Facilitating Information Exchange for the Mapping of Institutional Controls

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An institutional control (IC) is a non-engineered instrument, such as an administrative and/or legal control, that helps to minimize the potential for human exposure to contamination and/or protects the integrity of a remedy by limiting land or resource use. Institutional controls (e.g., zoning, permits, and easements) can provide an effective tool to prevent exposure to residual contamination; States and others have asserted that the absence of data standards for institutional controls has impeded the exchange of institutional controls data among the government agencies and other parties involved. In January 2006, the Institutional Controls Data Standard was adopted under the Environmental Information Exchange Network, which represents EPA, States, and Tribes. The standard references a technical specification for GIS information, which is based upon Federal Geographic Data Committee standards. As the Institutional Controls Data Standard is used to support data exchange, the exchange of information among the Environmental Protection Agency (EPA), States, Tribes, Local government, and others should be facilitated. In EPA's Superfund Program, EPA is responsible for the selection and protectiveness of remedies yet State and Local governments are the ones who implement, monitor and enforce the ICs.

Introduction

There are numerous remedial technologies that can be used to clean up a site. The remedy that is appropriate for a given site depends on waste or contaminant characteristics, ability to implement, effectiveness, cost, and other factors. While some sites are cleaned up to the point where unrestricted use, unlimited exposure will be appropriate, many cleanups leave residual contamination (i.e., any contamination remaining following the evaluation of a site and possibly a cleanup) that precludes unlimited use/unrestricted exposure. For these sites where unlimited use/unrestricted exposure is not appropriate, the use of ICs and engineering controls (e.g., landfill cap, containment system) are appropriate

Although it is EPA's expectation that under the Superfund Program treatment or engineering controls will be used to address high levels of contamination (i.e., principle threat wastes) and that groundwater will be returned to its beneficial use whenever practicable, ICs can and do play an important role in remedies. ICs are used when contamination is first discovered, when remedies are ongoing and when residual contamination remains onsite at a level that does not allow for unrestricted use and unlimited exposure after cleanup. The National Contingency Plan (NCP) emphasizes that ICs are meant to supplement engineering controls and that ICs will rarely be the sole remedy at a site.

Nationwide, state voluntary cleanup sites, leaking underground storage tanks, contaminated federal facilities lands, brownfields, RCRA facilities and Superfund sites

[1] Information presented in this paper is not a statement of EPA policy.

often have residual contamination following cleanup. Table 1 summarizes some information on these different types of sites. Any of these sites may use ICs where the residual contamination precludes unrestricted use/unlimited exposure. Residual contamination must be managed in order to provide for the safe reuse of properties. Taken together, these sites total in the hundreds of thousands and the effective management of these sites is a significant challenge. This paper highlights the role of GIS information in facilitating solutions to this situation.

Many Parties have Responsibilities for ICs at Sites

In the Superfund Program, EPA is responsible for the selection and protectiveness of remedies that include ICs yet State and Local governments are the ones who implement, monitor and enforce the ICs. Sites with potentially responsible parties, who will undertake cleanup responsibilities, will have EPA oversight as long as oversight is required (i.e., contaminant levels do not allow for unlimited exposure and unrestricted use). In these cases, EPA would expect responsible parties to work with State and Local agencies to ensure the success of institutional controls. For those sites that have been funded by EPA for cleanup, the State will take the lead role in overseeing the institutional controls along with any other operations and maintenance responsibilities. Clearly, this situation requires effective coordination and communications among all the parties involved. Moreover, it is in everyone's interest to hold the same information on the status of sites and associated institutional controls.

ICs are Documented in a Variety of Instruments

The need for effectively communicating information on ICs is further complicated by the sale of properties, changes to land records, permits, and excavation activities. Some analysts have estimated that there are approximately 7 million land transactions and 25 million excavations each year. Because ICs are implemented through a variety of instruments that differ in where they documented, the effectiveness of ICs will be dependent upon the choice of instruments that will be noticed by relevant parties. For example, a deed restriction to avoid digging where a cap covers residual contamination is unlikely to be noticed by an excavator. However, a permit (in an area where permits are routinely required for excavation) or the integration of IC information into one call systems could be very effective tools for the notification of excavators.

Development of the IC Data Standard

Because of the many parties involved in the selection, implementation, monitoring and enforcement of ICs, a group of states requested that EPA undertake the development of a data standard for ICs that could be used by all parties (ESDC, 2006). For EPA, the process of developing environmental data standards involves States, Native American Tribes, and US EPA. As part of our efforts to develop the IC data standard, we also undertook outreach to local governments (largely through ICMA [the International County Management Association]), other federal agencies, and various industries involved in title search, insurance, and other data management activities that would have an interest in ICs. Following about 4 years of work, the final IC data standard was published in January of 2006.

The data standard provides a standardized set of definitions and specifications for the exchange of environmental data on institutional controls. Data elements that make up the data standard include: Site Name/Location, Media Contaminated, the ICs in the Decision Document, IC Objective(s), IC Instrument(s), Implementation status, Source documents, and Contacts. This information along with geographic information will make for a much more robust body of information to identify, oversee and report on institutional controls.

The data standard design has several features that are expected to improve its utility among the different stakeholders involved in exchanging data on ICs. The data standard employs XML to facilitate the exchange of data between parties. It consists of XML schema definition (XDS), which defines how IC data should be organized, is modular to allow for reuse and extensibility and provides multiple methods of implementation for cataloging and transferring data.

Geographically referenced raster datasets should be fully self documenting and in compliance with FGDC/Spatial Data Transfer Standard (SDTS) Part 5 Raster Profile and Extensions (FGDC, 1999) as well as the FGDC Content Standards for Digital Geospatial Metadata (FGDC, 1998) and the FGDC CSDGM Extensions for Remote Sensing Metadata (FGDC, 2002) where applicable. To be included as an IC Resource, the embedded metadata must include complete spatial reference and data quality descriptions. The external spatial reference should be a known and well-defined system. Within the Spatial Data Quality module, Lineage documentation is particularly important, including radiometric correction and georectification processes. The Logical Consistency module may be used to describe the relationship between the raster dataset and the IC Location, but does not supersede the provision of the "Location Association Type" (ISO/IEC, 1999)

The IC Data Standard includes a Vector Profile technical specification (ESDC, 2006a). While this technical specification does not have the same status as a full standard, it provides a means for the exchange of boundary information. This effort to provide for the reporting of GIS information is the first within EPA that has been associated with a data standard. We expect that this technical specification will promote the exchange of GIS information and provide the Agency new experience in the exchange of GIS information.

Adopting the IC Data Standard

The IC Data Standard is intended to facilitate the transfer of information among different parties. The IC Data Standard calls for the use of common definitions and an exchange format. While parties interested in exchanging IC data could create a system using the IC standard, we expect that it is far more likely that parties will simply map data in their existing systems to the IC Data Standard or possibly expand their existing systems to add data elements in the IC Data Standard that they do not currently track. We expect that

State and Local government agencies will have an interest in exchanging information. The IC Data Standard will also facilitate the submission of data from responsible parties to government agencies that oversee sites. Site managers, system Data Base Administrators, analysts and others have all played a role in identifying benefits to their organization associated with the adoption of the IC Data Standard. While any of these parties may identify benefits of adopting the IC Data Standard, it is likely that the mix of different skills within any organization will provide for the best approaches to adopting standards.

Central Data Exchange IC Pilots

The Central Data Exchange (CDX) enables fast, efficient and more accurate environmental data submissions from State and Local governments, industry and tribes to the Environmental Protection Agency (EPA). We have worked with approximately a dozen states to support their efforts to develop/enhance their ability to track and exchange information on ICs.

In order to help build capacity for the CDX between EPA and States, EPA's Office of Environmental Information has included pilots for the exchange of IC data using the IC data standard as a part of the pilots that it has sponsored over the past few years. This program has helped States to develop their capability for the exchange of data through funding grants for the development of IC data flows.

Maintaining the Integrity of the Relationships among ICs, Contamination, Engineering Controls and Local Land Records

ICs are often tied to land records, which are typically maintained in parcels. The relationship between ICs and parcels could vary significantly because the IC may cover an entire parcel, a part of it, or if the contamination moves away from a parcel, then it might be removed from the parcel. Moreover, parcels can be reorganized, split or combined, possibly loosing the integrity of their relationship with the ICs. For this reason, overlaying ICs, area of contamination, and engineering controls over parcels to show the integrity of the relationships should be a useful practice. Similarly, the comparison of the areas of contamination, ICs and ECs are all useful and help to ensure that site management is effective.

Conclusion

The use of GIS provides a valuable tool to significantly enhance the effectiveness of ICs. The use of the data standard for ICs will promote the exchange of IC data among the different parties involved in selection, implementation, monitoring and enforcement of institutional controls. By overlaying IC, contamination, engineering control, and land use GIS layers, inconsistencies in legal documents recording ICs can more easily be identified and corrected. Civic leaders, elected officials, developers, and land use planners should all benefit from this information in managing the development of their community.

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Table 1. Sites that May Require ICs and ECs

Program	Universe of Sites	Comment
Superfund NPL	1,600	About 900 construction complete sites
RCRA Corrective Action	3,800	There is a much larger universe of generators and treatment, storage and disposal facilities that could require ICs
Underground Storage Tanks	260,000 Sites	Of these, about 900 sites are managed by EPA as Federal-lead Tribal
Brownfields/ Volunatry Cleanups	400,000-500,000	These sites are managed at the local/state level

References:

ESDC[2] (2006). Institutional Control Data Standard Standard No.: EX000015.1.

ESDC (2006a). Institutional Control Vector Profile Technical Specification Addendum To The Institutional Control [Ex0000015.1] Data Standard

FGDC (1999) Standard [FGDC-STD-002.5-1999]

FGDC (1998) Content Standards for Digital Geospatial Metadata [FGDC-STD-001-1998]

FGDC (2002) CSDGM Extensions for Remote Sensing Metadata [FGDC-STD-012-2002]

ISO/IEC (1999). ISO/IEC 2382-17: Information Technology Vocabulary—Part 17: Databases 17.06.05 metadata

[2] The Environmental Data Standards Council (EDSC) is a partnership among US EPA, States and Tribal partners to develop and agree upon data standards for environmental information collection and exchange. More information about the EDSC is available at http://www.envdatastandards.net.

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Appendix A

Glossary

Institutional Control: A non-engineered instrument, such as an administrative and/or legal control, that helps to minimize the potential for human exposure to contamination and/or protects the integrity of a remedy by limiting land or resource use.
IC Instrument: An administrative measure and/or legal mechanism that establishes a specific set of land or resource use restrictions.
IC Objective: The intended goal of an IC in minimizing the potential for human exposure to remaining contamination and/or protecting the integrity of an engineering control by limiting land or resource use in a particular media.
Location: A physical location or area defined by a geographic area description, a set of facility site descriptions, and/or a geographic coordinate description. Examples of two separate facility site descriptions for a single site are the 12-digit US EPA Site Identifier and the 7-digit Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS).
Site Identifier: These values would be captured through two separate facility site descriptions within the same location.
Engineering Control: A physical technology implemented to minimize the potential for human exposure to contamination by means of control or remediation.
IC Affiliation: Any individual or organization associated with an IC either directly or indirectly. An example of an affiliation with a direct IC relation is a party responsible for monitoring the IC. An example of an affiliation with an indirect IC relation is an owner of a site at which ICs are implemented.
IC Resource: Any document or source of information associated with an IC either directly or indirectly. An example of a resource with a direct IC relation is a document mandating an IC enforcement action. An example of a resource with an indirect IC relation is a map of a site at which ICs are implemented.