self storage areas. Two fet certified clean fill over open space and setback areas.
Westinghouse Electric Corp	Hillside Twp	N	5/10/2001	3/21/2004	3/21/2004	n/a	n/a	n/a	N	Asphalt parking lot, roadway, concrete floor, a soil berm and fence
J M Huber Corporation	Edison Twp	N	5/23/2001	5/23/2003	n/a	n/a	n/a	n/a	Y	Cap in Septic area & AOC N consists of geofabric , 2' clean fill, another layer of

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
										geofabric & 4" of crushed stone to stabilize the cap and prevent errosion. In the Tank room the bldg floor is the cap.
Komar Manufacturing Company Inc	Lambertville City	Y	6/1/2001	6/1/2003	n/a	n/a	n/a	n/a	Y	Site has been covered with various Ecs. Impervious asphalt, concrete walkways and manufactured aggregate ("shot rock" or "ballast"). All caps are 6 to 10" thick.
Albee Services Inc	Hoboken City	Y	6/22/2001	6/22/2003	n/a	n/a	n/a	n/a	Y	Parking lot excavated and replaced with clean fill and asphalt cap. Annual air samples will be taken in builidng interior.
Amtech Inc Paterson Gear Motor Division	Paterson City	n/a	6/26/2001	6/26/2003	n/a	n/a	n/a	n/a	Y	Fencing and asphalt
Harmony Press Incorporated	Harmony Twp	N	7/9/2001	7/8/2005	11/23/2004	2003	n/a	n/a	Y	1-1/2' layer of dense silty clay soil
Hebb Spring Company	Newark	N	7/19/2001	n/a	n/a	n/a	n/a	n/a	Y	Asphalt paving over all soil areas of property and the existing building foundation
D&R Radiators Unlimited	Plainfield City	N	7/20/2001	7/20/2003	n/a	n/a	n/a	n/a	N	At least 2" of compacted asphalt pavement
Campbell Soup Company	Camden City	Y	7/26/2001	7/26/2003	n/a	n/a	n/a	n/a	N	Combination of soil and impervious surface barriers (concrete walkways & bituminous pavement) that comprise the baseball stadium and surrounding improvements.)
Lacross	Newark	N	8/2/2001	8/2/2003	n/a	n/a	n/a	n/a	N	The specific area of concern is capped by concrete which is located with an industrial building.
Amerchol Corporation	Edison Twp	n/a	9/14/2004	9/14/2006	n/a	n/a	n/a	n/a	N	Institutional control only

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Onyx Chemical Co	Jersey City	N	9/21/2001	9/21/2003	n/a	n/a	n/a	n/a	Y	Concrete and 2' of soil
Quigley Co Sub Of Pfizer Inc	Sayreville Boro	N	10/3/2001	10/3/2003	n/a	n/a	n/a	n/a	Y	Caps of varying composition and thicknesses, including 4" topsoil on clay cap of landfill, 6" topsoil on landscaped areas with metals, 6" gravel cap over metals, asphalt caps of various construction, concrete cap, security fence.
Bridon American Corp	Trenton City	N	10/9/2001	10/9/2003	n/a	n/a	n/a	n/a	Y	Asphalt, concrete, clean fill in landscaped areas
Accurate Forming Div Tyco Labs	Hamburg Boro	N	10/18/2001	n/a	n/a	n/a	n/a	n/a	N	Clean fill cover, flooring, fencing
Dean Mcnulty Development	Paterson City	N	10/22/2001	10/22/2003	n/a	n/a	n/a	n/a	N	13' of clean soil
Alpha Chemical Plastics Corp	Newark	n/a	10/31/2001	10/31/2003	n/a	n/a	n/a	n/a	N	Impermeable cap consisting of 4" of asphalt, 4" concrete slabs, and concrete block buildings with 4" concrete floors.
Joseph Turner & Company Chemicals	Ridgefield Boro	N	10/31/2001	10/31/2003	n/a	n/a	n/a	n/a	N	4 types on-site: unpaved areas covered with 3/4" stone; building foundations; and paved areas with concrete or asphalt
Standard Tool & Manufacturing Co	Lyndhurst Twp	Y	11/7/2001	11/7/2003	n/a	n/a	n/a	n/a	N	Asphalt, concrete slab of the building, 2' soil/veg cover and perimeter (property) fence.
Mark Lighting	Moonachie Boro	N	11/7/2001	11/7/2003	n/a	n/a	n/a	n/a	Y	Ecs include concrete and asphalt pavement, lawn and vegetable covers. Photo documentation of th eiste coduction after the Ecswere installed was authorized

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Cp Manufacturing Inc	South Plainfield Boro	n/a	11/8/2001	11/8/2003	n/a	n/a	n/a	n/a	N	Chain link fencing and existing woodlands and wetlands outside of plant area. Limited asphaltic covoer within plant area.
Coyne Textile Services	Belleville Town	N	11/13/2001	11/13/2003	n/a	n/a	n/a	n/a	N	n/a
Sun Chemical Corp	Linden City	N	11/20/2001	11/20/2003	n/a	n/a	n/a	n/a	Y	Entire site is paved with asphalt
Precision Custom Coatings Llc	Totowa Boro	N	12/11/2001	12/11/2003	n/a	n/a	n/a	n/a	Y	The Ecs consist of landscaped areas, asphalt parking lots, a fenced-in area and the building footprint
Horizon House Apartments	Fort Lee Boro	N	12/20/2001	12/20/2003	n/a	n/a	n/a	n/a	N	4.5' of clean fill over one area and the concrete building slab over the second area
G & H Metal Finishers Incorporated	Paterson City	N	12/25/2001	n/a	n/a	n/a	n/a	n/a	N	Concrete and asphalt
Landtec Incorporated	North Bergen Twp	N	12/25/2001	n/a	n/a	n/a	n/a	n/a	N	2' soil cap
Temco Home Health Care Products	Passaic City	Y	1/14/2002	1/14/2004	n/a	n/a	n/a	n/a	Y	Asphalt and concrete paving over property, w/exception of 2 areas where exposed groundsurface is fenced w/warning signs posted
American Modern Metals	Dover Town	N	1/22/2002	1/22/2004	n/a	n/a	n/a	n/a	Y	AOC 6 - 6" asphalt cap; AOC1 - 6' asphalt cap and 6' chain link fence; AOC 7 - 3in. Asphalt cap; AOC 8-2' clean fill
Conwed Bonded Fiber	Delanco Twp	N	2/7/2002	2/7/2004	2/7/2004	n/a	n/a	n/a	N	Six inches reinforced concrete floor in the boiler room for the elevated levels of TPHC only
Princeton Nurseries	South Brunswick Twp	n/a	3/1/2002	2/10/2005	n/a	n/a	n/a	n/a	N	Block 4, Lot 3.05, 2 capped berm areas

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Photogravure & Color Company	Moonachie Boro	n/a	3/6/2002	3/7/2005	n/a	n/a	n/a	n/a	Y	PCBs (2.7), B/N (3.0, Arsenic (221) and Hexa-Chromium (4590) Total Chromium (9850)
Us Army Training Center & Ft Dix	New Hanover Twp	N	3/13/2002	n/a	n/a	n/a	n/a	n/a	N	Fence, cap
Westinghouse Electric Corp	Hillside Twp	N	3/22/2002	3/21/2004	3/21/2004	n/a	n/a	n/a	N	Asphalt parking lot, roadway, concrete floor, a soil berm and fence
Capital City Products Co	Kearny Town	Y	4/1/2002	3/31/2004	n/a	n/a	n/a	n/a	Y	Fence and Cap
Custom Chemicals Co	Elmwood Park Boro	N	4/9/2002	n/a	n/a	n/a	n/a	n/a	Y	Asphalt, concrete, soil with grass
Energy Coatings Co	North Arlington Boro	N	4/19/2002	4/18/2004	n/a	n/a	n/a	n/a	N	The EC consists of 4 components: a 24" soil cap with vegetation, a drainage swale which has a geotextile liner covered with 24" clean fill, an area of existing vegetation, and signs placed along the eastern perimeter of the property.
Fleet Bank	New Brunswick City	N	4/24/2002	4/23/2004	n/a	n/a	n/a	n/a	N	Concrete sidewalk
Arrow Group Industries Inc	Wanaque Boro	n/a	4/29/2002	n/a	n/a	n/a	n/a	n/a	Y	Asphalt, fencing, crushed stone, vegatative cover and concrete foundation
South Brunswick Landfill	South Brunswick Twp	N	4/29/2002	4/28/2004	n/a	n/a	n/a	n/a	Y	Fence, cover, gas vents
Energy Coatings Co	North Arlington Boro	N	5/1/2002	5/1/2004	n/a	n/a	n/a	n/a	N	The EC consists of 4 components: a 24" soil cap with vegetation, a drainage swale which has a geotextile liner covered with 24" clean fill, an area of existing vegetation, and signs placed along the eastern perimeter of the property.

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Fairfield Inn & Suites	Newark	n/a	5/16/2002	n/a	n/a	n/a	n/a	n/a	Y	2' clean fill with vegetation, buildings, parking area
Alcan Powders & Pigments	Union Twp	n/a	6/10/2002	n/a	n/a	n/a	n/a	n/a	Y	n/a
Pan Glo Ii	Maple Shade Twp	N	6/17/2002	6/16/2004	n/a	n/a	n/a	n/a	Y	1) On the south, east and western sides of the building, 24" of topsoil with erosion resistant vegetative cover. 2) North side is asphalt and concrete.
Synres Chemical Corp	Elmwood Park Boro	N	6/18/2002	n/a	n/a	n/a	n/a	n/a	Y	Veg, concrete, asphalt, building footprint, fencing
Rome Embroidery Corporation	West New York Town	n/a	6/24/2002	n/a	n/a	n/a	n/a	n/a	Y	Concrete builidng floor, concrete sidewalks, wooden planks and polywood.
Paterson Plaza Llc	Paterson City	n/a	7/1/2002	6/30/1995	n/a	n/a	n/a	n/a	Y	n/a
Mill Street Woodworking Company	Moorestown	N	7/1/2002	6/30/2004	n/a	n/a	n/a	n/a	N	Top 7' of clean soil is used as EC. PAH contamination is from historical fill. Xylene contaminated soil can't be removed without undermining the building.
300 Mill St	Moorestown	N	7/1/2002	n/a	n/a	n/a	n/a	n/a	N	7' soil over PAH area. No EC over xylene area.
Kearfott Guidance & Navigation Corp	West Paterson Boro	n/a	7/2/2002	7/1/2004	n/a	n/a	n/a	n/a	N	12 " earth cap over 6 oz non-woven geotextile filter fabric placed over a 6" layer of crushed stone. Earth cap is grass covered.
Ventnor City Fire Department	Ventnor City	N	7/22/2002	7/22/2004	n/a	n/a	n/a	n/a	Y	Building footprint and asphalt areas over entire property
Us Army Training Center & Ft Dix	New Hanover Twp	N	7/22/2002	n/a	n/a	n/a	n/a	n/a	N	Fence, Cap
Jersey City Redevelopment Agency	Jersey City	N	7/25/2002	7/24/2004	n/a	n/a	n/a	n/a	Y	Asphalt, concrete, soil and fencing

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Jersey City Justice Center	Jersey City	N	7/25/2002	7/24/2004	n/a	n/a	n/a	n/a	Y	Parking lot parcel -- asphalt, soil and concrete
Rf Products Incorporated	Camden City	N	7/29/2002	7/28/2004	n/a	n/a	n/a	n/a	Y	Concrete pavement (plating room floor) and asphalt pavement (drum dock area)
Amerace Corporation Elastimold Division	Washington Twp	n/a	8/1/2002	7/31/2004	n/a	n/a	n/a	n/a	N	Portion of building slab and adjacent concrete alleyway
Hayward Pool Products Inc	Elizabeth City	N	8/13/2002	8/12/2004	n/a	n/a	n/a	n/a	N	Concrete flooring in building
Polycel Corporation	Branchburg Twp	N	8/16/2002	n/a	n/a	n/a	n/a	n/a	N	Plastic liners installed in five interior pits
Alpha Chemical Plastics Corp	Newark	n/a	8/20/2002	10/31/2003	n/a	n/a	n/a	n/a	N	Impermeable cap consisting of 4" of asphalt, 4" concrete slabs, and concrete block buildings with 4" concrete floors.
Pioneer Industries Division	Carlstadt Boro	N	8/20/2002	8/20/2004	n/a	n/a	n/a	n/a	Y	EC consists of soil cap around perimeter of east and south propertyboundary, as well as asphalt at the southeast yard area and a concrete floor beneath the warehouse portion of the facility.
Allstate Can Corp	Clifton City	N	8/22/2002	8/21/2004	n/a	n/a	n/a	n/a	Y	1) Aggregate bituminous concrete 2) concrete floor slab of building 3) loading dock 4) retaining wall
Egan Machinery Division Plant 1	Bridgewater Twp	N	8/27/2002	8/26/2004	n/a	n/a	n/a	n/a	N	AOC 6 - Concrete floor must remain in place, PCBs TPHC. AOC-9 Former Septic System, maintain existing grade, PCBs
Spectra Colors Corporation	Kearny Town	N	10/2/2002	n/a	n/a	n/a	n/a	n/a	Y	Concrete flooring in building and asphalt parking lot
Global Colorants Inc	Kearny Town	N	10/2/2002	10/1/2004	n/a	n/a	n/a	n/a	Y	Asphalt pavement (parking lot) and concrete flooring (interior)

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Watson Graphics	Kearny Town	N	10/2/2002	10/1/2004	n/a	n/a	n/a	n/a	Y	Asphalt pavement (parking lot) and concrete flooring (interior)
Cavanagh Corporation	Delaware Twp	N	10/17/2002	n/a	n/a	n/a	n/a	n/a	N	Concrete slab/floor in garage. Lead contamination over RDCSCC but under NRDCSCC, so not a requirement unless use of property changes back to residential.
Tungsten Products Corp	North Bergen Twp	N	10/24/2002	10/24/2004	5/12/2005	n/a	n/a	n/a	Y	Asphalt/concrete from building slab
Energy Coatings Co	North Arlington Boro	N	11/8/2002	11/8/2004	n/a	n/a	n/a	n/a	Y	The majority of the site is capped by a 24" thick soil/vegetative cap planted with grass. Other Ecs include a roadway, asphalt cover, crushed stone and drainage swales with geotextile liners
Mack Wayne Plastics Company Closure Div	Wayne Twp	N	11/8/2002	11/7/2004	n/a	n/a	n/a	n/a	N	Asphalt cap
Energy Coatings Co	North Arlington Boro	N	11/12/2002	11/12/2004	n/a	n/a	n/a	n/a	N	The EC consists of 4 components: a 24" soil cap with vegetation, a drainage swale which has a geotextile liner covered with 24" clean fill, an area of existing vegetation, and signs placed along the eastern perimeter of the property.
Wallace & Tierman Incorporated	Belleville Town	Y	11/12/2002	11/11/2004	11/11/2004	n/a	n/a	n/a	N	2' of clean fill covered by buildings or asphalt pavement
Hyatt Clark Industries Inc	Clark Twp	n/a	11/13/2002	11/12/2004	n/a	n/a	n/a	n/a	N	Cap system consist of 6 layers. (top soil, barrier protection layer, geotextile filter fabrics, 40-mil LLDPE membrane, geotextile cushion layer, and general grading).

Table D.1 Summary of Sites with DNs Attached before December 31, 2002 (Continued)

Site Name	Municipality	Brownfields	DNs Filed Date	Biennial Due Date	Biennial Submission Date	Biennial Submission History	Inspection Date	Inspection Report Date	Entire Site Restricted	EC Description
Ibg Corp Dba Walco-Linck Co	Clifton City	n/a	11/21/2002	11/20/2004	n/a	n/a	n/a	n/a	Y	Asphalt 1.5 - 6.0 inches thick, Concrete slab and sidewalk areas 4" thick, geotextile (Marafi 140), clean soil (6") and vegetation (grass and plants) for landscape areas.
Arvind Auto Service Inc	Passaic City	N	12/20/2002	12/19/2004	n/a	n/a	n/a	n/a	Y	Site is covered by asphalt & masonary building

APPENDIX E

SURVEY

QUESTIONNAIRE: INSTITUTIONAL CONTROLS FOR SITE REMEDIATION/BROWNFIELD REDEVELOPMENT

This questionnaire is part of a study by Mr. Ronnachai Tiyarattanachai to fulfill his Ph.D. dissertation requirements in Environmental Science (Environmental Policy Concentration), entitled "Long-term effectiveness of institutional controls and engineering controls for Brownfield redevelopment". This questionnaire is designed to learn about the opinions of the Massachusetts Department of Environmental Protection (MADEP) staff members and the Massachusetts Licensed Site Professionals (LSPs) regarding long-term effectiveness of Institutional Controls (ICs) and Engineering Controls (ECs) as remedial tools for soil contamination in Brownfields. This survey is anonymous and your response is completely confidential.

NOTES AND DEFINITIONS

Scope of the Study:
This study intends to evaluate long-term effectiveness of ICs and ECs for Brownfield Redevelopment. The scope of the study is limited to only ICs and ECs implemented for addressing **soil contamination** on the Brownfields or contaminated sites.

Institutional Controls (ICs):
A practice that controls exposure to hazardous substances by establishing governmental controls on activities at the site and by providing legal enforcement tools. Institutional Controls referred to in this study are such tool generally used by the MADEP and LSP in site remediation (i.e., [Activity and Use Limitations, AUL])

Engineering Controls (ECs):
A practice implemented to treat or stabilize contamination, to physically contain or isolate waste, or to prevent access. ECs generally recognized, such as fencing, walls, and other barriers, are defined in this study to be evaluated.

Risk:
The probability of adverse effects resulting from exposure to an environmental agent or mixture of agents

INSTRUCTION

The questionnaire contains 17 questions in total, divided into 3 sections. Please try to answer as many questions as you can. You may leave it blank if you do not desire to give the answer. Please choose 'N/A' if you do not have an answer for that question.

Should you have any questions or comments, please contact him at:
Phone No.: 973-580-2711 Email: rt33@njit.edu
Please read the consent form below before proceeding the survey.

"I have been asked to participate in a research study under the direction of Dr. Daniel J. Watts and Mr. Ronnachai Tiyarattanachai. The purpose of the study is to learn about the opinions of the Massachusetts Department of Environmental Protection (MADEP) staff members and the Massachusetts Licensed Site Professionals (LSPs) regarding long-term effectiveness of Institutional Controls (ICs) and Engineering Controls (ECs) as remedial tools for soil contamination in Brownfields. This survey will be treated as anonymous and my responds will be treated as confidential. My participation to give my answers to the question will take about 20 minutes. I will be one of about 100 participants in this study. I have been told that the study described above may involve minimum risks, which would be no greater than risks encountered in my daily life. There also may be risks and discomforts that are not yet known. I fully recognize that there are risks that I may be exposed to by volunteering in this study which are inherent in participating in any study; I understand that I am not covered by NJIT's insurance policy for any injury or loss I might sustain in the course of participating in the study.

I understand confidential is not the same as anonymous. Confidential means that my name will not be disclosed if there exists a documented linkage between my identity and my responses as recorded in the research records. Every effort will be made to maintain the confidentiality of my study records. If the findings from the study are published, I will not be identified by name. My identity will remain confidential unless disclosure is required by law. I understand that this survey is being run from a "secure" https server through "http://www.surveymonkey.com", which is protected by the latest in firewall and intrusion prevention technologies (e.g., VeriSign SecuredTM) which are typically used to handle credit card transactions or a http server with greater risk for hacking. I understand that, as an online participant in this research, there is always the risk of intrusion by outside agents (i.e., hacking) and, therefore the possibility of being identified exists. I understand that only persons who are 18 years and above are permitted to participate. I understand that my participation is voluntary and I may refuse to participate, or may discontinue my participation or may decide not to submit my response at any time with no adverse consequence. I also understand that the investigator has the right to withdraw me from the study at any time.

If I have any questions about the research procedures, I understand that I should contact the principal investigator at:

Dr. Daniel J. Watts
Otto H. York Center for Environmental Engineering and Science,
New Jersey Institute of Technology (NJIT)
University Heights
Newark, NJ 07102
(973) 596-3465
watts@njit.edu

If I have any additional questions about my rights as a research subject, I may contact:

Dawn Hall Apgar, Ph.D., IRB Chair
New Jersey Institute of Technology
323 Martin Luther King Blvd.,
Newark, NJ 07102
(973) 580-2711
Dawn.apgar@njit.edu

I have read this consent form and I understand it completely. All of my questions regarding this form or this study have been answered to my complete satisfaction. I agree to participate in this research study. By checking 'Yes', I agree to respond to the questionnaire below.

□ Yes □ No

SECTION A: PERSONAL WORK EXPERIENCE AND BACKGROUND INFORMATION
Please select the choices which best describe your work experience and background information regarding site remediation and some related factors.

1. Which of the following organizations are you affiliated with?

   □ Massachusetts Department of Environmental Protection (MADEP)
   □ Licensed Site Professional Association (LSPA)
   □ N/A

2. What is your level of familiarity with:

   1. Not Familiar
   2. Somewhat Familiar
   3. Familiar
   4. Very Familiar
   5. Exceedingly Familiar

2a. Brownfield redevelopment	1	2	3	4	5
2b. Site remediation	1	2	3	4	5
2c. Institutional controls for contamination in soil	1	2	3	4	5
2d. Engineering controls for contamination in soil	1	2	3	4	5
2e. Remedial alternative selection	1	2	3	4	5

3. Please provide some background about your work experience with regard to site remediation and Brownfield redevelopment:

   3a. Approximately how long have you worked in site remediation?
   □ < 1 year □ 6-10 years
   □ 1-5 years □ >10 years

   3b. How many remedial alternative selection cases have you worked on?
   □ Never □ 6-20 cases
   □ 1-5 cases □ >20 cases

   3c. How long have you worked on Brownfield redevelopment?
   □ < 1 year □ 6-10 years
   □ 1-5 years □ >10 years

4. Regarding your work experience in site remediation, what were the major contaminants in most of the sites that you worked on? (Please select up to 3 most applicable choices)

   □ Heavy Metals □ Aromatic Hydrocarbons
   □ Chlorinated Solvents □ Pesticides
   □ Dioxin □ PCBs
   □ PAHs □ Others_____

SECTION B: LONG-TERM EFFECTIVENESS OF ICs AND ECs
Please circle the number which best describe your perspective or belief. The following questions ask your opinion on the long-term effectiveness of implementing ICs and/or ECs to reduce risk to human health and the environment from exposure to any contaminants left on a site.

5. It is necessary to incorporate ECs with ICs (for remedial action without other active remedial technologies) in order to make ICs effective in the long-term.

Strongly Disagree 1 2 3 4 5 Strongly Agree □ N/A

6. Implementation of ICs is necessary for a site which has contamination remained at concentration that may not be appropriate for all future uses.

Strongly Disagree 1 2 3 4 5 Strongly Agree □ N/A

7. On average, how long do you think property owners/site responsible parties will remain complied with requirements associated with AUL attached to their sites (e.g., restrict on certain type of use due to level of contamination remained at their remediated site)?

□ Less than 6 months
□ 1-2 years
□ 3-5 years
□ 6-20 years
□ More than 20 years
□ N/A

8. Should a responsible regulatory agency monitor remediated sites that have AUL attached to make sure that required restrictions are not violated and to ensure protectiveness of the sites?

□ Yes □ No □ N/A

Note: If your answer is "Yes", please continue on Question # 9 and 10. If your answer is "No" or "N/A" please skip to Question # 11.

9. How long should the responsible regulatory agency monitor remediated sites that have ICs (e.g., AUL) implemented?

□ Less than 6 months
□ 1-2 years
□ 3-5 years
□ 6-20 years
□ More than 20 years
□ N/A

10. How often should the responsible regulatory agency monitor remediated sites that have ICs (e.g., AUL) implemented?

□ Not Necessary
□ Every 3 months
□ Every half year
□ Other_____
□ Every year
□ Every 2 years
□ Every 5 years
□ N/A

11. You would be worried if you learn, in fact, that property owners/site responsible parties do not comply with requirements/restrictions associated with the AUL attached with their property

Strongly Disagree 1 2 3 4 5 Strongly Agree □ N/A

12. You would be worried if you learn that sites with AUL attached are not to be monitored/audited by a regulatory agency to ensure if the property owners/site responsible parties remain complied with requirements/restrictions associated with the AUL

Strongly Disagree 1 2 3 4 5 Strongly Agree □ N/A

13. To make ICs protective and efficient, should responsible parties submit self-monitoring reports to clarify the status of environmental restrictions at their remediated sites to a responsible regulatory agency?

    □ Yes □ No □ N/A

    Note: If your answer is "Yes", please continue on Question # 14. If your answer is "No" or "N/A" please skip to Question # 15.

14. If your answer on Question # 13 is "Yes", how often should responsible parties submit the documents clarifying the status of environmental restrictions at their remediated sites to the responsible regulatory agency?

    □ Not Necessary □ Every year □ N/A
    □ Every 3 months □ Every 2 years
    □ Every half year □ Every 5 years
    □ Other_____

15. Please rank the following recommendations, if they are needed, to improve/ascertain the effectiveness of ICs based on their importance. You may also specify your additional recommendations, if not listed, in the blank space and rank them among the given recommendations.

    __ Implement a financial assurance mandate for responsible parties of a site which as ICs implemented
    __ Enhance oversight and enforcement mechanism of responsible regulatory agency
    __ Ensure that the frequency and scope of monitoring of ICs sufficiently maintain their effectiveness
    __ Ensure that the information on ICs reported to/kept in the responsible regulatory agency accurately reflects actual conditions of the sites.
    __ (Your additional recommendation :_____)
    __ (Your additional recommendation :_____)
    __ (Your additional recommendation :_____)

SECTION C: RESPONDENT'S PROFILE

16. Respondent's Profile

    Gender: □ Male □ Female

    Age: □ <20 years □ 41-50 years
    □ 21-30 years □ 51-60 years
    □ 31-40 years □ >60 years

17. What is the highest level of education that you have completed?

    □ Some High School □ Graduate Study (In process)
    □ High School Diploma □ Masters
    □ Bachelors □ Doctoral

APPENDIX F

INSTITUTIONAL REVIEW BOARD NOTICE OF APPROVAL

NJIT NEW JERSEY INSTITUTE OF TECHNOLOGY

Institutional Review Board: HHS FWA 00003246
Notice of Approval
IRB Protocol Number: E123-08

Principal Investigator: Daniel Watts
York Center for Environmental Engineering and Science

Title: Long-term Protectiveness of Institutional Controls and Engineering Controls for Brownfield Redevelopment

Performance Site(s): Off-Site Sponsor Protocol Number (if applicable):

Type of Review: FULL [ ] EXPEDITED [X]

Type of Approval: NEW [X] RENEWAL [ ] REVISION [ ]

Approval Date: June 17, 2008 Expiration Date: June 16, 2009

1. **ADVERSE EVENTS:** Any adverse event(s) or unexpected event(s) that occur in conjunction with this study must be reported to the IRB Office immediately (973) 642-7616.

2. **RENEWAL:** Approval is valid until the expiration date on the protocol. You are required to apply to the IRB for a renewal prior to your expiration date for as long as the study is active. It is your responsibility to ensure that you submit the renewal in a timely manner.

3. **CONSENT:** All subjects must receive a copy of the consent form as submitted. Copies of the signed consent forms must be kept on file with the principal investigator.

4. **SUBJECTS:** Number of subjects approved: 100.

5. The investigator(s) did not participate in the review, discussion, or vote of this protocol.

6. **APPROVAL IS GRANTED ON THE CONDITION THAT ANY DEVIATION FROM THE PROTOCOL WILL BE SUBMITTED, IN WRITING, TO THE IRB FOR SEPARATE REVIEW AND APPROVAL.**

Dawn Hall Apgar

Dawn Hall Apgar, PhD, LSW, ACSW, Chair IRB June 17, 2008

APPENDIX G

SURVEY RESULTS

Please read the consent form below before proceeding the survey.

"I have been asked to participate in a research study under the direction of Dr. Daniel J. Watts and Mr. Ronnachai Tiyarattanachai. The purpose of the study is to learn about the opinions of the Massachusetts Department of Environmental Protection (MADEP) staff members and the Massachusetts Licensed Site Professionals (LSPs) regarding long-term effectiveness of Institutional Controls (ICs) and Engineering Controls (ECs) as remedial tools for soil contamination in Brownfields. This survey will be treated as anonymous and my responds will be treated as confidential. My participation to give my answers to the question will take about 20 minutes. I will be one of about 100 participants in this study.

I have been told that the study described above may involve minimum risks, which would be no greater than risks encountered in my daily life. There also may be risks and discomforts that are not yet known. I fully recognize that there are risks that I may be exposed to by volunteering in this study which are inherent in participating in any study; I understand that I am not covered by N

I understand confidential is not the same as anonymous. Confidential means that my name will no

I understand that only persons who are 18 years and above are permitted to participate. I underst

Dr. Daniel J. Watts
Otto H. York Center for Environmental Engineering and Science,
New Jersey Institute of Technology (NJIT)
University Heights
Newark, NJ 07102
(973) 596-3465
watts@njit.edu

If I have any additional questions about my rights as a research subject, I may contact:

Dawn Hall Apgar, Ph.D., IRB Chair
New Jersey Institute of Technology

Answer Options	Response Percent	Response Count
Yes, I agree to the above consent form.	97.5%	78
No, I don't agree to the above consent form.	2.5%	2
answered question		80
skipped question		0

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment

Which of the following organizations are you affiliated with?

Answer Options	Response Percent	Response Count
Massachusetts Department of Environmental Protection	44.1%	30
Licensed Site Professional Association (LSPA)	55.9%	38
N/A	0.0%	0
answered question		68
skipped question		12

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment

What is your level of Familiarity with:

Answer Options	Not Familiar	Somewhat Familiar	Familiar	Very Familiar	Exceedingly Familiar	Rating Average	Response Count
Brownfield redevelopment	0	12	22	25	111	3.5	770
Site remediation	0	2	8	27	34	4.3	771
Institutional controls for contamination in soil	0	1	10	37	23	4.1	771
Engineering controls for contamination in soil	0	4	13	33	21	4	771
Remedial alternative selection	0	3	12	27	29	4.1	771
						answered question	71
						skipped question	9

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment

Approximatly how long have you worked in site remediation?

Answer Options	Response Percent	Response Count
<1 year	0.0%	0
1-5 years	1.4%	1
6-10 years	5.6%	4
>10 years	93.0%	66
answered question		71
skipped question		9

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment

How many remedial alternative selection cases have you worked on?

Answer Options	Response Percent	Response Count
Never	4.3%	3
1-5 cases	7.1%	5
6-20 cases	18.6%	13
>20 cases	70.0%	49
answered question		70
skipped question		10

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment

How long have you worked on Brownfield redevelopment?

Answer Options	Response Percent	Response Count
<1 year	14.5%	10
1-5 years	24.6%	17
6-10 years	17.4%	12
>10 years	43.5%	30
answered question		69
skipped question		11

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment

Regarding your work experience in site remediation, what were the major contaminants in most of the sites that you worked on? (PLEASE SELECT UP TO 3 MOST APPLICABLE CHOICES)

Answer Options	Response Percent	Response Count
Heavy Metals	75.4%	52
Chlorinated Solvents	72.5%	50
Dioxin	0.0%	0
PAHs	58.0%	40
Aromatic Hydrocarbons	69.6%	48
Pesticides	4.3%	3
PCBs	21.7%	15
Other (please specify)	11.6%	8
answered question		69
skipped question		11

Number	Response Date	Other (please specify)
1	09/11/2008 13:50:00	petroleum-related compounds
2	09/11/2008 13:54:00	petroleum
3	09/12/2008 14:59:00	petroleum
4	09/12/2008 16:08:00	Petroleum from gasoline to No. 6 fuel oil
5	09/16/2008 16:57:00	poisons Arsenic creosote, cyanide, saxotoxins and biological-naturally
6	09/16/2008 19:42:00	Petroleum
7	09/16/2008 20:26:00	(gasoline and fuel oil as primary sources)
8	09/19/2008 14:51:00	radionuclides

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment		
It is necessary to incorporate ECs with ICs (for remedial action without other active remedial technologies) in order to make ICs effective in the long-term. Rate Strongly Disagree to Strongly Agree		
Answer Options	**Response Percent**	**Response Count**
Strongly Disagree	12.3%	8
Somewhat Disagree	16.9%	11
Neither Agree nor Disagree	13.8%	9
Somewhat Agree	23.1%	15
Strongly Agree	32.3%	21
N/A	1.5%	1
answered question		65
skipped question		15

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment		
Implementation of ICs is necessary for a site which has contamination remaining at a concentration that may not be appropriate for all future uses. Rate Strongly Disagree to Strongly Agree		
Answer Options	**Response Percent**	**Response Count**
Strongly Disagree	4.6%	3
Somewhat Disagree	9.2%	6
Neither Agree nor Disagree	4.6%	3
Somewhat Agree	13.8%	9
Strongly Agree	67.7%	44
N/A	0.0%	0
answered question		65
skipped question		15

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment		
On average, how long do you think property owners/site responsible parties will remain in compliancewith requirements associated with AUL attached to their sites (e.g., restrictions on certain types of use due to the level of contamination remaining at their remediated site)?		
Answer Options	**Response Percent**	**Response Count**
Less than 6 months	0.0%	0
1-2 years	9.2%	6
3-5 years	32.3%	21
6-20 years	32.3%	21
More than 20 years	20.0%	13
N/A	6.2%	4
answered question		65
skipped question		15

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment		
Should a responsible regulatory agency monitor remediated sites that have AUL attached to make sure that required restrictions are not violated and to ensure protectiveness of the sites? **Note: If your answer is "Yes", please continue on Questions #5 and #6. If your answer is "No" or "N/A" please skip to Question #7.**		
Answer Options	**Response Percent**	**Response Count**
Yes	89.1%	57
No	10.9%	7
N/A	0.0%	0
answered question		64
skipped question		16

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment		
How long should the responsible regulatory agency monitor remediated sites that have ICs (e.g., AUL) implemented?		
Answer Options	**Response Percent**	**Response Count**
Less than 6 months	0.0%	0
1-2 years	0.0%	0
3-5 years	1.7%	1
6-20 years	20.3%	12
More than 20 years	74.6%	44
N/A	3.4%	2
answered question		59
skipped question		21

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment

How often should the responsible regulatory agency monitor remediated sites that have ICs (e.g., AUL) implemented?

Answer Options	Response Percent	Response Count
Not Necessary	0.0%	0
Every 3 months	0.0%	0
Every half year	0.0%	0
Every year	15.2%	7
Every 2 years	32.6%	15
Every 5 years	52.2%	24
N/A	0.0%	0
Other (please specify)		17
answered question		46
skipped question		1

Number	Response Date	Other (please specify)
1	09/11/2008 08:32:00	10 - 15 years
2	09/11/2008 17:12:00	More frequently, such as every two years, initially, and then, based on site conditions, on a site-specific schedule
3	09/11/2008 17:15:00	Every 3 to 5 years
4	09/11/2008 21:31:00	Length and frequency depend on the nature/risk of problem!
5	09/16/2008 15:36:00	every 5 years or if regulatory agency obtains knowledge of violation of terms
6	09/16/2008 16:06:00	also as needed based on complaints/observations
7	09/16/2008 16:18:00	Depends on compliance history
8	09/16/2008 17:09:00	expeience dictactes me to respond "responsible agencies-aren't"
9	09/16/2008 17:44:00	Frequency should be based on current or intended use and location of the site- More frequently (e.g. every year) if potential for exposure is higher based on use, intended use or site's location, less frequent if potential is lower based on current or intended use and location. Also add the ability to change the frequency based on changing use or changes to the location making exposure more or less likely.
10	09/16/2008 20:27:00	with option for more often if deemed necessary.
11	09/16/2008 21:33:00	10 years unless the risk posed by failure of IC would pose Imminent Hazard
12	09/16/2008 22:01:00	Depends on contaminants
13	09/17/2008 14:07:00	Generally should be monitored, depending on the site inspections as long as they are in effect, inspected as needed such as after a change in ownership
14	09/17/2008 14:18:00	Every 3 years
15	09/17/2008 18:38:00	It should vary on a case by case basis
16	09/19/2008 14:59:00	random intervals, so they can't rush out periodically to do quick fix
17	09/19/2008 17:33:00	it should depend on the severity of the risk, if the IC is not followed

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment		
You would be worried if you learn, in fact, that property owners/site responsible parties do not comply with requirements/restrictions associated with the AUL attached with their property. Rate Strongly Disagree to Strongly Agree		
Answer Options	**Response Percent**	**Response Count**
Strongly Disagree	1.6%	1
Somewhat Disagree	1.6%	1
Neither Agree nor Disagree	9.4%	6
Somewhat Agree	28.1%	18
Strongly Agree	57.8%	37
N/A	1.6%	1
answered question		64
skipped question		16

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment		
You would be worried if you learn that sites with AUL attached are not to be monitor/audited by a regulatory agency to ensure that the property owners/site responsible parties remain in compliance with requirements/restrictions associated with the AUL. Rate Strongly Disagree to Strongly Agree		
Answer Options	**Response Percent**	**Response Count**
Strongly Disagree	3.1%	2
Somewhat Disagree	4.7%	3
Neither Agree nor Disagree	7.8%	5
Somewhat Agree	37.5%	24
Strongly Agree	45.3%	29
N/A	1.6%	1
answered question		64
skipped question		16

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment		
To make ICs protective and efficient, should responsible parties submit self-monitoring reports to clarify the status of environmental restrictions at their remediated sites to a responsible regulatory agency?		
Answer Options	**Response Percent**	**Response Count**
Yes	80.0%	52
No	18.5%	12
N/A	1.5%	1
answered question		65
skipped question		15

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment		
If your answer on Question #9 is "Yes", how often should responsible parties submit the documents clarifying the status of environmental restrictions at their remediated sites to the responsible regulatory agency?		
Answer Options	**Response Percent**	**Response Count**
Not Necessary	0.0%	0
Every 3 months	0.0%	0
Every half year	1.9%	1
Every year	29.6%	16
Every 2 years	33.3%	18
Every 5 years	25.9%	14
N/A	9.3%	5
Other (please specify)		8
answered question		54
skipped question		26

Number	Response Date	Other (please specify)
1	09/11/2008 21:31:00	Frequency depends on the risk/nature of the problem
2	09/16/2008 15:36:00	woudl depend of what the AUL required be done. If AUL requires monitoring be done, then reports submitted on frequency identifeid by AUL. If not, every 5 years or upon property transfer...
3	09/16/2008 16:18:00	that is a site specific question
4	09/16/2008 20:27:00	And whenever the property is transferred to another party.
5	09/16/2008 21:14:00	site specific
6	09/16/2008 22:01:00	Depends on contaminants
7	09/17/2008 12:46:00	More bureaucracy enhances penalty opportunities unrelated to
8	09/19/2008 14:59:00	my experience is they can't be trusted, I do mostly enforcement

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment

Please rank the following recommendations, if they are needed, to improve/ascertain the effectiveness of ICs based on their importance. You may also specify your additional recommendations, if not listed, in the blank space and rank them among the given recommendations.

Rank											
Answer Options	1	2	3	4	5	6	7	8	9	10	Response Count
Implement a financial assurance mandate for	8	4	8	14	14	2	1	4	0	5	60
Enhance oversight and enforcement mechani	11	8	8	6	5	2	8	7	1	4	60
Ensure that the frequency and scope of moni	15	11	8	0	4	0	6	4	4	9	61
Ensure that the information on ICs reported t	9	13	10	5	5	0	4	3	4	8	61

	on Totals
e section, please don't forget to rank among the given recommendations	21
answered	61
ed question	19

Number	Response Date	Your Additional recommendation (please don't
1	09/10/2008 20:54:00	Read the story of Love Canal, N.Y. (they had an IC)
2	09/11/2008 01:03:00	If a responsible party remediates a property to the point where a condition of no significant risk exists with the implementation of an AUL, I feel that the burden of compliance with the AUL requirements (which usually tend to be maintenance of pavement and/or building footprints) rests with future property owners. Future property owners have a responsibility to both negotiate compensation at the time of sale from the PRP with regards to maintaining the AUL requirements and they have a duty to comply with the requirements placed on the deed at the time of sale. (This comment assumes the most common scenario - that the PRP sells the AUL deed restricted property at some time in the relatively near future).
3	09/11/2008 17:12:00	I have recommended to MADEP that notice of an AUL be part of the information required when there is a "Dig Safe" request, and that the existence of an AUL be placed in the property file in Assessor's offices. This would alert both contractors as to the presence of an AUL as well as providing notice to purchasers prior to their conducting a title search.
4	09/11/2008 21:31:00	Local control by building/zoning/health authorities may be more effective than state-level control (may depend on nature of AUL filing, records, and enforcement mechanisms)
5	09/12/2008 12:46:00	I used 10 as the most and 1 as the least.
6	09/15/2008 17:39:00	Note: I used "1" as the highest rank and 4 as the
7	09/16/2008 13:30:00	1.In Massachusetts, enforce the statutory requirement that sites be cleaned up to those levels that would be present in the absence of the release.
8	09/16/2008 16:06:00	Maintain public data bases of sites with IC very
9	09/16/2008 16:28:00	Often new owners are not aware of institutional controls at a property.

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment		
Respondent's Profile:		
Answer Options	**Response Percent**	**Response Count**
Male	68.8%	44
Female	31.3%	20
answered question		64
skipped question		16

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment		
Age:		
Answer Options	**Response Percent**	**Response Count**
<20 years	0.0%	0
21-30 years	1.6%	1
31-40 years	10.9%	7
41-50 years	48.4%	31
51-60 years	32.8%	21
>60 years	6.3%	4
answered question		64
skipped question		16

Institutional Controls and Engineering Controls for Site Remediation/Brownfield Redevelopment		
What is the highest level of education that you have completed?		
Answer Options	**Response Percent**	**Response Count**
Some High School	0.0%	0
High School Diploma	0.0%	0
Bachelors	31.3%	20
Graduate Study (in process)	6.3%	4
Masters	60.9%	39
Doctoral	1.6%	1
answered question		64
skipped question		16

REFERENCES

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2. Asante-Duah, K. (2002). Public health assessment for human exposure to chemicals. Kluwer Acadamic Publishers. 68.

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