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Technology Overview

An Overview of Land Use Control Management Systems

December 2008

Prepared by
The Interstate Technology & Regulatory Council
Brownfields Team

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EXECUTIVE SUMMARY

Land use controls (LUCs) are used to provide protection from exposure to contaminants that exist or remain on a site. LUCs are classified as institutional (administrative and/or legal) controls or engineering (physical) controls. The determination as to the type and duration of a specific LUC depends on regulatory requirements and site-specific conditions, although many controls are put in place for long-term use. State environmental agencies are often charged with the responsibility for managing (which includes tracking and monitoring) the LUC over the long term. Therefore, these agencies have a particular interest in using LUC management systems or programs that are easily accessible and include accurate site-specific information about the use of LUCs. Many states have identified as a priority the need to develop registries or lists to manage LUCs. States that receive funding for the development and enhancement of the response programs from the U.S. Environmental Protection Agency's Brownfields Program under the authorities of Comprehensive Environmental Response, Compensation and Liability Act Section 128(a) are required to develop LUC registries as a condition for funding. It should be noted that various financing mechanisms exist for the long-term management of LUCs, such as stewardship fees, oversight fees, and trust funds.

The ITRC Radionuclides Team conducted a survey of seven states with major Department of Energy facilities (ITRC 2004) and found that the areas identified as significant challenges faced by state regulators included information exchange and management and monitoring of LUCs as well as the need to ensure long-term stewardship of LUCs. Subsequently, the ITRC State Engagement Team conducted a survey which identified the management and long-term stewardship issues surrounding LUCs as the top environmental priority. Because of the importance that states put on this issue, the ITRC Brownfields Team identified, researched, and reviewed various LUC management systems.

This document presents an overview of various systems and state programs that track, monitor, and/or educate people on LUCs. Moreover, it describes each of these systems and programs and explains what and how information is provided by each system. Information about the various technologies and their associated costs for development and implementation is provided, advantages and limitations are discussed, potential users are identified, contact information for the user is provided, and case studies offer insight into implementation efforts. It is important to note that, due to the ongoing and sometimes contentious debate about the "appropriateness" of LUCs in comparison to permanent, active, or "complete" remedies, this document does not evaluate the policy issues related to LUCs or their role as part of an appropriate solution to any specific environmental condition.

This document provides federal and state regulators, the regulated community, and interested stakeholders with information on the various systems or technologies that are currently available to manage LUCs as well as to notify and educate stakeholders. The intended target audience for this overview document includes state and municipal governments, including the environmental, cleanup, health, and related regulatory agencies. This document is structured to include the definition and purpose of LUCs and how they are used; descriptions of some of the various

administrative, regulatory, and legal processes for the implementation and long-term stewardship of LUCs (including the Uniform Environmental Covenants Act); overviews and summaries of various state programs; and summaries of the various management systems identified through team research. A technology matrix developed by the team allows for the comparison of each system that was reviewed.

Numerous important features and elements for LUCs have been identified and evaluated by states for inclusion in state LUC management systems. The ITRC Brownfields Team found that most states have some form of a LUC registry, although no two of those reviewed were exactly alike. The registries have varying levels of sophistication and provide different points of access for information. These registries range from a simple listing of sites that contain LUCs for restricted use to more complicated notification and tracking systems that identify when and where a LUC was implemented and whether the LUC may be compromised.

For the purposes of this document, the ITRC Brownfields Team subdivided LUC management systems into four categories: those that track properties that use LUCs, those that provide notification of any activity that may be occurring on a site that has LUCs, those used to conduct outreach to or educate a community about LUCs, and those that facilitate agreement among parties who share responsibility for the implementation and management of LUCs. Some systems were found to address issues in more than one category. In addition, some of the systems presented were developed for other purposes but are identified herein as potential tools for consideration or adaptation.

The review of case studies and other information compiled by the ITRC Brownfields Team determined that an effective LUC management system should be web-based; searchable; geographical information system (GIS) compatible; accessible to all stakeholders; and able to track permits, field inspections/activities, land use changes, and other information. The system should provide all information deemed necessary through appropriate links, including complete descriptions of controls, physical characteristics, contaminant data, reports, site plans, and information of public interest for training and outreach. In addition, such a system should be able to notify and/or alert the appropriate stakeholders in the event of threatening activities. In addition to managing LUCs, such a collection of information could be used for all aspects of site management, decision making, and communication.

Some of the current systems that were evaluated by the ITRC Brownfields Team were found to contain some limitations, including inability to combine tracking, notification, and outreach capabilities in a single system. Some systems currently track only certain contaminants or only sites under specific state programs but not all programs within a state. Finally, as typical with other GIS applications, there are still issues in identifying sites by specific or multiple attributes, such as site name (or names), address, parcel number, latitude/longitude, etc. Relative costs were difficult to compare as the costs of these systems were highly dependent on the multiple variables that each individual technology manages and were typically considered to be dependent on the needs of each specific client/user.

It was concluded that the underground utility mark-out and clearance services, collectively referred to as the One-Call system, provide a ready-made network that could be adapted to include LUCs. The One-Call system is an established, widely used, and familiar system, with a record of success in protecting subsurface utilities. Many of the informational tracking or notification systems, such as Terradex, Accela, or other third-party notification systems, complement each other and the One-Call system, and a combination of important aspects of each system would provide a high level of protection and adequate tracking, notification, and outreach. It is asserted that, through the use of more than one system or "layering" different technologies or significant aspects of these technologies, the effectiveness of the overall system being implemented will be improved.

The ITRC Brownfields Team concludes that states need to implement LUC management systems that include tracking, notification, and long-term stewardship (which include inspections and certifications of the LUCs' continued adequacy) as part of their mission. An appropriate system should be easily updated and upgraded, using existing technologies for high-resolution mapping, communication, and notification by various means. Consideration should be given to potential future requirements for interstate sharing of information, system compatibility, and uniformity in data presentation and user friendliness. States should also be certain that their systems are comprehensive and include all sites from all of the programs within their states.

States should develop an appropriate, comprehensive LUC management system offering the highest level of tracking and information dissemination. The system should be combined with and used by those who provide land use approvals and by those who conduct actual excavation and construction work. Such a scenario would offer significant benefits to the regulated community, by providing conditions whereby all stakeholders can become more comfortable with the use of LUCs as a viable remediation alternative.

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AN OVERVIEW OF LAND USE CONTROL MANAGEMENT SYSTEMS

1. INTRODUCTION

The U.S. Environmental Protection Agency (USEPA) and state cleanup programs may promote the development of contaminated sites by allowing the required level of cleanup to be adjusted to fit the reasonably anticipated, intended, and/or allowable future use of the site. Adjusting cleanup levels to the future use of the site generally makes it possible to redevelop sites that simply cannot be fully remediated to unrestricted use standards due to impracticality, cost, or technology constraints. This approach is known as "risk-based remediation." When sites are not remediated to unrestricted use standards, land use controls (LUCs) are put into place to prevent exposure to contamination remaining on site. The use of LUCs as part of site remediation has become an accepted common practice.

> Land use controls are legal and/or administrative mechanisms as well as physical installations that modify or guide human behavior at properties with residual contamination that remains in place.

LUCs are used when contamination is present and not yet addressed, when remediation is in progress, or when residual contamination is present in amounts that do not allow for the unrestricted use of the site. Their purpose to ensure that there is no exposure pathway to the remaining residual contamination. LUCs can also be used to restrict specific activity. Sites that use LUCs as part of the overall remediation plan rely on their effectiveness to successfully protect human health and the environment over the long term. The understanding of state and federal environmental programs is that LUCs will not be compromised. The maintenance of LUCs can be conducted by various parties, such as the landowners; parties responsible for conducting and maintaining the cleanup; or federal, state, or local government agencies. For a LUC to remain protective, information needs to be readily available concerning its existence, purpose, and maintenance requirements. Information management is crucial to ensuring that the management of LUCs takes place and that the LUCs' existence is effectively communicated.

Federal, state, and municipal governments are developing inventories of sites with LUCs and have implemented various tracking and notification systems to manage LUCs. In addition, these management systems also provide information regarding the use of LUCs as interim measures at sites undergoing remediation or at sites where the remedial activities have been completed. In general, LUC tracking and notification systems are management systems designed to provide site-specific information about the existence and purpose of the LUC, thereby supporting the goal of ensuring that the site is used in a manner consistent with its condition and is properly maintained to ensure the long-term protectiveness of the remedy. Effective LUC management systems are crucial to guarantee that site-specific information about a LUC is readily available to regulators, current property owners, future purchasers, redevelopment agencies, excavators, or anyone else who may make decisions about how a specific property is used or handled. These management systems are considered essential for the long-term success of risk-based remediation.

1.1 Purpose

The purpose of this document is to provide regulators, the regulated community, and interested stakeholders information on the various long-term stewardship and LUC management systems and/or technologies that are currently available to track and monitor LUCs, as well as to notify and educate stakeholders. The ability of LUCs to successfully protect human health and the environment depends on having LUC information available and reviewed when decisions are being made. The LUC management systems and/or technologies described in this document offer options for stakeholders that provide the right information at the right time to ensure that LUCs remain effective and uncompromised over time.

Examples of LUCs

- easements
- covenants
- zoning
- administrative or judicial orders
- permits
- fencing
- caps/covers

LUCs are meant to protect human health and the environment given a site's current use or anticipated change in use. It can be challenging, and at times costly, to maintain and enforce the terms of the LUCs over time. Maintaining long-term knowledge of LUCs can be difficult. For example, records may be lost, project managers may be reassigned, or new owners and/or tenants may not be aware of the LUCs' existence. In addition, the environmental regulators that required the implementation of LUCs as part of a particular remedial decision may not be involved in the land use development process for the site. Similarly, local land use decision makers are rarely involved in the environmental remediation processes and may not have reason to know that LUCs are in place at a site. It is important that decision makers be aware of the placement of LUCs to make sound land use planning decisions and to ensure proper maintenance for as long as the LUCs remain in place.

Federal, state, and local environmental agencies often have responsibility for LUCs over the long term. These agencies have a particular interest in locating LUC management systems or programs that are easily accessible and provide accurate site-specific information about LUCs. Therefore, a number of management systems for tracking LUCs have been developed. The successful use and long-term management of LUCs may require the implementation of several of these systems or technologies to ensure that LUCs remain protective over time. This use of several LUC management systems may be referred to as "layering."

This document presents an overview of many different technologies and state programs that can be used to manage LUCs. LUC management includes tracking and monitoring LUCs and educating people on the existence of LUCs that have been implemented on specific sites as part of a remedy. These management systems and programs are categorized into four types: those that track properties that use LUCs; those that provide notification of any activity that may be occurring on a site that has LUCs; those that are used to conduct outreach to or educate a community about LUCs; and finally, those that facilitate agreement among parties who share responsibility for the implementation and long-term management of LUCs. The four categories developed by the ITRC Brownfields Team for use in the assessment of the LUC management systems and/or technologies reviewed in this document are outlined below.

- **Tracking—**These systems keep track of when and where LUCs were implemented and what notification and reporting is required. Some of the systems evaluated under this category can be implemented by a municipality or by a state regulatory agency. These systems describe the LUC and provide a record of activity regarding the LUC. Systems can also include information on site inspections and details regarding the LUC and its purpose.

- **Notification—**These systems can be used to notify individuals or monitoring agencies if any activity is occurring on a site that has LUCs in place.

- **Community Outreach and Education—**These systems provide, or have the potential to be adapted to provide, the community with available information regarding LUCs.

- **Implementation Planning/Model Documents—**These systems provide information to the regulated community and implementing parties as well as provide agreement on the provisions of the LUC installation and management, including inspections.

Section 5 provides a listing and information about each technology under the categories outlined above and the associated costs for development and implementation. In addition, advantages and limitations are discussed, potential users are identified, contact information for the user is provided, and case studies offer insight into implementation efforts. The technology matrix in Appendix A allows the reader to compare the features offered by each tool and/or program and can be used to determine which tool would best meet a particular need.

1.2 Surveys Supporting the Need for Long-Term Stewardship and Management of LUCs

LUCs are being used more routinely as part of the remediation plan for sites that are overseen by the states and USEPA. In fact, the majority of cleanup sites have implemented some form of LUCs as part of the site remedy. The Government Accountability Office (GAO) report *Hazardous Waste Sites: Improved Effectiveness of Controls at Sites Could Better Protect the Public* (GAO 2005) includes information on LUCs at Superfund sites and Resource Conservation Recovery Act (RCRA) facilities where remedies were selected in fiscal years 2001–2003. The report indicates that 93 of 112 Superfund sites and 15 of 23 RCRA sites used institutional controls (ICs). The same report notes that only 10% of the Superfund sites deleted from the National Priorities List (NPL) during fiscal years 1991–1993 used LUCs, as opposed to 53% of those sites deleted in fiscal years 2001–2003. While it should be noted that mechanisms for implementation of LUCs were not widely in place prior to 1993, these data do demonstrate an increased reliance on LUCs over the past decade.

In the fall of 2002, the Interstate Technology & Regulatory Council (ITRC) Radionuclides Team surveyed state regulators with major U.S. Department of Energy (DOE) facilities to determine what challenges they faced regarding the long-term stewardship of LUCs. The survey, completed by 31 regulators from 7 states (Colorado, Missouri, New Mexico, Ohio, South Carolina, Tennessee, and Washington) led to the development of *Issues of Long-Term Stewardship: State Regulators' Perspectives* (ITRC 2004). The areas identified by the respondents as significant

challenges associated with LUCs included information exchange, management and monitoring, and long-term stewardship.

Case Study

An example of the need for the development of a LUC management system was demonstrated in Santa Clara, California, where a sewer line was being repaired under a parking lot that capped contaminated soils. The California Department of Toxic Substances Control (DTSC) required, as a condition of the cleanup, that a cap be placed on the property to prevent exposure to residual contamination. A restriction was recorded on the property deed to limit its use and preclude digging without DTSC approval. However, the contractors were issued a local permit to repair the sewer line, resulting in the removal of the cap and potentially exposing the workers and the public to the contaminated soil. This is just one example of the need for better LUC management systems. (California Local News CBS5, "Bay Area Construction Site on Toxic Waste List," May 5, 2006)

In August 2006, the ITRC State Points of Contact (POCs) completed a survey created by the ITRC State Engagement Team to identify current environmental priorities and emerging issues facing the states, defined as issues facing the states then or within the next three years. The states of Louisiana, Tennessee, Georgia, Delaware, Oklahoma, California, Missouri, New Jersey, and New Hampshire all identified the long-term stewardship issues surrounding LUCs as a top environmental priority for their state (ITRC 2006a). Many other states that completed the survey identified LUCs as one of their top two priorities. When the states were surveyed again one year later, Georgia, Louisiana, Tennessee, Delaware, Alaska, Oklahoma, and Missouri identified LUC tracking and monitoring as among their top four priorities; three of these identified it as their top priority. These surveys and other information researched by the team indicated the importance of evaluating the various tools and systems that currently exist and may be available to assist stakeholders in the development of new systems or to enhance current systems to manage LUCs.

1.3 Structure of the Document

For easy access to specific information about LUCs and tracking and monitoring them, this document is structured to include the following information:

- Section 2, "Land Use Controls," provides background information on LUCs and financial considerations and answers several questions: What are LUCs? What is their purpose? How are they used as part of a site remediation?
- Section 3, "Legal and Regulatory Procedures for Implementing LUCs," describes some of the various administrative, regulatory, and legal processes for the implementation and long-term stewardship of LUCs.
- Section 4, "Implementation of Land Use Control Programs," provides overviews and summaries of various state and federal programs that track and monitor LUCs.
- Section 5, "Research—Technology Overviews," summarizes the various technologies and management systems identified through team research that track, monitor, provide notification, and/or provide education to interested stakeholders on a LUC that has been implemented as a remedy on a contaminated site.
- Section 6 contains the findings and conclusions of this document, and Section 7 lists the references used in its development.

- Appendix A is the "Technology Matrix," and Appendix B provides the technology overviews for all of the technologies and management systems evaluated.
- Appendix C provides contact information for Brownfields Team members, and Appendix D lists acronyms used in this document.

2. LAND USE CONTROLS

As previously discussed, the use of risk-based decision making allows a contaminated site to be remediated for its intended reuse. This approach allows for contaminated environmental media to remain on site, resulting in the need for controls designed to ensure that the site remains protective of human health and the environment on an ongoing basis.

2.1 Overview of Land Use Controls

When a cleanup is completed to attain cleanup standards that do not allow for the unrestricted use of a property, a LUC must be put in place to prevent inadvertent exposures to the remaining contaminated environmental media. While unrestricted use is commonly referred to as "residential" use, it is more accurately described as a condition that allows a property to be put to any use without the need for limitations or restrictions to prevent unacceptable human exposure or environmental impacts from occurring as a result of the presence of contamination.

Some sites may require both ICs and engineering controls (ECs). One example is an asphalt cap that covers contaminated soil along with a land use restriction that prohibits residential use or disturbance of the cap. For other sites, an IC may be used without a corresponding EC. For example, a land use restriction may be used to prohibit residential use of a property due to residual soil contamination which exceeds an unrestricted use threshold but not an industrial threshold, and a cap is not required.

The determination as to whether an IC is sufficient or both an IC and an EC are needed depends on federal and/or state requirements and the site-specific conditions. When contaminated groundwater exists but is not in a groundwater use area, an IC to prohibit the installation of drinking water wells may be appropriate. On the other hand, if groundwater contamination exists in an area where drinking water wells are in use, an EC such as a slurry wall or the installation of pumping wells to provide hydraulic control of the plume may also be required to adequately prevent human exposure to the contamination.

2.2 Types of Land Use Controls

There are two categories of LUCs, engineering controls and institutional controls (ITRC 2006c). ECs are physical controls put into place at a site to prevent human and ecological exposure to contamination. ECs generally consist of physical measures designed to minimize the potential for human exposure to contamination by limiting direct contact with contaminated areas, reducing contamination levels, or controlling migration of contaminants through environmental media. Some examples are signage (Figure 2-1), fencing, capping, containment, slurry walls, extraction wells, and treatment methods that minimize the spread of contamination. Cleanups with ECs

involve ongoing evaluation, site inspections, periodic repairs, and sometimes replacement of remedy components.

ICs are nonengineered instruments, such as administrative and/or legal controls intended to minimize the potential for human exposure to contamination by limiting land or resource use. ICs may be used to supplement ECs to ensure their ongoing effectiveness, or they may be selected as a stand-alone response. ICs can be divided into four categories: governmental controls, proprietary controls, enforcement and permit tools with IC components, and informational devices.

Figure 2-1. Signage posted by the U.S. Navy warns the public of potential risk.

Governmental controls are usually implemented and enforced by a state or local government and may include zoning restrictions, ordinances, statutes, building permits, or other provisions that restrict land or resource use at the site:

- zoning—legal authority used by local governments to regulate land use for specific purposes
- federal, state or local ordinances or permits—outline specific requirements before authorizing an activity (e.g., building codes, drilling permit requirements) or restrict or control certain land uses
- tailored ordinances—local government controls placed on access to or use of certain areas within a property
- groundwater use restrictions—limit or prohibit certain uses of groundwater, including drinking and/or irrigation/dewatering (e.g., groundwater management zones)

Proprietary controls have their basis in real property law and are unique in that they may create legal property interests that restrict or affect the use of the property, relying on legal instruments placed in the chain of title for the property. Proprietary controls can be implemented between two parties without the intervention of any federal, state, or local regulatory authority. The enforceability of proprietary controls, including ones with environmental restrictions, should be evaluated under applicable (typically state) law. For example, some proprietary controls are enforceable upon execution, and others are enforceable upon the sale or transfer of the property. Examples of proprietary controls are as follows:

- Easements—Rights over the use over the property of another. Typically, for purposes of ICs, *negative easements* are used to limit uses of property that would otherwise be lawful. In many cases, *access easements* are used at sites to ensure that the current and future property owners allow access to the property to operate, monitor, or maintain engineered or institutional controls.

- (Real) Covenants—Agreements between landowner and others that are connected to the land and entitle the parties to either benefit or burden of the agreement. Typically used to establish an IC when property is being transferred to another party.
- State use restrictions/statutes/environmental covenants acts—State statutes providing owners of contaminated property with the authority to establish use restrictions, typically in the form of an easement or covenant.
- Conservation easements—State statutes establishing easements to conserve property and natural resources.

Enforcement and permit tools include permits, administrative orders, and consent decrees that are enforceable by state and/or federal agencies. Permits and orders may include requirements that restrict future land use. Most enforcement agreements are binding on only the signatories, and the property restrictions do not bind subsequent owners (i.e., do not "run with the land"). Some examples include the following:

- Administrative orders—Issued by an environmental regulatory agency and directing property owners to perform or not perform certain actions. Orders may require compliance with statutory or regulatory provisions that may affect the use of a property, including requirements to implement ICs. If violated, penalties may apply, and/or the matter may be referred to an administrative or judicial court for further enforcement.
- Consent decrees—Document an administrative or judicial court's approval of the settlement of an enforcement case filed in court. Typically, specify actions to be taken or not to be taken by the settling parties. Consent decrees may have penalties attached for noncompliance.
- Permits—Implemented by an environmental regulatory agency and may require compliance with a statutory or regulatory provision that may impact the reuse of the property.

Informational devices provide information about risks from contamination and generally are not legally enforceable. These devices include the following:

- Deed notices—Documents filed in public land records with the property deed that provide information about potential health risks from contamination left on the property to the future buyers or other interested parties.
- State registries of hazardous waste sites—Contain information about contaminated properties. Some state laws provide that the use of the registered property cannot be changed without state approval.
- Advisories—Warnings to the public of potential risks associated with using contaminated land, surface water, or groundwater, usually issued by public health agencies.

2.3 State Management of LUCs

As previously mentioned, in August 2006, ITRC State POCs completed a survey created by the ITRC State Engagement Team to identify current priorities and emerging issues facing the states. Many of the states that completed this survey identified LUCs as one of the top environmental priorities for their state (ITRC 2006a). A representative of the Michigan Department of Environmental Quality conducted a second, informal e-mail survey that year requesting that

states respond with information on how their states address the issue of LUCs. Thirteen states responded, and the survey revealed the following:

- Idaho, Oklahoma, South Carolina, and Wisconsin were in the process of developing tracking systems that would identify sites with LUCs in place.
- Idaho and Pennsylvania had developed legislative initiatives that would allow the state to enact the Uniform Environmental Covenants Act (UECA). (Pennsylvania later passed a UECA-based statute).
- Illinois, Kansas, Maine, Rhode Island, Pennsylvania, South Carolina, Tennessee, and Virginia have compiled lists of sites where a LUC have been implemented. Some lists are accessible by the public, others not.
- Wisconsin, Illinois, Rhode Island, Virginia, and Tennessee have implemented inspection programs of varying degrees and corresponding reporting requirements. In addition, Rhode Island conducts random inspections and requires the property owner to hire a qualified environmental professional to inspect the site and prepare an annual report.

What was evident from the responses to both the ITRC POC survey and the Michigan e-mail query is that most states are using LUCs in their remediation programs and the effective management of LUCs is a priority for states. Section 4 summarizes some of the state programs that manage and provide information on the LUCs implemented within their borders.

2.4 Financial Considerations for State Management of LUCs

Many states are struggling with the current funding levels available for the development of systems and/or programs to track and monitor LUCs. The costs vary depending on the system's elements and complexity, and various mechanisms may be implemented to fund development. For instance, states that receive funding to develop and enhance response programs under the authorities of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 128(a) are required to develop LUC registries. A portion of the CERCLA 128(a) funding may be used to support LUC management. The information contained on this list may include but may not be limited to the following: date the response action was completed, site name, the name of the owner at the time of the cleanup, location of the site, whether a LUC is in place, explanation of the type of LUC in place (e.g., deed restriction, zoning, etc.), nature of the contamination at the site (e.g., hazardous substances, contaminants, or pollutants, etc.), and size of the site in acres.

There are also various funding mechanisms to cover the costs incurred with monitoring LUCs, including the costs of conducting inspections of the properties with LUCs. Property inspections ensure that the current use of the property is in accordance with the provisions of a LUC and are conducted by the party that placed the LUC on the property and/or state regulators. These funding mechanisms include stewardship fees, oversight fees, and trust funds.

2.4.1 Stewardship/Oversight Fees—Public and Private

Some states are considering the use of stewardship and/or oversight fees to finance oversight activities associated with the implementation and maintenance of LUCs. According to one study

(Stateside Associates 2005), 22 states levy fees, put into place through legislation, for the oversight of LUCs. While these fees are usually not specific to the long-term stewardship of ICs, legislation could be written to include long-term stewardship. According to the study, some states charge an initial application fee (Idaho—$250, Hawaii—$1,000) or a fee for participation in the brownfields program (North Carolina—$2,000). Minnesota uses an hourly flat fee ($150). Kansas bases the fee on the size of the property.

Stewardship fees are paid by the entity responsible for the implementation of LUCs to an oversight agency (such as a state regulatory agency) or a third party. The oversight agency or third party may use the fee to fund site visits to ensure LUCs are still protective and, in some cases, assume additional responsibilities for the oversight of LUCs, such as reporting and permitting requirements. The fees may also financially support any activities associated with the failure of LUCs. It is important to note that stewardship fee programs may transfer the day-to-day oversight of LUCs but do not relieve the responsible party of liability. The Guardian Trust™ and Sentinel Trust are examples of privatized stewardship fee programs. Section 5 provides additional information on these programs, which provide and cover different aspects of day-to-day oversight of LUCs.

2.4.2 Trust Funds

Trust funds are established to receive funds into specific accounts that provide money for monitoring, maintenance, inspections, supervision, and restoration of properties. Many states have legislatively created trusts to fund the response to industry-specific releases, such as dry cleaners and leaking underground fuel tanks. The following is an example of a trust fund created through legislation, specifically a dry-cleaning trust fund; however the concept can be applied to all sites with LUCs in place).

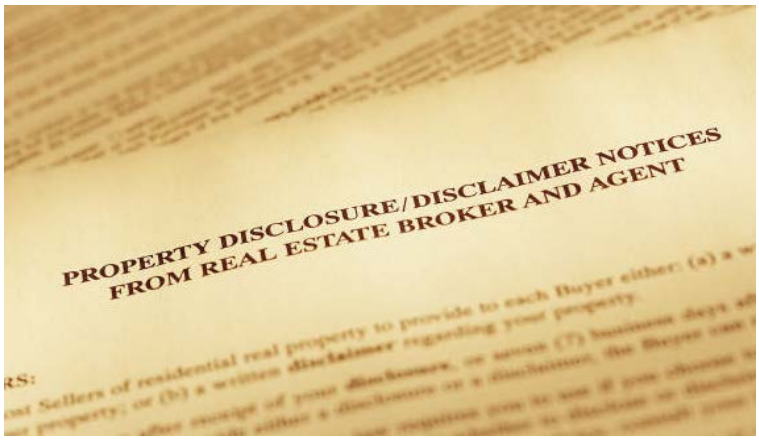
In 1995 the South Carolina General Assembly enacted the South Carolina Dry Cleaning Restoration Trust Fund Act at the urging of the industry (SCDHEC 2005). The South Carolina Dry Cleaning Restoration Trust Fund was created through the act. The trust fund was initially funded by two sources: annual fees paid by participating dry cleaners based on the number of employees and a surcharge levied on every gallon of dry-cleaning solvent purchased by a participating dry cleaner. The benefit of participating in the fund is that it will provide monies for the cost of environmental assessment and cleanup that exceed a facility's deductible. Annual fees range $750–$2250, and the surcharge is either $2 or $10 per gallon of solvent, depending on type. In 2004, the General Assembly added a 1% environmental surcharge on dry-cleaning sales to augment revenues in the fund. The program administered under the act requires LUCs to be placed on properties when a pollutant exceeds the standard for unrestricted use. Environmental work is performed by contractors with South Carolina Department of Health and Environmental Control (SCDHEC) oversight. The act provides for a limited number of staff to oversee the program.

The financial strategies listed above are not all inclusive, but rather are potential tools which are currently being used or evaluated to address the financial burden of creating a tracking system and long-term monitoring of LUCs.

3. LEGAL AND REGULATORY PROCEDURES FOR IMPLEMENTING LUCS

Depending on a state's requirements, LUCs may be recorded on the real property deed as either obligations or restrictions imposed on a property. Use restrictions recorded against the real property may be enforceable by the regulatory agency requiring the recordation. Enforcement actions vary from state to state but may include penalties, loss of liability protection, and lawsuits. These recordations have their basis in property law and other regulatory procedures.

3.1 Real Property Law



In the United States, real property law is governed by state law, which obviously varies from state to state. The basis of real property law in each state depends on local history and conditions. The basic legal mechanisms presented herein are detailed in *Essentials of Practical Real Estate Law* (Hinkel 2004).

Real property has historically been subject to such encumbrances as taxes, utility and access easements, zoning restrictions, etc. As a result of the federal environmental regulations enacted beginning in the late 1970s, the use of real property is now subject to environmental encumbrances, commonly known as "restrictions." While these environmental regulations focus on industrial properties such as manufacturing or commercial services, including dry cleaners and gas stations, they can also be applied in certain situations to existing residential properties. Under environmental cleanup laws generally, restrictions may be placed on the owner's use of the property to protect the public and the environment from unacceptable risks or damages that can be associated with residual contamination remaining on a property. Today, changes in land use from the industrial era to residential communities are commonly triggering the need for LUCs to protect the public from exposure to unacceptable risks from residual contaminants remaining in various media found on the property. Restrictions placed on the owner's use of the land can be media specific, meaning the restriction may prohibit exposure to surface soils, subsurface soils, groundwater, surface water, and/or unhealthy air or vapor.

Although the law pertaining to real property varies by state, many states use similar legal mechanisms (e.g., state registries of environmental sites and restrictions) to ensure the public is noticed of a LUC's existence. Certain mechanisms allow the LUC to continue long term by "running" with the title to the land. Some states require the recording of land use restrictions to disclose certain environmental risks, which may include penalties or fines for noncompliance. Various legal mechanisms guarantee that the current property owner accepts, at least to some degree, the use restrictions placed on the property and that future property owners are made aware of the restrictions during a title search.

These legal mechanisms ensure that the chosen remedial strategy remains intact, that the public is not exposed to unacceptable health risks, and that future land owners are aware of the

environmental conditions of the property prior to purchase. The various legal mechanisms include covenants and restrictions, deed notices, easements, and consent agreements. Each of these mechanisms is referenced in Section 2.2; however, one additional type of legal mechanism that has been developed and is currently being adopted and/or evaluated by states across the country is the Uniform Environmental Covenants Act.

3.2 Uniform Environmental Covenants Act

The UECA, drafted by the National Conference of Commissioners on Uniform State Laws (NCCUSL) and approved at its annual meeting in August 2003, is model statute that can be adopted into law by each individual state or territory. Also known as the Uniform Laws Commission, NCCUSL is a 115-year-old, nonprofit organization of members of the bar who are appointed in each state, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands.

The UECA provides the legal framework for state and federal agencies to create, modify, enforce, and terminate a valid real estate instrument—an environmental covenant or IC—to restrict the use of contaminated real estate or to impose affirmative obligations under state law and precludes the application of traditional common law doctrines that might otherwise hinder the validity or enforcement of ICs adopted under state property law or other mechanisms. In addition, the UECA provides mechanisms for states to develop and maintain a registry of sites with ICs.

As detailed on the UECA website (www.environmentalcovenants.org/ueca), the act makes environmental covenants enforceable by eliminating certain common law doctrines that might otherwise cast doubt on the covenants' long-term validity. The UECA is modeled on traditional property law principles to ensure that environmental covenants created under the act will have validity over the long term and be enforceable in accordance with their terms against successive owners of the site and against the parties liable for maintaining the IC on the site and performing other duties identified in the covenant.

If all parties to the covenant are confident that site-appropriate activity and use limitations (AULs) detailed in the covenant will be enforced, it is more likely that environmental regulators and the owners of contaminated sites will allow those sites to be redeveloped. The UECA incorporates the American Society for Testing and Materials (ASTM) terminology "activity and use limitations" to mean either restrictions or affirmative obligations. Often the terms "land use control" and "engineering/institutional control" are used instead of "activity and use limitation." While each term may have a unique meaning, the terms have become interchangeable to the extent that they have nearly the same meaning.

The UECA provides that environmental covenants be recorded in local land records or in an optional registry (if the state allows for a registry instead), making it easier to find information

about AULs through the traditional real property system. If future land uses are planned that would be inconsistent with the environmental covenant recorded in the local land records, then the party seeking to change the future land use must work with the applicable environmental agency and the grantor of the covenant to change the covenant. The UECA is a legal mechanism to ensure AULs can be readily found, maintained, and enforced over time.

The UECA does not change local zoning laws, building codes, or subdivision requirements, nor does it define the environmental cleanup standard to be used by a regulatory agency to determine when remedial activity is required or when an AUL should be applied. Moreover, the UECA does not define the terms of the AULs to be applied to the property. Noteworthy is that the UECA does not automatically invalidate prior recorded instruments that were created to address environmental remediation or automatically subordinate prior interests in the real property. The UECA also does not provide condemnation authority.

3.2.1 UECA Implementation at the State Level

To date, states that have adopted the UECA have done so for two main reasons: first, the UECA ensures that recorded covenants are legally valid and enforceable, and second, the UECA promotes the sale of and successful redevelopment of contaminated real property. According to the UECA web page (September 2008), the UECA has been adopted by 21 states, the District of Columbia, and the U.S. Virgin Islands. Since efforts to promote the adoption of the UECA did not begin in earnest until 2005, it is noteworthy that almost half the states have adopted it to date. It was enacted most recently by three of the seven states where it was introduced during the 2007–2008 legislative sessions: Georgia, Mississippi, and Pennsylvania. The UECA is targeted to be introduced in at least 10 more states during 2008 legislative sessions and is being studied by six additional states. Arkansas, North Dakota, and Texas each expect to introduce the UECA during their 2009 sessions. Other states have determined that their statutes and/or regulatory programs are adequate and therefore do not plan to adopt the UECA. Figure 3-1 depicts the status of the UECA among the states.

3.2.2 Modifications to Fit with Existing State Law, Policy or Guidance

In some states, the UECA has been modified slightly to fit more closely with various existing state laws and common law practices. Even though change to the legislation weakens the nationwide uniformity of the UECA, adoption even in a modified form provides greater consistency among state systems. The following examples present how three states made changes to the UECA prior to its adoption:

- Kentucky—The Environmental and Public Protection Cabinet has been given sole authority to make environmental response decisions and thereby has sole authority to impose an environmental covenant. Specifically, Kentucky has not included the federal government in this decision-making process [see UECA Section 2 and Kentucky Revised Statutes Chapter 224.80-100(3)].

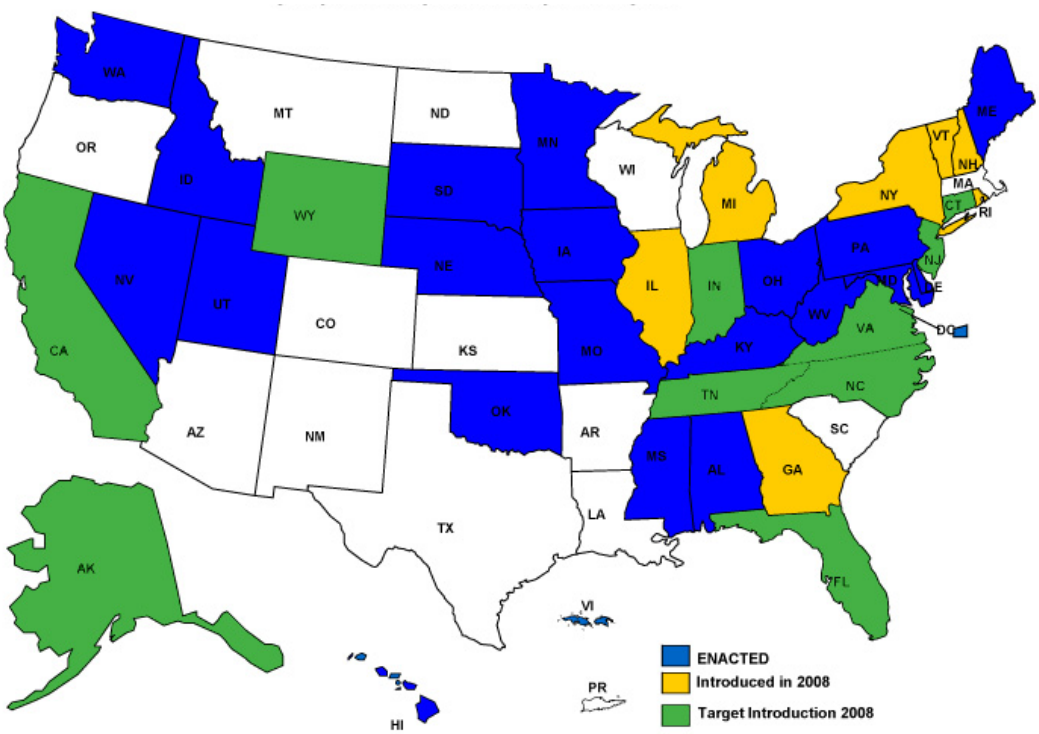


Figure 3-1. Status of the UECA across the country.
(*Source:* www.environmentalcovenants.org/ueca, updated April 7, 2008)

- Minnesota—The UECA allows for a "court" to make decisions to terminate the environmental covenant or to reduce the burden imposed by the covenant under the doctrine of changed circumstances. Minnesota decided to give this authority to the environmental agency imposing the covenant. In Minnesota, the environmental agency not only may terminate or reduce the burden of the covenant but may also impose additional requirements through modification of the covenant [see UECA Section 9.(b) and Minnesota Sec. 67. [114E.40].

- Nebraska—Nebraska did not want to become the "holder" of a limited interest in real property by becoming a party to of the environmental covenant. To address this concern, Nebraska changed the UECA "nature of rights" portion of the legislation to state that, unless the "State of Nebraska, a municipality, or another unit of local government" actually owned the real property, those units of government would not be identified as a "holder" and would not thereby acquire an interest in the real property [see UECA Section 3.(a) and Nebraska Section 76-2602(6) and 76-2603(a)].

Some states have also adopted accompanying documents to provide their citizens standard language. For example, in addition to the model environmental covenant form, Iowa has included preparation guidance, a model recording cover sheet, and a model subordination and consent agreement. The guidance states that parties are "expected to use the model environmental covenant," which was developed by the state's regulatory agency. In this way, Iowa has shifted the burden of document preparation from the state regulatory agency to the property owner while

making the documents themselves more uniform. States that have adopted supporting documents include but are not limited to Delaware, Hawaii, Maine, Maryland, Nebraska, Ohio, and Utah.

Some model covenant forms are limited to petroleum issues while other model forms, such as Hawaii's and Delaware's, cover a broad spectrum of hazardous substances. Iowa's model environmental covenant forms focus on underground storage tanks and petroleum; the forms are provided for owners of petroleum sites or owners of adjacent sites affected by a petroleum release. Maine's guidance document is for hazardous substances and "oil-contaminated soils."

3.2.3 Guidance for State Regulators, Especially in States Where the UECA Has Not Been Adopted

Environmental regulators' expertise may not extend to the requirements and limitations of property law and common law doctrines. State regulators, especially in states where the UECA has not been adopted, should become familiar with the following:

- Change in use of the real property—A change in the use of the property after an IC has been selected requires a review of the remedial decision and the type of IC that was used to determine whether the use restrictions and obligations imposed by the IC remain applicable and valid and who has the right to enforce the IC.

- Interest in real property—The concept that the agency may become a "holder" of a limited interest in the real property by becoming a party to and signing an environmental covenant may be unfamiliar to state regulators working in the environmental realm.

- Priority of interest—The regulator should be aware that, unless the "holder" of a prior interest (such as a mortgage or mineral interest) has agreed through a written instrument to subordinate its interest in the real property to the environmental covenant or other type of IC selected for the site, the environmental covenant or IC may not survive the exercise of this prior interest. Moreover, in states that have not adopted the UECA, an IC may be eliminated by means of a tax lien foreclosure, adverse possession, and/or a marketable title determination. An environmental covenant established pursuant to the state's version of the UECA is not subject to these risks.

- Notice of environmental covenant—While state regulators are familiar with the practice of recording environmental covenants and other types of ICs in the county's land records office, the regulators may not have been required to notify the municipality or other unit of government where the real property is located. This practice is encouraged under the "best practices" section of the UECA, as it would enhance public knowledge and may help ensure long-term stewardship of ICs.

3.3 Governmental Control Mechanisms

Governmental controls are typically implemented by state or local government entities using their legal mechanisms and regulatory authorities. Governmental control mechanisms are used as stand-alone LUCs or may be used as an additional layer of LUCs in conjunction with other legal

mechanisms such as proprietary controls. Governmental controls are different from property-based laws because no agreement between parties is necessary. A key concept to consider when evaluating a state or local government legal mechanism or regulatory authorities as a governmental LUC is that in most instances the authorities or controls are/were not necessarily designed or initially implemented to function as LUCs. They are/were typically designed to administer or control activities such as local zoning determinations, building code requirements, subdivision requirements, groundwater restrictions, and the land use tracking and notification process. These mechanisms or authorities can and are used as (or relied upon as) LUCs at sites. In some cases the governmental program may be developed specifically to be a LUC at a site or for multiple sites. However, in many cases, there is a potential disconnect between the original purpose or use of a particular state or local government mechanism or authority (such as zoning, permit systems, or others) and its ultimate use as a LUC. Practitioners may consider entering into written arrangements, memoranda of understanding (MOUs), or other similar documents to outline the roles, responsibilities, funding, and contacts for the multiple parties implementing, monitoring, and/or assuring the long-term validity of the control. Sections 5.7 and 5.8 discuss implementation planning/model documents.

3.3.1 Local Governmental Controls (Local Zoning Law, Building Codes, and Permits)

These mechanisms rely on existing authority of the governmental entity to impose LUCs and have a wide range of regulatory authority. Zoning ordinances are used to protect public health, safety, and general welfare and typically depict on a map the land use zones in the community. Ordinances and building codes can regulate land use, building materials and structures, and overall land use activities. Zoning and permitting can be used as LUCs, but they have limitations in that they can be repealed or recalled and are ineffective if not routinely monitored or enforced over the long term.

3.3.2 Groundwater Use Restrictions

Restrictions on groundwater use can be used to prevent exposures. Many state and local agencies will require permits to control the installation and use of wells properties to ensure proper installation and protect water resources. In residential communities that exist over contaminated groundwater, well drilling may be restricted to limit the use of groundwater or prevent cross contamination. The ability of a state to impose groundwater use restrictions varies and depends on the legal authority and policy of the agency. Laws and regulations to protect and control groundwater use can apply to entire regions, and they may limit or prohibit certain uses of groundwater, including drinking and/or irrigation/dewatering.

3.3.3 Advisories

Local or state health agencies issue advisories to notify the public of potential health or exposure risks associated with the land, surface water, or groundwater. These advisories can function as LUCs. For example, warning signs were posted along a walking trail in the foothills of California to caution users of the potential risk associated with high concentrations of arsenic in the vicinity of the trail. Advisories and notifications can also be used in conjunction with deed restrictions and notices to inform the public. Citizens living over contaminated groundwater plumes may be

advised of the condition and potential risk. Additionally, advisories can provide information to the community of recorded land use covenants.

3.3.4 Local Department of Health Programs

Local health departments can develop and implement LUCs at sites. For example, at the Bunker Hill Superfund Site in Idaho, it was determined that LUCs were needed to address residual soil contamination. The federal government, the State of Idaho, Shoshone County, the four cities located within the site boundaries and the Panhandle Health District (PHD) agency were all evaluated for their ability to administer the LUC program. Since the PHD could enact regulations that crossed jurisdictional boundaries, it was decided that PHD would administer the LUC program.

The LUC program developed by PHD includes regulations designed to ensure the integrity of clean soil and other protective barriers placed over contaminants left in place, educational activities, permitting and inspection procedures, monitoring and health surveillance programs, and records maintenance. The LUC program has been integrated into city and county building departments' permitting processes so that permits these entities require are not issued without PHD involvement and approval. This integration ensures that the LUC requirements are met when any activity that may impact a LUC is conducted. In addition, the PHD participates in the Shoshone County One-Call system. All work orders processed by the One-Call system are sent to PHD, allowing the identification of those projects that need a permit under the LUC program.

4. IMPLEMENTATION OF LAND USE CONTROL PROGRAMS

The development of a state LUC management system is an important component of an effective long-term stewardship program. A state agency's ability to inform the public where LUCs have been implemented and to track them internally is critical to effective management. LUCs are effective only if their existence is known or easily ascertainable; thus, many states are using tracking systems for LUC management.

The Small Business Liability Relief and Brownfields Revitalization Act, known as the Brownfields Amendments, amended CERCLA and added Section 128(a) to allow USEPA to provide assistance to states and tribes by awarding grants to establish or enhance response programs. As a condition of receiving CERCLA 128(a) funding, a state or tribe must develop and update annually a public record of sites where response actions were completed. This public record of sites must specify whether a site will be suitable for unrestricted use on completion of the response action. If a site is not suitable for unrestricted use, the public record must identify the LUC relied on as part of the remedy (www.epa.gov/brownfields). This public record can be initially used to identify sites with LUCs. Most states are recipients of the USEPA brownfield funds and have developed databases that identify sites where LUCs are implemented as a condition of the cleanup.

4.1 Important Elements of a State Land Use Control Management System

States that have very few sites with LUCs may use simple LUC management systems, such as a spreadsheet that can be requested by the public in hard-copy format or is available on the state agency's website. This simple tracking method meets the requirements for CERCLA 128(a) funding and cost-effectively meets the need to provide information to the public about the sites in the state that rely on LUCs as part of the remedy. States with large numbers of sites with LUCs often use management systems with a variety of features that enable the public to easily obtain detailed LUC and site information. These systems also provide information that allows agency staff to manage LUC implementation and compliance efforts.

The following, in no particular order, are important features and elements that should be evaluated in the development or enhancement of a state management system for LUCs. These features can provide the tracking, notification, and community outreach and education elements of a LUC management system.

- publicly accessible and up-to-date data
- lists and/or descriptions of site-specific LUCs
- mapping and/or geographical information system (GIS) capabilities
- searchable database
- contact information for state agency and/or for person responsible for the LUC
- nature and extent of contamination specific to media (i.e., soils, air, sediment, surface water, and/or groundwater)
- ownership history and/or notification of property transfers
- notification to project managers when inspections or certifications are required
- downloadable site-specific documents (maps, as-builts, reports, etc.)
- compliance tracking
- definitions of agency terminology and acronyms
- site location information (e.g., street address, latitude/longitude, lot/block/parcel)
- record of LUC inspections
- links to other pertinent information
- easily accessible/user-friendly format for information
- identification of changes in land use
- notifications and/or alerts of potential threats to controls

In 2005 the U.S. Army Environmental Center tasked Stateside Associates to conduct a survey of all 50 states to identify state laws, regulations, and guidance pertaining to ICs and how they are implemented. At the time of the survey (Stateside Associates 2005), 30 states had tracking systems ranging from a basic list of sites to searchable databases with detailed site and IC information enhanced by web-based mapping applications.

In January 2007, the ITRC Brownfields Team performed a review of many of the systems listed in the Stateside Associates report and/or each state's website to determine the types of LUC management systems in use and the information available to the public via the Internet. The review indicated that while the systems shared many common features, no two systems were

alike, and each had a unique combination of features. Sixteen states did not appear to have a LUC tracking system. Of the 34 existing systems, 10 used a simple spreadsheet that provided basic site information, including whether or not LUCs apply, but little or no detail regarding the LUCs. Twelve other states had databases that included detailed site and LUC information, and most of these databases were searchable from the Internet. The remaining 12 states had searchable databases with a web-based mapping application. Overall, one-half were searchable via the Internet; two-thirds included detailed, site-specific LUC information; one-half included detailed site information such as nature and extent of contamination; and several allowed site-specific documents such as reports and site plans to be downloaded.

4.2 Current State Agency Land Use Controls Systems

A state LUC management system can be categorized in various ways. As explained previously, LUC management systems should track information; notify interested stakeholders regarding potential land use changes; inform the community regarding an implemented LUC; and/or provide for an agreement on the provisions of the LUC installation management, such as inspections and required certifications to ensure its continued protectiveness. The state programs and systems described in this section are a sampling of what exists in various states across the country for the management of LUCs. It should be noted that the state systems presented in this document are at varying levels of sophistication and provide different points of access for information.

Case Study

In addition to the state LUC management systems described here, note that some cities throughout the country have also developed LUC management systems. One such system is currently operated by Rochester, New York. Rochester's Building Permit Flagging System was created to identify and control permit activities undertaken on properties that have undergone remediation. The purpose of the system, which identifies properties currently or formerly owned by the city that have LUCs in place, is to issue building permits that are compatible with the condition of the remediated property. The goal is to make sure that future construction activity does not disturb residual contamination. This management system uses electronic flags on the building permit operating system to identify to permit staff the existence of a LUC on a specific property. Through the use of the electronic flagging system, permit applicants are notified of the environmental conditions at the site.

4.2.1 Alabama Department of Environmental Management

The Alabama Department of Environmental Management (ADEM) defines LUCs as any restriction or control that serves to protect human health and/or the environment by limiting the use of and/or exposure to any portion of a property, including water resources. These controls may include engineering and institutional controls.

ADEM maintains an online system for tracking LUCs identified as the "Cleanup Inventory List," found at www.adem.state.al.us/LandDivision/Brownfields. The list contains information on sites that have completed or are currently undergoing remedial activities under the various Land Division programs (e.g., RCRA, CERCLA, Brownfield, etc.). Information available on the site includes site names (past and present), physical address, previous use(s), latitude and longitude, ownership history, contamination constituents, contaminated media, cleanup program, date of completion, and types of LUCs (including ECs).

The "Cleanup Inventory List" website is updated monthly and is an essential component for the redevelopment of brownfield sites in Alabama. The list allows citizens, potential developers, and local governments' access to information on sites that have undergone environmental cleanups with imposed LUCs. On opening the system, users see a map of Alabama counties. Clicking on a particular county enables finding sites in that county, making the system very user friendly. See www.adem.state.al.us for additional information on the Alabama LUC system. (Information provided by ADEM.)

4.2.2 California Department of Toxic Substances Control

The California Code of Regulations, Title 22, Section 67391.1 requires that a land use covenant be executed and recorded when hazardous materials, waste, constituents, or substances remain at a property at levels which are not suitable for unrestricted use of the land. In these instances, the California DTSC requires the execution and recordation of a covenant to notify existing and future property owners and other parties of the existence of residual contamination.

When covenants are a part of the remedy, DTSC uses a system of implementation that is based on the degree of threat to human health and the environment posed by site conditions. DTSC uses several administrative tools to achieve its layering strategy of managing LUCs, including a Deed Restriction Registry. All recorded covenants are included in an online database that can be accessed through DTSC's home page (www.dtsc.ca.gov). This registry provides a means for identifying land use covenants and their specific provisions on a site-by-site basis. The deed restriction registry is contained in and generated from DTSC's comprehensive EnviroStor database (Figure 4-1).

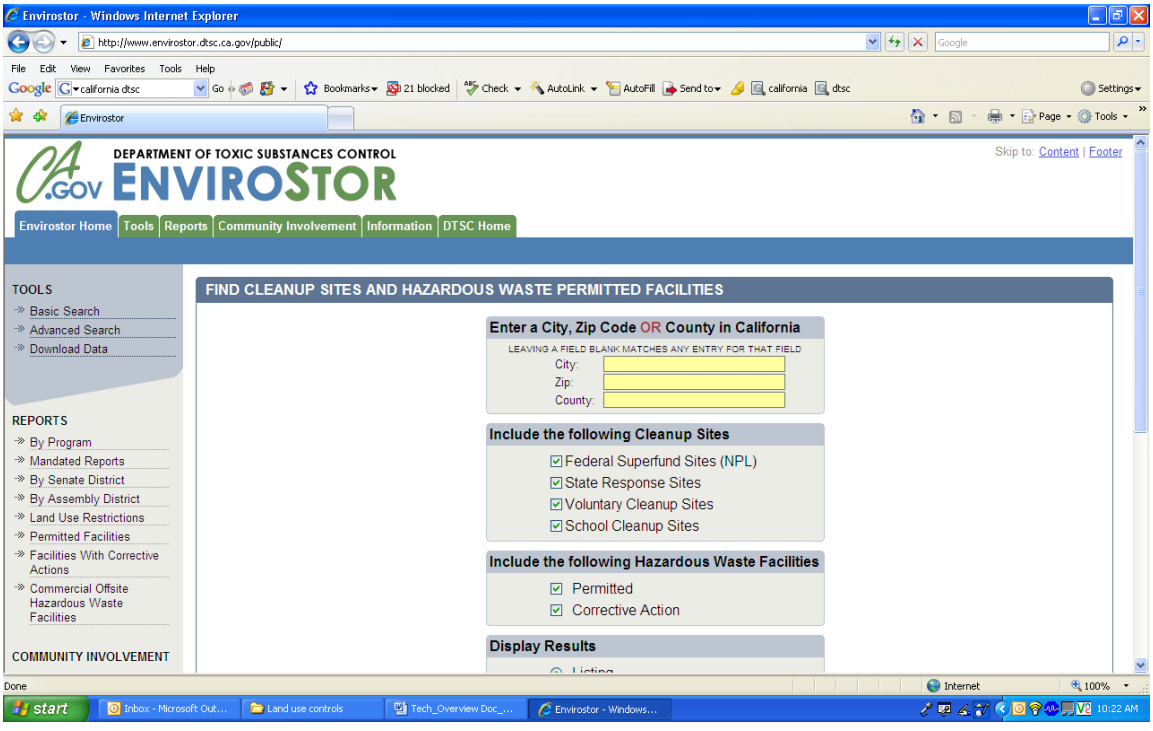


Figure 4-1. Screen shot of EnviroStor. (*Source:* California DTSC)

DTSC personnel use EnviroStor to manage all sites currently known to or overseen by the agency. Much of the information found in the database is available to the public via the Internet, including information associated with LUCs (www.envirostor.dtsc.ca.gov/public/). The public has access to information about all hazardous substance release sites known to or managed by DTSC. The "find a site near you" search feature can locate any site in California where DTSC has required/instituted a covenant. The public can access comprehensive site information, public documents (including land use covenants and eventually all new public documents and key historic documents), and links to DTSC project managers who possess full knowledge of current project status and historical information of the site.

Information in the EnviroStor system can be retrieved via individually tailored queries. Sites with LUCs in place can be found in multiple ways, and the actual covenant is available for viewing/printing. In addition, the list of sites with covenants can be exported to Excel and sorted by column headers including ZIP code, city, county, and street address.

DTSC has recently entered into a contract with Terradex to conduct electronic monitoring of all sites in the program where covenants have been recorded. Section 5 contains additional information on the Terradex system. DTSC is continuing to update the capabilities of its EnviroStor database and is currently pursuing data accessibility and sharing (between local, state, and federal government agencies) enhancements under an Environmental Information Exchange Network (EIEN) grant funded by USEPA.

The website for additional information on the California EnviroStor system is www.dtsc.ca.gov or http://www.envirostor.dtsc.ca.gov/public/. (Information provided by California DTSC.)

4.2.3 Colorado Department of Public Health and Environment

Colorado also uses covenants as a mechanism to ensure that LUCs that are part of environmental remediation projects are properly implemented and that engineered structures are protected and maintained. Effective July 2001, Senate Bill (SB) 01-145, "Concerning the enforceability of environmental real covenants," modified sections of the state hazardous waste statutes (25-15-101 et. seq.) to create the authority for the Colorado Department of Public Health and Environment (CDPHE) to approve requests by any party to restrict the future use of a property using an enforceable agreement called an "environmental real covenant." This law creates a method to enforce LUCs that may be imposed as part of a cleanup of a contaminated site, the first enforceable mechanism in Colorado to ensure such restrictions are protective. The statute requires CDPHE to create and maintain a registry of all environmental covenants. The official registry (www.cdphe.state.co.us/hm/covenant/index.htm), in database format, includes information on site name, location, contaminants of concern, covenant requirements, verification of covenant effectiveness, and other information deemed to be pertinent.

CDPHE believes there should be an accessible source of information for interested citizens, real estate personnel, and others regarding restrictions on individual properties. CDPHE is currently constructing a GIS-based mapping system on its website so the public can search for information on specific addresses or perform queries (e.g., contaminated sites within ½-mile of their home). To provide accurate information on the website, upon creation of an environmental covenant,

owners will be required to submit a certified land survey of the boundaries of the land covered by the covenant. CDPHE will also add electronic links to the text of the environmental covenant on affected properties. In the future, CDPHE may include information on other institutional controls not related to SB 01-145. These sites will be prioritized and added as resources allow. As a search tool, the proposed website will be a very accessible and powerful mechanism for interested parties to check on the presence of covenants on specific properties.

Additionally, CDPHE has agreed with the Colorado Division of Water Resources to provide a groundwater notification process for applicants wishing to install any form of groundwater well within boundaries prescribed by CDPHE. This notification process will allow potential users of contaminated groundwater to be notified of contaminant concerns and also provide for consultation with the regulating agencies prior to conducting any intrusive work. While this system has not been formalized and entered into the CDPHE GIS LUC system yet, two NPL sites have had groundwater LUCs, and additional sites are forthcoming.

The address for additional information on the Colorado LUC system is www.cdphe.state.co.us. (Information provided by the CDPHE.)

4.2.4 Florida Department of Environmental Protection

The Florida Department of Environmental Protection (FDEP) maintains the Institutional Controls Registry (ICR) for internal tracking of properties on which LUCs have been imposed pursuant to the provisions contained in Chapters 376 or 403 of the Florida Statutes. The ICR includes information for sites in the brownfields, petroleum, dry cleaning, Superfund (CERCLA), RCRA, or federal Hazardous and Solid Waste Amendments (HSWA) programs and nonprogram sites (i.e., state enforcement or voluntary cleanups).

The ICR (Figure 4-2) is accessible to the public via the FDEP website as either a database printout in PDF format or a GIS-based mapping application for all properties on the ICR (www.dep.state.fl.us/ waste/categories/brownfields/pages/ICR.htm). The Florida Brownfields GeoViewer, a mapping program for all brownfield sites, including those on the ICR, is also available via the website.

The ICR database includes the following fields for each property:

- name, street address, city, ZIP code, and county
- implementation mechanism (restrictive covenant, memorandum of agreement, etc.)
- IC type (water use restriction, land use restriction, digging restriction, etc.)
- EC type (impervious cap, vertical barrier, etc.)
- contaminated media (soil, groundwater, etc.)
- contamination (pesticides, petroleum, volatile organic aromatics, etc.)
- program area (RCRA, tanks, etc.)
- dates IC recorded, order issued, order amended, and IC removed

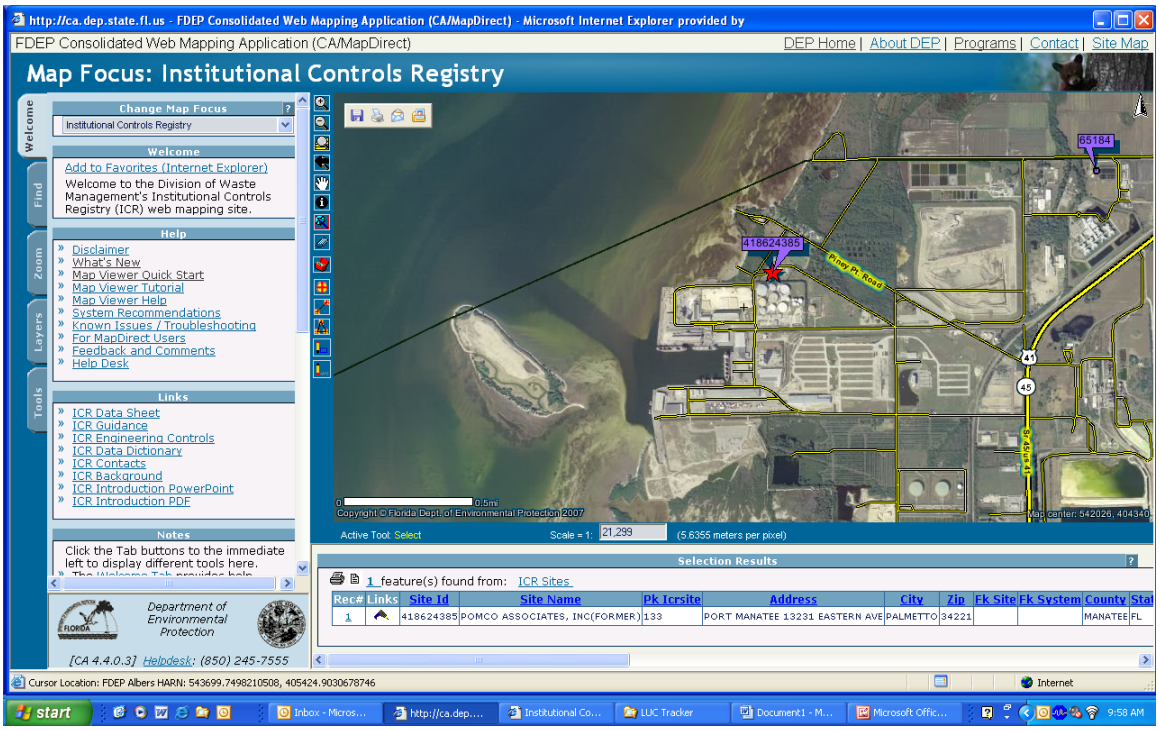


Figure 4-2. Screen shot of Florida Institutional Control Registry. (*Source:* FDEP)

Internal FDEP users can sort the database by any of these fields, while the printout or download available to the public is sorted alphabetically by site name. The ICR mapping application provides an interactive tool that allows users to find ICR properties, extract their records from the ICR database, and create/print maps at multiple scales. In addition, the application allows user to find properties by county, ZIP code, or section-township-range and generate a map providing property locations and site IDs. The user can zoom in on the map to identify various boundaries or coordinate systems, including county, city, ZIP code, street address, FDEP or water management district, drainage basin, latitude/longitude, or state plane coordinates, etc. The user can select individual properties and create and print maps using a variety of overlays.

The mapping application provides information on LUCs, makes it readily available to the public, and, in turn, improves local oversight. It contains a comprehensive inventory of properties from all programs and provides database query and sort functions including custom mapping features.

The address for additional information on the Florida LUC system is www.dep.state.fl.us. (Information provided by FDEP.)

4.2.5 Massachusetts Department of Environmental Protection

Similar to states previously discussed, the Massachusetts Department of Environmental Protection (MassDEP) Waste Site Cleanup Program allows the cleanup of contaminated sites to consider the current and likely future use of the property. If a cleanup is based on anything less than unrestricted use, the closure must include a MassDEP AUL that acts as a LUC specifying the allowable and prohibited uses of the property. MassDEP maintains a listing of AULs that have been implemented on various sites within the state.

Information about contaminated sites, including sites where AULs have been implemented, is available from the MassDEP Searchable Sites Database (www.mass.gov/dep/cleanup/sitesloc.htm, Figure 4-3). This database is the primary source for information about contaminated sites in Massachusetts. Relevant site information contained in the database includes, but is not limited to, response actions taken, affiliated parties, and AULs implemented.

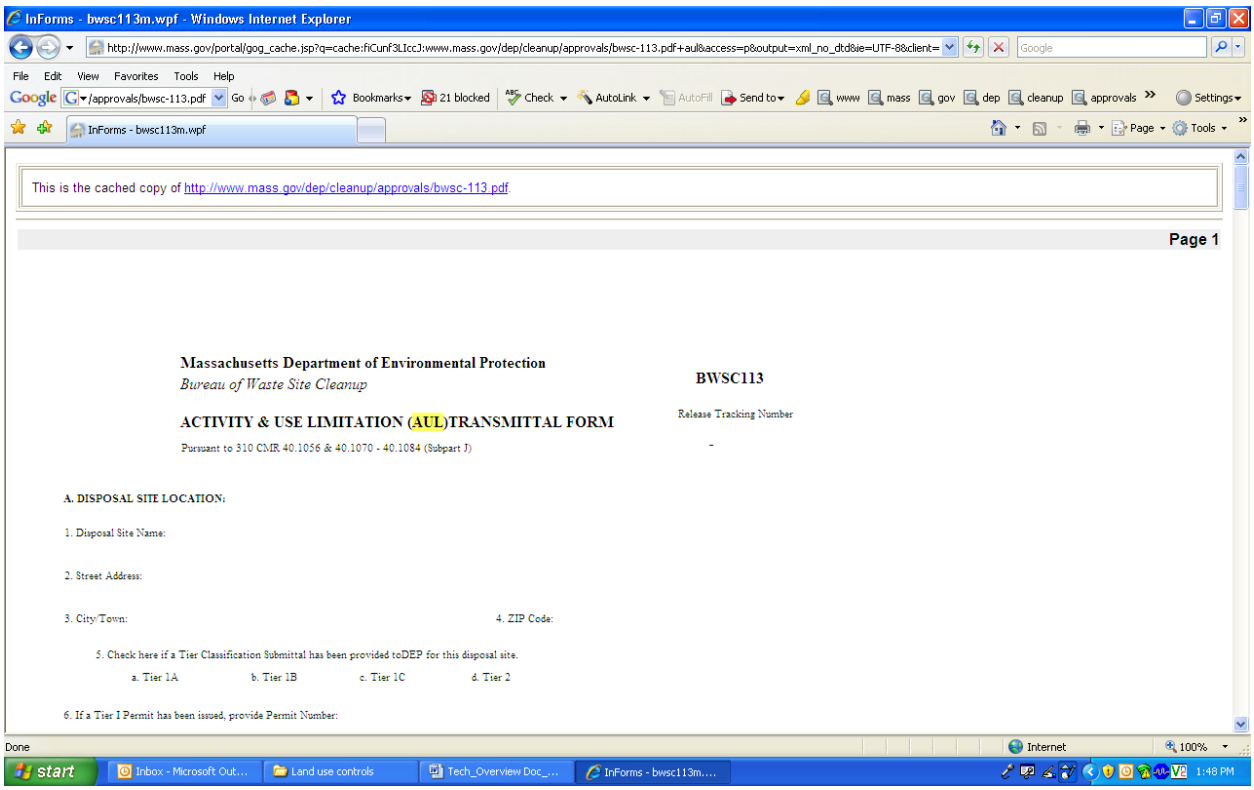


Figure 4-3. Screen shot of Massachusetts LUC system. (*Source:* MassDEP)

The Sites Database allows for searching only sites where an AUL has been implemented. It is not necessary to provide an entry into each field, so searches can be performed with limited information. For example, a user can choose "Only Sites with Activity and Use Limitations" and the town of interest. The database is searchable by the following fields:

- all sites or only sites with AULs
- town
- address
- release tracking number—the number assigned to a site upon notification
- site name
- status—current compliance status of the site
- chemical type—oil, hazardous material, or oil and/or hazardous material

The system is updated weekly and can output all program information in the database pertaining to an individual site. However, the data are limited to the Waste Site Cleanup Program, and choosing the appropriate "compliance status" field requires cross referencing a definition page on

the MassDEP website. The information provided in the database has been provided by site owners and other parties responsible for the AUL and their consultants.

The mapping data layer contained in the "MassDEP Oil and Hazardous Material Sites with Activity and Use Limitations (AULs)" is a statewide point dataset containing the approximate location of sites in Massachusetts where an AUL has been implemented. The sites mapped in this data layer represent only a subset of the total reported release sites tracked by MassDEP. The data contained within the database have the following limitations:

- The location data contained in the AUL data layer are based on MassDEP staff interpretation of information provided by the parties responsible for the AUL and their consultants. Thus, point features in this data layer can be considered only as an "approximation" or "best estimate" of site locations based on the information available at the time the site was mapped. MassDEP staff has not verified the accuracy and completeness of the information submitted.
- The AUL site data are temporal. Although the data layer will be updated on a periodic basis, it will never be complete or up to date.
- The data layer is incomplete, as some AUL sites cannot be located due to inadequate source materials.

For additional information on the Massachusetts LUC, see www.mass.gov/dep. (Information provided by the MassDEP.)

4.2.6 Minnesota Pollution Control Agency

Similar to Massachusetts, the Minnesota Pollution Control Agency (MPCA) maintains a searchable database inventory (www.pca.state.mn.us/data/index.html, Figure 4-4) of properties that includes those already investigated and cleaned up, those currently enrolled in the MPCA cleanup programs, and those investigated and found to be clean. The inventory includes information on whether ICs have been imposed at individual sites and is available to the public via the MPCA website, which is searchable via an interactive GIS-based viewer or several text-based methods. A separate, searchable database is maintained for petroleum storage tanks that provides basic site information, but not IC information. The inventory includes the types of sites listed below, but does not include leaking underground storage tank sites:

- Comprehensive Environmental Response, Compensation, and Liability Information System sites
- permitted solid waste sites
- no further remedial action planned sites
- unpermitted dumps
- federal Superfund sites
- state closed landfill sites
- state Superfund sites
- RCRA treatment, storage, and disposal facilities
- delisted state Superfund sites
- RCRA investigation/cleanup sites

- voluntary investigation and cleanup program sites
- state assessment sites

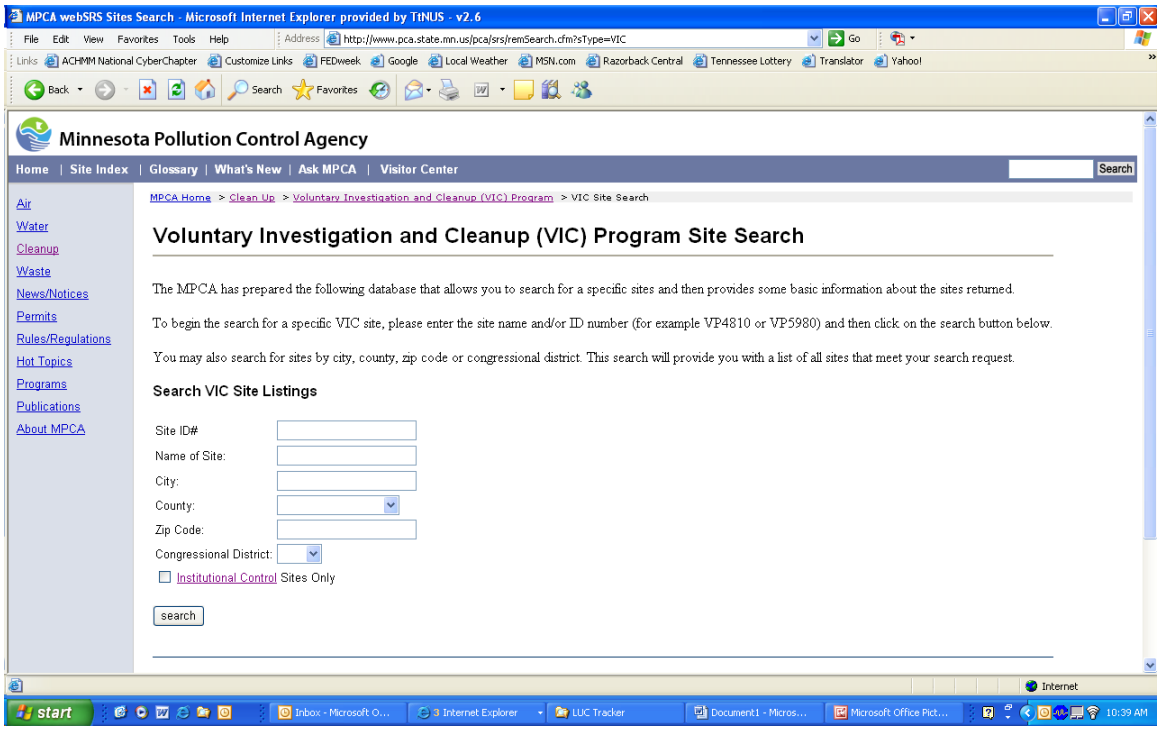


Figure 4-4. Screen shot of MPCA database. (*Source:* MPCA)

There are several options for locating sites with ICs in the MPCA inventory, including a GIS-based search capability entitled, "What's in My Neighborhood?" This interactive viewer (www.pca.state.mn.us/backyard/html) allows users to view sites by clicking on a printable map. Clicking on a site brings up a printable table that provides basic information about the site, including the MPCA site ID, name, address, and the applicable program types (see list above). This information can be used to obtain additional information by performing one of the text-based searches described below. If the site is enrolled in the Voluntary Investigation and Cleanup (VIC) Program, the table includes a link that performs a VIC database search yielding additional site-specific information that includes status (active/inactive) and size (acres), MPCA contacts, recent reports (names and dates), and events (regulatory process milestones and their dates), including IC information, when applicable.

"What's in My Neighborhood?" users who prefer a text-based search or have a slower Internet connection can search by site type (dropdown list of MPCA programs), site ID, site name, county (dropdown list), or ZIP code. Selecting a site type, county, or ZIP code will generate a list of sites from which an individual site can be selected. However, this method does not allow the user to limit the search to IC sites only. Selection of an individual site yields a small location map and the same information provided by the table in the GIS viewer. Users can also conduct separate searches of the RCRA, Superfund, and VIC program databases. The search can be conducted by site ID, site name, city, county (dropdown list), ZIP code or congressional district (dropdown list), and the user can limit the search to IC sites only.

At a minimum, IC information included in the inventory consists of the type of IC (e.g., restrictive covenant) and relevant dates. In some cases, MPCA project managers inputting the data include a brief IC narrative describing site-specific restrictions, notification requirements, and/or contaminants. The system provides the following capabilities:

- easy public access from anywhere via Internet
- easy-to-find search functions from home page (three clicks for any of the options)
- comprehensive inventory includes properties from all nonpetroleum programs
- searchable database
- web-based interactive viewer facilitates locating all sites in an area
- key regulatory process milestones ("events") are documented
- site-specific MPCA contact information available to public
- printable tables and maps
- program-specific database searches can be limited to IC sites only

The website for additional information on the Minnesota LUC system is www.pca.state.mn.us. (Information provided by MPCA.)

4.2.7 Nebraska Department of Environmental Quality

The Nebraska Department of Environmental Quality (NDEQ) used CERCLA Section 128(a) funds to support development of an IC program for cleanup programs administered by the Waste Management Division Remediation Section. Cleanup programs within the Remediation Section include Superfund, Voluntary Cleanup Program (VCP)/brownfields, RCRA solid and hazardous waste, and Department of Defense. NDEQ developed a Microsoft Access database to track sites where LUCs have been implemented. The tracking system is designed to comply with most of USEPA's Institutional Control Data Standard requirements and tracks all ICs implemented within the included cleanup programs. Site information contained in the database is available to the public and is known as the "Public Record." The Public Record is a list of voluntary cleanup sites at which environmental response actions have been completed during the previous year, are in process of being completed, or are planned to be addressed in the upcoming year or near future. In addition, this list identifies sites that upon completion of the response action are not suitable for unrestricted use and describes the LUC relied on in the remedy.

NDEQ has also performed a state-wide study evaluating existing ICs at properties where cleanups have been completed to evaluate implementation of the controls and compliance with the activity and use limitations. This study will be used to identify any recommendations or follow-up actions to establish a formal inspection program to periodically evaluate compliance and enforce the requirements of the ICs.

For additional information on the Nebraska LUC system, see www.deq.state.ne.us. (Information provided by the NDEQ.)

4.2.8 New Jersey Department of Environmental Protection

The New Jersey Department of Environmental Protection (NJDEP) has two tracking systems for LUCs. One, the New Jersey Environmental Management Information System (NJEMS), notifies NJDEP remedial project managers (RPMs) when a certification for a LUC is due. This function of NJEMS is not accessible by the public, as it is a system used only for internal tracking and notification. The NJDEP project manager enters the due date for a LUC certification into the system (certifications that LUCs remain protective must be submitted every two years). The system then provides notification of the due date on the project manager's to-do list and is highlighted if it is past due. If a certification is overdue, the NJDEP project manager can use the letter builder function in NJEMS to issue a notice of violation to the party responsible for submitting the certification, stating that the certification is past due.

Groundwater LUCs in New Jersey are referred to as "Groundwater Classification Exception Areas" (CEAs). Information on CEAs in NJEMS consists of the vertical and horizontal extent of the CEA, the contaminants that exceed standards, and any restrictions on wells within the CEA. Soil LUCs are recorded in New Jersey as deed notices. NJEMS stores information on the horizontal extent of the deed notice, the types and levels of contaminants that remain on the property above residential standards, and what type of LUC is required (if any). The NJDEP RPM must manually input all information regarding LUCs into NJEMS. NJEMS is an Oracle-based proprietary system developed for NJDEP and maintained by an outside firm.

The other LUC tracking system used by the NJDEP is a GIS-based system called i-MapNJ (www.nj.gov/dep/gis/newmapping.htm, Figure 4-5). Accessible by the public through the NJDEP website, this system shows the locations of and information about all LUCs in New Jersey. A tutorial is provided and recommended for those not familiar with the system. i-MapNJ uses ESRI software and is maintained by NJDEP Information Technology personnel. i-MapNJ provides:

- a search capability for the public and local officials to locate LUCs on a map by entering the address, municipality, or county
- an avenue for the public to find a site in their town or neighborhood with a LUC
- a publicly accessible route to site information including contaminants at the site and the phone number of the NJDEP project manager

For additional information on the New Jersey LUC system, see www.state.nj.us/dep/. (Information provided by NJDEP.)

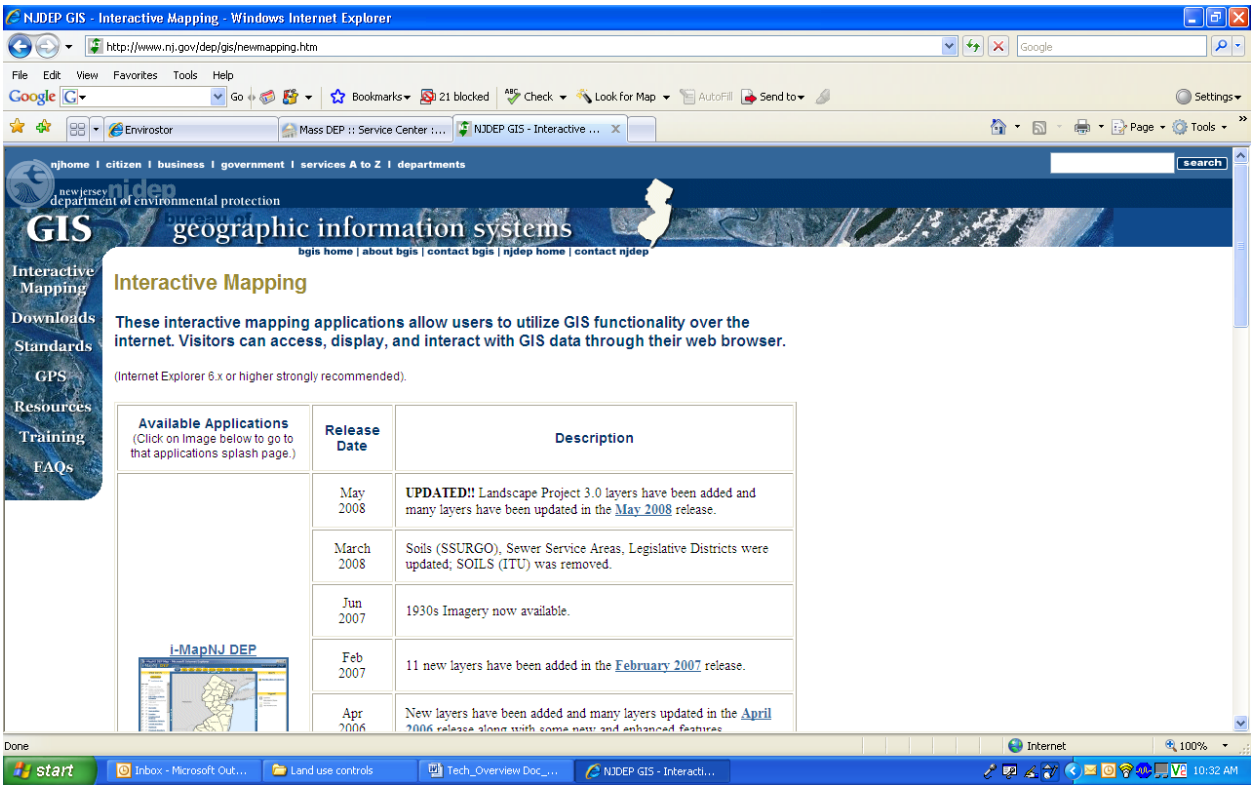


Figure 4-5. Screen shot of i-MapNJ. (*Source:* NJDEP)

4.2.9 Pennsylvania Department of Environmental Protection

In December 2007, Pennsylvania passed Act 68, the Uniform Environmental Covenants Act, into law. The legislation provides a standardized process for creating, documenting, and assuring the enforceability of AULs on contaminated sites. Pennsylvania's UECA specifies that an environmental covenant will be required whenever an EC or IC is used under an applicable Pennsylvania environmental law. Act 68 represents an attempt to harmonize the national uniform law with Pennsylvania's existing remediation and corrective action regime, including the Land Recycling and Remediation Standards Act (Act 2), the Storage Tank and Spill Prevention Act (Tank Act), the Hazardous Sites Cleanup Act, the Clean Streams Law, and the Solid Waste Management Act.

The Pennsylvania Department of Environmental Protection (PADEP) is required, and has already begun, to develop the Pennsylvania Environmental Covenant Registry. Until the registry is developed, PADEP will maintain an interim list of sites with an environmental covenant on its website (www.depweb.state.pa.us/dep/site/default.asp). The list will include location information (street address, municipality, county) about each site as well as digital copies of the applicable environmental covenant, notice of environmental covenant, or waiver. PADEP has also developed a model environmental covenant for use under Pennsylvania UECA implementation. PADEP must approve the covenant for it to be effective and may impose conditions for approval. PADEP, the current owner(s) of the property, the holder(s), and any other party specified by the

department must sign the covenant. Additional information concerning Pennsylvania's UECA program is available at www.depweb.state.pa.us/ocrlgs/cwp/view.asp?a= 1459&q=534040.

Under Act 2, persons who perform a site cleanup using the site-specific standard or the special industrial area standard may use LUCs as part of the response action. The Engineering and Institutional Controls website lists sites with ECs and ICs but does not specifically describe these LUCs. The webpage also links to additional listings of sites under CERCLA and RCRA that may have ECs and ICs. Both are links to the EPA webpage for CERCLA and RCRA Corrective Action sites.

For additional information on the Pennsylvania LUC system, see www.depweb.state.pa.us. (Information provided by PADEP.)

4.2.10 South Carolina Department of Health and Environmental Control

SCDHEC provides a registry of sites where environmental conditions have been assessed and the risk to human health and the environment has been evaluated. The placement of a restriction on the property may be due to the potential for exposure to petroleum or hazardous substances or may simply be due to the nature of the site (e.g., a landfill). The remedy for a site may include conditions that require long-term monitoring, maintenance, and reporting on LUCs. It is important to note that an entry in this database does not mean that a LUC has been placed on the property or that a restrictive covenant has been recorded on the deed.

The current program breakdown of the registry list is as follows:

- Non-Responsible Party Voluntary Cleanup Program (brownfields)
- Responsible Party Voluntary Cleanup Program (with deed restrictions)
- CERCLA NPL (with deed restrictions)
- dry-cleaner sites (with deed restrictions)
- RCRA sites (all have deed restrictions)
- solid waste (landfill) sites (should have deed restrictions)
- underground storage tank sites (none have deed restrictions; they are given a no further action [NFA] letter even when concentrations in the groundwater exceed the maximum contaminant level standard; natural attenuation is considered the remedy)

Accessible from the SCDHEC web page through the Environment portal, the Registry (www.scdhec.gov/environment/lwm/Databases/RCR/rcr_about.html, Figure 4-6), lists sites from five program areas within the Bureau of Land and Waste Management: CERCLA/Superfund, Dry Cleaning Facility Restoration Trust Fund Act, RCRA Subtitle C, Solid Waste, and Underground Storage Tank. It includes a brief definition of "conditional remedy" as well as a discussion of LUCs and when they are used and a description of each program area listed above. The registry is provided to inform the public of conditions at sites that may pose a risk to human health or to the environment. A decision to add a site to the registry is made by the project manager when a final remedy is chosen for the site.

Figure 4-6. Screen shot of the South Carolina Registry of Conditional Remedies.
(*Source:* SCDHEC)

The Registry is searchable by the following database fields:

- site name (usually the last manufacturer/operator)
- street address
- city
- ZIP code
- county
- SCDHEC Environmental Quality Control Region
- tax identification number
- EPA identification number
- permit number
- order or contract number
- latitude and longitude
- regulatory program (those listed above)
- any combination
- no filter (provides a list of all sites)

In addition, the registry identifies sites by the entity responsible for the implementation of the conditional remedy, the unit type/unit description (e.g., aboveground/underground storage tank or solid waste management unit), the affected media (soil, sediment, or groundwater), the area/acres affected by the condition, and the associated corrective action or response action taken. The

registry also identifies the specific contaminants of concern (e.g., petroleum-related hydrocarbons, volatile or semivolatile organic compounds, metals), the conditions or use restrictions, and contact information for the Environmental Quality Control Freedom of Information Office.

At this time, one staff member from each program area enters the data into a database that is uploaded into the registry on a quarterly basis. When the SCDHEC electronic data system is fully functional, the data will be entered by a project manager in the program and the information will be immediately uploaded into the registry.

The registry is accessible by the public; however, it is four layers down inside the SCDHEC web page, making it difficult for the public to readily access the information. Some knowledge of program areas and/or bureaus would be required to find the registry within the Bureau of Land and Waste Management. Moreover, the data are not real time, could lag behind as much as three months, and are not entered until a remedy is chosen, meaning that several years of assessment may pass while the site poses a risk.

For additional information on the South Carolina LUC system, see www.scdhec.gov. (Information provided by SCDHEC).

4.2.11 Tennessee Department of Environment and Conservation

At this writing, the Tennessee Department of Environment and Conservation, Division of Remediation (TNDEC-DOR) is in the process of developing and implementing a LUC tracking process. In October 2007, the division issued Policy Number ENF 1-2007, "Tracking of Engineering Controls/Institutional Controls (EC/IC)," stating, "It is the policy of the Division of Remediation that sites with engineering controls, institutional controls, continued monitoring, groundwater restrictions, conservation easements, etc. will be evaluated at least every five years, more often if resources are available or risk requires it to the determine their current status." (TNDEC-DOR 2007)

The purpose of this policy is to create and maintain a database of sites with long-term monitoring and/or maintenance obligations and/or land use restrictions and to provide the information required to ensure that sites continue to meet ongoing obligations that were relied on to limit a cleanup to anything less than residential standards. It is important to note that this policy is applicable only to the sites in the DOR program.

The tasks outlined for the development of the EC/IC tracking policy include the following:

- Compile the list of sites with identified ECs/ICs.
- Establish a procedure to consistently update the list by the DOR Enforcement Section.
- Develop an inspection/verification form along with a procedure to use the form.
- Create an inspection/verification schedule in cooperation with the DOR field office managers.

- Develop a proposed enforcement policy and proposal to seek a Director's Order for identified violations.

The EC/IC tracking system will be implemented using the following steps:

- The DOR Enforcement Section will notify each field office (or inspecting person) which sites require inspection for the coming fiscal year and the date that the inspection information is due.
- By May 31 of each year after 2008, all scheduled sites will be inspected and reported on using an established report form. The report will be sent to the DOR Enforcement Manager, and a copy of the report will be filed in the appropriate site file. Inspections will be reported to EPA each year on June 30 if needed.
- The DOR Enforcement Section will update the database for the sites based on the field office reports.
- Reports indicating that an obligation is no longer being met will be brought to the attention of the Director and will be subject to appropriate enforcement action.

For additional information on the Tennessee LUC system, see www.state.tn.us/environment. (Information provided by TNDEC.)

4.3 Federal Land Use Control Tracking Efforts

Led by USEPA and Environmental Council of States (ECOS) and conducted through the Environmental Data Standard Council, there is a national effort to standardize environmental information, including information related to LUCs. EIEN is a partnership among states, tribes, and USEPA to exchange environmental information and health data and share them securely over the Internet. In addition, efforts are being undertaken to standardize the information through the required use of common vocabulary and definitions to improve communication and understanding. Additional information on EIEN can be found at www.epa.gov/exhangenetwork/ and on the EIEN web page (www.exchangenetwork.net).

In addition, USEPA's Cleanups in My Community is a mapping and listing tool that shows sites where pollution is being or has been cleaned up throughout the United States. It maps, lists, and provides cleanup progress profiles for the following:

- sites, facilities, and properties that have been contaminated by hazardous materials and are being, or have been, cleaned up under Superfund, RCRA and/or brownfields cleanup programs
- federal facilities that have been contaminated by hazardous materials and are being, or have been, cleaned up under Superfund and/or RCRA cleanup programs and have some available IC information for sites at http://iaspub.epa.gov/Cleanups/advancedSearch.jsp (see the advanced search function)

In addition, USEPA provides information on certain Superfund sites with LUCs at www.epa.gov/ictssw07/public/export/regionalReport/ALL_REGIONS_IC_REPORTS.HTM.

4.4 One-Call Systems

In addition to the state systems outlined above, there is a quasi-public system referred to across the country as "One-Call." This system can provide a framework that can be used alone or in conjunction with existing tools and programs to track and monitor LUCs in tandem with land use decisions. The One-Call system is a national network of service providers that acts as the communication link between individuals planning digging activity and owners of underground facilities. Prior to doing any digging or excavating work, homeowners, construction or landscape contractors, road maintenance crews, telephone pole installers, or anyone else planning to dig must notify the local One-Call system, which is known in some states as "Dig Safe," "Call Before You Dig," or "Miss Utility."

The One-Call system identifies the underground facilities that may be near the location of the planned excavation and, in turn, notifies the facility owners/operators. Although the response time varies by state, the facility owner/operator generally has 48–72 hours to determine whether the planned excavation may conflict with its underground lines and to send crews to physically mark the location of the utilities with color-coded spray paint and/or flags. In 2007, the Federal Communications Commission federally mandated the 8-1-1 telephone number and launched it nationally as the standardized "call before you dig" hotline number. The number, designated to eliminate confusion over what number to call to notify utilities of excavation efforts, forwards callers to the correct local One-Call center (www.call811.com). Failure to call One-Call prior to excavating may result in a fine against the person or company conducting the excavation, particularly if negligence causes a major utility outage or serious accident or risks human health due to a natural gas leak or water line damage.

One-Call systems are operated on the state level and are generally governed by state law although they are normally not supported by tax dollars. One-Call centers are usually funded by the underground utilities and/or pipeline facilities in that state, usually on a per-call basis. The annual fee to become a member of One-Call varies by state. Several states have conducted pilot projects to determine how the One-Call system could be used to manage LUCs by providing location information prior to excavation activities occurring. Below are summaries on some of those states that have instituted One-Call pilot programs.

- **California.** In January 2003, California initiated a pilot study to use One-Call, county permits, the real estate Multiple Listing Service, and other commonly available sources of information as a way of providing information on the location of contamination, the location of LUCs, and land or water restrictions in advance of planned excavations and/or property transactions. The pilot program participants included USEPA; the California Environmental Protection Agency; the California One-Call system; and Terradex, Inc., a LUC monitoring service described in Section 5 of this document.

  Implemented February–June 2004, the pilot program included the monitoring of 18 sites where LUCs were implemented. A total of 1,124 land activities within or near areas of contamination and LUCs were detected and, as of July 2005, 21 land use activities that could have directly conflicted with the areas of contamination and the LUCs were identified before

they occurred. These activities included proposed excavations reported through the California One-Call system and through a combination of local agencies and public sources that provide information regarding building permits, real estate, water wells, and construction activities. The overall cost of the pilot was approximately $6,000 per site.

- **Wisconsin.** The Wisconsin Department of Natural Resources (WDNR) is a member of the Wisconsin Digger Hotline Inc., Wisconsin's One-Call system. In early 2002, the Wisconsin pilot placed closed properties on the Wisconsin One-Call system with the intent to require well modifications if a well driller proposed to construct a well on a contaminated property. Unfortunately, the database did not provide a high enough level of detail to precisely locate the properties, resulting in the issuance of a high percentage of false identifications and excessive costs without environmental benefit. To reduce the number of false tickets, WDNR requested that the One-Call system modify the standard list of questions to identify only sites where groundwater wells were installed; however this change was not made. WDNR participated in the One-Call system for over two years and has since ended the relationship due to the inability to determine the depth of excavations and the fact that the manual review of the information supplied was too burdensome and costly.

In addition to the pilot programs that have been implemented, some states have legislatively mandated the use of One-Call to identify and track LUCs. The following are summaries of two such programs.

- **Maryland.** Maryland is one of the few states that legislatively mandate reporting LUCs to the One-Call system. In Maryland, participants in the VCP can receive a certificate of completion using LUCs to contain or control residual contamination. A condition of the certificate of completion is that the participant send a copy of the Certification Letter to a One-Call system, as defined in Section 12-101 of the Public Utility Companies Article. The document is to be sent to Miss Utility, the Maryland One-Call system, within 30 days. While the VCP requires notification to the Maryland Department of the Environment of a property transfer, no specific notification is required for Miss Utility.

- **West Virginia.** Effective July 1996 (modified June 2006) West Virginia passed into law the West Virginia Underground Facility Damage Prevention Act (see www.muwv.org). This act established the One-Call system, known as Miss Utility, to notify users of the location of underground utilities. Recently, however, West Virginia amended the One-Call system to include the identification of LUCs and other environmental issues.

There are many advantages to using the One-Call system to provide notification of the existence and location of underground contamination and/or LUCs. Protecting excavators as well as the public from accidental exposure to contamination is one advantage that will have an immediate impact. Additional advantages include the following:

- The One-Call system has proven itself to be reliable and is a nationwide system familiar to most people. Excavators are required by law to call before they dig, which elevates compliance levels and increases reliability of the system. In some states, legislation requires

building/construction designers to notify One-Call during the construction design process if their design plans may impact underground infrastructure. This requirement provides knowledge earlier in the construction process.

- The One-Call system provides the ability to map and protect underground features through the use of geospatial mapping to identify the location of underground facilities and provide notification. This mapping feature is adaptable to LUCs.

Case Study

In January 2005, a landmark case decided in the U.S. District Court for the District of Minnesota heightened the concern of regulatory agencies regarding their responsibility and liability for informing excavators and others of the presence of residual contamination and underground remedy components. In United States vs. Qwest Corp. (2005 WL 195380), USEPA sued to recover costs incurred to repair a pump-and-treat groundwater piping system that had been ruptured by utility contractors while excavating to install underground utility lines near the MacGillis & Gibbs/Bell Lumber & Pole (MacGillis) Superfund site in New Brighton. EPA installed the underground piping to transport contaminated groundwater collected from points on the MacGillis site to an on-site water treatment plant. While excavating, utility contractors damaged a portion of the piping that ran under a public right-of-way immediately adjacent to the site. EPA asserted that the excavator qualified as an "operator" as defined by CERCLA Section 107(a) and therefore could be held liable for the cost to repair damage to the underground lines. The court dismissed EPA's suit, holding that the excavator did not qualify as an "operator" under CERCLA. The court explained that the excavators "were not even aware of the existence" of the piping and "had absolutely no control" over the underground piping. The court also pointed out that EPA "failed to register the underground water lines with the One Call Center utility locate program, as required by state law." (United States vs Qwest Corporation, 2005 WL 195380. Information obtained from USEPA Region 5 Regional Counsel-Enforcement Actions 2005, State of Minnesota website at http://www.epa.gov/reg5oorc/enfactions/enfactions2005/state-mn.htm#qwest.)

However, some limitations of One-Call systems have been identified, such as the following:

- Difficulty registering some LUCs—Some elements of a remedy that may require a LUC may not be able to be registered in One-Call systems. For example, area-wide soil contamination and certain engineered units like containment cells or caps may not meet the One-Call definition of "underground facilities/utilities."

- Construction delays—Building contractors and excavators have raised concerns that using One-Call to notify them of the presence of LUCs provides information too late in the construction process and that the time delay will limit their ability to get work done.

- Liability exposure—The lack of clearly defined roles and responsibilities can cause liability concerns for property owners, operators of the One-Call system, the state authorizing the use of the LUC, and companies authorizing and performing the digging and excavation work.

- Short time frames—The response to a notification of an excavation event must be made typically within 24–48 hours before the excavation is initiated. For example, under California's pilot program, site project managers are responsible for reviewing the alerts and

making decisions about notification. However, there is no system in place to respond to these alerts on a 24/7 basis.

- Overnotification and false reports—Systems often cannot identify the exact location of a LUC or delineate off-site contamination, particularly groundwater plumes. These uncertainties may require states to screen information using human judgment to determine whether there is a potential alert.

- Staff resources—Regulatory agency staff has to review the LUC alerts and determine whether the alerts are a potential threat to the LUC being compromised or a threat to human health and or the environment. This review adds to staff workloads.

5. RESEARCH—TECHNOLOGY OVERVIEWS

In addition to the state LUC management systems outlined in the previous section, there are also available technologies with the potential to assist in the tracking, notification, community outreach, and notification of the existence of LUCs. The ITRC Brownfields Team used the categories of tracking, notification, community outreach and education, and implementation planning and model documents to assess specific tools and options associated with the long-term management of LUCs. Many of these management systems can address issues in more than one category, and some of the systems presented were developed for other informational purposes, such as NETR (Nationwide Environmental Title Research) Online, which was developed to assist in the research of public records for the real estate market. When taken into consideration with the state LUC programs previously reviewed in this document, these technologies have been identified and evaluated as tools for consideration or adaptation in the development of existing or future state LUC systems or programs. The following summary includes the names of the systems and/or technology providers (collectively referred to as "systems") and an indication of how they fit within each category.

Tracking. The systems identified in this category keep track or could be adapted to keep track of when and where LUCs are implemented. Some of these systems can be implemented by a municipality or state regulatory agency. Moreover, these systems may contain data that can be used to describe each LUC and a record of related activity. These systems may include information on site inspections and details regarding the LUC and its purpose.

- Accela
- DPRA, Inc.
- Environmental Land Use Control WebRing
- EnviroStor
- Guardian Trust
- Navy LUC Tracker
- One-Call systems
- One-Stop Interactive Resource and Information System (OSIRIS)
- Parasec
- NETR Online
- Sentinel Trust
- Terradex

Notification. The systems identified within this category can be used or modified to notify individuals or monitoring agencies if any activity is occurring on a site that has LUCs in place. This category contains the following management systems:

- Guardian Trust
- Navy LUC Tracker
- One-Call systems
- OSIRIS
- Parasec
- Sentinel Trust
- Terradex

Community Outreach and Education. These systems have the potential to be adapted to provide the community with information regarding LUCs:

- Accela
- EnviroStor
- Guardian Trust
- Google Earth
- OSIRIS
- Sentinel Trust
- Terradex

Implementation Planning/Model Documents. These documents provide information to the regulated community and implementing parties as well as provide agreement on the provisions of the LUC installation, management, and inspections:

- LUCIP (Land Use Control Implementation Plan)
- LUC I&EP (Land Use Covenant Implementation and Enforcement Plan)

The Brownfields Team conducted research to determine whether these systems could be used or adapted for LUC management. The following summaries describe the systems and their advantages, limitations, costs, target audience, and case studies, where available. Arranged in alphabetical order, the summaries are based on the technology overview template developed and subsequently completed by the ITRC Brownfields Team for each management system to ensure that all of the tools were similarly evaluated, maximize consistency, and allow for fair comparisons of information. Appendix A contains the matrix developed to assist in the comparison of these systems. Technology overviews containing additional information are in Appendix B.

5.1 Accela Automation

Category: Tracking/Community Outreach and Education

Accela Automation (Accela) includes a land management module that tracks and manages land use and community development activities, including permits, building safety inspections and reviews, zoning, project plans, code enforcement, and more. It allows staff to access data, verify activities, check permit status, and obtain complete parcel information.

Accela is a web-based system (Figure 5-1) providing land management activities that include, but are not limited to, tracking and managing all permit types; generating a daily task list for reviewers and inspectors; attaching and retrieving CAD drawings, photographs, and other document files; recording and tracking special conditions; integrating with GIS; and recording all activities for each case application or permit in the system (e.g., inspection dates, notes, contacts, telephone calls, letters sent, photos taken). The database can hold all information associated with a particular piece of land. It can be tailored as a state version as well as one for the general public (there is a citizen access portion of Accela).

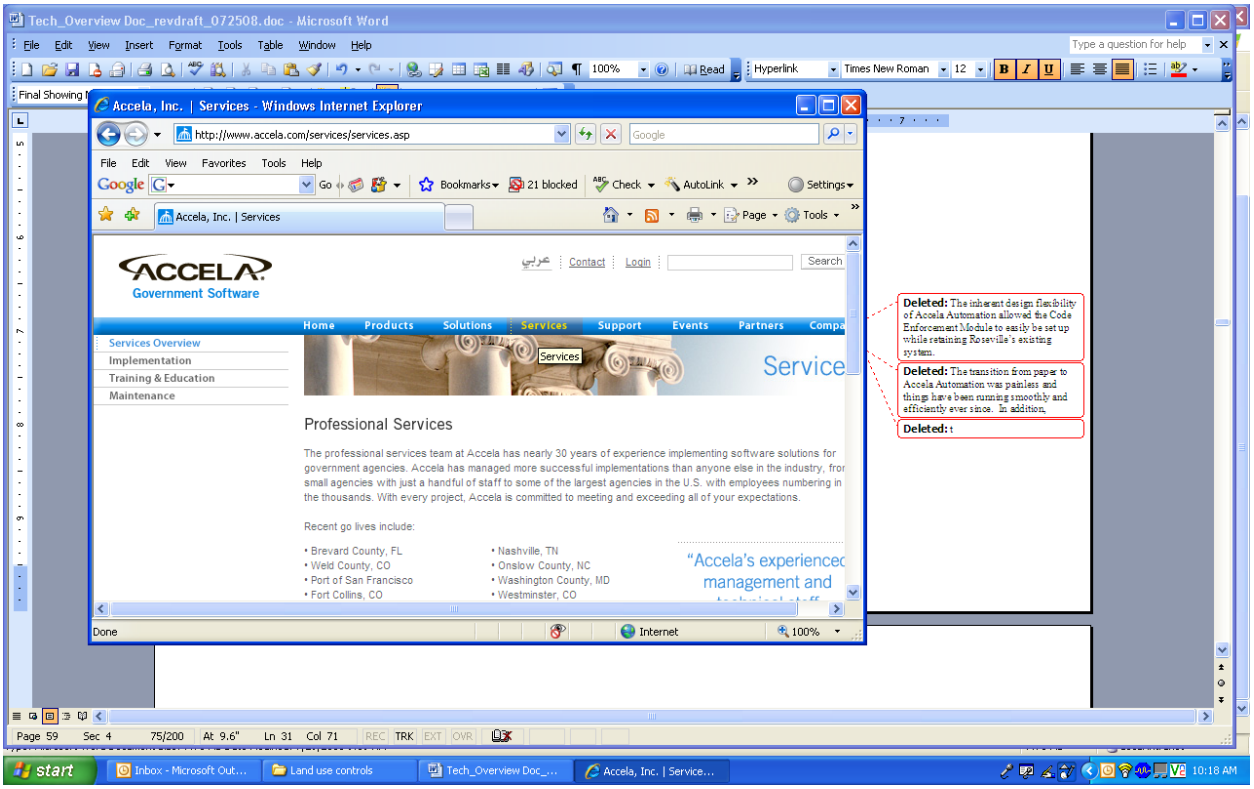


Figure 5-1. Screen shot of Accela software. (*Source:* Accela Government Software)

Public features of Accela include the convenience of 24/7 access and the ability to check the status of plans, inspections, or projects; review scheduled inspections; verify collection of fees; and look up information on permits, parcels, and history. Accela can also provide professional consulting services as required to successfully implement user agency requirements. These services may include the following:

- project initiation
- project management and administration
- configuration analysis
- system setup
- system configuration
- report development
- system training
- system testing and acceptance
- "go-live" assistance

Accela uses existing Internet and computer resources can be used internally by multiple offices. The system provides flexibility and allows different access by different users, and any template developed can be formatted to the needs of the state. However, specific templates need to be developed for the application of this system to manage LUCs. In addition, the system provides 24/7 operation and availability with easy access by the public and accessibility from field locations by state inspectors.

Case Study

The Colorado Inspection Agency (CIA) provides field inspections, plan reviews, and building department administration services to Colorado municipalities. This is a cost-effective outsourcing option for municipalities that do not staff a fulltime building department. Serving 17 municipalities with more than 150,000 citizens, CIA operates from three separate offices with inspectors rotating among these offices throughout the day. CIA staff relied on a computer database and paper records to keep track of their inspections, applications, and plan reviews. However, inspectors had no way to input their inspection results into the database from remote field locations. Additionally, a paper-based system was subject to filing errors and cumbersome searches for the latest information about an application.

CIA selected Accela Automation to automate workflow, forms management, activity tracking, cashiering, and other critical tasks. Accela hosts the application server, allowing CIA to recognize immediate cost savings in equipment and information technology (IT) support. The web-based system allows the CIA staff to access the application from any computer that has Internet access. Staff at the 17 client sites can log on to Accela Automation to submit a new permit request, check the status of an application, and print completed permit forms.

Accela Automation provides a central location for all of the data managed by CIA, sorted for each municipality so staff can easily access the information they need by logging in to the relevant municipality account. Any updates that are made to the database are done in real time, so staff are always viewing the most up-to-date information on any application. (*Source:* www.accela.com/products/success_stories.asp)

Accela services are priced according to the size of the implementation, including the number of departments involved, the number of permit and/or license types to be implemented, the number of reports to be developed, the number of users to train, and any additional history data conversions or interfaces to other systems. Accela can provide state and agency enterprise-level pricing with unlimited users if desired. Prices include agency-hosted licensing and software maintenance. Accela-hosted options are available as well. The intended target audience for the

Accela program is state regulatory agencies and the general public. Additional information on the Accela system can be found at www.accela.com.

5.2 DPRA Web-Base Customized Applications for LUC Mapping and Information Management

Category: Tracking

DPRA, Inc. develops customized, web-based applications for LUC mapping and IC information management. The system application for LUC mapping and information management consists of an Internet-accessed tool that identifies parcels encumbered by LUCs within a municipality and other information related to the environmental condition of parcels. The software can combine environmental cleanup, real estate parcel, and other information pertaining to LUCs to show whether any environmental conditions exist on a property. Providing easy access to LUC information on a parcel-by-parcel basis (searchable by parcel number or address), it can assist local agencies to easily review environmental concerns and LUC information as part of the permit issuance and review process.

Generally, the application overlays parcel boundaries on site aerials, streets, roads, and related geospatial information and highlights LUC parcels in red. Users can select red-highlighted parcels and view or print electronic versions of LUC documents. In addition to LUC information, the system also contains information related to site assessment and remediation. Thus, users can obtain technical details about LUC sites such as contaminants that exist on sites and remediation efforts.

Mapping applications can depict ECs, residual contamination, and the boundaries of LUCs based on information filed in local property record offices. Users can view title search documents and determine whether LUC instruments were recorded in the property records and other recorded encumbrances (e.g., utility easements) exist on a property. In addition, users can also identify which parcels within the boundaries of an environmental site contain LUCs. Information is primarily used by state and local governments although the public can access the information through the Internet. The system could be used by land development and real estate firms, as well.

The DPRA system enables both the public and municipal government to

Case Study

National City, California contracted with DPRA, Inc. to develop a web-based Brownfield Redevelopment Environmental Information System (BREIS) to provide city employees with information on LUCs on parcels so land use permit applications could be compared to LUC information to determine whether the permit should be issued. In addition, the BREIS allows easy access to environmental and redevelopment-related information within National City that can also be used by the public and developers.

The boundaries of the existing ICs are shown on a map. The user can then directly access the deed notice for each parcel with an IC. The deed notice specifies the contamination that remains on the property, the prohibited uses of the property (e.g., no residential housing or day-care facilities for children), and details of any required caps or other ECs that must be maintained, etc.

The system provides an overview of general site conditions, including high-resolution aerial photography, parcel boundaries, sewer lines, streets, etc. In addition, the BREIS allows interactive access to historical and environmental regulatory information, as well as the ability to view and download environmental site assessment reports. Additional information on this case study can be found at www.nationalcitybreis.org/.

make land use decisions with knowledge of LUCs, provides state agencies a local repository for LUC documents, fosters cooperation with local government, and provides an easy means to compare LUC locations in a GIS format to other land use–related items, such as zoning and floodplain maps. In addition, individual or multiple layers of information can be used to provide an overview of the areas of environmental concern (e.g., location of residual contamination or ECs) and the LUCs designed to protect against that risk. However, the DPRA system does not currently track LUC monitored events, nor is it a notification system. Applications require periodic "refreshing" with updated parcel information that must be manually performed by DPRA.

It should be noted that information-gathering costs can range widely. The tasks involve gathering geospatial, parcel boundary, and cleanup site information and copies of LUC documents. Application design and construction provide customized LUC tracking solutions which are city-wide or site specific. The basic design and construction of each application does not vary significantly, which generally keeps additional customizing costs minimal. For a city-wide application, the design, construction (and site launching) costs range $20,000–$50,000. Site-specific applications cost less. Maintenance costs involve web hosting, periodic uploads of new information (e.g., LUC instruments, updated parcel information), and occasional application upgrades. Yearly maintenance costs could average $10,000–$20,000. Additional information on the DPRA system can be found at www.dpra.com.

5.3 Google Earth

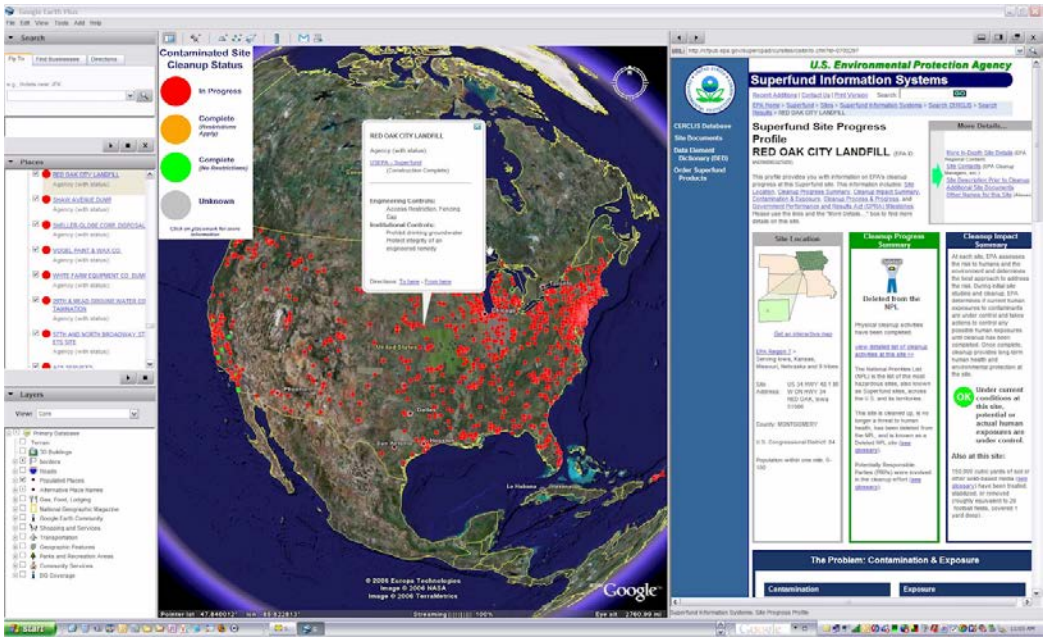
Category: Community Outreach and Education

The Terradex Environmental Layer within the Google Earth application (Figure 5-2) is a web-based tool that can serve as a resource to local or state governments that desire to map environmental site locations assembled from state and federal agencies. It allows the user to activate the environmental sites layer and browse through an area of interest for environmental sites. This application aggregates the information from more than 120,000 sites referenced on other environmental websites using primarily location, status, and URL and includes federal RCRA corrective action and Superfund sites. The layer also includes California (EnviroStor, GeoTracker, and Solid Waste Information System), Oregon, Washington, and New Jersey listed sites.

Together, Google Earth and Terradex provide a way for the general public to discover neighborhood environmental sites and learn their status, including any LUCs. Municipal and local planning departments can use this application as an easy way to find various sites within their jurisdictions and link to more specific information. Several industry groups representing excavators, water well drillers, and real estate agents have viewed the technology as another way to find/show data.

Federal or multiple state agency listings for sites with environmental concerns are displayed in a graphical format. All of the Internet links are embedded, allowing the user to browse from one state to another while not having to be concerned with any data updates or changes, since they all occur in the background. Colored icons are used to indicate the status of the site—red for cleanup

in progress, yellow typically for sites with ICs, and green for sites where cleanup has been achieved. The Google Earth application increases the use of a state environmental agency's Internet resources, while also introducing them to overlapping federal or regional resources. The system also provides the ability for a user to comment on the location or accuracy of an



environmental site record. The target audience is the general public, city or local government planning departments, state environmental agencies, and industry/industry groups.

Figure 5-2. Screen shot of Google Earth. (*Source:* Bob Wenzlau, Terradex)

This system has the capability to locate all known environmental site data, is simple and easy to use, relies on complex data presentations by individual agencies, points the user to the correct agency website, and does not replace important state website information but rather complements it. Basic site information depends on an agency's website and the data contained in it. Terradex does not qualify the accuracy of the information available. It should be noted that there is a cost for business/government to use Google Earth that the browser-based version would offset.

The effort to date has been self-funded by Terradex. It is hoped that in the future these services would be sustained through commercial advertising or by government funding. The Google Earth layer is a link or tool that connects the user to existing websites or Internet pages. Additional information on the Google Earth system can be found at www.earth.google.com.

5.4 The Guardian Trust™

Category: Tracking/Notification/Community Outreach and Education

The Guardian Trust program is an integrated management system that can provide comprehensive long-term stewardship services to clients in both the private and public sectors. Guardian Trust provides many services, depending on client needs, including site inspection, monitoring and reporting on land use and engineering controls, financial assurances, transfer of

environmental liabilities, information and data management services, development of post-closure plans, and public training and outreach to local government and communities. Guardian Trust maintains all site, property, ownership, tenant, and real estate information in a broad database containing more than 600 data fields.

At this writing, 12 sites throughout the United States (e.g., New York, Pennsylvania, California, Michigan, South Carolina, Rhode Island, Illinois, and Ohio) use Guardian Trust to provide assured monitoring of LUCs. To do this, it develops an implementation plan consisting of all finite tasks and elements to properly execute the LUC, then creates procedures and protocols to implement all the tasks, whether major or minor, and provides long-term (anywhere from 30 years to forever) management of the LUC.

Guardian Trust services include the following:

- design and implementation of site operations and maintenance programs
- inspection and monitoring of all site soil and groundwater controls, including caps, leach fields, and other restricted areas
- verification of indoor air quality
- inspection and testing of vapor barrier and soil venting systems
- providing current owners and tenants with annual notifications concerning all site environmental restrictions
- supervising receipt of annual owner and tenant acknowledgements concerning site environmental restrictions
- inspection of land use records to verify environmental easements, changes in land ownership, and changes in zoning
- conducting routine on-site maintenance activities to support in place engineering remedies
- management of response activities in the event of a contamination release
- creation and maintenance of a database of permit issuance (for construction, demolition, and soil movement permits) connecting to particular cities that enables Guardian Trust to be aware of any permits issued for a property within 24 hours of issuance (This allows Guardian Trust to take immediate action where indicated to prevent any adverse impact.)
- coordination of communications between owner and tenants on environmental issues
- attendance at tenant association meetings on behalf of owners
- preparation and dissemination of reports detailing annual activities, status of all land use and engineering controls and recommendations for improvements in the functioning of controls
- preparation of easement documents including all title work, surveys, and title opinions
- providing oversight and training of site personnel on response and reporting procedures
- training of contractors at the site on environmental hazards and safety protocols

Guardian Trust offers its long-term stewardship services to both the private and public sectors. The advantages of using the trust include the following:

- offers all-inclusive program of inspection, monitoring, and reporting
- relieves companies of day-to-day management of environmental post-closure issues

- provides experienced management of post-closure environmental tasks
- mitigates post-closure environmental risks (Guardian Trust is exploring the ability to allow clients to remove all liabilities associated with LUCs.)
- facilitates transfer of properties for redevelopment
- provides public and private stakeholders with a way of meeting their post-closure responsibilities
- helps regulators to minimize oversight costs and maximize knowledge of site activities

The target audience is private sector companies and state and federal regulatory agencies. One limitation is that the Guardian Trust is not currently accepting sites that involve nuclear contamination.

Guardian Trust contracts with each client to perform the long-term stewardship of the land use and engineering controls for periods of 30 years or more (including in several instances perpetual stewardship). In exchange for a one-time payment representing the present discounted value of the sum of the initial and annual costs for the implementation and maintenance of the LUCs, Guardian Trust assumes the stewardship obligations associated with the site. Initial costs include implementation, underwriting, legal, and engineering expenses. Additional information can be obtained at www.theguardiantrust.org.

Case Study

Guardian Trust is being used for the implementation and operation of LUCs at the Peterson/Puritan Superfund Site in Cumberland and Lincoln, Rhode Island. Guardian Trust is also implementing the required environmental easements on behalf of the responsible parties, USEPA, and Justice Department. This work includes the preparation of all surveys, title work, and title opinions.

5.5 International City/County Management Association (ICMA) Environmental Land Use Control Web Ring

Category: Tracking

The ICMA Web Ring is a web-based navigation tool providing one-stop, direct access to a multitude of LUC web pages, including web-accessible federal, state, local, and commercial LUC databases, private sector, and researcher information sites. The Web Ring groups a variety of LUC-related web pages in an interactive graphic directory designed to speed Web Ring users to specific web pages in two clicks of a mouse. The overall goal of the Web Ring is to provide information on the implementation and long-term effectiveness of LUCs and their use in the redevelopment of environmentally impaired properties. Websites on the ring are grouped into sectors to help with searches for information. Each web page on the Web Ring contains a small icon linking back to the navigation tool. The site can be used by anyone seeking information on LUCs, such as developers, community members, government regulators, researchers, and more. Joining the Web Ring increases traffic to members' sites, helps disseminate existing LUC information to those who need it, and allows members to share information among the growing community around the issue of ICs. However, the Web Ring itself does not have the ability to search multiple databases of information on sites. It only allows the user to better find individual databases or information sources on sites.

This web-based system requires little or no software or expertise. Adding an icon to an existing web page is an easy process that takes minutes. Ring members must work through their existing IT staff and protocols to add their site to the Web Ring. The website contains detailed information on how to add the icon to a site and a selection of icons to choose from. It is estimated to take less than one hour of IT staff time to add an icon to a site. Currently, there is no cost associated with joining the Web Ring. There will never be a cost for government agencies to join since their web pages are the primary source for LUC information for users of the Web Ring. There may be a small operation and maintenance fee assessed to private-sector firms on the Web Ring in future applications. Additional information on the Web Ring can be found at www.lucs.org or by calling ICMA at 202-962-3506.

5.6 Navy Land Use Control Tracker

Category: Tracking/Notification

The Navy LUC Tracker is a web-based data management system used by Navy RPMs and installation personnel responsible for LUC implementation and monitoring. LUC Tracker is a secure system for collecting, maintaining, selectively sharing, and managing LUC data. This data management system tracks site information including ownership, type of contamination, and interim and long-term LUC restrictions and requirements. In addition, the LUC Tracker provides information on inspection, certification, and reporting requirements and includes information to those responsible for submitting such information.

The LUC Tracker application was developed for the Navy to meet its specific needs. However, the application can be customized to meet the particular needs of other potential users, such as state regulatory agencies, municipalities, private industry, or other service branches and their facilities. LUC Tracker data are available on an installation-specific basis to members of the respective project teams. Thus, users see only the data for installations/projects with which they are associated. Navy personnel have full access to data, while other team members (e.g., regulators or contractors) may have access to select portions of data and/or features of the system. The ability to grant multiple parties access to appropriate system features facilitates LUC implementation at joint service bases and mitigates the effects of personnel turnover associated with changes in command or project team membership.

Most data access features (e.g., view, print, query, download) are available to all users; however, data input, updating, and editing are normally restricted to the personnel directly responsible for LUC monitoring (e.g., RPMs) and inspection (e.g., Navy contractors or installation personnel). Depending on access rights, the LUC Tracker allows the user to create or enter information on new LUCs using a standard entry form with drop-down lists and narrative fields; review information on existing LUCs; access inspection templates; view/print LUC documents such as deeds, maps, and management plans; create standard inspection reports using templates provided by the system; document and track deficiencies noted and corrective action taken; notify appropriate parties of noncompliance; view/print previous inspection reports; and certify compliance to regulatory requirements. Users can query the application database for inspection

results, types and frequencies of restrictions, controls and/or violations, and contaminants driving the need for LUCs.

Documentation of these requirements is facilitated through the generation of standardized forms and reports that help to keep information input consistent. While the LUC tracker provides centralized data storage regarding LUCs, it also provides automatic reminders to Navy RPMs, regulators, owners, operators, and tenants of required submissions. LUC Tracker contains a query component that enables the user to find information on the number and or types of violations, common contaminated media, and affected media. Future versions will include an environmental GIS and modules for evaluating and documenting decisions related to requests for temporary waivers (LUCWAIVER) or termination (LUCTERM) of existing LUCs. Certain proposed reuse, redevelopment, and construction activities may require a LUCs waiver from the Navy and/or state and federal regulators prior to initiation of project activities.

The LUCWAIVER module will guide users through evaluations of these requests by identifying the types of information that should be submitted with a request, walk the user through the evaluation process, and document the final decision made by the Navy and/or applicable regulatory agency. LUCTERM will provide detailed instructions for terminating a LUC. The LUCTERM component will serve to compile the information needed to evaluate a LUC termination request, document the decision-making process, and result in a document that can be forwarded to the appropriate regulatory authorities for concurrence. LUCWAIVER and LUCTERM are currently envisioned as tools that will be fully shared with non-Navy parties responsible for enforcing (e.g., states) and complying with (e.g., transferees) LUCs.

Case Study

The Navy LUC Tracker is in the early stage of implementation. Beta testing has been completed, and several installations, both closed and active, are beginning implementation, including Naval Support Activity Mid-South in Millington, Tennessee; Naval Air Station Key West, Florida; the former Naval Training Center, Orlando, Florida; and the Charleston Naval Complex, South Carolina.

The application evolved from a request for a simple tracking spreadsheet for RPMs to an Access database to a web-based interface available to all. A pilot facility was selected for data entry, and changes were made during development based on the lessons learned while entering the data. A beta testing period followed, during which all Naval Facilities Engineering Command engineering field divisions were provided access for one or two test installations via the Installation Restoration Collaborative Gateway (IRCG), resulting in additional feedback and revisions. LUC Tracker went "live" on the IRCG in early 2007 and will be migrated to Naval Installation Restoration Information Solution (NIRIS). More changes and enhancements are anticipated as feedback is received from the increased number of installations and users.

The LUC Tracker is a hosted service that is globally accessible and technology independent, contains no IT/management information system costs, and can be easily customized. As an internal management tool, it is not currently set up to share information with the public, and off-site hosting might be in conflict with state or other organization management information system policies.

Costs vary depending on the degree of customization, the number of individual users in an organization, the number of sites being tracked, and the number of LUCs. Implementation costs include initial customization, installation and setup, and data entry. A monthly hosting fee includes data storage, archiving, backup, and retrieval of information. An annual maintenance fee is required for application upgrades, help desk access, data management and assistance, key creation, and system maintenance. Data entry costs are primarily front-end labor costs associated

with entering installation, facility, or organization-wide information (ownership, points of contact, etc.), entering site-specific information (contaminants, restrictions, controls, etc.) for each "Controlled Area" (i.e., a parcel or site with LUCs) at a location, and uploading documents to the data management system. After initial data entry, labor costs drop off significantly. Other than occasional costs for adding new sites or revising data to reflect modification or termination of LUCs, labor costs would mainly be associated with entering inspection results to create reports. Additional information on the Navy LUC Tracker can be found by contacting the Navy at NAVFAC Atlantic at 757-322-4983 or Tetra Tech at 412-921-8942.

5.7 Land Use Covenant Implementation and Enforcement Plan

Category: Implementation/Planning Model Documents

The purpose of the LUC I&EP is to ensure that the selected LUC for the site is implemented, monitored, and enforced. LUCs are described in a cleanup decision document, along with an implementation and enforcement plan to ensure the controls are maintained in an effective manner. The LUC I&EP is the tool used to ensure the LUC is implemented and remain in place.

LUC I&EPs are public and legal documents that specify all aspects of LUC implementation, monitoring, and enforcement and clearly define roles, responsibilities, and expectations for all parties. The document is developed with buy-in from owner, oversight agency, and locality as needed and alerts potential property buyers to the LUCs in place on a site.

The LUC I&EP model framework is adapted to each site. Basic information may include site information and the purpose and objective of the implementation and enforcement plan. This typically covers site history and the status of investigations and remedial actions taken; the selected remedy(ies) and any implementation of land use restrictions; and responsibilities of the responsible party(ies), the property owner, and regulatory agencies. Land use restrictions may include monitoring, reporting, self-certification, annual inspection and certification of land use restriction implementation, community outreach and notification, discovery of contaminated soil or groundwater, and oversight cost reimbursement to agencies.

The LUC I&EP clearly defines roles, responsibilities, and expectations and provides inspection forms and certification checklists to assist property owners in managing and enforcing LUCs. The LUC I&EP works only if people read it and follow recommendations, and there is an implied reliance on self-monitoring and reporting; however, its limitations can be addressed through application of other IC technologies designed to monitor for inappropriate site use.

Costs depend on the size and scope of the site, and the complexity of the remaining pollution and engineering controls. In general, most of these costs will be those associated with remedy selection and cleanup, including implementing the LUC. The development of a LUC I&EP generally requires an engineering consultant and environmental attorney, followed by review and comment by the oversight agency. Reaching the final version of the plan may require several rounds of revisions and negotiation.

Ongoing costs with implementing the plan depend on the specific monitoring activities selected in the plan. Annual inspections, reports, and certifications will bear some production costs. The time spent by an environmental professional and attorney will represent some of the annual costs, as will the oversight agency's oversight costs. These annual costs can be estimated in the LUC I&EP itself to ensure future owners are aware of them. Additional information on the LUC I&EP can be found by contacting USEPA Region 9 at 415-972-3003.

5.8 Land Use Control Implementation Plan

Category: Implementation/Planning Model Documents

A LUCIP is a written memorandum of understanding or agreement between two entities documenting what residual contamination remains on site and the LUC implemented to ensure protection of human health and the environment. It identifies the party(ies) with responsibility for the long-term maintenance and monitoring of the LUC. Moreover, the document formalizes the roles and responsibilities of state and/or federal environmental regulators, local government officials, and private stakeholders in the long-term administration and management of LUCs (Burke and Sullivan 2003).

The model LUCIP was developed under a cooperative agreement between ICMA and USEPA's Office of Brownfields Cleanup and Redevelopment. The actual framework is based on a plan developed between the city and county of Denver and the state of Colorado. The model is designed as a menu from which local governments and other stakeholders can select elements appropriate to their particular LUC circumstances. Therefore, site-specific LUCIPs may contain all of these elements, just a few of them, or modifications that may be more appropriate to the local situation. LUCIPs should be tailored to fit the specific types of sites, the relevant regulatory frameworks, and the stakeholders involved.

Like the LUC I&EP, the LUCIP provides a clear indication of responsibilities for the management and maintenance of LUCs as well as the necessary steps and timelines to follow to ensure effectiveness of LUCs is maintained. In addition, it provides a standard for reporting. Although not a computer application, the LUCIP MOU can be stored in a database, depending on how the state manages LUC information. Often nonbinding, LUCIPs may involve the property owner, potentially responsible parties, state environmental regulators, and/or local government departments. A LUCIP can take many forms, depending on the nature of the contamination, the type of LUCs used, and the relevant regulatory authorities. Complimentary electronic copies of the model LUCIP can be found at ICMA's LUC information clearinghouse, www.lucs.org.

This tool provides a clear indication of responsibilities for monitoring and maintenance of LUCs, indicates the necessary steps and timelines to follow to ensure that the effectiveness of LUCs are maintained, and provides a standard for reporting. It is important to note that this is not a tracking tool and does not provide notification to affected or interested parties. It is an internal management tool only and is not set up to share information with the public.

Costs vary depending on many variables, such as the degree of customization of the model document and associated staff time. These documents can be a time-intensive effort to ensure

that everyone's needs are met. Additional information on the LUCIP can be found at www.lucs.org or by calling ICMA at 202-962-3506.

5.9 NETR Online—Real Estate Information and Public Records Research

Category: Tracking

NETR Real Estate Research and Information, LLC (NETR) is a web-based system that allows users to research any state's tax and public record information. The system acts as a portal to official state websites and to certain tax assessor and recorder offices that have developed websites for the retrieval of available public records over the Internet. The site provides access to real estate public records and research information regarding property information, such as deeds and mortgage copies, tax records, liens, easements, parcel maps, assessment records, and other public records. The NETR Online system can be used by anyone seeking information about real property, such as developers, community members, government regulators, researchers, lawyers, and other real estate professionals.

The NETR Online system (Figure 5-3) is searchable by state, a point on the map, an address or assessor's parcel number, the name of the property owner, or even a site alias (i.e., historical name or project name). In addition, NETR Online provides a glossary of commonly used real estate terms. The NETR system comprises three main areas: Property Data Store; Public Records Online, and Environmental Issues.

Figure 5-3. Screen shot of NETR. (*Source:* NETR Online)

The Data Store products include property information such as aerial, parcel, and topographic maps; property and transfer details; and property detail reports. The Public Records area provides access to state and county government records, using a U.S. map where each state can be searched for information concerning recorded instruments such as real property records, mortgages, liens, and easements. The Environmental Issues area presents environment-related information that may affect real estate, such as asbestos, underground storage tanks, etc. The site also provides an introduction to due diligence and USEPA's All Appropriate Inquiry Rule. including historic chain-of-title reports as well as the environmental/regulatory background.

The NETR Online tool allows users to research any state's tax and public record information. It is important to note that the user may be limited to searching for sites known to the user. It is helpful to have prior site knowledge (i.e., the name of the property owner, address, tax map serial number, county, and state). However, the tool itself does not have the ability to search multiple databases of information on sites. The database is limited to those counties, states, or entities that have made public records available on the Internet. The costs of this system vary depending on the service chosen. Additional information on the NETR Online tool can be found at www.netronline.com.

5.10 One-Stop Interactive, Resource and Information System

Category: Tracking/Notification/Community Outreach and Education

OSIRIS tracks, notifies, and informs users of mapped real estate parcels contained within a database. The database maintains key information on institutional controls (e.g., deed restrictions and other key documents) and links to regulatory agency websites (e.g., GeoTracker and EnviroStor). It also includes links to other GIS web-based applications that apply to real estate and land use planning. The system can be used by state, local, and county governments or anyone who is interested in obtaining real estate information.

The system (Figure 5-4) can list and display sites with LUCs and other environmental information, such as soil and groundwater data. It contains links to regulatory agency sites and includes date of notification, message, and e-mail contact fields that provide a message to key persons if an action is due on a property with a LUC. The system is searchable by a point on a map, address of the property, assessor's parcel number, or even site alias (i.e., historical name or project name). Reports of wells/borings and LUC information are also available through this system. There are also a range of planning/zoning and real estate functions available.

The system can provide customized query functions and allows searches by address, owner name, etc. The capability to search by contaminant and cleanup status is planned for a future release. All data storage is centralized. The system can be easily customized to the user's specification because the entire site is managed with little or no additional coding necessary; data can be exported from the system, and it provides automatic database and site backups. The data must be kept current by the user agency, so there is an associated impact to agency staff and the expense involved with keeping data current.

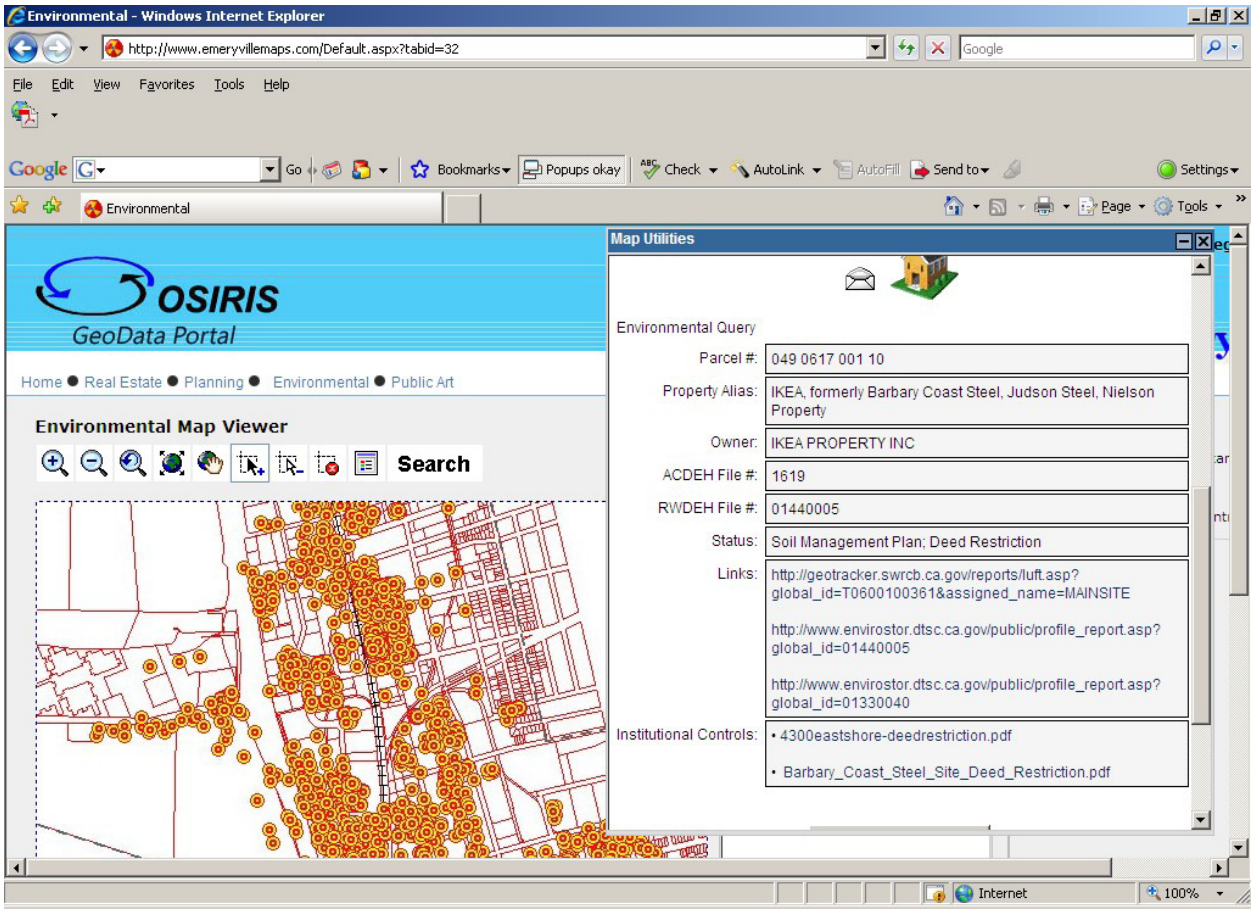


Figure 5-4. Screen shot of OSIRIS database.

Costs are highly dependent on the level of functionality desired in the system and whether or not it is a "hosted solution" (maintained by an off-site provider). Development costs for projects similar to the case study (see box) have run the scale from $25,000 for a simple mapping site employing simple map exploration tools to more than $100,000 for a complex system with customized features. Hosting costs run around $2,000 per month to host the entire system, manage data, and provide access for public users. For more information on how the City of Emeryville uses the OSIRIS System, contact the city at 510-596-4356 or Sanborn at 970-490-5900.

Case Study

The City of Emeryville, California has been evaluating the use of this system and determined that the system requires some additional work; therefore, application data are not currently available. The city is adding more features, such as Sanborn maps and historic photos. Additional information on the OSIRIS system can be obtained at www.ci.emeryville.ca.us/econdev/osiris.html.

5.11 Parasec

Category: Tracking/Notification

Parasec (Figure 5-5) is a resource used as a filing and retrieval system nationwide. It provides the user with a system that enables an agent to file or retrieve documents, perform due diligence, and

compile title records, etc. Parasec's service focuses on supplying information to accountants, attorneys, paralegals, lenders, title companies, corporations, and other professionals. Parasec staff can physically file and retrieve documents and provide an array of reports, depending on the client's request. Potential users include regulatory agencies and city and county planners.

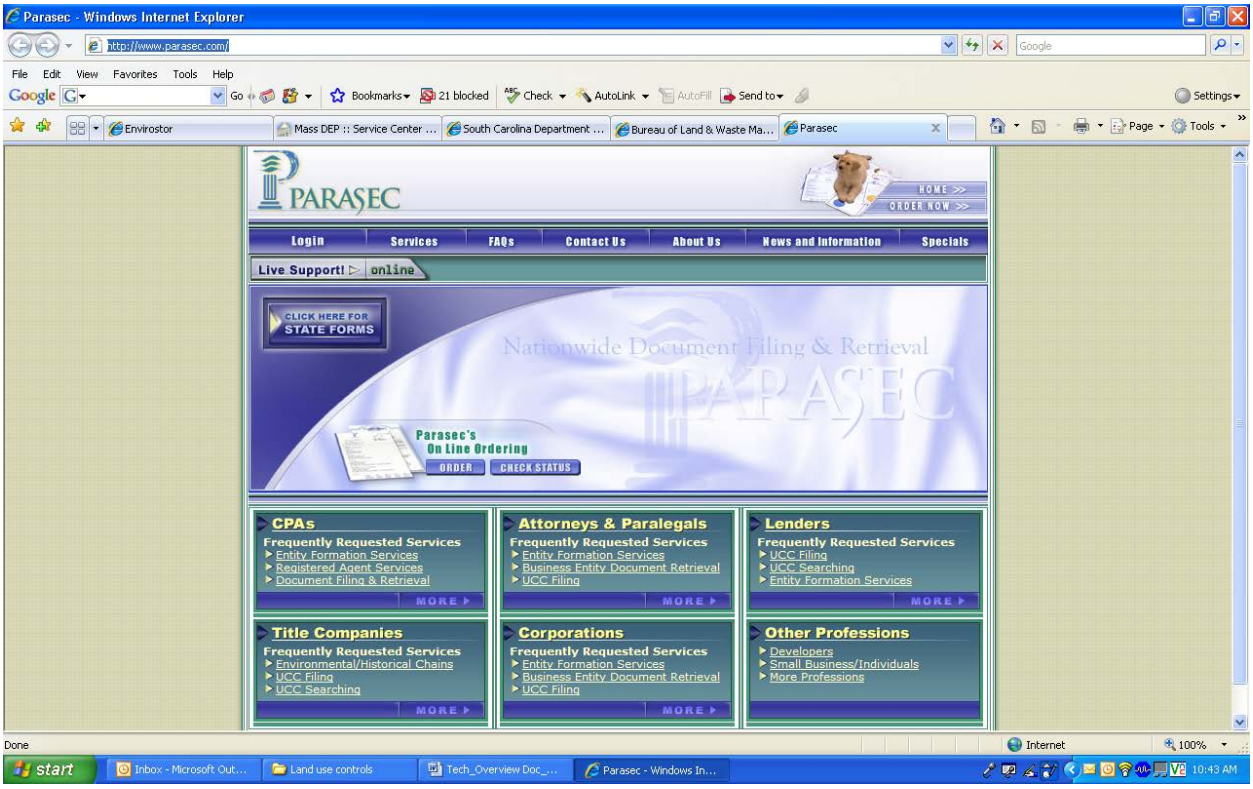


Figure 5-5. Screen shot of Parasec.

Parasec employs a physical agent who is available to submit and retrieve documents at records offices. It also provides a link to the ICMA LUC Web Ring. Once the pertinent information has been recorded in the appropriate records office, Parasec automatically informs the client when a recorded LUC is within 90 days of expiring.

The cost of the Parasec service varies based on the service rendered, such as the type and retrieval of a particular document. Additional information on the services provided by Parasec can be found at www.parasec.com or by calling 800-867-7870.

5.12 The Sentinel Trust

Category: Tracking/Notification/Community Outreach and Education

Sentinel Trust is a not-for-profit program that uses trust funds as its financial source. Part of the American Brownfields Assurance Company (ABAC), Sentinel Trust provides a mechanism for comprehensive long-term stewardship services to clients in both the private and public sectors. Sentinel Trust offers many services, including site inspection, monitoring and reporting on land use and engineering controls, financial assurances, information and data management services,

development of post-closure plans, and public training and outreach to local government and communities. The target audience for this program is states and/or responsible parties.

Sentinel Trust provides a mechanism to assure protection of land use controls. In addition, it requires all parties responsible for the monitoring, maintenance, and reporting on LUCs to contribute to the trust. This aspect of the trust ensures that all sites are professionally managed and provides a pool of financial resources. Sentinel Trust provides verification services in the field through the use of site visits and electronic monitoring. It also offers assistance with biennial certification processes and financial assurance mechanisms (ABAC 2007).

Sentinel Trust offers flexibility in its services to both the private and public sectors. The advantages of using the trust include a broad range of products and services to meet the needs of the long-term stewardship of LUCs. Sentinel Trust does not serve as notification tool. It offers standardized LUC stewardship services and will develop a cost schedule to assist in the analysis of the costs and benefits of a risk-based versus a complete cleanup (ABAC 2007).

Additional information on the Sentinel Trust can be found at www.ambrassco.com and www.state.nj.us/dep/srp/stakeholders/whitepapers/inst_controls.pdf. (Information in this document was obtained from NJDEP 2007 and ABAC 2007.)

5.13 Terradex Institutional Control Tracking

Category: Tracking/Notification/Community Outreach and Education

The Terradex Institutional Control Tracking (Terradex) system is a commercial web-based service that provides layers of information on land activity and contains a monitor and an alert service. Terradex has hosted this system for five years. The application aggregates information from approximately 120,000 sites referenced on websites. The system includes national federal RCRA corrective action and Superfund sites, as well as California (EnviroStor, GeoTracker, and Solid Waste Information System), Oregon, Washington, and New Jersey listed sites (www.Terradex.com). This system can be accessed by various stakeholders who register for the service. Regulators, responsible parties, state and local governments, LUC holders, and the public can all benefit from the information collected.

The Terradex system (Figure 5-6) is designed to notify users and stakeholders of properties with LUCs, as well as potential activities that could compromise the integrity of site-specific controls. The only computer hardware requirement is an Internet connection. The system can be customized to meet a state or responsible parties' needs.

The main features of Terradex include data collection, filtering and screening of data collection, an alert system, the identification of stakeholders, and record keeping. In regards to data collection, Terradex requires the initial input of information by the customer, such as the location of the parcel(s) with a LUC. This information includes the location of parcel by parcel number, street address, or GIS shapefile; the activity or use restrictions (e.g., no excavation, no residential use); the follow-up actions if a breach is detected; and the parties to be notified of a potential breach of a LUC.

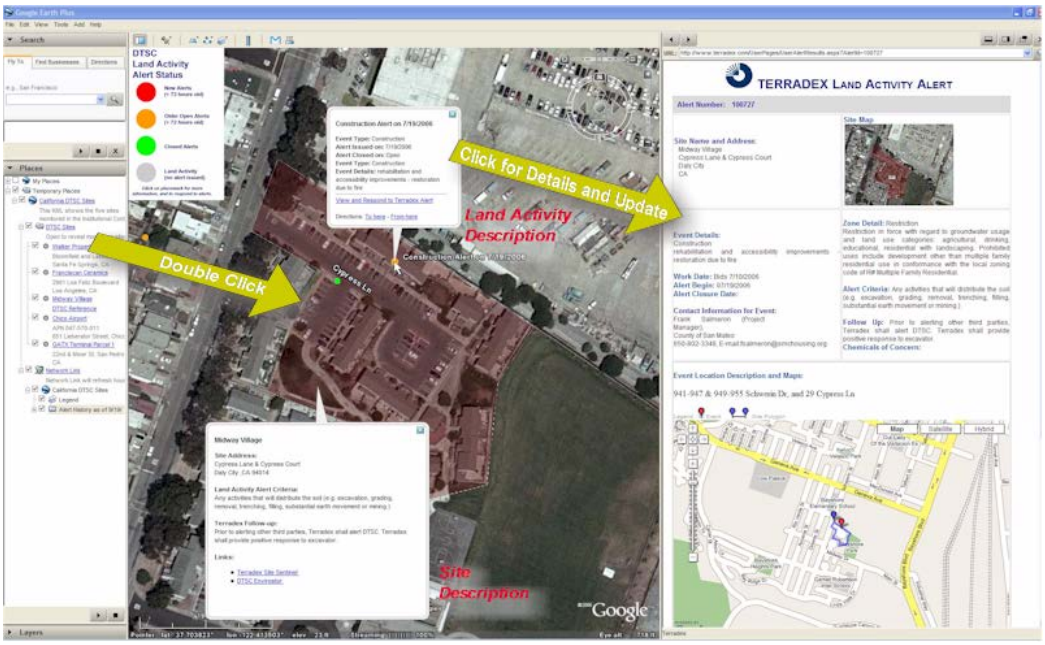


Figure 5-6. Screen shot of Terradex. (*Source:* Bob Wenzlau, Terradex)

When the customer is a state agency the "setup" of Terradex consists of synchronization to existing data registries a state agency may hold for LUCs. The state agency serves as the "registry" of the site, and Terradex serves as the monitoring and tracking service for land uses and activities around sites with LUCs. When the user is a responsible party, the setup is performed with information associated with a LUC implementation plan. If procured by a responsible party, regulatory agencies can access the system. The Terradex system complements existing LUC registries by providing notice to stakeholders who may otherwise not be noticed. Terradex can screen land activities so the user may be alerted only when land use activities are being undertaken that may have the potential to compromise a LUC.

Since the system is heavily data-driven, the compilation and accuracy of data used in the setup of the system is critically important. A continuous data flow from various sources is desirable, and raw data can be accepted from multiple sources to help improve data quality. The technology can be used to complement existing data systems. As previously discussed, California DTSC's existing EnviroStor database is an example of how the Terradex technology builds on current and existing data systems. Terradex uses available information but does not create or modify existing data. If the existing data registry is inadequate, the user will need to update the database to make the technology useful. An agency data manager is required to understand the data exchange and interface with the Terradex system to provide a useful output. Although Terradex does not generate information, some activities may be captured through the service that would not normally be picked up otherwise. There is no local level input generated by municipal or city governments; however, as stakeholders, they can benefit from the information. The filtering and screening of collected data is conducted to determine what data are relevant. A test or break-in period may be necessary to determine an acceptable level of data necessary to meet the user's needs and requirements.

The technology monitors events and activities and alerts users and stakeholders to predetermined events. Some events may be elevated to alerts but others not at all, depending on end user needs and/or requirements. These events could involve specific site-related factors (e.g., real estate transactions, building permit issuance, or natural occurrences, such as flooding, earthquakes, or local disasters). An e-mail alert is sent when a land activity reasonably appears to have or the potential to have compromised a LUC. The alert carries a link to the website, where a map of the LUC boundary is displayed with the location of the future land use activity. The user is required to review the e-mail and work with Terradex to determine whether the land activity breaches the LUC. If the activity would potentially breach the LUC, Terradex notifies the stakeholder. All interactions are recorded into a conversation "blog" around the alert, creating a record of consideration and actions. This approach was developed with the USEPA pilot as an idea to consolidate feedback that might come from multiple sources (USEPA 2006).

Primary and secondary contacts are normally designated by each organization to receive notifications and take the necessary actions in each other's absence. For example, California's system notifies two primary state contacts and the associated project managers. The secondary contact is the project manager's supervisor to keep him or her in the communication loop. Local government is primarily considered a stakeholder, and notifications at this level are normally performed as a service to those agencies. Federal agencies, such as USEPA, may also receive concurrent notifications.

Record keeping is an important function of the system. Terradex uses an automatic record-keeping system to memorialize the entire process and document notifications issued, actions taken, and other relevant data. The data are tracked and results stored to a searchable database containing alerts, reports, etc. This information is also available in paper or electronic format.

The Terradex system can be used alone or to enhance existing state LUC programs. In addition stakeholders do *not* have to know about websites holding LUC lists (or even what a LUC is), but instead receive a telephone call, fax, or e-mail from Terradex informing them of an activity or use limitation. For example, excavators would learn of the LUC based on information they submit to the One-Call center, and the notice they receive back shows their future excavation location relative to the boundaries of the LUC. Excavators could then be directed to view an agency website to learn more or to call the responsible party.

The limitations to the use of the Terradex system include the fact that the system is not a specific LUC repository and relies on others to serve as that repository. The system is not generally accessible or available to the general public, the

Case Studies

Terradex had a multi-year engagement for IC implementation at a large urban Del Amo Superfund site. Land activities monitored include real estate, building permits, sensitive uses, and excavation. The system has been successful in preventing land use activities that otherwise would have breached ICs. In particular, one excavation was averted that would have caused a cathodic well to perforate a confining clay layer, potentially causing contamination to leach to underlying potable water aquifers.

Terradex monitored a portfolio of properties across California so that the project environmental staff of DTSC could evaluate the technology. The staff was oriented to the service and given account access to site information and received updates to land use and activities at and near sites with ICs.

system does not provide field inspections that might be a component of LUC implementation (though it can track their fulfillment), and users cannot comment on the location or accuracy of an environmental site record.

The fees for the Terradex service are paid as an annual subscription. Terradex typically offers a demonstration site for a client to test the service at no charge. The fees depend upon the number of sites, the size of a site, and the data sources monitored. Terradex may also request an activation fee to begin the service that is variable depending on the customization a user requests. Additional information on the Terradex system can be found at www.terradex.com or by calling 650-328-6140.

6. FINDINGS/CONCLUSIONS

6.1 LUCs and LUC Management

LUCs are being implemented on a more routine basis than ever before. Risk-based remediation and the theory behind this approach allow for residual contamination to remain on a property while facilitating its reuse. When a site is not remediated for unrestricted use and residual contamination is left in place, LUCs are used to ensure that site conditions protect human health and the environment. LUCs restrict the use of, or access to, a site and may include certain actions (e.g., tracking, monitoring, maintenance, and notification) that need to be performed as part of an overall remedial action strategy. Due to this approach to cleanup it is critical to be able to track LUCs and monitor their continued effectiveness. In addition to protecting public health and the environment, environmental cleanup activities are implemented in part to return a site to a condition where it can be redeveloped for its intended and/or appropriate use.

There are two types of LUCs: ICs (administrative and/or legal controls) and ECs (physical controls put in place to prevent exposure). The determination as to the type, timing, and duration of specific controls depends upon regulatory requirements and the site-specific conditions. ICs can be further divided into governmental controls, proprietary controls, enforcement and permit tools, and informational devices. Each type of IC has a specific use, format, and/or mechanism and can be employed singly or in combination, usually as required by applicable laws.

Information on what LUCs exist at a site is essential to developers, planners, and communities when determining future land use activities, in part, to ensure that the public is not exposed to contamination. Effective management of the data and other information associated with a LUC is critical to the success of its long-term implementation. Ensuring that LUCs are tracked, maintained, and properly monitored is a recurring issue for parties involved in remedy selection, implementation, enforcement, notification, and outreach at contaminated properties. LUCs can have both short- and long-term expenses associated with their implementation and management. Financing mechanisms to sustain long-term management (including inspections) and ensure compliance include oversight fees, stewardship fees, and trusts.

Restrictions are also placed on the use of a site simply to ensure that future land owners are aware of the environmental conditions of the site. The legal tools that restrict land use and

protect the public and the environment are covenants and restrictions, deed notices, easements, and consent agreements. The use of these legal mechanisms may be specifically required under various state programs, under different legal scenarios, or as a result of negotiations and/or agreements. In addition to state-specific legal mechanisms, the UECA was created to help states better implement, modify, enforce, and terminate environmental covenants. However, the UECA may present conflicts with existing state laws and common law practices, and some states that have adopted the UECA have done so with modifications.

States generally develop the programs that provide for the long-term tracking and maintenance of LUCs and have indicated that long-term stewardship issues surrounding LUCs are a major state priority. In addition to the implementation or placement of LUCs on sites where residual contamination remains, challenges that confront federal, state, and municipal governments relating to LUCs include the following:

- the long-term obligation to monitor the control for its continued effectiveness in protecting human health
- cost-effective and efficient means to maintain and enforce controls over time
- communicating (through outreach and notification) to the public and local land use authorities who are rarely involved in the environmental remediation processes and may not have reason to know that LUCs are in place with respect to a property

The ability of LUCs to successfully protect human health and the environment depends on the consideration of LUC information when land use decisions are being made. Many states have identified the need to develop registries or lists to manage (i.e., track) LUCs and have identified the need to ensure that LUCs remain uncompromised over the long term. States that accept CERCLA 128(a) funding are required to develop registries, have some means of tracking, and make information available to the public about sites that use LUCs. To meet these challenges, a number of innovative measures for managing LUCs have been developed. The successful use and long-term monitoring of LUCs may require the implementation of several of these systems to ensure that they remain protective over time.

It is recommended that states make LUC management part of their mission and develop the best possible LUC management systems to achieve the highest possible level of tracking, notification, and outreach. An appropriate system should be easily updated to provide current information and be able to be upgraded as the use of these tools expand (such as for municipal permitting and approvals for land use) and more useful components for mapping and tracking become available. The tools and mechanisms for high-resolution mapping and communication and notification by various means already exist and should be incorporated. Consideration should be given to potential future requirements for interstate sharing of information, system compatibility, uniformity in data presentation (as envisioned by EIEN, for example) and user-friendliness (searchability, sort capability, query capability, etc.). States should also be certain that their systems are comprehensive and include all sites from all programs within the state. The lack of a complete listing devalues the system and the information within if users have doubts about information that may be missing or not current.

6.2 LUC Management Systems/Tools

The importance of a state environmental agency's ability to identify where LUCs have been implemented is critical to eliminate breaches of these controls and subsequent potential human exposure to residual contamination. Numerous important features and elements for LUCs have been identified and evaluated by states for inclusion in state LUC management systems. The ITRC Brownfields Team found that most states have some form of a LUC registry, although no two of those reviewed were exactly alike. The state systems reviewed for this document have varying levels of sophistication and provide different points of access for information. These types of management systems have been developed in varying forms, ranging from a simple listing of sites that contain LUCs for state agency use to more complicated notification and tracking systems that identify when and where a LUC has been implemented and whether the LUC may have been compromised.

In this document, tools were identified and reviewed that provide a means for managing LUCs. The tools are categorized into four types:

- Tracking systems keep track of when and where LUCs were implemented and may describe the LUCs.
- Notification systems can notify individuals or monitoring agencies if any activity is occurring on a site that has LUCs in place.
- Community outreach and education systems provide the community with information regarding LUCs.
- Implementation planning/model documents provide information to regulated and implementing parties as well as provide agreement on the provisions of the LUC installation and management.

Some of the tools address issues in more than one category. LUC stewardship systems described in this document offer options to ensure that LUCs remain effective and uncompromised over time.

The Brownfields Team completed technology overviews, reviewing information and case studies provided on the various technologies. The review determined that, in general, the various technologies contained some of the following important attributes:

- a web-based, Internet navigator and/or search engine capable
- description of controls, their configurations, characteristics, and limitations
- tracking and managing all permit types, field inspections, reports, and other information
- tracking site activities that may constitute a threat to a control
- tracking land use changes that may constitute an exposure scenario
- accessible to responsible or involved parties, regulators, invited participants, and/or the public
- notifying/alerting, by various means, of potential threats to controls
- developing implementation plans with procedures and protocols for long-term management

- generating lists and/or reports, including site inspection, monitoring and reporting on land use and engineering controls, financial assurances, information and data management services, development of post closure plans, and public training and outreach activities
- collecting/storing/locates/retrieves/shares various data, attachments (files, maps, etc), and other information, ranging from general to very specific
- GIS compatible
- providing information for decision making
- providing links to other information, contacts, etc.

In addition to the lack of any of the listed attributes, limitations identified in the various systems included the following:

- lack of ability to combine tracking, notification, and outreach capabilities in a single tool
- lack of ability to track individual monitoring events
- inability of some tools to track all types of contaminants
- providing information for only certain types of sites under a specific state program (and not other programs in the same state)
- ability to locate sites may be complicated by limitations on site location (address, parcel, latitude/longitude, etc.)
- variations in search capability, linking to other sources

Relative costs were difficult to compare as the cost of these systems were highly dependent on the multiple variables that each individual technology manages and were typically considered to be dependent on the needs of each specific client/user. Costs provided by suppliers vary depending on the service or complexity of the system provided and generally ranged from thousands to hundreds of thousands of dollars.

As it pertains to LUCs and this document, the One-Call system is unique in that it is an existing tool used for the tracking and management of subsurface utilities and other nonenvironmental systems requiring controls. However, it is concluded that, as an established, widely used, and familiar system with a record of success in protecting subsurface utilities and other systems, the One-Call system provides a ready-made network that could be easily adapted to LUCs. Additional work needs to be done to adapt the One-Call system for use with ECs, starting with the will to do it and including providing necessary funding/funding mechanisms to include LUCs within the One-Call system.

The technologies that were reviewed were identified through the use of web-based searches and compared to existing programs to determine data gaps that may exist in current state LUC programs. Moreover, many of these technologies complement each other, and a combination of important of aspects of each tool would provide a high level of protection and provide adequate tracking, notification, and outreach (for instance, the level of information as available from Terradex or other third-party notification tools combined with the field verification and notification attributes of the One-Call system or the adaptability to local permitting functions as reported by Accela and similar tools). It is asserted that, through the use of "layering" different technologies or significant aspects of these technologies, the effectiveness of the overall system

being implemented will be improved. Many of the technologies that were researched for this document are continuously undergoing improvements and changes to enhance their utility. As with most technologies, they are in a constant evolutionary cycle of improvement.

A final thought on the future success of LUC management systems is the realization that, to succeed in protecting LUCs, the management and tracking systems to be developed or currently in use have to be, eventually, comprehensively adapted and used by those municipal governments, other governmental organizations, and other land use authorities that provide approvals and by the public or private entities that conduct the actual intrusive work that presents the ongoing threats to existing LUCs. The success of a LUC management system will depend on consistent use by those individuals making land use planning decisions and making sure that the information is accurate and readily available.

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Appendix A

Technology Matrix

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TECHNOLOGY MATRIX

Tool	Notification	Tracking	Outreach	Public/Private Users	Schedule and Inspection	GIS Capable	Links to Resources
Accela Land Management	No	Yes	Yes	Private[a]	Yes	Yes	No
DPRA, Inc.	No	Yes	No	Public	Yes	Yes	No
Google Earth	No	No	Yes	Public	No	Yes	Yes
Guardian Trust	Yes	Yes	Yes	Private	Yes	No	No
ICMA Web Ring	No	Yes	No	Public	No	No	Yes
Navy LUC Tracker	Yes	Yes	No	Private	Yes	No	No
LUC I&EP[b]	No	No	No	Public	Yes	No	No
LUCIP[c]	No	No	No	Public	Yes	No	No
NETR Online	No	Yes	No	Public	No	No	Yes
One-Call	Yes	Yes	No	Public	No	Yes	No
OSIRIS	Yes	Yes	Yes	Public	Yes	Yes	Yes
Parasec	Yes	Yes	No	Public	No	No	Yes
Sentinel Trust	Yes	Yes	Yes	Private	Yes	No	No
Terradex	Yes	Yes	Yes	Private	Yes	Yes	No

[a]Can be configured for state/public access.
[b]MOU/cooperative agreement.
[c]Written agreement between two parties.
Note: Relative costs were difficult to compare and therefore were not included in this matrix. The costs of these systems are highly variable and depend on the needs of each specific client/user.

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Appendix B

Technology Resource Overviews

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TECHNOLOGY RESOURCE OVERVIEWS

ACCELA LAND MANAGEMENT

Description of Technology

Accela Land Management tracks and manages land use and community development activities including permits, building safety, inspections and reviews, zoning, project plans, code enforcement, and more. It allows staff to have access to input data, verify activities, check permit status, and obtain complete parcel information.

Features of Technology

- Track and manage all permit types
- Maintain a database of vital contractor information
- Generate daily task lists for reviewers and inspectors
- Attach and retrieve CAD drawings, photographs, and other document files
- Record and track special conditions
- Check zoning and special circumstances
- Integrate with GIS
- Auto-route information and tasks to different departments and agencies
- Perform field inspections
- Review project plans
- Assign and sign off tasks
- Perform fee calculations
- Issue automatic warnings
- Record all activities for each case application or permit in the system (e.g., inspection dates, notes, contacts, telephone calls, letters sent, photos taken)
- Track recovery costs for code enforcement

<u>Features (General Public)</u>

- Provide convenience of 24/7 access
- Check the status of plans, inspections, or projects
- Schedule and sign off inspections
- Set up fees and business rules to allow for online payment
- Look up information on permits, parcels, and history

Technology Platform

- Web-based solution—host server with quest
- Purchase software and run on own server
- Internet Explorer—current Java engine installed

Cost Associated with Implementation

The Accela Automation pricing model is on a named user basis. Accela can provide state and agency enterprise-level pricing with unlimited users if desired. Accela can provide professional consulting services as required to successfully implement Accela Automation per customer requirements. These services may include but not be limited to the following:

- project initiation
- project management and administration
- configuration analysis
- system setup
- system configuration
- report development
- system training
- system testing and acceptance
- go-live assistance

These services are priced according to the size of the implementation, including the number of departments involved, the number of permit and/or license types to be implemented, the number of reports to be developed, the number of users to train, and any additional history data conversions or interfaces to other systems. Additional information is required to determine project implementation costs.

Advantages

- Internal use for multiple offices
- Tracks field inspections
- Allows for mobile field inspections
- Easy access by public

Limitations

- It doesn't appear that there is a specific template for LUCs, but that also means that the template can be formatted to the needs of the state.
- Data presented are a function of what is entered internally.

Users

This is a database set up to hold all information associated with a particular piece of land. It can serve both the state and the public (there is a citizen access portion of Accela).

Case Study

Since 1992, Colorado Inspection Agency (CIA) has provided field inspections, plan reviews, and building department administration services to Colorado municipalities. CIA provides a cost-

effective outsourcing option for municipalities who do not staff a fulltime building department. Today, the agency serves 17 municipalities in Colorado, providing services to more than 150,000 citizens (www.accela.com/products/success_stories.asp).

CIA operates from three separate offices with inspectors rotating among these offices throughout the day depending on where their appointments are scheduled. When the agency first began, staff relied on an Access database and paper records to keep track of their inspections, applications, and plan reviews. While this method proved effective initially, it did present certain problems. For example, if inspectors ended their day far from their home office (a very typical scenario), they had no way to input their inspection results into the database. Consequently, those results were not updated until the next time the inspector went to the office. Additionally, a paper-based system was subject to filing errors and cumbersome searches for the latest information about an application.

In 2000, CIA began looking for a new, automated solution to replace its existing system. The agency needed a solution that would be flexible enough to meet everyone's needs:

- the three CIA offices that shared information and resources
- the building inspectors who traveled between the CIA offices and different job sites
- the 17 different municipalities that had their own unique permitting workflow

CIA selected Accela Automation, a Web-based, enterprise solution that provides the agency with a complete solution to automate workflow, forms management, activity tracking, cashiering, and other critical tasks (www.accela.com). The application delivers specific functionality that benefits the agency's unique business model.

Accela Automation is a Web-based system which allows the CIA staff to access the application from any computer that has Internet access. This feature is well-suited for field inspectors who often end the day away from the home office. The CIA staff are not the only users of the system either. At any given time, staff at the 17 client sites can log on to Accela Automation to submit a new permit request, check the status of an application, or print completed permit forms. The accessibility of the system allows client sites to keep their citizens informed and provide good customer service.

CIA opted for a hosted solution with Accela Automation, meaning Accela hosts the application server. This option allowed CIA to recognize immediate cost savings in equipment and IT support. In fact, CIA operates successfully with only one IT person on staff. This person is able to meet all of CIA's internal IT support needs as well as provide the system administration duties for the Accela Automation application.

Accela Automation provides a central location for all of the data managed by CIA. These data are sorted for each municipality so CIA staff can easily access the information they need by logging in to the relevant municipality account. Any updates that are made to the database are done in real-time so staff are always viewing the most up-to-date information on any application.

Although CIA provides a standard set of building department services to its clients, each of the 17 municipalities has a unique workflow for processing permit applications. When the Accela Automation system was implemented, a unique workflow for how applications are submitted, processed, and approved was created for each municipality. When CIA staff log in to a particular municipality account, they know exactly what steps need to be completed for that application.

In 2004, CIA processed 6,500 permit applications, conducted 3,000 plan reviews, and performed more than 50,000 on-site inspections. Despite this workload, the agency has managed to keep a very lean staff. In fact, CIA serves all of its clients with a staff of only 24, most of whom are the building inspectors who spend much of their time in the field.

References

www.accela.com/

DPRA WEB-BASED CUSTOMIZED APPLICATIONS FOR LAND USE CONTROL MAPPING AND INFORMATION MANAGEMENT

Description of Technology

DPRA, Inc. (www.dpra.com) develops web-based customized applications for LUC mapping IC information management). DPRA developed a web-based tool that identifies parcels encumbered by LUCs within a municipality and other information related to the environmental condition of parcels. Generally, the application overlays parcel boundaries on site aerials, streets, roads, and related geospatial information, and highlights LUC parcels in red. Users can select red-highlighted parcels and view or print electronic versions of LUC documents. In addition to LUC information, the system also contains information related to site assessment and remediation. Thus, users can obtain technical details about LUC sites such as contaminants that exist on sites and remediation efforts.

DPRA's web-based LUC mapping applications depict ECs, residual contamination, and the boundaries of LUCs. Such applications have focused on the mapping of "recorded LUCs" or, in other words, those LUCs filed in local property record offices. Users can view title search documents and learn whether LUC instruments were recorded in the property records and whether other recorded encumbrances (e.g., utility easements) exist on a property. Users can identify which parcels within the boundaries of an environmental site contain LUCs.

Features of Technology

DPRA's web-based LUC mapping applications perform the following:

- combine environmental cleanup, real estate parcel, and LUC information to show whether any environmental conditions exist on a property
- allow local agencies to easily review environmental concerns and LUC information as part of the permit review and issuance process
- provide easy access to LUC information on a parcel-by-parcel basis (searchable by parcel number or address)

Technology Platform

DPRA is a web-based, Internet-accessed system. DPRA's LUC mapping applications are hosted web applications typically using Java and SQL Server applications with ArcIMS (the map functionality). In some cases DPRA may employ HTML/JavaScript web pages or may employ more advanced server-side applications using Java or .NET with a SQL Server.

Cost Associated with Implementation

Costs can generally be divided into three categories:

- Information gathering—Information-gathering costs range widely. The tasks involve gathering geospatial information, parcel boundary information, cleanup site information, and copies of LUC instruments.
- Application design and construction—DPRA provides customized LUC tracking solutions which, to date, are city-wide or site specific. Even though DPRA provides customized applications, the basic design and construction of each application does not vary significantly, keeping additional customizing costs minimal. For a city-wide application, the design, construction, and site-launching cost ranges approximately $20,000–$50,000. For site-specific applications, the effort costs less.
- Maintenance—Maintenance involves web hosting, periodic uploads of new information (i.e., LUC instruments, updated parcel information), and occasional application upgrades. Yearly maintenance costs total approximately $10,000–$20,000.

Advantages

- Enables both the public and municipal government staff to make land use decisions with knowledge of LUCs.
- Allows state LUC-issuing agencies a local repository for LUC documents (fostering LUC cooperation between state and local government).
- GIS format provides easy means to compare LUC locations to other land use–related items, such as zoning and floodplain maps.
- By allowing users to select individual or multiple layers of information, enables an overview of the areas of environmental concern (e.g., location of residual contamination or engineering controls) and the LUCs designed to protect against that risk.

Limitations

- Does not track LUC monitoring events.
- Is not a notification system.
- Applications require periodic "refreshing" with updated parcel information that must be performed by DPRA by manually inputting information.

Users

Systems to date have been created for municipalities as well as one state to manage LUC information. The information is accessible by the public via the Internet.

Case Study

Project Location: National City, California

Project Team
- J. Michael Sowinski, Jr., DPRA, Inc., 760-752-8342 x18, Michael.Sowinski@DPRA.com
- Patricia Beard, Redevelopment Manager, City of National City, California, 619-336-4255

Description of Technology Implementation

The city of National City, California contracted with DPRA, Inc. to develop a web-based Brownfield Redevelopment Environmental Information System (BREIS). The purpose of the system is to provide city employees with information on LUCs on parcels so land use permit applications can be compared to the LUC information to determine whether the permit should be issued. In addition, the BREIS allows easy access to environmental and redevelopment-related information within National City that can also be used by the public and developers.

The user can obtain information by area, parcel, or address. The following information is provided:

- Institutional controls—The boundaries of the existing ICs are shown on a map. The user can then directly access the deed notice for each parcel with an IC. The deed notice specifies the contamination that remains on the property, the prohibited uses of the property (e.g., no residential housing or day-care facilities for children), details of any required caps or other engineering controls that must be maintained, etc.
- General site conditions—An overview of general site conditions is provided including high-resolution aerial photography, parcel boundaries, sewer lines, streets, etc.
- Environmental site assessment—The BREIS allows interactive access to historical and environmental regulatory information and offers the ability to view and download environmental site assessment reports.

Project Outcome/Lessons Learned

LUC documentation (e.g., deed notices) is provided by the state to National City; therefore, coordination with the State of California is extremely important. However, it would have been helpful for the system to provide notification to city employees when LUC monitoring events are required and allow employees to track monitoring events.

References

National City California Brownfield Redevelopment Environmental Information System (www.nationalcitybreis.org).

ENVIROSTOR

Description of Technology

EnviroStor is a comprehensive cleanup site database that is used internally by the California DTSC for project management purposes. Much of the information found in the database is made publicly available through the Internet. Information contained within EnviroStor associated with LUCs is made publicly available via the Internet.

Features of Technology

- Public access to all hazardous substance release sites known to/managed by DTSC.
- An avenue for the public to "find a site near you."
- A search capability for locating any site in California where DTSC's Site Mitigation and Brownfields Reuse Program has required/instituted a land use covenant (currently 274 sites statewide with land use restrictions, 382 total land use restrictions).
- A publicly accessible route to comprehensive site information, direct access to public documents (including land use covenants and eventually all new public documents and key historic documents), and links to DTSC project managers with full knowledge of current project status and historical information.
- An internal comprehensive database for DTSC use in managing all sites currently known to or overseen by the agency.
- Tools for use by DTSC personnel to manage project schedules and make portions of that schedule information available to the public.

Technology Platform

EnviroStor is a web-based database built/modified from off-the-shelf software. It is vendor hosted and maintained by EcoInteractive. Help desk capabilities result in same-day problem resolution (often within an hour).

Cost Associated with Implementation

Costs vary based on the number of sites being managed and the number of persons within the organization who use the database. In California, EnviroStor costs for managing a database containing approximately 900 active projects and 8300 total projects were/are $200,000 in contracted startup costs and $200,000 in annual contracted operating and maintenance costs.

Advantages

- Broadly available to the public and private sector via the Internet.
- Search capabilities allow for individually tailored results.
- Sites with LUCs in place can be found in multiple ways and the actual covenant is available for viewing/printing as a PDF document.
- Listing of sites with land use covenants can be exported to Excel and sorted by column headers including ZIP code, city, county, and street address.

- EnviroStor serves as both a robust internal project management tool and as a reservoir for the release of information to the public via simple Internet access.

Limitations

- Tracking and outreach capability, but no notification element.
- Generally limited to cleanup sites in California where DTSC's Site Mitigation and Brownfields Reuse Program is in a lead oversight role.
- Currently does not include approximately 45 sites where LUCs are in place but under the jurisdiction of DTSC's Hazardous Waste Management Program (RCRA). A separate registry is available for these sites.
- Also does not include approximately 90 sites with LUCs in place which are under the oversight of any of the nine Regional Water Quality Control Boards operating in California. There is a separate registry for these sites.

Users

- State regulatory agency
- Local environmental, planning, and development agencies
- Members of the public

Case Study

Project Location: Colton, California

Project Team: DTSC brownfields contact located in central California, small southern California commercial developer (developer)

Description of Technology Implementation
DTSC was contacted by a representative of the developer in the spring of 2006. The developer was exploring the possibility of acquiring property for a small retail center anchored by a minimart in South Colton and expressed an interest in recent brownfield legislation passed in California that would make development of a brownfield property more viable. The DTSC brownfields contact explained the existence of the new EnviroStor site database and by phone, walked the developer's representative through the process of accessing EnviroStor via the Internet. Using the basic search feature of EnviroStor, nine sites were identified in Colton where past releases of hazardous substance were of concern.

Reviewing this list allowed the developer's representative to identify, by partial address, one property in the vicinity of properties under consideration for development. The particular property in question had the indicator attached to the Status field that "land use restrictions" were in place. By clicking on the "Reports" link and then the "View Covenant" link in EnviroStor, the developer's representative was able to immediately access a copy of the recorded instrument (Covenant to Restrict Use of Property Environmental Restriction), which provided detail on the specific restrictions in place. The developer's representative was also shown how to find

additional information on the site's status, including the type and concentrations of contaminants present, the party responsible for the site, and the name and contact information for the DTSC Project Manager.

Had this situation occurred prior to the development of the EnviroStor database, the DTSC brownfields contact would have been able to help the developer's representative search DTSC's old database for sites in Colton, finding approximately 23 sites (including a large number of potential school sites where a finding of "no further action" had been made). Using this database, the site would likely have been identified; however, a detailed review and interpretation of a "Profile Report" available by link from the search page would have been necessary to determine that the site was "land use restricted." Furthermore, the DTSC project manager would then have had to be contacted to find out any information on the specific restrictions on the property and to obtain a copy of the recorded document.

Project Outcome/Lessons Learned

The developer obtained valuable information in a matter of a few minutes that historically would have taken several days to acquire. Although it is unknown at this time whether the developer is continuing to pursue development of a site in South Colton, the ease of access to the information contained in EnviroStor certainly made the task of identifying brownfield properties easier. In addition, this situation, along with the experiences of other parties using EnviroStor in its early days, has led to improvements in DTSC's web page design and presentation to make EnviroStor easier to find and use.

EnviroStor is accessible through DTSC's web page (www.dtsc.ca.gov) or directly at www.envirostor.dtsc.ca.gov/public.

References

- Mr. Kevin Shaddy, P.E.
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- Mr. Dean Wright, P.G.
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FLORIDA INSTITUTIONAL CONTROLS REGISTRY

Description of Technology

The Florida Department of Environmental Protection (FDEP) Institutional Controls Registry (ICR) is maintained by FDEP for internal tracking of properties upon which an EC and/or IC (LUC) has been imposed pursuant to the provisions contained in Chapters 376 or 403 of the Florida Statutes. The ICR includes information for sites in programs, including the following:

- brownfield
- petroleum
- dry-cleaning solvent cleanup
- Superfund (CERCLA)
- RCRA or HSWA
- nonprogram (i.e., state enforcement or voluntary cleanup)

The ICR is accessible to the public via the FDEP website as either a database printout in PDF format or a GIS-based mapping application for all properties on the ICR. The Florida Brownfields GeoViewer, a mapping program for all brownfield sites, including those on the ICR, is also available via the website. Links to the database and mapping applications are provided below.

Features of Technology

The ICR Database includes the fields listed below for each property. Internal FDEP users can sort the database by any of these fields, while the printout or download available to the public is sorted alphabetically by site name.

- name, street address, city, ZIP code and county
- implementation mechanism (restrictive covenant, memorandum of agreement, etc.)
- IC type (water use restriction, land use restriction, digging restriction, etc.)
- EC type (impervious cap, vertical barriers, etc.)
- contaminated media (soil, groundwater, etc.)
- contamination (pesticides, petroleum, volatile organic aromatics, etc.)
- program area (RCRA, tanks, etc.)
- dates—IC recorded, order issued, order amended, IC removed

The ICR mapping application provides an interactive tool that allows users to find ICR properties, extract their records from the ICR database, and create/print maps at multiple scales. The user can do the following:

- Identify and select individual properties from a state map, then zoom to an aerial photo/map of the site and generate a printable table of the site-specific information in the ICR.

- Find properties by county, ZIP code or section-township-range and generate a map and list providing their locations and site IDs. The user can then select individual properties from the map or list to generate site-specific ICR information and/or a site map/aerial photo.
- Zoom to maps showing ICR properties based on various boundaries or coordinate systems, including county, city, ZIP code, street addresses, FDEP or Water Management District, drainage basin, latitude/longitude, or state plane coordinates, etc. The user can then select individual properties, as described above.
- Create and print maps using a variety of overlays.
- Extract spatial data to one of four output formats (shapefile, GML file, XLS [Excel] file, or map image).
- Generate advanced map queries.

Technology Platform

- ICR Database—Access database
- Mapping applications—web-based GIS (ESRI ArcIMS)

Cost Associated with Implementation

The database and mapping applications were developed in-house by FDEP personnel at an estimated cost of $50,000 over a period of one year. Other than occasionally adding new sites or revising data to reflect modification or termination of ICs, ongoing maintenance requirements are minimal (approximately one hour per month). Thus, long-term maintenance costs are low.

Advantages

- Easy access from anywhere via Internet
- IC information readily available to public improves local oversight
- Comprehensive inventory of properties from all programs
- Standardized data content
- Database query and sort functions (internal to FDEP)
- Printable and/or downloadable content, including custom maps

Limitations

Currently, the ICR does not include the following; however, there are plans to add some of these features:

- reminders/alerts to FDEP personnel of upcoming inspection or certification due dates
- hot links to downloadable site-specific documents (planned)
- tracking of inspection history/results
- site-specific IC boundary maps (planned)
- narrative descriptions or summaries of site history, environmental condition, etc.

Users

FDEP and the general public

Case Study

Project Location: Tallahassee, Florida

Project Team
- Mike Sole, at the time Assistant Director, Division of Waste Management
- Linc Clay, GIS Manager, Bureau of Information Systems
- Abby Dunn, DBA, Bureau of Petroleum Storage Systems
- Roger Register, Brownfields Liaison, Bureau of Waste Cleanup
- Francie Stoutamire, Webmaster, Division of Waste Management
- Dixie Davis, GIS Programmer, Bureau of Information Systems

Description of Technology Implementation
The ICR website has evolved since the first project meeting in July of 2000 and its first launch a year later. Software upgrades, content enhancements aimed at improving information regarding the registry, and data updates have all been accomplished in the last six years.

Original implementation:

- Windows 2000 Server SP2
- Apache 1.3.20
- Jakarta-Tomcat 3.2.3
- J2RE1.3.1/J2SDK 1.3.1
- ESRI ArcIMS 3.1

Current implementation:

- Windows 2000 Server SP4
- IIS 5.0
- Tomcat 5.0.2.8
- J2SE/J2SDK 1.4.2_06
- ESRI ArcIMS 9.1
- GeoCortex 5.1.002

Project Outcome/Lessons Learned
This project served as a pilot project for guiding future Internet mapping development at FDEP. ICR became the first production ArcIMS application for the department. It helped surface design considerations at both the application and system level that eventually contributed to the successful development and launch of the FDEP Web Mapping System, the department's enterprise Internet mapping system.

Links can be found at the following URLs:

- Institutional Controls Registry Database (pdf): www.dep.state.fl.us/waste/quick_topics/database_reports/default.htm
- Institutional Controls Registry mapping application: www.dep.state.fl.us/waste/categories/wc/default.htm
- Brownfields GeoViewer mapping application: www.dep.state.fl.us/waste/categories/brownfields/default.htm

References

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THE GUARDIAN TRUST™

Description of Technology

The Guardian Trust program (www.theguardiantrust.org) is a web-based integrated management system that can provide comprehensive long-term stewardship services to clients in both the private and public sectors. Guardian Trust provides many services, dependent on client needs, including site inspection, monitoring and reporting on land use and engineering controls, financial assurances, transfer of environmental liabilities, information and data management services, development of post-closure plans, and public training and outreach to local government and communities. Guardian Trust maintains all site, property, ownership, tenant, and real estate information in a broad database containing more than 600 data fields. Twelve sites throughout the United States (e.g., New York, Pennsylvania, California, Michigan, South Carolina, Rhode Island, Illinois, and Ohio) use Guardian Trust.

Guardian Trust technology provides assured protection of LUCs. It develops an implementation plan consisting of all finite tasks and elements to properly execute the LUC, then creates procedures and protocols to implement all the tasks whether major or minor, and provides long-term (anywhere from 30 years to forever) management of the LUC.

Features of Technology

- Design and implement site operations and maintenance programs
- Inspect and monitor all site soil and groundwater controls, including caps, leach fields, and other restricted areas
- Verify indoor air quality
- Inspect and test vapor barrier and soil venting systems
- Provide current owners and tenants with annual notifications concerning all site environmental restrictions
- Supervise receipt of annual owner and tenant acknowledgements concerning site environmental restrictions
- Inspect land use records to verify environmental easements, changes in land ownership, and changes in zoning
- Perform routine on-site maintenance to support in-place engineering remedies
- Manage response activities in the event of a contamination release
- Create and maintain database of permit issuance (for construction, demolition, and soil movement permits) connecting to particular cities, enabling the trust to be aware of any permits issued for a trust property within 24 hours of issuance and allowing immediate action where indicated to prevent any adverse impact
- Coordinate communications between owner and tenants on environmental issues
- Attend tenant association meetings on behalf of owners
- Prepare and disseminate reports detailing annual activities, status of all land use and engineering controls, and recommendations for improvements in the functioning of controls
- Prepare easement documents, including all title work, surveys, and title opinions
- Oversee and train site personnel on response and reporting procedures

- Train contractors at the site on environmental hazards and safety protocols (The trust is exploring the ability to allow clients to remove all liabilities associated with LUCs. This includes the trust assuming the liability under "What if...?" scenarios in terms of environmental risk management.)

Technology Platform

Guardian Trust maintains web-based access for each site of all general ownership, regulatory experience, tenant, site, land use, and real estate information, as well as the periodic inspection and monitoring data generated via field activities. The information is kept in an integrated database that can be accessed by owners, regulators, contractors, and the general community with varying levels of access and security via a project website.

Cost Associated with Implementation

Guardian Trust contracts with each client to perform the long-term stewardship of the land use and engineering control for periods of 30 years or more (including in several instances perpetual stewardship). In exchange for a one-time payment representing the present discounted value of the sum of the initial and annual costs for the implementation and maintenance of the LUCs, the trust assumes the stewardship obligations associated with the site. Initial costs include implementation, underwriting, legal, and engineering expenses. However, as a not-for-profit entity, the trust does not require a profit margin. Thus, Guardian Trust is able to give clients an accurate below-market fixed price for its services.

Advantages

- Offers long-term stewardship services to both the private and public sectors
- Offers all-inclusive program of inspection, monitoring, and reporting
- Relieves companies of day-to-day management of environmental post-closure issues
- Provides experienced management of post-closure environmental tasks
- Mitigates post-closure environmental risks
- Facilitates transfer of properties for redevelopment
- Provides public and private stakeholders with a way of meeting their post-closure responsibilities
- Helps regulators to minimize oversight costs and maximize knowledge of site activities

Limitations

Guardian Trust is not currently accepting any sites that involve nuclear contamination.

Users

This system is currently being evaluated by 12 private-sector companies and state and federal regulatory agencies. Specifically, Guardian Trust is being used in a pilot project for institutional controls at a Superfund site. As part of the pilot project, Guardian Trust will develop a monitoring plan to perform tasks for at least 30 years. On behalf of the landowner, monitoring

tasks include aspects of verification, inspection, and reporting of LUCs. On behalf of the regulatory agency, the trust will be responsible for oversight tasks usually performed directly by the regulatory agencies, such as periodic inspection and monitoring of ECs and compliance assessments.

Case Study

Project Location

Guardian Trust is being used for the implementation and operation of LUCs at the Peterson/Puritan Superfund Site in Cumberland and Lincoln, Rhode Island. In addition to supervision of the LUCs, the trust is also implementing the required environmental easements on behalf of the responsible parties, USEPA, and the Justice Department. This work includes the preparation of all surveys, title work, and title opinions.

Project Team

- Guardian Trust
- Guardian Trust Management Services, LLC (the manager of the trust)
- Earth Pledge Foundation (the sponsor of the trust)
- Trustees of the Trust

Description of Technology Implementation

Detailed information can be provided upon request as this is proprietary information. In general terms, Guardian Trust will provide oversight of the LUCs. In all aspects, Guardian Trust coordinates with the towns, local community (residents), and state and federal regulators to ensure all LUCs are properly executed. The trust will also provide implementation of the required LUCs for the site.

Project Outcome/Lessons Learned

To successfully implement long-term stewardship, there is a need to identify all specific procedures to verify, inspect, and report the execution of LUCs. Identifying and separately pricing all procedural tasks, whether big or small, will mitigate the risks of long-term stewardship. The use of such detailed methodologies combined with sophisticated statistical modeling provides a method of accurately pricing such long-term activities over many years.

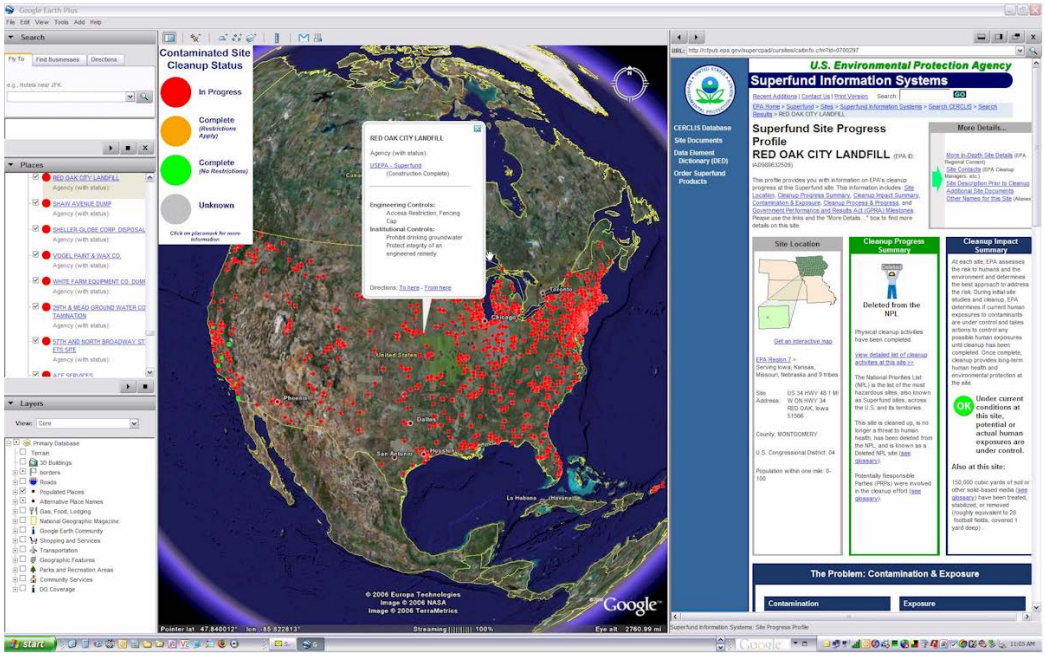
References

- Scott Spoerl, Unilever
- Catherine Smith, USEPA Region 1
- Bruce-Sean Reshen, CEO, The MGP Group

GOOGLE EARTH ENVIRONMENTAL LAYER BY TERRADEX

Description of Technology

Google™ Earth is a web-based technology that allows the user to open Google Earth, activate the environmental sites layer (now an Internet link), and then browse through an area of interest for environmental sites (www.earth.google.com). The user would see that some sites have federal or multiple state agency listings. The user doesn't have to worry about finding which agency website to visit; the Internet links are embedded. The user can browse seamlessly from one state to another and not be burdened with any change—that is done in the background.



The Terradex application (www.Terradex.com) aggregates the information from 120,000 sites referenced on websites—primarily location, status, and URL. The layer includes national federal RCRA corrective action and Superfund sites. The layer also includes California (EnviroStor, GeoTracker, and Solid Waste Information System), Oregon, Washington, and New Jersey listebsites.

Features of Technology

- The Google Earth application can serve as a resource to any local or state government that desires to map environmental site locations assembled from state and federal agencies. The technology has served several audiences.
- Colored icons illuminate the status of the site—red for cleanup in progress, yellow typically for sites with ICs, and green for sites where cleanup has been achieved.
- Mouse-over a site to learn its name; click on the site to display basic information.
- Within the site description, choose to link on the regulatory link(s).
- Zoom out to show federal facilities.

- When a link over a site is clicked, the integrated Internet browser window displays the site-specific agency website. The Google Earth application increases the use of a state environmental agency's Internet resources, while also introducing them to overlapping federal or regional resources.
- Ability for a user to comment on the location or accuracy of an environmental site record.

This layer within Google Earth is a work in progress. Within the states of California, Oregon, Washington, and New Jersey, one can see representative data density. The balance of the states do not yet have the site data collected and processed into this layer.

Technology Platform

The Terradex Environmental Layer with Google Earth is a computer platform technology which requires that the user download Google Earth (Version 4). The data are in a SQL2005 server, and the Google Earth network link is served from an Internet server. Terradex hosts the data layer and has entered discussions with Google to incorporate the information within the public views. Now a user obtains the link to the content from Terradex's website. Given the hundreds of thousands of data points, the environmental sites are transferred to users based on the latitude and longitude of their view window. As a user zooms closer, the server increases the site shown. With some compromises in speed, Terradex also maintains a Google Maps Internet version of the same data that can be done through a web browser without having to use the Google Earth software. The data are obtained through freedom-of-information requests and from agency websites. Terradex then process the site data and geocodes those without latitude and longitude.

Cost Associated with Implementation

The effort to date has been self-funded by Terradex. Implementation would cost about $250,000. It is hoped that the layer would be sustained through advertising or could be supported by government funding. After funding, the application would allow greater state participation in managing the Google Earth layer. There is no cost to the individual user. The Google Earth layer is a link or tool that connects the user to existing websites or Internet pages.

Advantages

- Has the capability to locate all environmental data
- Relies on complex data presentations by individual agencies
- Points the user to the correct agency website
- Complements but does not replace important state web presence

Limitations

- Not all sites are shown because some agencies do not have websites or have poor address records. (Google Earth can show basic site information, pending an agency's creation of a web presence; geocoding can be provided during the assembly of the application.)
- Now using Google Earth. Terradex has a prototype built on viewing through an Internet browser based on Google Maps API. This version is slower, but with some investment might

augment the Google Earth deployment. There is a cost for business/government to use Google Earth that the browser-based version would offset.

- Google Earth Version 4 is a beta test, so some links may have errors, and the national coverage is not complete.
- Terradex provides an interpretation of site status that seeks to simplify understanding. To date, Terradex has discovered approximately 200 different status statements for sites and chose to simplify to three statuses for the site icons. Terradex's attempt to balance ease of understanding may cause some initial loss of information embodied in the precision of regulatory status statements.

Users

- General public—The target audience is the public. Google Earth and Terradex provide an intuitive way for the general public to discover neighborhood environmental sites and learn their status, including any LUCs.
- Planning departments—City or local government planning departments have used it as an easy way to find various sites within their jurisdictions. Planning departments have been able to follow links to more specific information.
- Environmental agency staff—Regulators have used the site as a way to see the overall environmental site setting within a jurisdiction ("feds" see state, states see feds, etc.)
- Industry—Several industry groups representing excavators, water well drillers, and real estate agents have viewed the technology as another way to find/show data.

Case Study

Project Location: Palo Alto, California

Project Team: Palo Alto Planning Department

Description of Technology Implementation
The environmental sites layer has been a resource to planning staff in the discretionary planning process. The layer has permitted radius searches for impaired properties, thereby informing planners as they evaluate projects.

Project Outcome/Lessons Learned
The service has been helpful to planning, required little training to apply, and did not burden IT staff. Challenges were encountered when upgrades to Google Earth occurred, but these were resolved through Terradex.

First, follow the link to install the Version 4 Beta of Google Earth. You must update Google Earth (http://earth.google.com/download-earth.html)

Then click the link to download the BETA environmental sites layer network link. The link is available at http://terradex.com/publicpages/ge/env.kmz.

References

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INTERNATIONAL CITY/COUNTY MANAGEMENT ASSOCIATION (ICMA'S) ENVIRONMENTAL LAND USE CONTROL WEB RING

Description of Technology

ICMA's Environmental Land Use Control Web Ring (www.lucs.org) is an Internet navigation tool providing one-stop, direct access to a multitude of IC/LUC web pages, including web-accessible federal, state, local, and commercial IC/LUC databases and private-sector and researcher information sites. The Web Ring groups a variety of IC/LUC web pages in an intuitive, interactive graphic directory designed to speed Web Ring users to specific web pages in two clicks of a mouse.

Features of Technology

- Websites on the ring are grouped into sectors to help with searches for information. There is also a search function.
- Each web page on the Web Ring contains a small icon linking back to the navigation tool.
- The site is used by anyone seeking information on LUCs: developers, community members, government regulators, researchers, and more.
- The overall goal of the Web Ring is to make LUCs for redevelopment on environmentally impaired properties more effective.

Technology Platform

This web-based tool requires little or no software or expertise. Adding an icon to an existing web page is an easy process that takes minutes. Ring members must work through their existing IT staff and protocols to add their site to the ring. The website contains detailed information on how to add the icon to a site and a selection of icons to choose from.

Cost Associated with Implementation

- It is estimated to take less than one hour of IT staff time to add an icon to a site.
- Currently, there is no cost associated with joining the Web Ring, and there will never be a cost for government agencies to join since their web pages are the primary source for IC/LUC information for users of the ring.
- In the future there may be a small operation and maintenance fee assessed to private-sector firms on the Web Ring. Private-sector firms should realize an increase in business activity due to membership on the Web Ring.
- Web Ring members are encouraged to create new web pages dedicated to the issue of IC/LUCs, which might incur additional costs, but that is decided on an individual basis.

Advantages

- Joining the Web Ring will increase traffic to members' site and help disseminate existing IC/LUC information to those who need it.

- Joining the Web Ring allows members to share information among the growing community around the issue of ICs.

Limitations

- The Web Ring itself does not have the ability to search multiple databases of information on sites.
- It only allows the user to better find individual databases or information sources on sites.

Users

Any interested party with access to the Internet. The idea behind the Web Ring is to provide an easy-access clearinghouse of Web-related IC/LUC information.

References

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LAND USE CONTROL (LUC) TRACKER (NAVY)

Description of Technology

The Navy-developed LUC Tracker is a web-based data management system for use by Navy RPMs and installation personnel responsible for LUC implementation and monitoring. LUC Tracker is a secure system for collecting, maintaining, selectively sharing, and managing LUC data. The data management system tracks site information, including ownership, type of contamination, and interim and long-term LUC restrictions and requirements. In addition, LUC Tracker provides information on inspection, certification, and reporting requirements and includes information on those responsible for submitting such information. Documentation of these requirements is facilitated through the generation of standardized forms and reports that help to keep information input consistent. While LUC tracker provides centralized data storage regarding LUCs, it also provides automatic reminders to Navy RPMs, regulators, owners, operators, and tenants of required submissions. LUC Tracker contains a query component that enables the user to find information on the number and or types of violations, common contaminated media, and affected media.

LUC Tracker data are password-protected and available on an installation-specific basis to members of the respective project teams. Thus, users see only the data for installations/projects with which they are associated. Navy personnel have full access to data; other team members (e.g., regulators or contractors) may have access to select portions of data and/or features of the system. The ability to grant multiple parties access to appropriate system features will facilitate LUC implementation at joint service bases and mitigate the effects of personnel turnover associated with changes in command or project team membership.

The LUC Tracker application was developed for the Navy by Tetra Tech NUS, Inc. and MIJARA Corporation to meet the specific LUC management needs of the Navy. The application can be customized to meet the particular needs of other potential users, such as state regulatory agencies, municipalities, private industry, or other service branches and their facilities.

Features of Technology

Most data access features (e.g., view, print, query, download) are available to all users; however, data input, updating, and editing are normally be restricted to the personnel directly responsible for LUC monitoring (e.g., Navy RPMs) and inspection (e.g., Navy contractors or installation personnel). Depending on access rights, LUC Tracker allows the user to do the following:

- create/enter information on new LUCs using a standard entry form with drop-down lists and narrative fields
- review existing LUCs
- access inspection templates
- view/print LUCs documents such as deeds, maps, and management plans
- create standard inspection reports using templates provided by the system
- document and track deficiencies noted and corrective action taken

- notify appropriate parties of noncompliance
- view/print previous inspection reports
- certify compliance
- query the application database for inspection results, types and frequencies of restrictions, controls and/or violations, and contaminants driving the need for LUCs

Future versions will include an environmental GIS and modules for evaluating and documenting decisions related to requests for temporary waivers (LUCWAIVER) or termination (LUCTERM) of existing LUCs. Certain proposed reuse, redevelopment, and construction activities may require a LUCs waiver from the Navy and/or state and federal regulators prior to initiation of project activities. LUCWAIVER will guide users through evaluations of these requests by identifying the types of information that should be submitted with a request, walk the user through the evaluation process, and document the final decision made by the Navy and/or applicable regulatory agency. LUCTERM will provide detailed instructions for terminating a LUC. The LUCTERM component will serve to compile the information needed to evaluate a LUC termination request, document the decision-making process, and result in a document that can be forwarded to the appropriate regulatory authorities for concurrence. LUCWAIVER and LUCTERM are currently envisioned as tools that will be fully shared with non-Navy parties responsible for enforcing (e.g., states) and complying with (e.g., transferees) LUCs.

Technology Platform

The LUC tracker is a hosted, web-based data management system. The Navy currently accesses LUC Tracker through the Installation Restoration Collaboration Gateway, a web portal for Naval Facilities Engineering Command Southeast project teams). It will soon be migrated to the Naval Installation Restoration Information Solution (NIRIS), a Navy-wide environmental database and information application. LUC Tracker can also be accessed remotely in the field, enabling project team members to input real-time information and data.

Cost Associated with Implementation

Costs vary depending on many variables, such as the degree of customization, the number of individual users within an organization, the number of sites being tracked, and the number of LUCs. In general, annual costs should be in the range of tens of thousands of dollars, not hundreds of thousands.

Implementation costs include the following:

- initial customization, installation, and setup
- data entry
- hosting—a monthly fee that includes data storage, archive, backup, and retrieval
- maintenance—annual fee for application upgrades, help desk access, data management and assistance, key creation and maintenance

Data entry costs are primarily front-end labor costs associated with entering installation, facility, or organization-wide information (ownership, points of contact, etc.), entering site-specific information (contaminants, restrictions, controls, etc.) for each "controlled area" (i.e., a parcel or site with LUCs) at a location, and uploading documents to the data management system. After initial data entry, labor costs drop off significantly. Other than occasional costs for adding new sites or revising data to reflect modification or termination of LUCs, labor costs are mainly associated with entering inspection results to create reports.

Advantages

- Secure system for collecting, storing, selectively sharing and managing LUC data
- Centralized data storage
- Easy access, including remotely from the field
- Standardized data content and reports
- Efficient tracking of LUC requirements and compliance and land use changes through storage and retrieval of previous inspection reports
- Automatic e-mail reminders and notifications regarding upcoming inspections and outstanding issues (e.g., corrective action requirements)
- Makes LUCs a more viable part of remedies by facilitating implementation and monitoring
- Query function
- Hosted service—globally accessible, technology independent, no IT/management information system costs, automatic hardware/software patching, antivirus maintenance, backup servers
- Capable of browser-based field data (inspection) collection with or without (off-line synchronization) Internet connection
- Can customize to create export files in user-specified formats (e.g., USEPA Institutional Control Data Standard or state-defined formats)
- Easily customized

Limitations

- Internal management tool—not currently set up to share information with public
- Off-site hosting might be in conflict with state or other organization management information system policies

Users

Currently, the system is for use by the Navy and its project teams, but it has the potential to be adapted for use by various LUC stakeholders, such as state regulatory agencies, other service branches, and municipalities.

Case Study

<u>Project Location</u>
Eventually, implementation will be Navy-wide. Currently, LUC Tracker is in the early stage of implementation. Beta testing has been completed, and several installations, both closed and

active, are beginning implementation, including Naval Support Activity Mid-South in Millington, Tennessee; Naval Air Station Key West, Florida; the former Naval Training Center, Orlando, Florida; and the Charleston Naval Complex, South Carolina.

Project Team

- Navy, Tetra Tech, and MIJARA Corporation
- Installation Restoration Collaborative Gateway
- Naval Installation Restoration Information Solution

Description of Technology Implementation

The application evolved from a request for a simple tracking spreadsheet for RPMs to an Access database to a web-based interface available to all. A pilot facility was selected for data entry, and changes were made during development based on the lessons learned while entering the data. A beta testing period followed during which all Naval Facilities Engineering Command engineering field divisions were provided access for one or two test installations via the Installation Restoration Collaborative Gateway (IRCG), resulting in additional feedback and revisions. LUC Tracker went "live" on the IRCG in early 2007 and will be migrated to Naval Installation Restoration Information Solution (NIRIS) sometime during the same calendar year. More changes and enhancements are anticipated as feedback is received from the increased number of installations and users.

Project Outcome/Lessons Learned

The system is being successfully deployed, and the database populated; however, it is too early to provide examples of successes related to the inspection process. Lessons learned during development and implementation include the following:

- There was not a standard process for managing LUCs in place when this project started, so potential users did not know exactly what they wanted. Rather than try to design a system with every conceivable bell and whistle, it was more efficient to develop a basic system and add enhancements based on ideas and needs identified during beta testing period. This process will repeat itself as the system goes live and feedback is received from more users. For example, the current query function has a finite set of options relative to the potential combinations of query parameters. Rather than try to anticipate every possible parameter for dropdown lists, this function will be continuously enhanced as users identify the search parameters they need.
- Initial collaborative feedback is important—different users have different requirements.
- Adding an installation or facility to the system requires a relatively high level of effort for data entry on the front end, but the system becomes self-sustaining and requires little maintenance other than inputting inspection reports.
- Data entry level of effort is highly variable depending on availability and completeness and format of the records to be used/uploaded (e.g., maps, deeds, LUC management documents).

References

- Dan Waddill, Naval Facilities Engineering Command Atlantic, 757-322-4983

- Mike Kuhn, Tetra Tech, 412-921-8942

LAND USE COVENANT IMPLEMENTATION AND ENFORCEMENT PLAN

Description of Technology

LUC I&EP is a tool for ensuring LUCs are implemented and remain in place. It can be applicable to land use restrictions applied as part of cleanups in California and other states.

Features of Technology

The purpose of the LUC I&EP is to ensure the selected LUC for the site is implemented, monitored, and enforced. Typical objectives of a LUC are as follows:

- restrict future use of the property to prevent exposure to certain receptors (e.g., no residential use, no child-care centers, no hospitals)
- prevent disturbance of contaminated soil without an approved soil management plan
- protect groundwater monitoring wells from damage
- prevent use of groundwater for domestic purposes
- set forth LUC monitoring and reporting frequencies

The LUC I&EP model framework should be adapted to each site. However, the following basic information is included:

1. Site information, purpose and objective of the implementation and enforcement plan
   a. History and status of investigations and remedial actions taken
   b. Selected remedy and implementation of land use restrictions
   c. Implementation of LUC provisions; responsibilities of the responsible party, the owner, and regulatory agencies
2. Land use restrictions monitoring, reporting, and self-certification
   a. Annual inspection and certification of land use restriction implementation, community outreach and notification
   b. Discovery of contaminated soil or groundwater
   c. Oversight cost reimbursement to agencies
3. Enforcement of land use restrictions/land use covenant
4. Annual agency oversight cost estimate

Technology Platform

While the LUC I&EP is a written document detailing the LUC strategy, many individual tools and/or methods may be called for in the plan that are used to implement and monitor the LUC. These could include any of the other tools mentioned in this document.

Cost Associated with Implementation

Costs depend on the size and scope of the site and the complexity of the remaining pollution and engineering controls. In general, most of these costs will be those associated with remedy selection and cleanup, including drafting the LUC itself. The development of a LUC I&EP will

generally require an engineering consultant and environmental attorney, followed by review and comment by the oversight agency. Reaching the final version of the plan may require several rounds of revisions and negotiation.

Ongoing costs with implementing the plan depend on the specific monitoring activities selected in the plan. Annual inspections, reports, and certifications will bear some production costs. The time spent by an environmental professional and attorney will represent some of the annual costs, as will the oversight agency's oversight costs. These annual costs can be estimated in the LUC I&EP itself to ensure future owners are aware of them.

Advantages

LUC I&EPs

- are public and legal documents that specify all aspects of LUC implementation, monitoring, and enforcement
- clearly define roles, responsibilities, and expectations
- can provide inspection forms and certification checklists to assist property owners in monitoring and enforcing LUCs
- are developed with buy-in from owner, agency, and locality as needed
- alert property buyers to the LUCs in place site

Limitations

- Paper documents work only if people read them and follow recommendations.
- Generally there is a reliance on self-monitoring and reporting.
- Limitations can be addressed through application of other IC technologies designed to monitor for inappropriate site use.

Users

This tool is currently undergoing evaluation.

References

Gary Riley, USEPA Region 9, 415-972-3003

LAND USE CONTROL IMPLEMENTATION PLAN

Description of Technology

A LUCIP is an (often nonbinding) agreement that formalizes the roles and responsibilities of state and/or federal environmental regulators, local government officials, and private stakeholders in the long-term administration and management of LUCs (www.lucs.org, Burke and Sullivan 2003). LUCIPs may involve the property owner, potentially responsible parties, state environmental regulators, and/or local government departments. A LUCIP can take many forms, depending on the nature of the contamination, the type of LUCs used, and the relevant regulatory authorities.

The LUCIP model framework is based on a plan developed between the city and county of Denver and the State of Colorado. LUCIPs should be tailored to fit the specific types of sites, the relevant regulatory frameworks, and the stakeholders involved. The model is designed as a menu from which local governments and other stakeholders can choose elements appropriate to their particular LUC circumstances. Therefore, site-specific LUCIPs may contain all of these elements, just a few of them, or modifications that may be more appropriate to the local situation. The International City/County Management Association (ICMA) recommends that governments using this model framework tailor it to fit their own particular needs.

The model LUCIP was developed under a cooperative agreement between ICMA and the USEPA Office of Brownfields Cleanup and Redevelopment. Complimentary electronic copies of the model LUCIP can be found at ICMA's LUC information clearinghouse, www.lucs.org.

Features of Technology

- Provides information on existing LUCs.
- Describes roles and responsibilities for monitoring and maintenance.

Technology Platform

A LUCIP is a written memorandum of understanding/agreement (not a computer application) between two entities on what residual contamination remains on site and the LUC implemented to ensure protection of human health and the environment. It identifies the party(ies) with responsibility for long-term maintenance and monitoring. The MOU can be stored on a database, depending on how the state manages LUC information.

Cost Associated with Implementation

Costs varies depending on many variables, such as the degree of customization of the model document and associated staff time. These documents can be a time-intensive effort to ensure that everyone's needs are met.

Advantages

- Provides a clear indication of responsibilities for monitoring and maintenance of LUC.
- Provides the necessary steps and timelines to follow to ensure effectiveness of LUC is maintained.
- Provides a standard for reporting.

Limitations

- Doesn't provide a tracking tool.
- Doesn't provide a notification tool.
- Internal management tool—not currently set up to share information with public.

Users

Currently, versions of the LUCIP are being used by some state regulatory agencies.

Case Study

The LUCIP model framework is based on a plan developed between the city and county of Denver and the State of Colorado. LUCIPs should be tailored to fit the specific types of sites, the relevant regulatory frameworks, and the stakeholders involved in LUCs. This model is designed as a menu from which local governments and other stakeholders can choose elements appropriate to the particular LUC circumstances. Therefore, LUCIPs may contain all of these elements, just a few of them, or modifications that may be more appropriate to the local situation. ICMA recommends that governments using this model tailor it to fit their own particular needs.

References

Additional information on LUCIPs can be found at www.lucs.org.

MINNESOTA SITE INVENTORY DATABASE

Description of Technology

The Minnesota Pollution Control Agency (MPCA) maintains a searchable database inventory of properties that includes those already investigated and cleaned up, those currently enrolled in MPCA cleanup programs, and those investigated and found to be clean. The inventory includes information on whether ICs have been imposed at individual sites and is available to the public via the MPCA website. It is searchable via an interactive GIS-based viewer or several text-based methods. The inventory includes the types of sites listed below, but does not include leaking underground storage tank sites. A separate, searchable database maintained for petroleum storage tanks provides basic site information but not IC information.

- CERCLIS sites
- no further remedial action planned sites
- federal Superfund sites
- state Superfund sites
- delisted state Superfund sites
- permitted solid waste sites
- state assessment sites
- unpermitted dumps
- Voluntary Investigation and Cleanup (VIC) Program sites
- state closed landfill sites
- RCRA treatment, storage, and disposal facilities
- RCRA investigation/cleanup sites

Features of Technology

There are several options for locating sites with ICs in the MPCA inventory:

GIS-Based Search. The "What's in My Neighborhood?" interactive viewer allows users to view sites by clicking on a printable map. Users can go to the area they are interested in using a zoom tool or quick-zoom to a city or county. They can then click on individual sites shown on the map or search for sites by city/town/place (dropdown list), site ID, site name (dropdown list), street address, township/range, and ZIP code. After zooming in to a smaller scale area, the user can toggle between the map and an aerial photograph.

Clicking on a site brings up a printable table that provides basic information about the site, including the MPCA site ID, name, address, and applicable program types (see list above). This information can be used to obtain additional information by performing one of the text-based searches described below. If the site is enrolled in the VIC Program, the table includes a link that performs a VIC database search yielding additional site-specific information that includes status (active/inactive) and size (acres), MPCA contacts, recent reports (names and dates), and events (regulatory process milestones and their dates), including IC information, when applicable.

Comprehensive Text-Based Search. "What's in My Neighborhood?" users who prefer a text-based search or have a slower Internet connection can search by site type (dropdown list of MPCA programs), site ID, site name, county (dropdown list) or ZIP code. Selecting a site type, county, or ZIP code generates a list of sites from which an individual site can be selected. This method does not allow the user to limit the search to IC sites only. Selection of an individual site yields a small location map and the same information provided by the table in the GIS viewer. If available, IC and event information is also included.

Program-Specific Text-Based Search. Users can also conduct separate searches of the RCRA, Superfund, and VIC program databases. The search can be conducted by site ID, site name, city, county (dropdown list), ZIP code or congressional district (dropdown list), and the user can limit the search to IC sites only. Searching by city, county, ZIP code, or congressional district generates a list of sites from which an individual site can be selected.

Selection of an individual site yields the basic site information described for the other search methods above and additional site-specific information that includes status (active/inactive) and size (acres), MPCA contacts, recent reports (names and dates), and events (regulatory process milestones and their dates), including IC information, when applicable.

At a minimum, IC information included in the inventory consists of the type of IC (e.g., restrictive covenant) and relevant dates. In some cases, MPCA project managers inputting the data include a brief IC narrative describing site-specific restrictions, notification requirements, and/or contaminants.

Technology Platform

The MPCA site inventory is a single Access database. The inventory does not include petroleum storage tanks, which are in a separate database. The GIS-based interactive mapping application is powered by ESRI's ArcIMS Internet technology. Street address matching for the viewer is based on Geographic Data Technology's Dynamap 2000.

Cost Associated with Implementation

The database for remediation sites was developed by a contractor about 10 years ago for a cost of approximately $15,000. The "What's in My Neighborhood" GIS viewer was developed more recently by in-house MPCA personnel for an estimated cost of $80,000. The GIS viewer was developed for multiple MPCA programs and has a variety of other uses. Ongoing maintenance costs for staff members to clean up data, add new sites, or revise data for existing remediation sites, including the modification or termination of ICs, are approximately $8,000 per year. Efforts are also under way to include information about remediation sites in another database called "Delta," which will ultimately be used to inform the "What's in My Neighborhood" application.

Advantages

- Easy public access from anywhere via Internet.
- Easy-to-find search functions from home page (three clicks for any of the options).

- Comprehensive inventory includes properties from all nonpetroleum programs.
- Searchable database.
- Web-based interactive viewer facilitates locating all sites in an area.
- Key regulatory process milestones ("Events") are documented.
- Site-specific MPCA contact information available to public.
- Printable tables and maps.
- Program-specific database searches can be limited to IC sites only.

Limitations

The database inventory does not currently include the following functionality and/or content:

- an "IC Sites Only" filter for "What's In My Neighborhood?" searches (GIS- and text-based)
- detailed IC information (restrictions, controls, boundaries)
- narrative descriptions or summaries of site history, environmental condition, etc.
- reminders/alerts to MPCA personnel of upcoming inspection or certification due dates
- tracking of inspection history/results
- hot links to downloadable site-specific documentation

Users

Currently in use by MPCA and the public.

Case Study

Project Location

The MPCA's GIS graphical interface "What's in My Neighborhood" was developed in-house by MPCA staff. MPCA Project Team:

- Linda Moon, project manager/process owner
- Karin Erickson, GIS data developer and ArcIMS developer
- John Abbott, ColdFusion and mySQL developer
- Pat Lannon, Access developer
- Andrea Wieland, web designer
- Carole Nelson, project assistant
- Walker Smith, communication development and consultant

Also, the Minnesota Department of Agriculture (MDA) consulted with MPCA developers, when developing its web page (www.mda.state.mn.us/incidentresponse/neighborhood.htm), which is also called "What's in My Neighborhood." MDA named the site the same so people would get used to going to "What's in My Neighborhood" when wanting to look up site information. The MDA is the lead agency for response to and cleanup of agricultural chemical contamination in Minnesota.

Technology Used

- Access and mySQL databases
- ColdFusion
- Dreamweaver
- Java Script
- ArcIMS

The MPCA is migrating to an Oracle database back end this year.

Lessons Learned

- It was important to include staff with diverse backgrounds during the development of "What's in My Neighborhood." For example, program staff are knowledgeable about the data to be included and the audience to be served. Technical experts are able to develop and design an application that best meet the needs of both internal staff and external parties, and communication experts are essential to the success of the web page.

- It is important to have people with little to no experience using GIS software test the application before going live. What seems obvious to GIS users can be quite confusing to people unfamiliar with the terms and tools of GIS.

- You learn quickly about the value of good data. People will let you know quickly if a site is incorrectly located.

References

Links for these searches are available in several places on the MPCA website, including the following:

- MPCA Searchable Environmental Data: www.pca.state.mn.us/data/index.html
- What's in My Neighborhood?: www.pca.state.mn.us/backyard/neighborhood.html

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NETR ONLINE—REAL ESTATE INFORMATION AND PUBLIC RECORDS RESEARCH

Description of Technology

NETR Real Estate Research and Information, LLC (NETR, www.netronline.com) provides nationwide information services. The system acts as a portal to official state websites and those tax assessors' and recorders' offices that have developed websites for the retrieval of available public records over the Internet. The site provides access to real estate public records and research information portal for property information, deeds and mortgage copies, tax records, parcel maps, assessment records, and public records nationwide. State and county government records can be accessed through the Public Records Online portal, and property information can be obtained through the online Property Data Store.

Although not every county and parish has data online, many have home pages, and where neither is available, NETR provides a telephone number. NETR's Public Records Online portal provides access to information about recorded instruments such as real property records, mortgages, liens, easements, etc. NETR also provides historical chain-of-title-reports for due diligence to satisfy the requirements of the USEPA's All Appropriate Inquiry Rule.

Features of Technology

- The three main areas available are Property Data Store, Public Records Online, and Environmental Issues.
- The Data Store Products include aerial, parcel, and topographic maps, property and transfer details, property detail reports, etc.
- The site provides a U.S. map where each state can be searched for public records.
- The tab for Environmental Issues introduces the user to a list of environmental issues that may affect real estate, such as asbestos, underground storage tanks, etc. When the user identifies a specific environmental issue and a specific state, NETR provides a list of service providers for that issue and a list of regulatory agencies within that state.
- The system is searchable by name of property owner, a point on the map, address, assessor's parcel number, or even site alias (i.e., historical name or project name).
- The site provides an introduction to "due diligence" and "all appropriate inquiry" as well as the regulatory background.
- The site provides a real estate glossary.

Technology Platform

The technology appears to be a front-end web portal application with an integrated mapping module.

Cost Associated with Implementation

There is a charge based on the portal that is chosen. For example, a Transfer Detail Report is priced at $5.00, and an example of the finished product is available for viewing. The retrieval of a Parcel Map costs $3.00 and may provide the book, page, and date of recordation.

Advantages

- Allows the user to research any states' tax and public record information.
- Allows the user to quickly switch from one state to another.

Limitations

- The user may be limited to searching for sites about which the user has prior knowledge, i.e., the name of the property owner, address, tax map serial number, county, and state.
- The web-based tool itself does not have the ability to search multiple databases of information on sites; i.e., the user cannot randomly search for all of a certain type of sites within a county or state.
- The user may be able to more easily find individual databases or information sources about sites.
- The database is limited to those counties, states, or entities that have made public records available on the Internet.
- LUCs are not listed among the environmental issues.

Users

The site can be used by anyone seeking information about real property and the instruments that have been recorded, particularly restrictions on real property. Developers, community members, government regulators, researchers, and others would be able to find the LUCs once they are recorded and made available through the Internet.

References

- www.netronline.com
- NETR Real Estate Research and Information, LLC, 2055 E. Rio Salado Parkway, Suite 201, Tempe AZ 85281

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION'S LUC TRACKING SYSTEMS

Description of Technology

NJDEP has two tracking systems for LUCs. One system, the New Jersey Environmental Management Information System (NJEMS), is used by the NJDEP RPMs to provide notification when a certification for a LUC is due. This function of NJEMS is not accessible by the public; it is a function used only for internal tracking and notification purposes. NJEMS also stores information on LUCs. Groundwater LUCs are referred to as Ground Water Classification Exception Areas. Information on CEAs in NJEMS consists of the vertical and horizontal extent of the CEA, the contaminants that exceed standards, and any restrictions on wells within the CEA. Soil LUCs are recorded in New Jersey as deed notices. NJEMS stores information on the horizontal extent of the deed notice, the types and levels of contaminants that remain on the property above residential standards, and what type of EC is required (if any). The NJDEP RPM must manually input all information regarding LUCs into NJEMS.

The other system is i-MapNJ, a GIS-based system. This system can be accessed by the public through the NJDEP website and shows the locations of all LUCs in New Jersey as well as information about the LUCs.

Features of Technology

<u>NJEMS</u>

- The ability for the NJDEP RPM to enter the due date for a LUC certification into the system (certifications that LUCs remain protective must be submitted every two years in New Jersey). The system then provides notification of the due date on the project managers' to-do list and is highlighted if it is past due.
- If a certification is overdue, the NJDEP RPM can use the letter builder function in NJEMS to issue a notice of violation to the party responsible for submitting the certification, stating that the certification is past due.
- Information on LUCs at sites including the location, contaminants that remain on site, restrictions, and ECs.

<u>i-MapNJ</u>

- A search capability for the public and local officials to locate LUCs on a map by entering the address, municipality, or county.
- An avenue for the public to find a site in their town or neighborhood with a LUC.
- A publicly accessible route to site information including contaminants at the site and the phone number of the NJDEP project manager.

Technology Platform

NJEMS is an Oracle-based proprietary system developed for NJDEP and maintained by an outside firm. i-MapNJ uses ESIR software and is maintained by NJDEP IT personnel.

Cost Associated with Implementation

The equivalent of two IT professionals is needed to maintain and update i-MapNJ. Approximately 10% of the RPMs' time is needed to update information in NJEMS.

Advantages

- NJEMS notifies NJDEP project managers when a LUC certification is due and provides easy access to LUC information.
- i-MapNJ enables both the public and municipal government staff to make land use decisions with knowledge of LUCs since it identifies parcel by parcel restrictions.

Limitations

- NJEMS notifies NJDEP project managers of due dates: however, the due date information must be manually input into the system first by the project manager.
- Some of the information in i-MapNJ can be a challenge to access for a first-time user. A tutorial is provided and is recommended for those not familiar with the system.

Users

NJDEP RPMs use NJEMS. The public, municipalities, developers, and environmental professionals regularly use i-MapNJ to identify LUCs.

Case Study

Project Location: Woodland Township, Burlington County, NJ

Project Team: NJDEP staff

Description of Technology Implementation
A New Jersey resident called NJDEP asking about the quality of the groundwater in Woodland Township, Burlington County, New Jersey, since she was considering building a home in that township and installing a well for drinking water purposes. The resident heard that there were two Superfund sites in the township and that the groundwater was contaminated. She wondered if this contamination could impact the groundwater on the property she might purchase. The NJDEP staff person confirmed that there are two Superfund sites in Woodland Township that had groundwater contamination and an IC (a CEA) was in place for each of the groundwater contamination plumes.

The NJDEP staff person then directed her to i-MapNJ on the NJDEP website. The resident was able to access the application on her home computer. Over the phone the NJDEP staff assisted her in finding the location of the property she might purchase as well as the location of the two CEAs, which are clearly shown on i-MapNJ. It was confirmed that the contaminated groundwater would not impact the property.

Project Outcome/Lessons Learned

i-MapNJ has proven to be very useful in this instance as well as many others. If this application had not been available, an inquiry such as this would have resulted in the staff member obtaining the address of the property and speaking with the project manager assigned to the Superfund sites. By using maps in the project file, it would be determined whether the property's groundwater was impacted. By using i-MapNJ, a considerable amount of time was saved, and it was very helpful to the resident to be able to see for herself where her considered property was located in relation to the contaminated groundwater.

References

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ONE-CALL SYSTEM

Description of Technology

The One-Call system (called "Dig Safe" or "Miss Utility" in some states) is a notification and information system initially developed for the pipeline and utility industry as a clearinghouse for excavation activities. The One-Call center helps to protect 911 emergency telephone services, underground power lines, water and sewer pipes, and energy pipelines. The One-Call program is set up so that anyone who will be digging or excavating using mechanized or other equipment, such as commercial contractors, road maintenance crews, telephone pole installers, fence builders, landscape contractors, or homeowners, can make one telephone call to provide notice of a plan to dig and allow owners and/or operators of underground utilities or pipelines 48–72 hours to mark out the lines with spray paint and/or flagging. These systems are set up in various states and are usually funded by the members who use it. A member is any company that has utilities that would be interrupted during the subsurface activities (town, electric companies, cable companies, etc.).

When a call comes in, One-Call locates where the work will occur and what members need to be notified of the proposed work. All members in the immediate vicinity are contacted to determine whether the proposed work could impact subsurface utilities.

This technology could also work for sites that have an IC placed on them. The owner of the property where a LUC has been implemented could become a member of One-Call and receive notices of subsurface work that may be occurring at or in the vicinity of the property.

Features of Technology

- Track sites with ICs.
- Notify to caller, state, and property owner of a request to conduct subsurface work.

Technology Platform

Based on the EPA pilot study, it appears that the location of the sites would have to be compatible with the platform used by the One-Call system.

Cost Associated with Implementation

The cost associated would be the annual fee to become a member of One-Call, estimated as $200+ per year. One-Call systems are operated on the state level and are generally governed by state law although they are normally not supported by tax dollars. One-Call centers are usually funded by the underground utilities and/or pipeline facilities in that state usually on a per call basis.

Advantages

The advantage of the One-Call system would be advanced notification of a proposal to conduct subsurface work at or near a site that has an IC placed on it. Once the notification was made, the entity responsible for the site could locate and determine whether the proposed subsurface work would negatively affect the IC placed on the site and contact the party who made the request.

Limitations

This system cannot be used by the general public to locate sites with ICs. Due to the One-Call system not working as a search engine, the state may need to have another public database in conjunction with One-Call.

Users

Currently One-Call is set up to serve the companies that own/maintain utilities. If transformed to focus on ICs, it would serve the property owner and the state, who would both be trying to maintain the IC.

Case Studies

The Pennsylvania Department of Environmental Protection (PADEP) One-Call Pilot focused on evaluating the feasibility and associated impact of requiring contaminated properties to join the Pennsylvania One-Call system. Draft legislative language was developed and proposed in the Pennsylvania legislature. Unfortunately, an agreement could not be reached between PADEP and the One-Call system. Future efforts will revisit the possibility of including the LUC information with the One-Call system.

In early 2002, the Wisconsin Department of Natural Resources (WDNR) One-Call Pilot placed closed properties on the Wisconsin One-Call system with the intent to require well modifications if a well driller proposed to construct a well on a contaminated property. Unfortunately, the database did not provide a high enough level of detail to precisely locate the properties, resulting in the issuance of a high percentage of false identifications ("tickets") and excessive costs without environmental benefit. In an attempt to reduce the number of false tickets, WDNR requested that the One-Call system modify the standard list of questions to flag only sites where groundwater wells were installed; however, this change was not made. WDNR participated in the One-Call system for more than two years and has since ended the relationship.

New York State Department of Environmental Conservation (NYSDEC) One-Call Pilot involved the evaluation of the existing NYSDEC IC tracking system and its compatibility with the New York One-Call system. Prior to this undertaking, NYSDEC decided to reformat its IC tracking system to a web-based database that is not complete at this writing.

Project Teams

- USEPA
- Pennsylvania Department of Environmental Protection

- Wisconsin Department of Natural Resources
- New York Department of Environmental Conservation

Project Outcome/Lessons Learned

In many cases the implementation of the One-Call system as a way to alert individuals of environmental concerns such as LUCs at contaminated sites was halted due to the expense of the service.

References

- www.epa.gov/superfund/action/ic/pdfs/hess.pdf
- www.epa.gov/superfund/action/ic/pdfs/hess_study.pdf
- www.epa.gov/superfund/action/ic/pdfs/mccutcheon.pdf

ONE-STOP INTERACTIVE RESOURCE AND INFORMATION SYSTEM

Description of Technology

The City of Emeryville, California considers its OSIRIS (One-Stop Interactive Resource and Information System) Mapped Real Estate Parcel Database to be a tracking, notification, and outreach technology. It includes date of notification, message, and e-mail contact fields that provide a message to key persons if an action is due on a property with an IC. The database has the key information on ICs (i.e., deed restrictions and other key documents) and links to regulatory agency websites such as GeoTracker and EnviroStor. It also includes links to other city GIS web applications such as real estate and planning.

Features of Technology

- The graphical interface works off GIS.
- Can list and display sites with ICs and other environmental information such as soil and groundwater results.
- Links to regulatory agency sites.
- Searchable by point on map, address, assessor's parcel number, or even site alias (i.e., historical name or project name).
- Produces reports of wells/borings and IC information.
- Has a range of planning/zoning and real estate availability functions.

Technology Platform

On the front end, the system is an ASP.NET web portal application with an integrated mapping module. All content and maps are dynamically created at runtime based upon a role-based permissioning model. It acts as a fully featured content management system. The system is supported on the back end by Microsoft's SQL Server, although it has an extensible provider model allowing for multiple database support. Currently the mapping components are supported by ESRI's ArcIMS. More complex functions (data editing, cartographic quality outputs) can be supported through the use of ESRI's ArcGIS Server.

Cost Associated with Implementation

According to information provided by system representatives, costs are highly dependent on the level of functionality desired in the system and whether it is a hosted solution maintained by Sanborn (the current off-site host). Development costs for projects similar to Emeryville's have run the scale from $25,000 for a simple mapping site with map exploration tools to $100,000 for a complex system full of custom tools. Hosting costs are generally around $2,000 per month to host the entire system and all data and to provide bandwidth for public users. This approach also mitigates the need for clients to purchase expensive SQL Server and ESRI ArcIMS licenses of their own (savings of approximately $25,000 + 20% annual maintenance). With regards to system maintenance, the system works best when integrated within the larger IT infrastructure.

Advantages

- Many custom query functions (search by address, owner name, etc.). In addition, searching by contaminants and cleanup status for brownfield parcels is planned for an upcoming release.
- Centralized data storage.
- Ease of customization (entire site is managed at runtime with little or no additional coding necessary).
- Ability to export data from the system.
- Automatic database and site backups.

Limitations

Difficulty and expense with keeping data current (labor-intensive).

Case Study

Project Location: City of Emeryville, California

Project Outcome/Lessons Learned
The City of Emeryville effort presents unique challenges relating to the distributed nature of data updates coupled with an off-site hosting plan at Sanborn. The system requires a little more massaging to get data in to be served through the portal. A full integration within the organizational IT infrastructure, while more expensive up front, would produce a more easily maintainable system over the longer term. The system's maintainability will always be affected by processes that are manual in nature (scanning PDFs of environmental reports to link to, etc.).

Emeryville has been evaluating the use of this system. The city is in the process of adding more features, such as Sanborn maps and historic photos.

References

- Ignacio Dayrit, City of Emeryville, 510-596-4356
- Brian Noyle, Sanborn, 970-490-5900

PARASEC

Description of Technology

Parasec (www.parasec.com) provides a means for document filing and retrieval nationwide. Parasec's service focuses on supplying information to such professionals as accountants, attorneys and paralegals, lenders and title companies, corporations, and other professions. Parasec employs a group of professionals who can physically file and retrieve documents and provides an array of reports, depending on client request.

Features of Technology

- Physical agent available to submit and retrieve documents at records offices.
- Link to ICMA LUC WebRing.

Technology Platform

Parasec provides the user tools to enable an agent to file or retrieve documents, perform due diligence, compile title records, etc. Parasec provides an institutional and engineering control type file and tracking system. Once the pertinent information has been recorded in the appropriate records office, Parasec's system automatically informs the client when the control is within 90 days of expiring.

Cost Associated with Implementation

The cost of the service is varies based on the service rendered, such as cost of retrieval of the requested document as well as the type of document requested.

Advantages

- Tracking system can be modified for users by adding steps to meet any document need or tracking requirement (e.g., the notification period).
- Provides the necessary steps and timelines to follow to ensure effectiveness of LUC is maintained.

Limitations

Provides no tracking or notification tools.

Users

Potential users include regulatory agencies and city/county planners.

References

- Parasec, 640 Bercut Dr., Suite A, Sacramento, CA 95814, 800-533-7272, www.parasec.com

- Keven Gusé, Title Search, 800-867-7870

THE SENTINEL TRUST

Description of Technology

Sentinel Trust, a not-for-profit program that uses trust funds as its financial source, provides a mechanism for comprehensive long-term stewardship services to clients in both the private and public sectors (NJDEP 2007). Sentinel Trust provides many services dependent on client needs, including site inspection, monitoring and reporting on land use and engineering controls, financial assurances, information and data management services, development of post-closure plans, and public training and outreach to local government and communities.

Sentinel Trust technology provides assured protection of LUCs. In addition, it requires all parties responsible for the monitoring, maintenance, and reporting on LUCs to contribute to the trust, ensuring that all sites are professionally managed and maintaining a pool of financial resources. Sentinel Trust provides a proactive approach to the long-term monitoring of LUCs.

Features of Technology

Sentinel Trust provides verification services in the field through the use of site visits and electronic monitoring. It also offers assistance with biennial certification processes and financial assurance mechanisms (ABAC 2007).

Cost Associated with Implementation

Sentinel Trust offers standardized LUC stewardship services and will develop a cost schedule to assist in the analysis of the costs and benefits of a risk-based versus a complete cleanup (ABAC 2007).

Advantages

Sentinel Trust offers flexibility in its services to both the private and public sectors. The advantages of using the trust include a broad range of products and services to meet the needs of the long-term stewardship of LUCs.

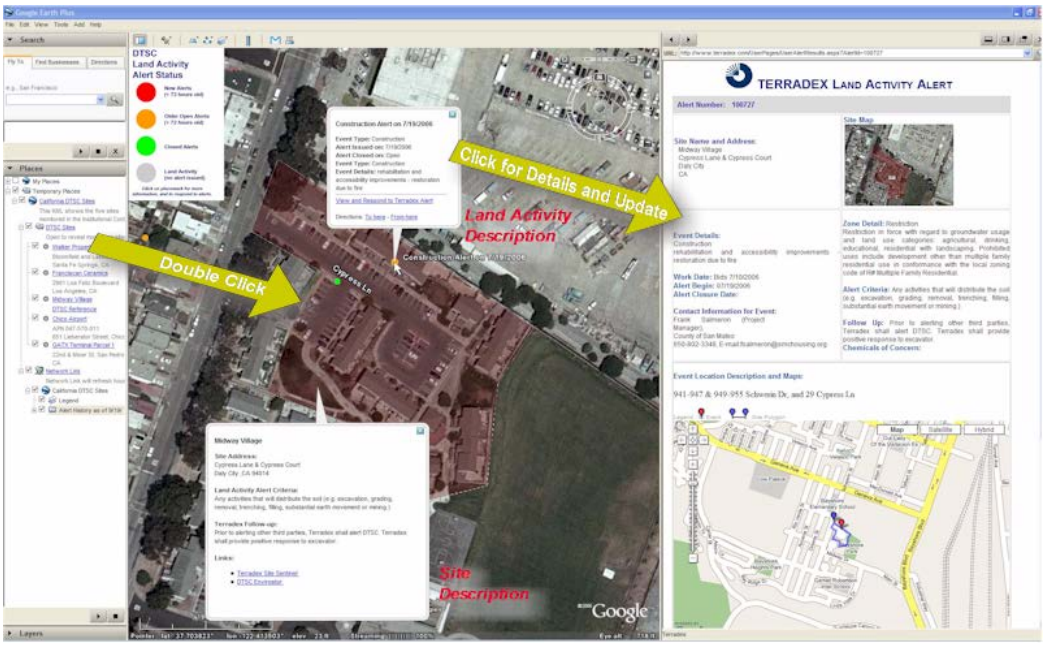
Users

Currently, this system is being evaluated by the State of New Jersey as a mechanism to monitor LUCs implemented as part of a cleanup on sites throughout the state.

INSTITUTIONAL CONTROL TRACKING BY TERRADEX

Description of Technology

Terradex Institutional Control Tracking is a commercial service that provides information on land activity and contains a monitor and an alert service that assists IC holders and regulators in maintaining protectiveness of ICs, notifying *users* and *stakeholders* of potential activities that could compromise the integrity of site-specific controls. Terradex defines a *user* as an owner or environmental regulator interested in effective IC implementation, and a *stakeholder* as a party that receives notice of the existence and ramification of an IC. Stakeholders are typically local government officials, potential purchasers, developers, contractors, and other interested parties. The technology developed by Terradex is a web-based database complemented with systems for land activity record collection.



Terradex Institutional Control Tracking requires the following initial input by the user:

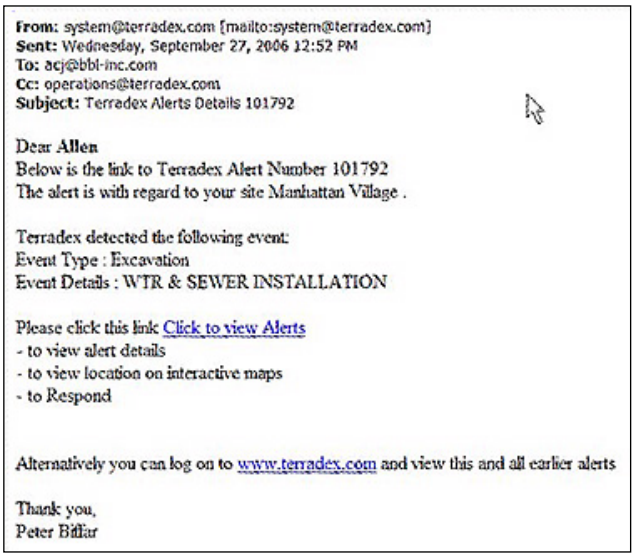
- Location of the parcel(s) with an IC. The location can be by parcel number, street address, or GIS shapefile.
- Activity or use restrictions (e.g., no excavation, no residential use).
- Follow-up actions if a breach is detected.
- Parties to be notified of a potential breach of an IC.

The following are some examples of potential land activity data for monitoring by Terradex:

- Excavation clearance—alerts from One-Call excavation clearance centers of new excavations
- Real estate—new commercial and residential multiple listings for property transactions

- New construction forecasts—future construction leads used by contractors/architects but repurposed to IC
- Building applications and permits—records of applications for and or permits issued by local building departments
- Sensitive uses—water well permits, day-care permits, and other sensitive uses collected from state websites

After activation, the most common interaction from Terradex to a user is through an e-mailed "Activity Alert," sent when a land activity reasonably appears to have conflicted with an IC. The alert carries a link to the website where a map of the IC boundary is displayed with the location of the future land use activity. A simple example is shown at right.


From: system@terradex.com [mailto:system@terradex.com]
Sent: Wednesday, September 27, 2006 12:52 PM
To: acj@bbl-inc.com
Cc: operations@terradex.com
Subject: Terradex Alerts Details 101792

Dear **Allen**
Below is the link to Terradex Alert Number 101792
The alert is with regard to your site Manhattan Village .

Terradex detected the following event:
Event Type : Excavation
Event Details : WTR & SEWER INSTALLATION

Please click this link Click to view Alerts
- to view alert details
- to view location on interactive maps
- to Respond

Alternatively you can log on to www.terradex.com and view this and all earlier alerts

Thank you,
Peter Bifflar

The user is required to review the e-mail and works with Terradex to determine whether the land activity breaches the IC. This effort may entail directing Terradex to contact stakeholders to learn more of their actions. If the activity would potentially breach the IC, Terradex notifies the stakeholder. Alternately, the user can choose to notify the stakeholder. All interactions are recorded into a conversation "blog" around the alert, creating a record of consideration and actions around the alert. This approach was developed with the USEPA pilot as an idea to consolidate feedback that might come from multiple sources (USEPA 2006).

The Terradex system maintains a website that can be accessed either through Google Earth or through www.terradex.com. The Google Earth version is shown at the beginning of the description. On the right side is listed the sites monitored, in the center is the boundary of the site, with icons for the various land activities, and on the left side is a web page created for each activity alert. It is on the activity alert web page that the user enters consideration of the e-mailed activity alert. The Google Earth version is convenient when users are managing multiple portfolios or can take advantage of the faster aerial photography browsing. The Internet version still has the advantages of the Google Maps (aerial and map) and can work through a browser.

A stakeholder would discover the Terradex service through the receipt of a notice. The strength of the Terradex approach is that stakeholders would not have to know about websites holding IC lists (or even what an IC is), but instead would receive a telephone call, fax, or e-mail from Terradex (or the user) informing them of an activity or use limitation that they might in the context of the stakeholders' pending activity. For example, an excavator would learn of the IC based on the information submitted to the One-Call center, and the notice received back shows the future excavation location relative to the boundaries of the IC. The stakeholder (for example, an excavator) could be directed to an agency website to learn more or to call the responsible party. Typically, stakeholders have been very understanding and responsive to alerts.

The initial information on the ICs tracked by Terradex is provided by the customer. When the customer is a state agency, then the setup of Terradex is through synchronization to existing data registries a state agency may hold for ICs. The state agency serves as the registry of the site with an IC, and Terradex serves as the monitoring and tracking service for land uses and activities around these sites with LUCs. When the user is a responsible party, the setup is typically made from documents associated with an IC Implementation Plan, an emerging feature of site remedy documents.

Features of Technology

- Alerts users of activities (e.g., real estate transactions, building permit issuance, etc.) that have or are planned to occur on a property with ICs.
- Stakeholders are provided with notices from multiple means: a telephone call, fax, and/or e-mail informing them of use limitations they may breach.
- Stakeholders are directed to agency website or to call the responsible party.
- All interactions between user and stakeholder are recorded in conversation "blog."
- Documentation is generated of IC compliance.
- Available for any site within the United States, though certain land activity data sources will vary based upon state circumstances.

Technology Platform

The Terradex service has been hosted by Terradex for five years and is accessible to a user through an Internet browser and/or Google Earth. There are no hardware requirements for the user other than an Internet connection. Because the service is web-based, it can be initially configured to meet a state or responsible party's requirements. For example, if the service is used as part of a state-wide IC tracking system, the website can be presented with the look of the state's environmental agency.

Cost Associated with Implementation

The fees for the service are paid typically on an annual subscription. Terradex typically offers a demonstration site for a client to test the service for no charge. The fees depend on the number of sites, the size of a site, and the data sources monitored.

- When a large number (>50) of sites are monitored, the fees are $500 or less per site per year.
- When a large Superfund site is monitored with extensive support, the fees are higher, ranging $10,000–$20,000 per year.
- Typically, regulatory agencies with large portfolios and simpler data source requests operate near the $500/site per year range.
- Terradex may also request an activation fee to begin the service that is variable, depending on the customization a user requests.

The Terradex service can be affiliated with a funding trust or structured settlement to facilitate long-term operation. Terradex introduces the user to third parties who specialize in this financial and insurance service and are also familiar with the Terradex model.

Advantages

- Complements existing IC registries by providing notice to stakeholders who may otherwise not discover the repository's existence.
- Can be applied to areas where ICs may not exist, e.g., providing notice of impaired aquifers. This aspect has been applied routinely around sites where there is concern that a water well installed as far away as one mile might destabilize a groundwater contamination plume. While it may be impractical to place an IC over such a broad area, the detection and mitigation of new water wells can offer equivalent protection without the burden of recording to potentially hundreds of property records.
- Screens land activities, so the user is alerted only when land use activities are at risk.
- Can be procured by a responsible party but allow state regulatory agencies access to monitoring and alert data.
- Can be accessed either through Google Earth or through www.terradex.com.

Limitations

- This notification tool is not an IC repository and relies on others to serve as that repository (see separate Google Earth Technology Profile).
- Does not provide field inspections that might be a component of IC implementation (though it can track their fulfillment).

Users

This tool can be accessed by various stakeholders that register for the service.

Case Studies

Project A Location: Del Amo Superfund Site, Torrance, California

Project Team: Del Amo Superfund Potential Responsible Parties

Description of Technology Implementation
Multiyear engagement for IC implementation at a large urban Superfund site. Land activities monitored include real estate, building permits, sensitive uses, and excavation.

Project Outcome/Lessons Learned
Service has been successful in preventing land use activities that other wise would have breached ICs. In particular, one excavation was averted that would have caused a cathodic well to perforate a confining clay layer potentially causing contamination to leach to underlying potable water aquifers.

Project B Location: State of California

Project Team: California Department of Toxic Substances Control

Description of Technology Implementation
Terradex monitored a portfolio of properties across the state to evaluate the technology. The users were the project environmental staff of California DTSC. The staff were oriented to the service, were provided account access to their site information, and received updates to land use and activities at and near sites with ICs.

Project Outcome/Lessons Learned
The state plans to proceed with a broader systematic deployment of IC tracking and monitoring. USEPA issued report evaluating the Terradex technology (USEPA 2006), which can be viewed at www.terradex.com/PublicPages/Download/USEPAOneCallTerradexReport.pdf. Terradex will arrange guest user access to review the system based upon request.

References

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Appendix C

Brownfields Team Contacts

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Appendix D

Acronyms

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ACRONYMS

ABAC	American Brownfields Assurance Company
ADEM	Alabama Department of Environmental Management
ASTM	American Society for Testing and Materials
AUL	activity and use limitation
BREIS	Brownfield Redevelopment Environmental Information System
CDPHE	Colorado Department of Public Health and Environment
CEA	Classification Exception Area
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CIA	Colorado Inspection Agency
DOE	U.S. Department of Energy
DTSC	Department of Toxic Substances Control
EC	engineering control
ECOS	Environmental Council of the States
EIEN	Environmental Information Exchange Network
ERIS	Environmental Research Institute of the States
FDEP	Florida Department of Environmental Protection
GAO	Government Accountability Office
GIS	geographic information system
HSWA	Hazardous and Solid Waste Amendments
IC	institutional control
ICMA	International City/County Management Association
ICR	Institutional Controls Registry
IRCG	Installation Restoration Collaborative Gateway
IT	information technology
ITRC	Interstate Technology & Regulatory Council
LUC	land use control
LUC I&EP	Land Use Covenant Implementation and Enforcement Plan
LUCIP	Land Use Control Implementation Plan
MassDEP	Massachusetts Department of Environmental Protection
MDA	Minnesota Department of Agriculture
MPCA	Minnesota Pollution Control Agency
MOU	memorandum of understanding
NCCUSL	National Conference of Commissioners of Uniform State Laws
NDEQ	Nebraska Department of Environmental Quality
NETR	Nationwide Environmental Title Research
NFA	no further action
NIRIS	Naval Installation Restoration Information Solution
NJDEP	New Jersey Department of Environmental Protection
NJEMS	New Jersey Environmental Management Information System
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
OSIRIS	One-Stop Interactive Resource and Information System

PADEP	Pennsylvania Department of Environmental Protection
PHD	Panhandle Health District
POC	point of contact
RCRA	Resource Conservation Recovery Act
RPM	remedial project manager
SCDHEC	South Carolina Department of Health and Environmental Control
TNDEC-DOR	Tennessee Department of Environment and Conservation, Division of Remediation
UECA	Uniform Environmental Covenants Act
USEPA	U.S. Environmental Protection Agency
VCP	voluntary cleanup program
VIC	voluntary investigation and cleanup
WDNR	Wisconsin Department of Natural Resources