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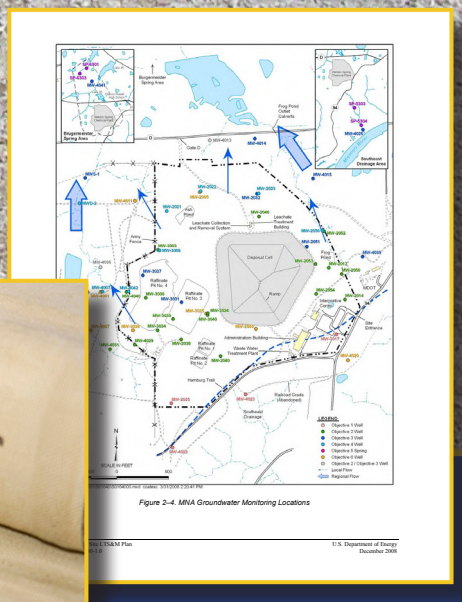
U.S. DEPARTMENT OF ENERGY | Legacy Management

Guidance for Developing and Implementing Institutional Controls for Long-Term Surveillance and Maintenance at DOE Legacy Management Sites

January 2015



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Abbreviations

CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
EC	Environmental Covenant
EPA	U.S. Environmental Protection Agency
FIMS	Facilities Information Management System
GEMS	Geospatial Environmental Mapping System
GIS	Geographical Information System
GSA	U.S. General Services Administration
ICMP	Institutional Controls Management Plan
ICs	institutional controls
ICTS	Institutional Controls Tracking System
LM	Office of Legacy Management
LTS&M	long-term surveillance and maintenance
LTSP	Long-Term Surveillance Plan
NPL	National Priorities List
NRC	U.S. Nuclear Regulatory Commission
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SEEPro	Site Environmental Evaluation for Projects
UMTRCA	Uranium Mill Tailings Radiation Control Act
USACE	U.S. Army Corps of Engineers
UU/UE	unlimited use/unrestricted exposure

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1.0 Purpose and Scope

This guidance document is to help U.S. Department of Energy (DOE) Office of Legacy Management (LM) personnel understand what is necessary and acceptable for implementing the provisions of DOE Policy 454.1, *Use of Institutional Controls*, for long-term surveillance and maintenance (LTS&M) at LM sites.

LM's philosophy is that institutional controls (ICs) require careful evaluation and active management. For ICs to be effective, all parties affected by their implementation must have institutional knowledge of them. These parties include the long-term stewards; local, regional, and federal agencies; property owners; members of the public; and any affected party who has an interest in the required restriction.

This document:

- Summarizes elements of DOE's policy and guidance to facilitate a common understanding of the requirements that help ensure the protection of public health and the environment for many years into the future—in most cases, in perpetuity.
- Creates a framework for the consistent use of ICs throughout LM.
- Reaffirms DOE's commitment to using ICs effectively.
- Establishes a consistent approach to developing, implementing, maintaining, and enforcing required restrictions.
- Integrates the use of well-designed, effective, and reliable tools to manage, monitor, and transfer real and personal property under LM's control.
- Ensures that all sites are appropriately evaluated for required ICs.
- Ensures that ICs are routinely monitored for changes and violations.
- Helps ensure that there is adequate enforcement of ICs whose violation could create an exposure pathway for contamination.

Where required for protectiveness, ICs are a vital component of most remedies for, and the LTS&M of, LM sites. Over time, LM should continue to review ICs' requirements and evaluate their effectiveness in light of any changes to land use, communities, laws and regulations, residual contamination, or responsible parties. While ICs have been established for a number of years, the specific requirements, the roles and responsibilities of all parties, and the consequences of violations are becoming better defined and more effective.

DOE's approach to ICs, including planning, implementing, maintaining, and enforcing ICs, is a concept that is applicable regardless of regulatory regime and closely follows the continuous improvement concepts of the Integrated Safety Management System and the Environmental Management System. The ICs process mirrors the core concepts of the Plan–Do–Check–Act cycle (Figure 1). When the ICs process is carefully considered and executed, ICs will be adequate for protection, will be visible or readily accessible to all parties whom they affect, will have their rationale and progress fully documented, and will be enforced to ensure protectiveness and compliance.

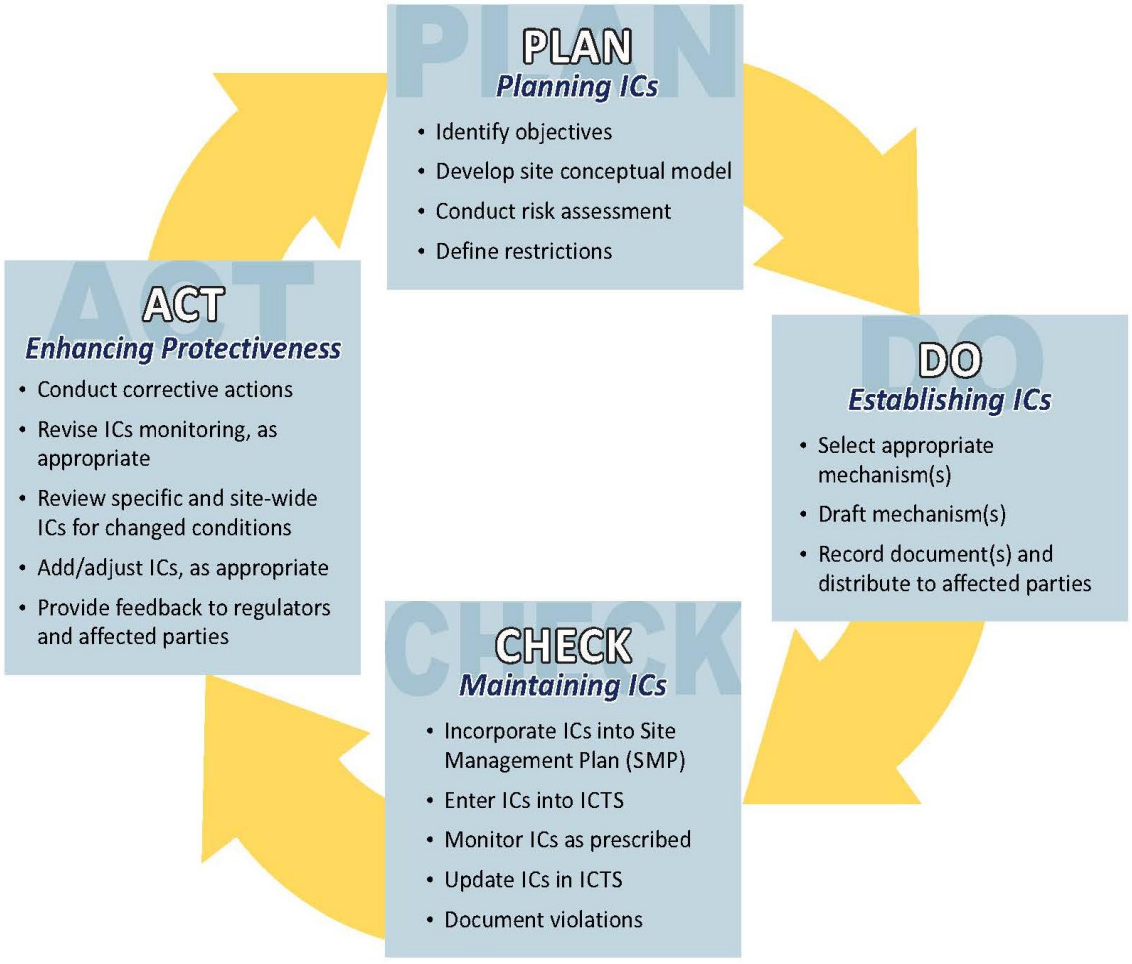

Figure 1. ICs Process

2.0 Introduction

LM's mission is to fulfill DOE's postclosure responsibilities and ensure the future protection of human health and the environment for DOE sites without a continuing mission. LM uses the term "institutional controls" to broadly define the mechanisms and documents that are maintained to inform current and future generations of potential hazards and risks at a site. ICs are crucial to protection of human health and sensitive resources at LM sites. ICs are instruments, notices, and physical controls that help minimize the potential for human exposure to contamination, maintain security, or protect the integrity of a remedy.

LM acknowledges that ICs apply to short-term actions where protectiveness is warranted, such as restrictions to an area under remediation or access to a construction area; however, this guidance will only address the ICs needed for LTS&M. This guidance is intended for the restrictions needed for sites with contamination left is place where DOE is required by law to conduct LTS&M to ensure protectiveness. Under DOE's radiological protection directives, there is no time limit associated with this responsibility.

ICs usually apply to the remedy or LTS&M for LM sites, where they limit access to sites or contaminated media when there is the potential to create a completed pathway for exposure, but they can apply to other resources as well. DOE is charged with maintaining identified natural, cultural, and historic resources at its sites. Once such resources are identified, LM must restrict access to them and the use of the surrounding land, as appropriate, to protect their integrity.

ICs also apply to personal property and short-term controls assigned in permits for operational activities. For example, ICs apply to managing chemicals when regulations and permits regulate how chemicals must be inventoried and stored, to limit people's exposure to them. ICs also encompass the proper inventorying of other personal property to ensure that excess items are not released without proper authorization and that equipment is not stolen. This document will not address short-term permit requirements for controls, as those requirements are adequately covered in other documents and procedures.

Several ICs can apply to an LM site, including those needed for access control, contaminated media, or protectiveness of a site's remedy. Because all ICs will need to be considered in the phases of the process, this guidance will refer to ICs in the plural (e.g., the ICs process).

LM is the responsible land manager and steward of all sites under its jurisdiction. LM has sites in more than 25 states and Puerto Rico. Sites are anticipated to transition into LM for the foreseeable future. All sites that are LM's responsibility are listed in the *LM Site Management Guide* ("the Blue Book") (DOE current version). LM uses ICs to manage the lands, facilities, and materials under its jurisdiction and to protect resources under its jurisdiction. ICs may be required as a component of the environmental remediation of a site when contamination is left in place or may be required as part of the cleanup actions mandated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); the Uranium Mill Tailings Radiation Control Act (UMTRCA); the Resource Conservation and Recovery Act (RCRA); the Nuclear Waste Policy Act; Formerly Utilized Sites Remedial Action Program (FUSRAP); or other cleanup or resource management statutes. Where there are no specific statutory requirements, LM may implement ICs as a best management practice to supplement active remediation, public and resource protection, physical security, or engineered remedies.

LM manages sites under a number of regulatory regimes with oversight by federal regulators, primarily CERCLA and UMTRCA. LM also has regulators from state agencies at sites in states where the federal regulators have delegated the authority to a state agency to oversee the site activities. The various federal and state agencies add a layer of complexity to the discussion of ICs due to varying levels of understanding and state-specific regulations for implementing ICs. Tribal considerations for ICs add another layer of complexity to implementing ICs. In addition, the U.S. Environmental Protection Agency (EPA) and DOE have differing definitions for ICs. In *Institutional Controls: A Guide to Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites* (EPA 2012), EPA defines ICs as: "Non-engineered instruments, such as administrative and/or legal controls, that help minimize the potential for human exposure to contamination and/or protect the integrity of the remedy."

In DOE Policy 454.1, *Use of Institutional Controls*, DOE uses a broader definition by stating that ICs "May include administrative or legal controls, physical barriers or markers, and methods to preserve information and data and inform current and future generations of hazards and risks."

LM acknowledges these differences and believes that the protection of the site, the remedy, or other resources is the most important factor in the discussion. This guidance follows the DOE broader definition and the associated data standard for ICs. No attempts will be made to rename ICs set forth in regulatory documents by a site regulator. However, for the sake of grouping similar ICs, LM may track ICs under its framework for categories and types of ICs. LM's definitions of the types of ICs are further described in Section 2.

Where unlimited use or unrestricted exposure (UU/UE) of property is not desirable, practical, or possible, ICs are necessary to LM's mission to protect human health and the environment, including natural and cultural resources. LM uses a wide range of ICs as part of its efforts to:

- Ensure regulatory compliance.
- Protect the environment (including cultural and natural resources).
- Appropriately limit access to sites to keep LM sites and facilities secure.
- Appropriately restrict the uses of land, facilities, and personal property to prevent or limit inadvertent human or environmental exposure to residual contamination or other hazards.
- Ensure prompt notification of and responses to degraded site conditions, catastrophic failures, and violations of enforceable ICs.

DOE Policy 454.1, *Use of Institutional Controls*, states that it is DOE policy to use ICs as essential components of a defense-in-depth (layering) strategy that uses multiple, relatively independent layers of requirements for protection. This strategy should employ a graded approach to attain a level of protection appropriate to the risks involved. On the basis of risk associated with the residual contamination or other hazards, the layering strategy creates a reasonable expectation that if one control fails, other controls will be in place, or additional actions will be taken, to mitigate the consequences of the failure. Federal statutes regulate protection of sensitive cultural and natural resources. LM will consult with the appropriate agency and implement the protections required.

DOE Policy 454.1 further states that ICs are not to be used to circumvent or substitute for permanent solutions when such solutions are reasonably achievable. ICs will not be applied, or will be amended or terminated, when LM determines that they should be changed or are no longer required. However, LM will maintain ICs as long as necessary to perform their intended protective purposes.

LM will establish, implement, and manage ICs in an integrated manner to ensure that:

- The ICs' purposes are clearly identified, and their need well established, early in the planning process.
- All aspects of the ICs process are well documented and made available to the public as appropriate and allowed by law.
- Mechanisms are in place to ensure that ICs are effective, implemented as planned, properly maintained, inventoried, periodically reevaluated, and modified as necessary to reflect changes in conditions, needs, or technological advancements.
- ICs address multiple goals for restrictions, in an integrated and cost-effective manner.
- Actions are taken to maintain long-term site stability.
- Maintenance requirements for established controls are as low as practical for engineered controls.
- Maintenance requirements for administrative controls are adequate to maintain awareness of the required restrictions.
- Decisions to reduce or terminate established controls are documented and made available to the public, as appropriate.

2.1 General Roles and Responsibilities

The LM site manager[1]is responsible for:

- The identification, use, implementation, oversight, integration, and maintenance and termination of ICs at LM sites.
- Ensuring compliance with all applicable requirements.
- Monitoring ICs to ensure that they are effective and that relevant parties are aware of them.
- Documenting all pertinent decisions regarding ICs and ICs violations.
- Ensuring that required corrective actions are taken.
- Communicating with other federal, state, and local government entities; tribal governments; and other affected stakeholders.

These actions will remain the responsibility of the LM site manager for as long as ICs are needed to fulfill their intended protective purpose.

[1] In this guidance, the LM site manager is the LM staff member responsible for site LTS&M. This definition differs from EPA's terminology (EPA 2012), in which the site manager is the EPA remedial project manager or another EPA official.

Should LM determine additional ICs are necessary for a site, LM realty officers will help the site manager select and establish the appropriate ICs instruments and mechanisms to ensure that there is an entity to enforce compliance with ICs, to keep all current or future parties aware of ICs, and to ensure that ICs endure for as long as they are needed. In addition, LM may use staff from the Environmental Management Consolidated Business Center (EMCBC) to review current and planned ICs to ensure that DOE interests are contained in the appropriate ICs instruments.

The Legacy Management Support (LMS) contractor staff will support LM site managers in all phases of ICs implementation and will provide data and make recommendations to inform decision making.

2.2 Categories and Types of ICs

LM divides ICs into two categories: (1) ICs that are imposed by a site regulator as part of the site remedy, and (2) ICs that DOE imposes on sites either because DOE is self-regulated or because the ICs are supplemental measures DOE deems appropriate to ensure protectiveness. Within both categories, the ICs can be enforceable.

There are three general types of ICs: (1) administrative (legal) controls, (2) informational controls (methods of preserving risk and hazard information for current and future generations), and (3) physical controls (physical barriers and engineered or structural features). These categories are not mutually exclusive, and one type may contain aspects of another type. For example, a sign that warns of radioactivity at a disposal site serves as both a notice of the radiation and a physical control to limit access to the site. LM uses this broad context of titles and protections to incorporate the terminology and common use of ICs in different regulations, such as CERCLA and UMTRCA, and as may be used in state statutes regarding restrictions. For instance, EPA considers ICs a subset of land use controls, while DOE uses ICs to convey the broad definition for protective measures, with land use controls as a type of administrative control. In addition, EPA does not recognize engineered controls as a type of land use control, but DOE recognizes physical and engineered controls as one of the types of ICs. DOE's broad definition is necessary to encompass the diverse regulatory regimes applied to LM sites and helps ensure an LM-wide approach to all aspects of the ICs process. Figure 2 shows the categories and some examples of the types of ICs; these are also described in the LM ICs Data Standard (LMS/POL/S10250).

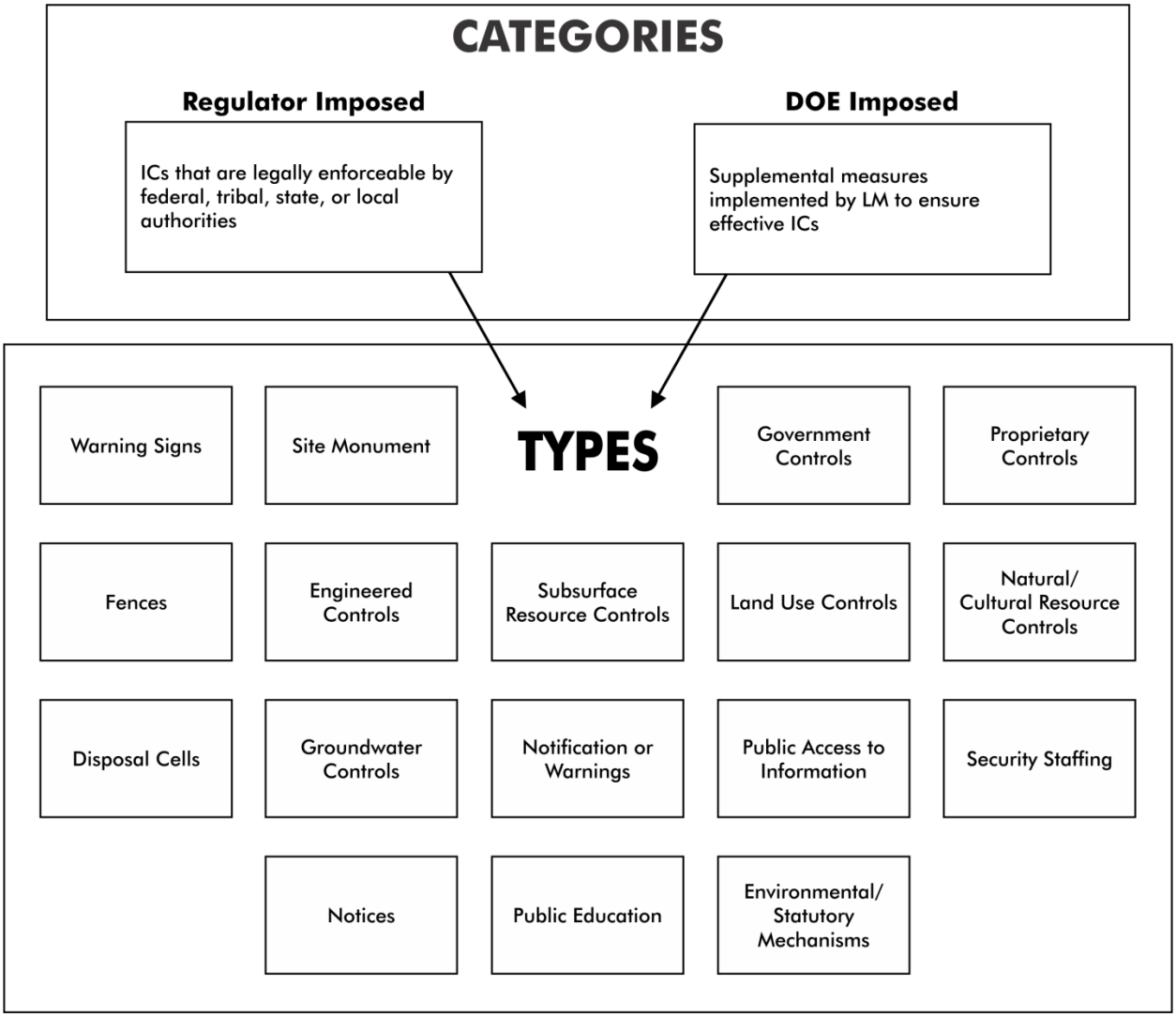

Figure 2. Categories and Examples of Types of ICs

Categorizing ICs and the specific names for ICs are less important than understanding the degree of protection they provide and ensuring that all required restrictions, notices, and barriers are properly established and effective. Administrative controls are legally enforceable restrictions by which a violating entity can be compelled to comply with the restriction in a court action. Informational controls can act as a deterrent to discourage certain practices by disclosing conditions of the land or resources and help maintain public awareness of past activities and potential residual contamination. Physical controls are barriers to site access or sensitive natural or cultural resources. Engineered controls are the most important type of physical controls. These are manmade structures that provide barriers to limit access to contamination (e.g., a disposal cell cover) or engineered features that protect the integrity of a manmade structure (e.g., drainage channels around a disposal cell). The appropriate types of control for a given site depend on the nature and extent of contamination remaining and the consequences if exposure should occur. Figure 3 shows a list of ICs types described in the ICs Data Standard (LMS/POL/S10250).

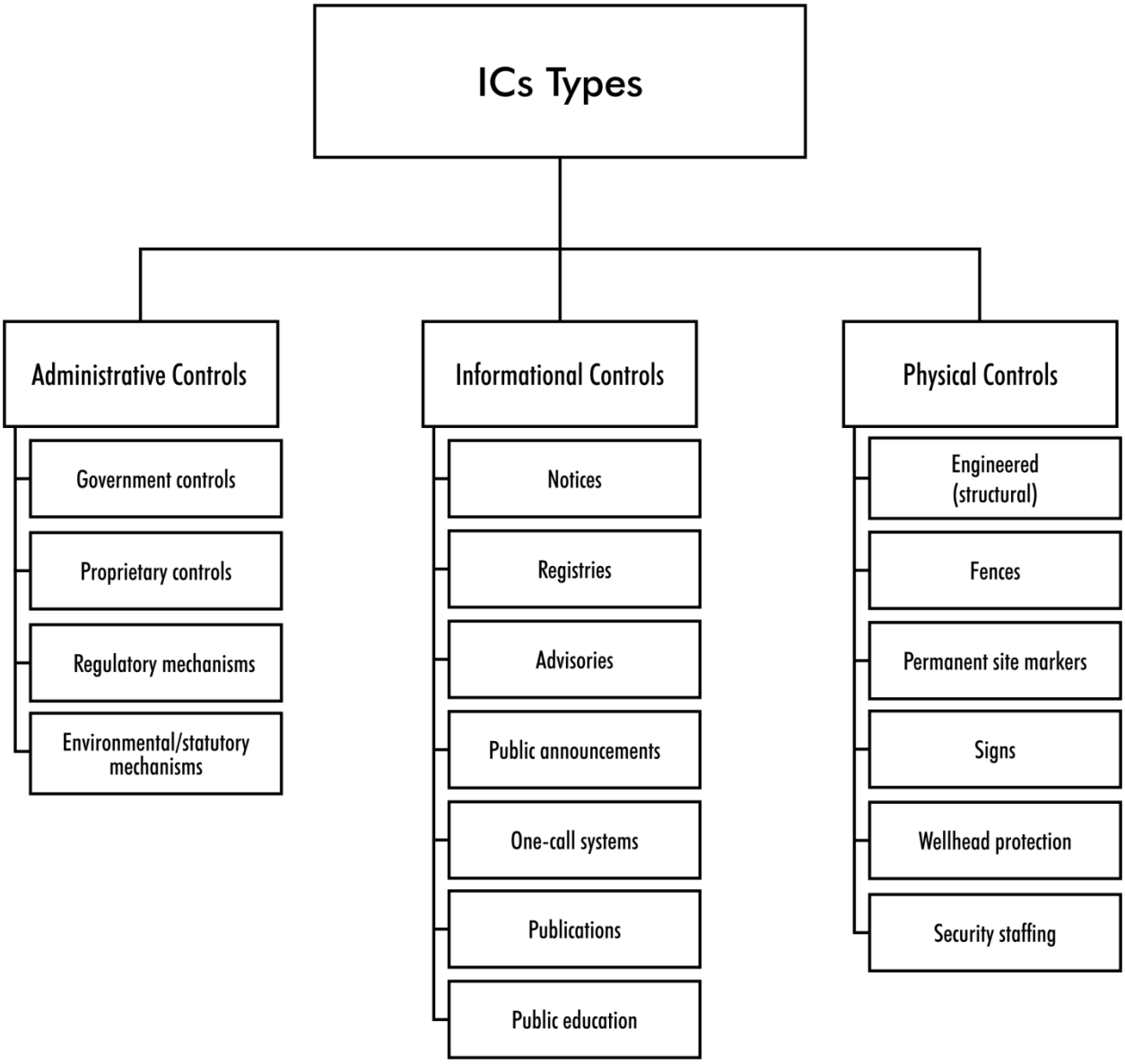

Figure 3. Types of ICs from IC Data Standard

2.2.1 Administrative Controls

Administrative controls in effect at LM sites are legally enforceable mechanisms that fall into one of four subtypes: (1) government controls, (2) proprietary controls, (3) regulatory mechanisms, and (4) environmental and statutory mechanisms. "Enforceable" means that an identified entity has the legal power to halt any activity that violates an established control.

Government controls are mechanisms that use the authority of federal, state, or local government agencies to impose restrictions on land or resource use. Examples of this type of control are zoning ordinances, state well-drilling restrictions, and groundwater protection mechanisms. The most effective form of a government control is federal ownership.

Proprietary controls are based on state or tribal private property law and are designed to limit or completely restrict activities that may compromise the effectiveness of the remedy or to restrict activities or future resource use that may result in unacceptable risk to human health or the environment. These controls are placed in the property chain of title and are said to "run with the land," which means that the restriction passes to each successive landowner until the restriction is terminated. The most common examples of proprietary controls for restrictions include restrictive easements and environmental covenants (ECs).

Regulatory controls are those enforceable documents that contain provisions for ICs, such as Records of Decision (RODs) under CERCLA, Federal Facility Agreements, and Long-Term Surveillance Plans (LTSPs) under UMTRCA. These documents are an integral part of the remedial actions and LTS&M. They define the remedy and limit or mandate the performance of certain activities (e.g., restricting access to contaminated groundwater) to maintain protectiveness, or they define those actions required during LTS&M to maintain the protectiveness established during remediation. Controls specified in these documents may only be in effect for the duration of a remedial action or for as long as the landowner retains the property. Other ICs may need to be put in place after an enforcement document expires or for the duration of LTS&M.

Environmental statutory mechanisms are federal, state, or local laws mandating protection of sensitive resources, such as the National Historic Preservation Act and the Endangered Species Act. These laws define a sensitive resource, and DOE must maintain compliance with these laws regardless of the presence of residual contamination or site hazards.

2.2.2 Informational Controls

Informational controls are mechanisms that inform current and future generations about past site activities and maintain awareness of residual contamination, sensitive resources, and the associated restrictions on the land use or resource. These controls are readily available to the public through a variety of sources, including state and local registries of restricted properties, health advisories, one-call systems, publications, and various forms of public education. LM routinely distributes site information through public meetings and presentations, conferences and workshops, and public websites. Two continuing sources of public education are the Visitors Center at the Fernald, Ohio, Site and the Interpretive Center at the Weldon Spring, Missouri, Site.

Deed notices are a commonly used informational device to convey site history and the potential for residual contamination. Unlike proprietary controls, notices contained in deeds or separately recorded in local land records are not intended to convey an interest in real property. These notices do not typically serve as enforceable restrictions on future use of the property. These documents are intended to provide notice to any future landowners of former site activities and potential contamination. They are recorded so that persons reviewing the chain of title will be aware of past site activities.

If restrictions are warranted, deed notices or other informational devices are unlikely to be sufficient to ensure protectiveness but may serve as a deterrent. Further, notices and other informational devices may be useful as an additional "layer" of protection in conjunction with other ICs.

Whether the landowner's approval is needed to record a notice depends on the jurisdiction. In some jurisdictions, third parties can record notices, whereas in other jurisdictions, only the landowner can.

Some states employ an instrument titled a "notice" that is enforceable by the state as a result of the state policing authority. If this type of instrument is used, the restrictions will be listed specifically, the enforcement authority defined, and the consequences of ICs violations clearly stated. More states are adopting these provisions for landowners who are reluctant to execute an EC or other ICs mechanisms.

Some of the most useful and accessible public notices are the registries that states maintain of contaminated sites. These registries are available to the public. Enforceable ICs at LM sites should be listed on state registries.

2.2.3 Physical Controls

Physical controls are manmade structures or site staffing that limit access or that provide physical barriers to limit access to a site. They may also limit intrusion to residual contamination or entombed waste. Physical controls include fences, gates, radiological-hazard signs, wellhead protection, and active human intervention, such as guards. Engineered controls are the subset of physical controls that are designed for site-specific conditions to provide isolation from residual contamination or site hazards. Engineered controls include disposal cells, cell covers, drainage channels, entombment of reactors, and wellhead protection. Physical controls that LM must maintain are tracked in the Facilities Information Management System (FIMS).

Signs and site monuments are classified as physical controls that provide notices to site visitors. They define the site boundary, provide information on the contamination, and provide a contact number should LM need to be advised of activities on or near the site.

3.0 Planning ICs

ICs are required for any site where conditions do not allow UU/UE for all exposure pathways and types of land uses. This often encompasses activities on the land surface as well as subsurface intrusion. These ICs may be short-term and temporary (required during a response action) or part of the long-term remedy (required, perhaps, in perpetuity). Surface remediation at LM sites is substantially complete when a site transitions to the LM program, and any associated ICs become part of the permanent remedy for the site. However, at a number of LM sites, either active or passive groundwater remediation is expected to continue for some time. In addition, LM reserves the right to add additional layers of protection if deemed appropriate. Restrictions are required while contaminant levels are elevated, but some restrictions on groundwater use will probably be removed as remediation progresses and cleanup goals are met.

Changes in ICs requirements may be affected by other factors that could alter the protectiveness of a remedy (e.g., newly discovered information about the site, new data on the risks posed by site-related contaminants, changes to regulations or requirements) and the need for controlling site access. Therefore, the ICs process is iterative, and the adequacy of ICs must be reviewed periodically, starting with the steps outlined in the planning process. Many changes have taken place over the years as the use of ICs has matured and has become more standardized. Periodic reviews of ICs at LM sites may identify new ICs that are more effective than existing ones. Section 5.0 discusses the monitoring and maintenance of established ICs in more detail.

When planning ICs, project staff needs to consider not only the restrictions themselves but also the implications and consequences of implementation in the future. To ensure that all aspects of the ICs are evaluated, addressed, and documented, the Planning Checklist for ICs is a useful tool to consider all aspects of required restrictions (Attachment 2). Most ICs are considered encumbrances on the land and may not be viewed favorably by the landowner. Such encumbrances may require compensation to the landowner for the loss of land use or loss of availability of a resource, such as groundwater or surface water, to which the landowner would have had rights absent the ICs.

3.1 Roles and Responsibilities

The planning of ICs (or review for sites with existing ICs) is largely the responsibility of site personnel (LM site managers, LMS contractor site leads, and subject matter experts). Site personnel are responsible for identifying which restrictions are required based on known site conditions and objectives. Site personnel are also responsible for helping to select ICs and maintenance processes, using information assembled during the planning phase.

3.2 Identify ICs Objectives and Necessary Restrictions

A clear understanding of the ICs objectives is necessary to ensure effectiveness. ICs are required for one of two general objectives: (1) protection of human health and the environment by limiting exposure to contaminants, and (2) protection of the integrity of an engineered control (or some other site resource, such as wetlands and cultural resources). These two categories are not completely independent of each other. For example, if an engineered control is compromised, human health or the environment may be threatened. However, the relative importance of these objectives may significantly guide the selection of appropriate ICs. In addition, different types of

information will be needed to determine required restrictions for these two objectives. Of most importance for the protection of human health and the environment are the types of contaminated media, contaminants, and concentrations that remain accessible at a site. For the protection of an engineered control that prevents direct access to contaminated materials, such as breaching a disposal cell, it is more important to understand which activities or processes could lead to the contaminated materials' release.

As noted in Section 2.0, certain regulatory or statutory requirements dictate that certain ICs be used. For example, under the U.S. Nuclear Regulatory Commission (NRC) regulations in Title 10 *Code of Federal Regulations* Part 40 (10 CFR 40), "Domestic Licensing of Source Material," ownership of land used for disposal of uranium mill tailings must be transferred to the United States or the state in which the land is located for long-term stewardship. Some states have laws that require ICs on properties where soil or groundwater concentrations exceed specified numerical limits (e.g., Florida's cleanup target levels). Many laws, however, are less prescriptive and require only that a remedy is protective of human health and the environment. It is incumbent on site personnel to determine what restrictions are needed to achieve and maintain protectiveness consistent with the specific ICs objectives. During the planning phase, site personnel should identify any regulatory requirements for ICs, as these will factor into the ICs selection process (see Section 4.4).

3.2.1 Planning ICs for Protection of Human Health and the Environment

The first step in identifying necessary restrictions is the development of the site conceptual model. Where the main objective of ICs is protection of human health and the environment, this initial step requires describing the nature of residual contamination left at a site (contaminated media, contaminants, concentrations); the extent of site-related contamination; projected future uses of land, groundwater, and surface water; and potential human and ecological receptors that could come into contact with the specified contamination in the absence of controls.

Each potentially complete exposure pathway should be evaluated to determine if it would result in unacceptable exposures or risks. To determine acceptable and unacceptable uses of various contaminated media, concentrations in those media can be compared to standards (e.g., drinking water, groundwater, surface water), screening levels (e.g., soil screening levels developed by various states and EPA), risk-based concentrations (e.g., EPA regional screening levels [EPA 2013]), or other relevant benchmarks.

In using benchmarks or screening levels to identify necessary use restrictions, it is important to understand the basis for the numerical values being used. For example, Colorado has soil evaluation values for "residential" and "worker" use. However, "worker" denotes an indoor office worker who would have occasional contact with the soil, and not an outdoor worker who is routinely engaged in activities that would bring him or her into contact with the soil. State standards, guidelines, and regulations should be reviewed during the planning process to determine the need for restricting certain uses.

ICs will be needed when standards or benchmarks are exceeded or if any pathways result in unacceptable risks either during or following the completion of remediation. Restrictions can be broad (e.g., no wells allowed in a contaminated aquifer) or narrow and tailored to meet response objectives (e.g., wells allowed for livestock watering but not for domestic drinking water).

Broader restrictions may be easier to enforce but may require more justification for imposing greater limitations on site or resource use.

Required restrictions must be specific enough to make clear which uses are prohibited and include an explanation of how the restrictions meet the objectives of the ICs. "Prevent unacceptable uses of groundwater," for instance, is not specific enough. Common groundwater uses (often with corresponding standards) include domestic, agricultural, and livestock use. Categories of surface water use include aquatic life (including human consumption of aquatic organisms), drinking water, and recreational. Land use and corresponding soil concentrations are evaluated for suitability for residential, industrial, commercial, or recreational use. Residential use entails the most restrictive ICs; recreational use entails the least. Soil screening levels have been developed to assess contaminants' potential impact on groundwater (i.e., leachability values). Some states require an in-depth discussion of prohibitions in preparing ICs. For example, Florida requires that land use restrictions prohibit uses as defined by the North American Industry Classification System.

The need for ICs and the specific restrictions required should be documented in site decision documents (e.g., RODs, Closure Plans). They should also be included in site management plans (e.g., LTSPs or equivalent or an ICs Management Plan [ICMP]) to ensure that they remain valid and can be maintained.

It is beyond the scope of this document to discuss specific cleanup standards. However, it should be noted that standards and guidelines can vary by program, by state, and by agency. Implementation of standards may also vary (e.g., use of average versus maximum or individual measurements). Site personnel should be aware of ambiguous or conflicting requirements when establishing appropriate restrictions. Consultation with the appropriate regulatory agencies may be necessary to resolve these issues.

3.2.2 Planning ICs for the Protection of an Engineered Control

Where ICs are needed to protect an engineered control, it is still necessary to develop a conceptual site model. However, this model differs from that for protection of human health and the environment in that it focuses on the function and performance of the engineered control. An engineered control will serve as a containment mechanism for residual contamination, and direct exposure is not an issue. In this case, it is necessary to determine which activities might interfere with the system's performance (i.e., serve as release mechanisms) so that those uses can be restricted; characteristics of the contaminated media contained by the engineered control are of secondary importance as long as the containment function of the control is preserved.

Past disposal practices often assumed that waste disposal systems serve only that function and that all access must be limited and controlled, especially for sites that DOE owns. It was assumed that DOE could control any and all surface uses, and long-term planning documents for these sites did not necessarily enumerate all acceptable (or unacceptable) uses. With LM's goal of beneficial reuse, however, it may be necessary to look more specifically at what additional uses of a site are permissible and do not jeopardize the overall objective of preserving the integrity of an engineered control. For example, land occupied by disposal cells may be suitable for different uses depending on how the cells are designed. An asphalt cover on contaminated soils at a disposal site may be suitable for use as a parking lot without restrictions as long as the cell cover

and associated structures are adequately maintained and remain protective. Disposal cells on remote federal lands may not necessitate surface restrictions if projected land use—such as grazing and recreation—does not interfere with the system's performance.

Further, DOE may allow access to mineral resources under a disposal cell as long as the cell's integrity can be guaranteed. A good reference for reuse considerations is *Reusing Superfund Sites: Commercial Use Where Waste Is Left on Site* (EPA 2002).

3.2.3 Planning Protection of Other Resources

If an LM site is found to contain cultural resources eligible to be listed on the National Register of Historic Places, or contains resources otherwise culturally important to a local or historically present population, such as buried remains, LM will use ICs to protect the resource from future disturbance. Similarly, LM will use ICs to control other protected resources such as jurisdictional floodplains and wetlands, threatened and endangered species habitat, or any other resource that requires protection from disturbance or intrusion. ICs may include the use of "no penetration" statements for specific areas, or exclusion statements related to the potential future uses of an area. Monitoring of the identified resources will be tracked using the Institutional Controls Tracking System (ICTS). Sensitive cultural resource information will be accessible only to DOE and LMS contractor staff with a need to know, as knowledge of the specific locations could potentially put the resource at risk of intrusion.

3.3 Planning for ICs Selection

The selection of specific ICs mechanisms is the responsibility of LM realty officers and the LMS contractor Real Property Management staff (discussed in Section 4.0) working in collaboration with the LM site manager. During the planning process, site personnel must assemble certain information to assist in the selection process. Thought should be given to the consequences that would be expected if ICs were not put into effect. This may influence the types of ICs that are appropriate for a given site (e.g., enforceable versus informational). This information includes the following:

- For what duration are ICs required? Can ICs ever be partially or wholly removed?
- Are there any specific state requirements for ICs?
- Does the state have a tracking system ("one call" system) or other registry available for sites that have access restrictions?
- Does the state have a registry of all property required to maintain ICs?
- What level of control is required for the site (e.g., deterrence versus prohibition)?
- Is there a need for multiple controls (i.e., layering)?

The answers to these questions will help establish which specific types of controls might be most appropriate for a site.

3.4 Planning for Maintenance and Enforcement

Planning for maintenance and enforcement of ICs must be considered both before and after ICs are selected. Many of these considerations are similar to those used in planning for ICs selection. These considerations include the following:

- How long will ICs be needed?
- Are ICs primarily informational or are they enforceable?
- If ICs are temporary, what are the criteria for releasing them, and what data are needed to support this decision?
- How frequently is monitoring required? (This is largely dependent on the consequences of access and proximity to population centers.)
- What specific types of maintenance are required (e.g., sign replacement, inspections, phone calls)?
- What annual costs are entailed (e.g., replacement of materials, travel, fees to regulatory agencies)?

3.5 ICs in the Transition Process

Most of the discussion in this section assumes that ICs are part of the final site remedy, and as such, they should be in place before a site transitions into the LM program. LM involvement would typically occur during the transition process. ICs required as part of the site remedy are determined between the site owner (or agency with authorization for cleanup in the case of the U.S. Army Corps of Engineers [USACE] for FUSRAP remediation) or licensee and the site regulator. LM cannot mandate ICs at this stage in the site remediation process, but LM may be invited to provide input. It is in DOE's best interest to ensure that the ICs and mechanisms being established will meet DOE's expectations of protection for the long term. LM's main responsibility during the transition process would be to understand what ICs are in place (and why they are needed) and evaluate their adequacy from a legacy management perspective. The information required for ICs selection should already be documented. However, as site conditions change, it may be necessary to go back through the planning process to reassess the need for and suitability of existing ICs. As a result of the ICs evaluation, LM may decide to establish additional ICs as a best management practice to increase the likelihood of maintaining protectiveness. The additional ICs may be added to site management plans for approval by the site regulators or may be documented in a separate ICMP.

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4.0 Establishing ICs

To ensure protectiveness, LM must ensure the durability of all required ICs, including both the enforceable administrative ICs and the physical or engineered controls. Durability means that ICs must provide assurance to regulators and stakeholders that measures are in place to minimize or eliminate the potential for creating a complete exposure pathway or for disturbing a sensitive cultural or natural resource. All ICs should be established and in full force when the site enters the LM inventory. Physical controls are typically part of the site remedy, such as engineered disposal cells and associated structures, or may be a remnant of past operations or the remediation (e.g., fencing). The potential for physical controls to change over time may be less likely than that of changes for required administrative ICs, which could be triggered by changes in contaminant concentrations, or resources or land use. Part of the continuous improvement cycle is to mandate periodic evaluation of all ICs. As site conditions change, there may be the need to modify any of the existing ICs or establish new restrictions. While all ICs must be evaluated for continued effectiveness and the potential need to modify existing restrictions or establish new requirements, this section will focus on administrative ICs.

LM's ICs challenges involve ensuring that administrative ICs are in place or establishing ICs that will endure for as long as they are needed, are visible or readily accessible to all parties whom they could affect, and are enforceable. This depends on clearly articulating what the restrictions are and why they are necessary. Once ICs are determined, the appropriate mechanisms must be developed to put them in place. A number of factors should be considered in evaluating whether ICs can be effectively implemented to protect the remedy and the public for the long term. These factors, and the roles of various interested parties, may differ depending on the types of instruments for the ICs, the site-specific circumstances, and which authorities are applied.

For many LM sites, the residual contamination is extensive enough to require that the land stay in some form of federal ownership. ICs for land under DOE ownership or jurisdiction are less problematic, as DOE has greater control of land use and access to protected resources. The greatest challenge for LM is implementing ICs on properties whose owners did not cause or contribute to the contamination. This is true for most LM sites under federal ownership where contamination has spread off-property or for property that was never under federal ownership, such as UMTRCA sites that were remediated under and will remain in private ownership. Under FUSRAP, there are also instances where contamination remains on sites under private ownership. Convincing private owners to place restrictions on their property in perpetuity can be daunting. The challenge can be mitigated by convincing landowners that although the IC instruments encumber their property in the future, they also establish the party responsible for the contamination and, therefore, establish who will provide future cleanup, should it ever become necessary. In these cases, the landowner is not responsible for the contamination but will be responsible for complying with and maintaining the ICs on his or her property.

To monitor and maintain ICs, LM has developed an ICTS to collect information on all elements of ICs. The ICTS will provide all information on site ICs and will compel the appropriate monitoring to ensure that site or resource protection is durable.

4.1 Roles and Responsibilities

The LM site manager is responsible for the protection of human health and the environment at, and for the regulatory compliance of, his or her assigned site. That responsibility includes the assurance that any ICs required as part of the remedy are established and remain in full force and effect until no longer necessary. The site manager is responsible for all aspects of the site's ICs, including identifying, implementing, and maintaining ICs; documenting assessments of needs and changes; and conducting any actions that ICs violations warrant.

Because LM is not normally involved in remedial activities, the physical controls associated with the remedy (e.g., cells, drainage structures, and signage) are already in place. As part of site operations, the LM site manager will determine the need for and fund any additional physical controls at the site. If changes are needed, the LM site manager will involve the appropriate site regulator.

Once the need for enforceable ICs is determined, including specifics about all contaminated media and restrictions on land use or access to the media or sensitive resources, the LM site manager may request the services of the LM realty officer and the LMS contractor Real Property Management staff to develop the ICs instruments that establish the enforceable ICs. Real Property Management staff should also review deed notices to ensure that the language does not try to establish any real property interests where none are intended.

If ICs are to succeed, the owner of the land that requires restrictions must participate in their enforcement. For most enforceable instruments, the landowner must concur with the restrictions, and the landowner's execution of the instrument binds him or her, and future owners, to the required restrictions.

The site regulator has approval authority for any site remedy and changes to the site remedy over time. Therefore, the regulator plays an essential role in determining the need for ICs and may play a part in establishing ICs. For DOE-imposed ICs, the site regulator may be consulted, and DOE may provide additional ICs for informational purposes. DOE reserves the right to make changes to the DOE-imposed ICs without regulator approval.

Early involvement with other federal agencies, state and local governments, and other appropriate state agencies should increase the potential for successful implementation of ICs, especially where there is a need for ICs on property DOE does not own. For all ICs affecting tribes or property adjacent to tribal lands, the affected tribal governments may wish to establish their own ICs or, at the very least, must provide input to ICs that affect them.

4.2 ICs for Transitioned Sites

Many of the sites that became part of the LM inventory when LM was established in 2003 were previously under the LTS&M program that DOE started in 1988. The sites under this program had ICs identified, and their site management plans contained the ICs. The most common IC is federal ownership and inspection of the physical controls at the site. However, these sites must be regularly evaluated for the sufficiency and effectiveness of any ICs, and the results of the monitoring and evaluation will be included in the ICTS.

4.3 ICs for Transitioning Sites

LM is the DOE program office that receives sites when only LTS&M activities or records-related activities are needed. LM is a partner in transition activities and plays an integral role in helping develop the ICs that will be needed to maintain site security and protect human health and other resources. Required restrictions should be in full force and effect prior to transition.

A transition team will be identified for each site being transitioned to LM. The team will consist of subject matter experts in all areas of site operations. Each subject matter expert will identify all actions in his or her area of responsibility that either must be closed out prior to transition or must be transferred to LM for LTS&M. ICs are one of the items that must be closed out if not needed or tracked to completion for transfer.

In 2004, the DOE Office of Environmental Management (EM) and LM developed a transition framework (DOE 2005c) that defined general roles and responsibilities and provided guidance for a Site Transition Plan (or equivalent) to establish requirements in the following 10 areas:

1. Authority and accountability
2. Site conditions
3. Engineered controls, operation and maintenance requirements, and emergency and contingency planning
4. ICs and enforcement authorities (real property)
5. Regulatory requirements and authority
6. LTS&M
7. Information and records management
8. Public education, outreach, information, and notices
9. Natural, cultural, and historical resource management
10. Business functions, including contractor pensions and benefits

To provide sufficient detail and address all elements that could affect transition, LM developed a checklist (DOE 2005b) that not only ensures that questions are asked and answered for all elements, but also can track the actions that are to be closed out and those actions to be transferred. The physical and engineered controls and site features are addressed in the engineering and operations portion of the checklist. ICs and real property instruments containing restrictions are addressed in the real property portion of the checklist.

For transitioning UMTRCA Title II sites, LM developed a complete transition process (DOE 2012), which includes ensuring that all DOE interests will be in place prior to the fee land transfer into LM. This process also addresses post-transition needs, including ICs. Once a site is transitioned to LM, all associated ICs will be entered into the ICTS for monitoring and evaluation.

More than 20 additional sites are predicted to transition into LM from FUSRAP from 2014 through 2025. For those FUSRAP sites that may require ICs, the USACE will establish the required site restrictions, which will become part of LM's LTS&M requirements. Similar to the

UMTRCA Title II process, the LM site manager is encouraged to interact with USACE personnel while the ICs are being established prior to transition to ensure that the ICs mechanisms are sufficient for LTS&M.

4.4 Selection of ICs

This section addresses only enforceable ICs mechanisms, notices, and informational instruments. LM can use various management tools, such as laws, regulations, DOE orders, internal procedures, agreements, consent orders, *Federal Register* and other notices, informational announcements, and other real property instruments to ensure that ICs needs are met. For most LM sites, due to factors such as the nature of the hazards, statutory requirements, or ongoing missions, federal control of land and federally required restrictions will likely be needed indefinitely.

For sites in the LM inventory and for sites transitioning into LM, ICs requirements will be established and will be evaluated periodically to ensure that affected parties know of them and that they are effective for protectiveness. Should the need arise for additional ICs, or if the remedy has not been completed, and sites are in the process of identifying restrictions and establishing ICs, LM will need to determine which mechanisms apply and should be considered.

Essential information in selecting ICs mechanisms includes the restrictions required, the area to be covered by the restrictions, the number of properties within the restricted area, the potential future land use, stakeholder input to the ICs, and state laws and regulations. Having a clear understanding of all aspects of the restrictions and the affected property will help the LM site manager, with help from Real Property Management staff and attorneys (if needed), select the appropriate mechanisms to apply to the site. The elements of the IC Data Standard (LMS/POL/S10250) provide a handy guide to the information that should be collected for all site ICs.

4.4.1 Individual Property ICs

Restrictions enacted with a single landowner fall under the category of proprietary controls, referred to under DOE as one of the types of administrative controls. For remote LM sites and those sites where restrictions are best addressed on a property-by-property basis, LM may choose instruments such as perpetual restrictive easements or state ECs. These instruments grant a property right (or interest) but not possession of the land. In addition, these types of instruments are executed by the landowner and run with the land. ICs are provided in instruments as a property right when the landowner, known as the "grantor," conveys the restriction to another party, known as the "grantee." The transfer of property rights is documented in the instrument, is executed by both parties, and is recorded in local land records, so it will remain known to all future owners of the property. One of the signatories to the document—the regulatory authority, the host state, or DOE—is identified and charged with the enforcement of these instruments.

When DOE negotiates with a landowner for a restriction on his or her property, it may be determined that the restriction has an associated value to the landowner that requires compensation for the property right restricted. DOE can engage USACE as its agent to secure the restriction for DOE and determine the appropriate value of the surrendered right or can conduct this work under authority of the Atomic Energy Act. DOE or USACE will appraise the land and

determine an appropriate amount to compensate the landowner for restrictions and access to maintain the remedy.

Since proprietary controls rely heavily on state law and practice, it is important to maintain awareness of relevant state legislation and regulations. More states are enacting legislation following the Uniform Environmental Covenants Act (National Conference of Commissioners on Uniform State Laws 2004), model legislation that may reduce the legal and management complications associated with using ECs as ICs. For most states, the EC is executed between the landowner and the state, and DOE may not be a signatory to the instrument. The state, as either the regulator for the cleanup or the regulator for the residual contamination, has the enforcement authority for the EC. However, DOE is the owner of the contamination and is, therefore, either named or implied to be a third-party beneficiary to the restrictions. In this case, the EC requires that LM review and approve any actions that could violate the ICs before proceeding. Recognizing that the position held by the third-party beneficiary in the EC may not be as strong as needed, many states are revising their IC laws to include the owner of the contamination as a "holder" of the restriction and to make the holder a signatory to the EC. This position allows for more oversight in the implementation and establishes the third party as the enforcement authority if a violation occurs. See further discussion in Section 4.5.

4.4.2 Multiple-Property or Multiple-Landowner ICs

If groundwater is contaminated, if there is a large area to be covered, or if the area comprises land owned by numerous landowners, it may be more useful to use mechanisms that bind many properties and landowners with a government control in one instrument, such as a zone overlay or well-drilling restriction. These mechanisms are enacted through state, local, or tribal government agencies, who also provide the enforcement. Stakeholder input for zoning initiatives is provided through established processes for gaining approval for such measures. Examples of these mechanisms include zoning restrictions for land use (e.g., residential, landfills) or groundwater (e.g., mandatory access to city water). These ICs will be included in the ICTS for periodic monitoring to ensure that the mechanisms are in effect and are being enforced.

4.4.2.1 Groundwater Management Zones

Many states require permits for all wells that access groundwater for monitoring, consumption, and other uses. For sites where there is a need to restrict access to contaminated groundwater, LM should pursue restrictions with the entity that has authority to grant well permits, such as the State Engineer's Office or other water management entity. This office has authority over water rights and well construction. Groundwater restrictions can take many forms, including establishing groundwater management zones or protection areas, prohibiting or limiting (e.g., drilling to specified depths) groundwater uses in designated areas, capping or abandoning wells, and limiting new well permits. It may be possible to specify geographical areas or hydrologic zones within geographical areas to restrict well drilling for all purposes that pose a human health or environmental risk. Well construction permit processes can be used to limit access to aquifers that are contaminated without prohibiting drilling altogether. Limiting access to only contaminated aquifers, if appropriate, can help alleviate concerns by landowners that all water rights have been taken. For states where well permitting is not required, groundwater restrictions will need to be secured by other mechanisms.

Caution should be exercised to ensure that both the water-quality and water-rights issues are addressed. In some states, separate entities grant water rights and well permits. In these states, it is possible for a permit to be granted to the legitimate owner of a water right even though the water is contaminated, because water quality may be determined in another branch of state government. It is essential that required restrictions cover both water quality and water rights.

The concept of compensation may apply for restrictions to large areas where there is a need to restrict access to contaminated groundwater. If DOE takes the landowner's legitimate rights to groundwater, the water resource must be replaced or compensated for. Where there is a large groundwater contaminant plume, and LM has determined to eliminate access to groundwater, DOE has provided funding to the local municipality to extend water lines to residents with water rights within the boundary of the contaminant plume.

4.4.2.2 Zoning Ordinances

Zoning ordinances can be effective government ICs mechanisms when large areas of land are subject to restrictions as part of the remedy or LTS&M. Establishing zoning ordinances for ICs entails using the "police power" of the state or local government to implement and enforce the ICs. An ordinance may regulate land use, types of structures, mandated water use (city- or county-provided water), density of population, and other general development considerations. A zone overlay may be used to restrict development along an area of contamination or to protect resources in a designated area. One of the most effective uses of zone ordinances would be that anyone seeking a building permit for construction activities be notified of contamination and informed of any relevant soil management practices. This would control or eliminate any excavation that would result in unacceptable exposures in areas where contamination remains. With the exception of federal lands, the authority to regulate land use resides with state and tribal governments. Most of the authority is delegated to municipal and county governments.

LM must work with the entity that has jurisdiction for the zoning in the area needing restrictions or protection. Most counties have planning and zoning boards that propose and implement specific zoning needs in their jurisdictions. Zoning changes require an application from the owner of the property. In the case of multiple properties, the zoning authority may propose the change on DOE's behalf. The approval process entails a series of notifications and public hearings before a planning commission or governing body (e.g., county commissioners, city council) to collect input from affected landowners prior to formal approval. It is important for LM to participate in the public hearings to explain the need for the zoning change and the restrictions and to answer questions posed by the public, planning officials, and members of the jurisdiction's governing body. Once approved, the change will become part of the official regulations for the jurisdiction and will be enforceable as a code violation should there be an infringement on the restrictions.

One of the weaknesses of zone ordinances and overlays is that they can be changed. An area can be rezoned, or variances can be granted. It is important to periodically evaluate whether zoning serving as ICs is in effect and is operating in a way that is protective and is supporting the remedy. For sites in more populated areas and where the potential exists for the development or reintroduction of residential interests (e.g., conversion of previously zoned industrial or

commercial areas to residential land use), zoning should be checked more frequently as land use and other pertinent changes are more likely.

4.4.3 Notices

Unlike administrative controls, notices for contamination contained in deeds or other instruments to be filed in local land records are not intended to convey an interest in real property. Consequently, such notices usually do not serve as enforceable restrictions. Because they are recorded, notices are discovered during a title search on a particular parcel or parcels. Notices provide background information on previous activities on the property, background on the cleanup efforts, and any potential contamination.

Notices are easier to develop and implement than administrative controls. However, they are not protective and should not be used as the sole IC if an enforceable restriction is warranted. Language in notices should be carefully drafted to avoid unintentionally suggesting that a notice creates rights or obligations.

There are some important considerations for notices. Some jurisdictions require that property rights be conveyed for an instrument to be recorded in local land records. Other jurisdictions have statutes that indicate what may be recorded, the contents of a recordable document, and the procedures for recordation. In addition, jurisdictions vary on whether the landowner's approval is needed to record a notice; some allow third-party recordation, while others allow only the landowner to record an instrument.

While the intent of a notice is generally to inform current and future landowners, LM does have examples of recorded notices that are enforceable. Some state ICs mechanisms call their instruments "notices," but these ICs have clearly stated enforcement authorities and processes. All enforceable ICs contained in notices are categorized as administrative ICs. The enforceable restrictions in the instrument determine the classification as an administrative IC.

4.4.4 Registries, One-Call Systems, and Advisories

Each one of these mechanisms provides information about the property and any residual contamination. In most cases, registries are state or local lists of all properties that are subject to land use or resource restrictions due to residual contamination or a protected resource. State and local jurisdictions may also maintain a "one-call system" that is a repository for history of contamination on a site.

Advisories are warnings that give potential users of a resource notice of existing or potential risks associated with that use, such as an advisory not to swim or fish in waters that are potentially contaminated. Advisories are issued to the public by public health agencies at the federal, state, or local level when a determined threshold standard is reached.

4.5 Drafting ICs Language

Because ICs not only involve restrictions but also must include access to ensure compliance, the Real Property Management staff must support the Projects/Programs staff to execute mechanisms and instruments that are enforceable, visible (readily accessible), and enduring. All

instruments must be crafted to clearly state the required restrictions and to maintain access for LM and regulators to compel compliance with the ICs. Developing the appropriate instruments and language entails a working knowledge of federal and state environmental laws, federal and state regulations, and state real estate law and practice. One of the challenges faced is translating the land and resource use restrictions into the appropriate instruments.

State laws and regulations for ICs are constantly changing and should be checked each time ICs are required for a site. Each instrument requiring restrictions should present the following information:

- A description of the objectives to be attained in terms of the specific land and resource use restrictions.
- A description of the types and locations of residual contamination.
- A legal description and map of the restricted areas.
- A detailed list of all restrictions required.
- Identification of the entities responsible for implementing, maintaining, and enforcing the ICs (e.g., grantor, grantee, and holder, if applicable).
- Specific notice and approval requirements for the lease or transfer of property.
- Specific notification to any lessee of property regarding the ICs.
- Identification of the duration of ICs and requirements for periodic assessments.
- Language specific to the binding nature of the instrument on subsequent purchasers.
- A discussion of the steps for modifying or terminating the ICs.
- The requirement for notifying all parties of any violation of restrictions.
- Provisions for enforcement and the identification of all parties with enforcement authority under the instrument.

If appropriate, it may be necessary to have the site surveyed, have permanent monuments erected to properly document the location of the affected areas, and conduct a review of the title to the property to identify all parties that have a real property interest the restrictions may affect. Clearly defining the ICs boundaries and all affected properties may prevent unnecessary confusion and may facilitate beneficial reuse. Accurate maps should be prepared in both hardcopy and electronic formats and should be made available as a mechanism for maintaining the restrictions' visibility.

The grantee for an ICs instrument is the party who holds property interest or restriction. The grantee, sometimes called the holder, holds the covenant or title to the real property interest and has the primary responsibility for maintaining compliance with the ICs. As stated previously, some states have regulations that allow for an additional party to be named the holder in the EC, which allows that party to take legal action to maintain the ICs. Where this is allowed, DOE typically becomes the holder of the instrument. This status strengthens DOE's position to maintain and enforce the remedy and associated restrictions. Because of the important roles all parties play in establishing, implementing, and enforcing ICs, a thorough evaluation should be performed before and during the establishment of all ICs instruments.

To identify the roles of all parties, consideration should be given to:

- The potential for the parties to cease to exist, or for their roles to change, during the duration of the ICs.
- The willingness and ability of the enforcing party to maintain the ICs (e.g., are funds available to maintain control or to take legal action against any party that violates the ICs?).
- The appropriateness of assigning enforcement authority to an entity that is not accountable through a consent decree, order, permit, or other legislatively provided authority.

4.6 ICs on Tribal Lands

DOE has several sites on tribal lands in the western United States. Tribes are sovereign nations with authority and jurisdiction over land use and associated restrictions. Although all tribes may not recognize ICs at this time, some mechanisms to limit grazing and water use restrictions have been established.

For sites on tribal lands, DOE has a Care and Custody Agreement or a similar agreement that ensures DOE the right of access to conduct LTS&M at these sites. DOE currently holds cooperative agreements with the Navajo Nation, the Hopi Nation, The Spokane Tribe, and the Northern Arapahoe and Eastern Shoshone Tribes to conduct LTS&M activities and ongoing groundwater remediation at the sites that affect theses Tribes. DOE and its representatives work in cooperation with tribal agencies to prevent access to areas of tribal lands as may be identified to facilitate remedial action and for protection of human health and the environment.

DOE will work with tribal representatives to identify needed restrictions, the areas affected by the restrictions, and the process to periodically evaluate the restrictions to ensure they are in place and are working as intended. As the authority for their land use, tribes need to develop the mechanisms to establish the restrictions, the processes to ensure the mechanisms are known to those who are affected by them, and the enforcement procedures to ensure the restrictions will remain in full force until they are no longer needed.

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5.0 Maintaining and Managing ICs

This section focuses on maintaining and managing ICs that have been deemed necessary for site protectiveness or that are needed to protect a sensitive site resource. Maintenance is an ongoing process that ensures that the primary purpose of the ICs is fulfilled. At this point, ICs are assumed to have been developed, reviewed by responsible and other interested parties, and established. Managing is the process for ensuring that the ICs remain effective and that there is a timely and appropriate response to situations in which the ICs are found to not accomplish the intended objective. Maintenance requirements will be specific to a given IC and will be incorporated into a site management plan (e.g., LTSP, LTS&M Plan, Site Operations Plan) or a specific plan for ICs, such as an ICMP or the *Comprehensive Legacy Management and Institutional Controls Plan, Volume II-Institutional Controls Plan* developed at the Fernald site. Where layering is invoked, maintenance requirements for individual ICs may overlap, but each IC must be evaluated individually.

EPA suggests that the following principles govern ICs maintenance and management (EPA 2012):

- Monitoring ICs effectiveness.
- Keeping responsible parties and other stewards aware of and knowledgeable about ICs.
- Conducting regular assessments.
- Modifying ICs to maintain their effectiveness.

ICs maintenance will be integrated with other postclosure care responsibilities. LM's ICs program will incorporate many of the postclosure care requirements imposed on LM, such as surveillance (keeping a watchful eye on activities at or near the site), monitoring (annual inspections of ICs), reporting (documenting the status of site ICs or any excursions from anticipated ICs performance), notification (conducting notifications to a regulator in the event of ICs violations), and assessment (evaluating each IC and site protectiveness as a whole to maintain the remedy) into the ICTS. The objective is to ensure that the site remains protective and in regulatory compliance.

5.1 Maintaining Awareness

For ICs to remain effective, knowledge and awareness of them must be maintained. Most ICs failures are the result of a loss or lack of awareness (loss of visibility or access) of the requirement for ICs and the mechanisms providing details of the restrictions (for example, see NRC 2003). LM's ICs monitoring must be designed to prevent this loss of awareness or alternately discover and reverse a loss of awareness.

The site management plan or equivalent plan for ICs should describe how the parties to the ICs are kept informed of ICs' requirements and performance. Communication with affected parties may have a regulatory basis or be implemented as a best management practice. These communications will be tracked and documented in the ICTS.

Mechanisms through which ICs awareness may be lost should be considered and addressed during ICs design and tracked for routine monitoring. Layering should be implemented to reduce the potential of ICs failure through loss of awareness by a single party or agency. Regular

targeted communication with parties affected by ICs will be the most effective means of preserving ICs knowledge. LM should also keep public information systems current. The assessment process will determine the effectiveness of the program to maintain awareness, and adjustments to this program will result from the evaluation.

LM will use the tools available for maintaining ICs awareness. These include the ICTS; LM public website; routine communications, reports, and notifications; press releases; and meetings with stakeholders. LM should seek confirmation that ICs information is received and understood, and solicit feedback from affected parties on a routine basis and as part of the assessment process. Ineffective communication methods should be revised.

5.2 Roles and Responsibilities

The primary responsibility for maintaining established ICs will fall to LM, which has jurisdiction over all the sites with ICs in its inventory. However, while establishing ICs, and as an ongoing action to ensure continued maintenance, LM should evaluate the community of affected parties to ensure that proper notifications are made, and information shared, as land use and political changes occur. Following are general descriptions of how different affected parties (or stewards) will be involved in ICs monitoring and maintenance. Affected parties are identified in specific ICs instruments (for administrative controls) included in the site management plan and the ICTS, and their roles and responsibilities should be described.

DOE

The LM site manager has primary responsibility for maintaining ICs for his or her assigned site. LM site managers will use the assigned LMS contractor members to conduct maintenance identified in the site management plan or equivalent plan for ICs to ensure that the established ICs are in full force and effect and are operating as designed. DOE is assumed to be the responsible party for ICs for an LM site, as defined by EPA (EPA 2012). This is consistent with DOE's role regarding CERCLA and UMTRCA sites, and it applies to sites where DOE is either self-regulated or has entered a state's voluntary cleanup program (e.g., Decontamination and Decommissioning Program sites, FUSRAP sites, Nevada Offsites).

The LM site manager has primary responsibility for:

- The identification, use, implementation, oversight, integration, and maintenance of ICs at his or her site.
- Ensuring compliance with all applicable requirements.
- Ensuring that all ICs (both regulator-imposed and DOE-imposed controls) are captured in the ICTS.
- Monitoring ICs for effectiveness and verifying that all stewards are aware of the ICs.
- Documenting all pertinent decisions regarding ICs and ICs violations.
- Communicating with other federal, state, and local government entities; tribal governments; and other affected stakeholders.

The LM site manager will engage appropriate resources to maintain ICs for a given site. Maintenance and monitoring activities may include:

- The inspection and surveillance of a restricted area.
- Monitoring to document site conditions.
- Maintaining access barriers and engineered controls.
- Complying with the statutory, regulatory, and self-imposed requirements defined in the ICs instruments.
- Evaluating risk if controls are degraded and completing appropriate corrective action.
- Evaluating failures of administrative controls and completing appropriate corrective action.
- Conducting periodic reviews of ICs' effectiveness.
- Preserving records and information.
- Keeping all interested parties aware of all required ICs.

The LM site manager will acquire the resources necessary to fulfill these responsibilities. This will usually entail using federal and LMS contractor resources to provide the necessary expertise for routine monitoring and responses to extraordinary occurrences. For example, LM may use the EMCBC and Office of General Counsel attorneys to review existing and planned ICs for sufficiency and long-term effectiveness.

Regulators

Most ICs will have a regulatory basis that is coupled with enforcement authority. This role will have been defined during the ICs development process. ICs will establish that basis and any requirements for regulatory oversight, which may include surveillance and reporting requirements to keep the regulator informed of site conditions and to demonstrate that the ICs remain effective. The oversight role may extend to regulators' acceptance of a site management plan that defines site ICs and the program for maintaining them.

Landowners

As most ICs address real property interests, the landowner is a primary party to ICs maintenance. Land use must remain consistent with ICs requirements and should not constrain acceptable uses. This will be defined in the ICs instruments, and ICs maintenance could include conducting surveillance of land use, comparing actual land use to restrictions and acceptable uses, and reporting to the designated parties.

Stakeholders, the Public, and Other Interested Parties

Other stakeholders may be interested in ICs maintenance. This will be determined by the site setting, land use on the site and on adjacent property, and development trends.

Owners of adjacent land can play an essential role in maintaining ICs by informing LM of site conditions and occurrences that may indicate compromised protectiveness (this concept is referred to as "community monitoring" in EPA 2012). These landowners might also be available

to acquire information on site conditions from remote sites if information is needed quickly (e.g., in response to severe weather or an earthquake). When practicable, LM maintains a working relationship with a local maintenance subcontractor or another local entity who will support this function.

ICs maintenance will entail interaction with other interested parties that have concerns about protectiveness, access restrictions, or other specific agendas. A site management plan or equivalent plan for ICs may include site-specific measures to disseminate information to these parties.

The general public consists of members of a local community who do not necessarily have an interest in site conditions or DOE activities until a noteworthy event occurs. The site management plan may include information-dissemination requirements to provide site information to members of this group.

Local Officials

Local officials are a key interface between LM and the local community. This group may include elected officials, land use planners and managers, and first responders.

Citizens' concerns are often forwarded to local officials before they are submitted to DOE. Keeping local officials aware of site conditions and stewardship activities can help prevent incorrect assumptions by the local community that arise from incorrect information or a lack of information. Local officials are crucial to ensuring that local resources respond appropriately to unusual occurrences at an LM site and can supplement the need to maintain surveillance of LM sites.

5.3 Establishing ICs Requirements in Site Management Plans or Equivalent Plans for ICs

When ICs are incorporated into the postclosure care program, the site management plan should specifically describe the risk that the ICs will mitigate, the nature of the ICs instruments, the regulatory basis for the ICs, and requirements to maintain the ICs. The ICs should be appended to the plan with other real property documentation.

A site management plan details the requirements for maintaining a site in a manner that is protective of human health and the environment. It also helps maintain compliance with regulatory or statutory requirements. If a site is self-regulated or is part of a state's voluntary cleanup program, the site management plan will define DOE's rationale for establishing and maintaining ICs.

The regulatory basis for conducting LTS&M should be stated in the plan. This includes the basis for each IC that will be managed in accordance with the plan.

Some regulatory agencies have guidance for developing a site management plan that includes addressing ICs. For example, Appendix D of NRC's *Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites under Title II of the Uranium Mill Tailings Radiation Control Act of 1978* (NRC 2003) provides guidance for the NRC staff's review of an LTSP. The

guidance includes a list of elements that the LTSP should include, as specified in 10 CFR 40.28, "General License for Custody and Long-Term Care of Uranium and Thorium Byproduct Materials Disposal Sites," and the equivalent licensing requirements at 10 CFR 40.27, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites." The NRC guidance does not anticipate the use of administrative ICs as part of the remedy per se. (The disposal cells addressed by this regulatory structure are considered engineered controls or barriers in the context of the NRC guidance.) However, the enabling legislation, UMTRCA, established that government ownership is required, which is an effective IC to control land use (UMTRCA; NRC 2003).

DOE guidance includes *Planning and Implementing RCRA/CERCLA Closure and Post-Closure Care When Wastes Remain Onsite* (DOE 1999). This applies to DOE sites regulated under CERCLA where hazardous materials or contaminated groundwater remain onsite after closure.

The NRC and DOE guidance apply to the development of a site management plan for LM sites regulated under any authority, including DOE actions under Atomic Energy Act authority. Both sets of guidance require a site description of sufficient detail to demonstrate how the LTS&M program addresses potential risk. Risk will be identified on the basis of the site conceptual model and final site conditions. Risk factors that should be considered include effects on human health, ecological impacts, regulatory compliance, cost, and stakeholder confidence.

ICs requirements for maintenance may be stipulated in the ICs instrument. The hazardous-waste regulations of many states provide specific requirements for maintenance. In addition to the NRC and DOE guidance referenced above, other guidance is found in the LM Transition Checklist (DOE 2005b), which should point out postclosure care requirements addressed by ICs.

The site management plan establishes the entire program for postclosure care. It should reference administrative systems that support protectiveness, such as records and information management systems, quality systems, public affairs protocols, and health and safety systems. If an alternative plan is used, such as an ICMP, it should address ICs in a similar manner. Common elements relevant to ICs include (or provide direct reference to):

- A description of the remedy and the rationale for its selection.
- The site setting, including factors that affect protectiveness, such as climate and land use.
- The extent of residual contamination and processes and features that affect contaminant migration and exposure.
- ICs description, goals, and objectives, including:
  - Engineered controls, including as-built conditions and a description of the proper function of the engineered controls (referred to as baseline conditions in 10 CFR 40.27, 10 CFR 40.28, and EPA 2012);
  - Access and land use provisions and restrictions; and
  - Tools for maintaining ICs awareness.
- Responses to changed conditions that affect the remedy's performance and protectiveness (for example, see 10 CFR 40.28 [B][4] and 10 CFR 40.28 [B][5]), including notification requirements.

- The location of documentation of the remedy decision, risk assessment, and remedy implementation, including regulator concurrence.
- A description of and the rationale for the postclosure care program, including reporting requirements.
- Copies of any ICs instruments.

ICs maintenance will be specific to the restriction and level of control needed. The following are some methods that may be addressed in the site management plan.

Surveillance—The site management plan should present the ICs that must be maintained so that observed conditions can be compared to the conditions that indicate effective control of a specific risk. Surveillance can be required for access controls, engineered controls, and other resources that must be protected. Protocols for addressing damage or evidence that the ICs are not functioning as designed should be provided.

Monitoring—Environmental monitoring may be prescribed as a means to track risk and ensure compliance with cleanup standards. This includes the monitoring of contaminated media to indicate the extent of contamination and conditions at locations that are not contaminated (negative data); the monitoring of slow modifying processes that might indicate degradation of engineered controls; and the monitoring of conditions of other resources, such as vegetation or wetlands. The site management plan should present the rationale for the monitoring, benchmarks for assessing results, and protocols for addressing unusual results.

Notification—The site management plan should specify procedures for distributing routine and nonroutine findings and observations to parties to the ICs and other affected parties in accordance with regulatory requirements and public affairs protocols. Conditions that indicate degraded control and damage or potential hazards may trigger urgent notification requirements.

Documentation, Reporting, and Certification—Surveillance and monitoring findings and activities must be analyzed and preserved for use by decision makers and future stewards. Results of ICs monitoring activities should be distributed to affected parties and preserved to document that the ICs remain effective and to identify trends that may indicate a need to reassess an IC. The site management plan should specify documentation and reporting requirements.

Assessment—The site management plan should specify requirements for the periodic assessment of the ICs' effectiveness and the potential for modification or termination. A site management plan should also describe specific and conceptual criteria that would trigger a nonperiodic assessment.

When LM chooses to establish ICs for a site or to augment regulatory requirements for ICs with additional layers of protection, the site manager may choose to create an ICMP. This plan is not a regulatory document, but LM may choose to provide it to site regulators for informational purposes. Because the ICs are not required by regulation, DOE may choose to amend the ICs as site conditions allow without regulator approval. The site manager may also choose to amend the site management plan to include DOE-imposed ICs. Any changes to a regulatory site management plan will likely include a regulatory (and potentially a public) approval process. Prior to inclusion in an approved site management plan, DOE must determine if regulatory approval is warranted for DOE-imposed controls. The DOE-imposed ICs in the ICMP will be added to the ICTS and will operate and function similarly to the controls imposed by regulators.

5.4 Managing ICs

LM maintains systems that are designed to preserve and disseminate site knowledge, including knowledge of site-specific ICs. These include the LM public website at www.lm.doe.gov, records (official records management and real property working files), information and data management systems, and tracking systems.

ICs Tracking System

LM developed the IC Data Standard to define elements of ICs required to describe IC information. The ICTS is the repository for the ICs information. The ICTS is used to collect data on ICs for all LM sites, will generate the checklists needed to monitor and maintain ICs on the frequency specified, and will serve as the repository for specifics on ICs events, such as periodic assessments of ICs efficacy and details of ICs violations.

The ICTS contains ICs information by site, including the specific locations of ICs, the regulatory authority for the site and if the ICs are required by statute or regulation or if they are self-imposed by DOE, the type of IC and any instrument containing the details of the ICs, the contaminated media and ICs events, and the status of any ICs that are being developed or have been implemented. The LMS contractor will appoint a coordinator for the ICTS who will be responsible for the data quality. The LM site manager and LMS contractor site lead are responsible for ensuring that all ICs are included in the ICTS.

The most important aspect of the ICTS for managing ICs is the module which tracks the ICs that require monitoring, the frequency with which they should be monitored, and the results of the assessment effort. This module also contains information about violations of ICs and periodic assessment of sitewide ICs. Monitoring, violations, and sitewide assessments are termed IC events in the Data Standard. At the time of the required monitoring, the ICTS will generate a checklist of the ICs to be monitored. The checklist will be completed by the LMS contractor site lead, and the results will be entered into the ICTS for the next monitoring event. Not only are individual ICs monitored, but the ICTS also tracks periodic sitewide evaluation of ICs to account for groundwater plumes or other changed site conditions.

Monitoring ICs

The site management plan and programatic guidance should specify the requirements for the periodic monitoring of required ICs. This is an essential component of the Plan–Do–Check–Act cycle. Periodic monitoring will be driven by risk and, in some cases, regulation. Generally, the monitoring is a portion of a performanced-based approach to maintaining protectiveness, consistent with EPA guidance (EPA 2012). Uncertainties about site conditions or the durability of engineered controls or other provisions implemented to ensure protectiveness are also evaluated through periodic assessment.

Requirements for periodic monitoring should be established during the ICs development process and documented in the site management plan. Monitoring requirements will be based on the potential for and consequences of ICs failures. ICs should include the flexibility, if technically justified and provided for under applicable regulations, to modify the assessment frequency or terminate the ICs. Most sites undergo an annual inspection, and monitoring and maintenance of the engineered controls are conducted at that time. Assessment of the administrative ICs will be

added to the inspection checklist and conducted at that time or with the frequency determined by the LM site manager. In addition, CERCLA requires periodic reviews at intervals no longer than 5 years and starting no later than the fifth anniversary of the signing of the ROD. Therefore, for a CERCLA site, the assessment period would not extend beyond 5 years.

Regulations governing hazardous materials may change. ICs requirements should be checked against current regulations to assess compliance. For example, reporting or other administrative requirements may change to reflect changes in the regulator's organization or information management processes. While provisions of a site remedy should be firmly established upon regulator concurrence, it is conceivable that risk parameters (e.g., groundwater movement, changes in chemistry) may change, and ICs will require assessment to determine if modification is needed to ensure protectiveness.

Assessment parameters should be defined during the development of the ICs. These will be driven by the site conceptual model and should reflect the potential for completion of exposure pathways. Assessment parameters may address the following:

- Do risk assumptions remain valid?
- Are the ICs functioning as intended (do they prevent restricted activities)?
- Has an engineered control changed from as-built condition, and is it performing as designed?
- Do trends of conditions indicate a pervasive degradation of structures or control?
- Is physical maintenance needed?
- Do responsible and affected parties remain aware of the ICs?
- Is the postclosure care program effective, or should it be modified?
- Is DOE in compliance with applicable regulations?
- Are the ICs still needed?

ICs monitoring should include a recommendation for when the next monitoring event will occur. When the recommendation is accepted, the schedule is entered into the ICTS.

Nonperiodic Monitoring of ICs

When LM learns that site features may be damaged or otherwise suffer diminished protectiveness, LM will acquire additional information needed to conduct a site assessment and then evaluate potential risk. LM's response will be determined by the severity of the situation and the potential for exposure to hazardous materials. Regulator and stakeholder notification requirements will be followed for an initial report and subsequent updates as the assessment proceeds.

LM maintains a process for notifying LM site managers and LMS contractor site leads of severe weather and earthquakes. LM monitors the media to learn about stakeholder concerns or changes to local land use. LM also maintains a 24-hour reporting phone line to receive reports of concerns about LM sites.

The site management plan should establish procedures for responding to damage or loss of protectiveness.

Response to Violations, Failures, or Protectiveness Issues

The site management plan will include a conceptual framework for responding to instances of loss or threat of loss of protectiveness. The response will be governed by the severity of the threat. Minor changes (e.g., a change of ownership) require an administrative response, such as informing new owners of restrictions and other ICs provisions. (The new owner should already be aware of ICs if the restriction is tied to real property records that would be identified through a title search.) Other changes may require a more immediate response. For example, offsite development may alter site hydrology and necessitate a change to controls needed to prevent exposure to contaminated groundwater. DOE's response would include a nonperiodic assessment. The objective would be to restore protectiveness and inform all stewards of response actions and the results of the nonperiodic assessment.

Violations of administrative controls and the resultant response and resolution will be added to real property records in the file for the specific ICs instrument that was violated.

DOE maintains an emergency notification apparatus. The regulator's agency will also have similar provisions. The site management plan should describe notification requirements. LM will conduct immediate intervention in severe cases when the public or DOE property may be at risk. Follow-up actions will be coordinated with the regulator. This is consistent with NRC requirements to include in the site management plan provisions for reporting "unusual damage or disruption."[2] DOE notification should describe the changed condition and at least an initial assessment of risk.

Documenting ICs Events

Results of all ICs monitoring, whether individual ICs monitoring or sitewide evaluations of ICs, and information about violations to ICs or IC failures will be summarized in the ICTS. The site management plan should describe all requirements for documentation and reporting (e.g., annual inspections and CERCLA 5-Year Reviews) of ICs events. ICs event results will be documented and preserved in the site file in accordance with LM protocols. LM will inform regulators and stakeholders of assessment results in accordance with the requirements stipulated in the ICs and in LM protocols.

Other Information Systems

The LM public website presents site and program information to the public and is designed to answer stakeholder questions about the LM program and conditions at any given site. Site information includes site descriptions and remedy documentation, regulatory requirements, and surveillance and monitoring data.

The LM website also provides access to the Geospatial Environmental Mapping System (GEMS), which presents property boundaries, monitoring locations and results, and ICs boundaries and associated instruments. These may be presented along with U.S. Geological Survey topographic map coverage or satellite imagery.

[2] 10 CFR 40, Appendix A, Criterion 12.

Site information presented on GEMS is dynamically extracted from the LM Geographical Information System (GIS). Electronic drawing information is linked to GIS. Real property information, such as ownership and control boundaries, is captured in GIS, and geographical information is managed as "bases," including a civil base of as-built conditions, a survey base of boundary information, and a topological base.

Through GEMS, a user can access monitoring data, which usually consists of groundwater monitoring results and trending information but can include other monitoring data. The monitoring data are extracted from the LM Site Environmental Evaluation for Projects (SEEPro) database. A site transition activity entails acquiring historical environmental monitoring data and incorporating it into SEEPro. This process entails a thorough evaluation of data documentation. These data are essential for assessing the risk associated with modifying or terminating ICs.

Site information usually includes records and documentation acquired when a site transitions to LM. The site transition process includes a careful assessment of information that LM needs to maintain site integrity and protectiveness and includes design data (e.g., engineering calculations and drawings), closure plans (which demonstrate how the remedy will be implemented), as-built conditions, and pretransition performance monitoring results (see DOE 2005a and DOE 2012). This information establishes baseline conditions and maintenance requirements, and is used to develop the site management plan.

LM records management systems comply with applicable regulations. Systems are designed to preserve records for availability to the LMS contractor and stakeholders. As a nonrecord form of gathering information, the LMS contractor real property staff maintains a file on all administrative ICs and notices, which should be updated with any pertinent information (Attachment 3). All engineered controls are identified and reported in FIMS. FIMS data are updated yearly with input from the LM and LMS contractor site staffs.

5.5 Modification or Termination of ICs

Periodic assessments will consider whether ICs continue to be required to protect human health, the environment, or DOE property. The assessment refers to the objective of the ICs and criteria for terminating the ICs. For example, if groundwater contaminants attenuate to concentrations below maximum contaminant levels, a groundwater use restriction may be eligible for termination.

LM will determine the feasibility of terminating any restrictions and coordinate ICs termination with the regulator. LM will review and trend data and may request revised risk assessments to evaluate release criteria. A review by DOE general counsel may be appropriate. Caution should be exercised to ensure that ICs can be terminated without adversely affecting site or sensitive resource protectiveness.

Termination actions must be fully documented. This will include the rationale for termination, an assessment of risk resulting from termination, public notification actions and responses, and regulator concurrence. Information on the termination of any or all of the ICs contained in an instrument will be added to the real property files along with the instrument being amended or terminated. Upon the ICs' termination, LM will modify the site management plan and update the ICTS status element and other information systems, such as the civil base (mapping) and GEMS.

6.0 Enforcing ICs

The preferred and fastest approach to enforcing ICs is to seek voluntary compliance through early problem identification and informal communication with the landowner or violating entity. Informal communication with the landowner or violating entity may begin with a phone call, which should be documented for the record. If resolution can be reached through the initial contact, a letter should be sent stating the resolution and to complete the record. If the violation is unacceptable to DOE and cannot be resolved, more formal actions will be required. Enforcement can occur in several ways depending on the type of ICs instrument, the authority being used, and the parties involved in the violation and those responsible for upholding the restrictions.

Administrative and physical controls can be violated. Except when a notice is an enforceable instrument, notices are for information only, and because they do not contain restrictions, they do not carry any obligations and cannot be violated. However, states are increasingly establishing laws that allow the state to enforce placement of notices in the local land records under state environmental laws. Similarly, many states are developing laws that require sites with ICs to be placed in a registry. These laws serve as informational controls and only apply to required listings in a registry. They limit land or resource use at a site.

As stated in Section 3.0, when remedies include ICs, LM strives to ensure that the parties to the instrument know their roles and will implement, maintain, and enforce ICs to maintain protectiveness. It is likely that most violations are caused by a lack of awareness of specific restrictions and not willful negligence, so a cooperative approach involving all affected parties is the appropriate place to begin the process of evaluating any infractions and determining if mitigative measures are warranted.

6.1 Roles and Responsibilities

Enforcement of specific ICs in administrative controls is determined by the governmental authority with jurisdiction over the restrictive mechanism for government controls (e.g., county government for development code) or the named enforcement party for proprietary controls, such as ECs.

While conducting site operations such as monitoring and annual inspections, LM and the LMS contractor may be the first parties to discover potential ICs violations. The LM site manager should notify the appropriate enforcing authority and determine who will contact the landowner or violating entity. If there is no voluntary compliance with the ICs, the enforcing entity is obligated to pursue whatever remedies are allowable under their authority. The LM site manager is responsible for ensuring that needed enforcement action is taken.

6.2 Enforcement of Administrative Controls

Administrative controls include those governmental controls (e.g., zoning ordinances) and proprietary controls (e.g., restrictive easements, ECs), and other instruments that have ICs components.

Government controls, such as zoning ordinances, are implemented and maintained by a government entity other than the one performing or regulating cleanup or LTS&M. These controls are documented in the codes of the appropriate government jurisdiction. Violations are violations of the code and are governed by defined administrative processes, including written notices of violations, administrative hearings, and fines. When establishing these types of ICs, LM should meet with those responsible for establishing the control to define the risks incumbent in violations and LM's expectations for enforcement should a violation occur.

The most common proprietary controls LM uses are restrictive easements and ECs. If ICs are established using state legislation (an adaptation of the Uniform Environmental Covenants Act), the resulting EC will clearly state enforcement authorities and procedures among the grantee, the state, and LM, if identified as a third-party beneficiary or holder. State regulations vary, but under state-adopted laws modeled after the Uniform Environmental Covenants Act, many parties may have the authority to enforce an EC, including (1) those granted specific enforcement authority in the document, (2) the state's environmental entity, (3) a person whose interest in the property or liability may be affected by the violation of the ICs, and (4) a unit of local government. If a state does not have legislation addressing ECs, proprietary controls are enforced on the basis of the state's contract and real property law. If DOE is to enforce against violations of ICs, it must refer the case to the U.S. Department of Justice for appropriate action.

Other documents with IC components that could be violated include consent decrees and Federal Facility Agreements. These instruments are executed at the beginning of remedial action and often end at the end of the remediation. As stated previously, the ICs provisions may apply to the cleanup phase or the ICs may endure for the time the contamination is above regulatory requirements, up to and including perpetuity. The appropriate regulatory entity for these documents maintains the enforcement authority for any violation. When an IC enforcement authority is pursuant to an agreement, decree, or contract that may terminate, LM should review their termination provisions to ensure that the appropriate rights are retained in the long term for the effective maintenance and enforcement of restrictions for the duration they will be needed.

7.0 ICs for Reuse and Property Transfers

One element of LM's mission is to ensure beneficial reuse of as many of its assets as possible or practicable. Sites are continually assessed for reuse potential, including uses of the land while DOE maintains ownership, such as renewable energy uses and grazing. For every reuse opportunity, LM evaluates the reuse opportunity with consideration of the ICs on the land and the potential of the proposed reuse to violate any of the required restrictions. In developing the appropriate real property instruments that allow the reuse, all restrictions are specifically addressed to ensure compliance and protectiveness. The instruments will also contain any monitoring of reuse activities that could uncover infringements on or violations of ICs.

In addition, LM reviews its requirements for LTS&M and determines if land is excess to DOE's needs. When land or assets are deemed no longer needed, LM uses disposition of the land or asset as the best possible reuse. LM carefully considers whether the land or asset can be safely transferred to others. If contamination is present, LM will ensure that ICs will remain in place and be effective for as long as needed.

DOE must comply with statutory and regulatory requirements applicable to property transfer. Transfer of DOE property follows a well-defined process and must be conducted in accordance with the requirements of DOE Order 430.1B, *Real Property Asset Management*. Information on the environmental requirements associated with real property transfer is contained in *Cross-Cut Guidance on Environmental Requirements for DOE Real Property Transfers* (DOE 2005a), including provisions for CERCLA Section 120(h), which provides for disclosure of past contamination on the property. Transfers can come from other DOE offices, such as EM (e.g., the Rocky Flats, Colorado, Site; the Fernald site), from other federal agencies and programs (e.g., FUSRAP), and from private entities (e.g., UMTRCA Title II sites from private licensees).

7.1 Roles and Responsibilities

With the help of the transferring DOE office, another federal agency, or the private entity, the LM site manager must identify all restrictions associated with a site transitioning into LM and ensure that all of the ICs needed for protectiveness are addressed either prior to or concurrent with the transition into LM. For acquisitions, USACE assembles the transition package, including the deed for the fee land transfer and all required ICs as provided by the licensee. Further, when property or a property right is determined to be excess to site needs, the LM site manager must identify all of the restrictions that must remain with the property. For dispositions, the U.S. General Services Administration (GSA) or DOE assembles the appropriate package and conveyance and includes the ICs, if needed.

DOE and LM have developed several transition documents that are helpful to identify all elements of a site transition, thus enabling successful transitions with few overlooked issues. EM and LM developed the *Site Transition Framework* (DOE 2005c), which established requirements in 10 areas (see Section 4.3). Section 4.0 specifically addresses ICs, real and personal property, and enforcement authorities. LM developed the *Process for Transition of Uranium Mill Tailings Radiation Control Act Title II Disposal Sites to the U.S. Department of Energy Office of Legacy Management for Long-Term Surveillance and Maintenance* (DOE 2012). During the transition of Title II sites into LM, ICs are identified, and the

instruments containing the restrictions become part of the acquisition package. For dispositions, required ICs are identified in the disposition package prepared for GSA, and the restrictions become part of the conveyance to others.

7.2 ICs in Real Property Transfers

Before LM accepts a property acquisition or commits to a property disposal, all ICs should be identified, and there should be a reasonable expectation that the ICs requirements can be met. This applies to all affected owners of restricted property for either an acquisition or recipient and other affected land and real property rights holders for property disposals.

When considering the transfer, sale, lease, or change of management of any property or property right, LM must assess whether the property is subject to requirements for ICs and whether the restrictions for the property or property rights are in place. Entities such as parties with economic development interests, local reuse authorities, local municipalities, DOE realty officers, and LM site managers should be involved in identifying potential future uses for the site to determine the most appropriate ICs for the long term. LM should consider the following actions:

- Notify the appropriate site regulators (e.g., EPA, NRC, the State) before any action is taken, in accordance with applicable requirements.
- Retain any interests LM may need for LTS&M.
- Ensure that the required restrictions are attached to the property conveyance.
- Notify all affected parties of the transfer.
- Conduct all other stakeholder notifications as may be necessary and prudent.

DOE Policy 454.1 states that "DOE will determine whether responsibility for required institutional controls on the transferred property can be maintained by subsequent landowners consistent with applicable law. If this implementation responsibility cannot be reliably assured, then DOE will retain necessary responsibility and authority for the institutional controls, including continued ownership of the property, if necessary." LM uses the ICTS to monitor awareness of the ICs to ensure that they are effective in maintaining awareness and compliance with the necessary restrictions.

LM must ensure that all parties affected by a property acquisition or disposal understand the requirements and conditions imposed by the ICs. The nature of the limits and restrictions on property needs to be publicly available and documented. All those affected must have the authority, willingness, and capability to fulfill the responsibilities imposed by the restrictions. If DOE disposes of property where maintenance of certain features or resources is incumbent in the ICs, the conveyance should incorporate written commitments for continued maintenance. The conveyance should also include contingencies to mitigate the consequences of potential abandonment of the property, bankruptcy of the owner, or failure to maintain or uphold the ICs. For a property disposal, DOE can either make the ICs the responsibility of the new owner or retain the right of access to continue that responsibility.

Property acquisitions in fee are most commonly conducted for the benefit of DOE by USACE. USACE will work closely with all parties in the acquisition to ensure that all LTS&M requirements are addressed in the property acquisition. For the UMTRCA Title II sites, LM

works closely with the site licensee to identify all property that must be restricted. It is the licensee's responsibility to transition the site when all LTS&M elements covering fee lands are complete and in place. USACE will ensure that proprietary ICs instruments are part of the land transfer package. LM is responsible for establishing any ICs for federal lands that will be reflected in the long-term care boundary.

DOE is responsible for the transfer of all federal land and other real property rights, such as mineral, oil, and gas rights. All transfers from federal agency to federal agency, such as transfers from the U.S. Bureau of Land Management to DOE, result in the land remaining in federal ownership. If ICs are required, no instruments need to be developed because, as stated previously, federal ownership is one of the most effective ICs. However, all transfers are subject to prior existing rights, and DOE may be unable to acquire all of the property or rights necessary for residual contamination to remain undisturbed. In these cases, it is DOE's responsibility to establish ICs with any owner of rights that are senior to DOE request.

GSA is the federal agency DOE generally uses as the broker to conduct most property disposals. When required for protectiveness, ICs are an essential component of the disposal packages prepared for GSA to conduct the disposal on behalf of DOE. Information pertinent to the ICs is provided to GSA for inclusion in the conveyance (e.g., restrictions, boundary, duration). Because DOE is still the party responsible for any residual contamination, the ICs on transferred property will continue to be monitored for awareness and effectiveness. If DOE conducts a property disposal under the authority of the Atomic Energy Act, ICs obligations are defined in the document that conveys the property.

Under UMTRCA, DOE must also be a party to the disposal of any former mill tailings site properties by the cooperating states or subsequent owners of the properties. Under the legislation, the host state acquired the processing site for the cleanup. When cleanup actions were completed, the host state conveyed the property either to DOE for the disposal cell or, if the tailings were moved offsite, to a local governmental agency. If the property is later determined to be excess to the state or if the subsequent owner decides to sell the property, the ICs in the original conveyance (which runs with the land) mandates that DOE be provided notice and approval rights for the property transfer. This lets LM ensure that all ICs are appropriately represented in the property transfer and allows for communication with the new buyer about the restrictions on the property.

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8.0 Records

Once executed copies of the ICs and any associated background information for a site are received, they will be coded into the appropriate category in the project and real property file plan, and the original hard copy will be sent to the Records Management group for retention. If received electronically, data will be downloaded, and a copy will be sent to the Records Management group. Copies of all ICs should be directed to the LMS contractor Real Property point of contact for proper coding and disposition.

8.1 Real Property File Plan

Because DOE maintains a real property interest in enforceable ICs, copies of all ICs will be maintained in the real property records. The file plan was designed to differentiate among the types of ICs: administrative (which are usually enforceable), notices and notifications (those that provide information on past activities or potential contamination), and engineered controls. Although a category exists in the real property working file for engineered controls, the most current and significant information regarding engineered controls is entered in FIMS. FIMS maintains current information on any engineered control that must be monitored and maintained for protectiveness.

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9.0 ICs Lessons Learned

9.1 Introduction

This section describes experience gained in implementation and management of ICs on LM sites. LM can also benefit from lessons drawn from sites that LM does not manage, and these are described in literature from many programs, including U.S. Department of Defense and U.S. Department of the Interior sites.

LM has extensive experience with managing ICs because LM is responsible for many sites regulated under various regulatory regimes, situated in diverse locations, and having multiple conditions that require management to prevent unacceptable exposure to residual contamination. LM must ensure that appropriate ICs are established and maintained in performance of LM's primary mission to maintain protectiveness and regulatory compliance.

ICs have been in use long enough for case histories of successes and failures to be well documented and widely available. "ICs failure" means the control did not achieve the desired objective. A failure does not necessarily result in harmful exposure. Consequences of an ICs failure can be as severe or innocuous as an inappropriate land use in violation of a restriction, compromise of containment or exposure of receptors to hazardous materials, a loss of knowledge about a hazardous situation and the associated IC, or a loss of confidence in the sustainability of a remedy.

The following sections describe LM's direct experience in implementing and managing ICs. Most LM ICs have been successfully implemented. At several sites, protective measures, including ICs, have been modified after they were found to be less effective than needed. The lessons learned from LM ICs experiences are grouped into lesson categories, and specific lessons are offered for the individual cases.

9.2 Successful Prevention of Exposure

UMTRCA Title I Sites
Contaminated groundwater remains at most UMTRCA Title I uranium processing and disposal sites, including sites at Ambrosia Lake, New Mexico; Durango, Colorado; Grand Junction, Colorado; Green River, Utah; Gunnison, Colorado; Lakeview, Oregon; Monument Valley, Arizona; Naturita, Colorado; Rifle, Colorado; Riverton, Wyoming; Shiprock, New Mexico; Slick Rock, Colorado; and Tuba City, Arizona. The selected remedy for many of these sites is natural attenuation (also called natural flushing) and ICs. DOE must prevent exposure to the contaminated groundwater until concentrations are reduced to safe levels. UMTRCA stipulates that processing sites be offered to the previous owner or conveyed to a government entity for public use; in the latter case, this restricts land use and would prevent potentially harmful exposure scenarios, such as residential use or subsistence farming. Surface remediation is complete at all UMTRCA Title I processing sites, and the sites have been returned to beneficial use except where tailings disposal cells were constructed on the sites.

Various remedies have been implemented to prevent exposure to the contaminated groundwater at most of the processing sites, and implementation at other sites is ongoing. At the Riverton and Gunnison sites, water from the contaminated shallow aquifer was routinely used for consumption

and irrigation. DOE provided alternate water supplies to these communities and conducts routine monitoring to ensure that local residents do not access the contaminated groundwater.

DOE is working with Colorado officials to implement environmental covenants or environmental restrictions to restrict groundwater consumption at the Durango, Naturita, and Slick Rock sites. These measures are invoked in accordance with state law, and the State has enforcement authority. Implementation is ongoing and has been delayed by requirements to conduct title abstract work for all affected properties to identify owners and other parties with an interest in the properties. The owner of a portion of the former Durango processing site does not want additional ICs implemented on the property.[3]

Rifle, Colorado, Processing Sites

There are two remediated processing sites at Rifle, in different settings and with different land uses. The City of Rifle is using the New Rifle site for industrial development and a wastewater treatment plant. Private development is taking place, subject to City review and with concurrence from Colorado Department of Public Health and Environment (CDPHE) and DOE. A portion of the Old Rifle site is used for municipal shops, and a portion is used for DOE-sponsored research into the biogeochemical behavior of tailings-contaminated groundwater. ICs at the Rifle processing sites include groundwater use restrictions in the deed conveying the properties to the City of Rifle (one of several restrictions included in the conveyance deed), zoning restrictions, restrictions on excavating into contaminated soil, and a requirement to connect to the municipal water system or install reverse osmosis water treatment. The area requiring ICs for groundwater extends well beyond the former processing sites. All these ICs should be highly visible to developers during plan review for building permits. However, excavation into contaminated soil has occurred because the contractor either was not informed of the restrictions or the restrictions were ignored.

Figure 4. Development at the New Rifle Site

Issue: A Title I processing site is not licensed by NRC unless tailings were disposed of on the site. NRC regulates groundwater at processing sites. Remedies have not been established for all the sites, and those sites do not usually have site management plans. DOE is actively working with regulators and stakeholders on remedy decisions for the remaining sites. ICs have not been

[3] Some regulatory regimes allow ICs to be imposed without owner consent.

implemented at all processing sites. However, regular groundwater monitoring is performed at the sites, and samplers observe changes in land use.

Lessons Learned: Establishing ICs can be difficult, time-consuming, and expensive, and requires the cooperation of owners, regulators, and the long-term care steward. ICs will generally require active management, and DOE must adjust the monitoring of ICs compliance to correspond to the level of site activities and development surrounding the site. Regular contact with stakeholders is necessary to ensure that awareness of ICs is maintained.

Falls City, Texas, UMTRCA Title I Disposal Site

In accordance with UMTRCA, the State of Texas acquired the abandoned mill site at Falls City for remediation. Only a portion of the mill site was required for tailings disposal, and the State requested DOE concurrence in the sale of the remainder. DOE reviewed site conditions and developed land use restrictions that would prevent unsafe use of the excess property; the restrictions were then incorporated into the quitclaim deed. The restrictions include a requirement that DOE approve development on the property. DOE then requested and received NRC concurrence in the sale, and the property was conveyed to a private owner. The conditions of the former processing site and the use restrictions imposed on the site are presented in the LTSP for the licensed disposal site. DOE has regulatory responsibility to manage the ICs at the site and observes site conditions and land use during the annual inspection of the disposal site. A State representative usually accompanies the inspectors, and the State has enforcement capability. DOE has not observed a violation of the ICs since the sale of the former processing site. Site owners and oil and gas developers are aware of the restrictions and have contacted DOE with questions about development.

Issue: Knowledge of site conditions must be preserved and conveyed to owners. If some land uses may pose unacceptable risk, DOE, in conjunction with other authorities, must implement a program of management and monitoring to prevent unsafe exposure to residual contamination.

Lessons Learned: Frequent surveillance and interaction with the landowner can ensure that no activities are allowed or conducted that will create a complete exposure pathway for contamination.

Grand Junction, Colorado, Site

This site, formerly called the Grand Junction Projects Office, had several uranium mills where milling technologies were developed in the 1950s. These activities resulted in contamination of the site surface and groundwater with mill tailings. DOE completed surface remediation around 1994 and selected a natural flushing remedy for the groundwater contamination in the alluvial aquifer. The remedy entails periodic environmental monitoring and ICs. DOE was able to apply a State-enforced environmental covenant to site groundwater that allowed the property to be transferred to another owner for reuse while retaining responsibility for ultimate compliance with groundwater regulatory limits. The IC prevents groundwater use while the aquifer is flushing. DOE manages the IC through regular surveillance, periodic groundwater quality evaluation, and signs prohibiting use of surface water bodies. The final radiological conditions of the site and the use restrictions imposed on the site are presented in the LTSP for the site. DOE is a tenant at the site and will observe unauthorized groundwater use. The landlord receives the annual inspection report.

Figure 5. Warning Sign Prohibiting Groundwater Use at the Grand Junction, Colorado, Site

Issue: DOE is responsible for the groundwater contamination at the Grand Junction site and needs a means to prevent exposure to the contamination while allowing site reuse to occur.

Lessons Learned: State environmental covenants provide a method to control exposure to residual contamination and enforce use restrictions. Frequent monitoring and regular contact with the party that controls land use will reduce the possibility of an IC violation.

9.3 Preserving Knowledge

Grand Junction, Colorado, UMTRCA Title I Processing Site

The Grand Junction mill site was remediated to conditions that allow recreational use. Soils were cleaned up to standards in 40 CFR 192, and groundwater contamination was left to flush naturally; background groundwater is high in selenium and not suitable for consumption without treatment. The selected groundwater remedy was natural flushing, use restrictions, and limited monitoring. Two ICs were implemented. An ordinance was passed requiring new construction within the plume boundary to be connected to the municipal water supply for domestic use. Also, in the real property deed transferring the former mill site to the City, an IC was stipulated that requires DOE and CDPHE approval of development plans for the former mill site to ensure that proposed uses do not expose the public to contaminated groundwater. DOE accomplishes this IC by contacting City of Grand Junction officials annually to determine if there are construction plans for the coming year and to remind them that DOE approval is required. DOE also invites State and City officials on the annual inspection to ensure that all parties are aware of the restrictions and know who to contact with questions.

Before the LTS&M program assumed responsibility for managing the site, the City Parks and Recreation department was involved in constructing concrete walking trails across the site. This occurred without DOE or CDPHE knowledge. Although no one was injured by exposure to site groundwater, this is considered to be an IC failure.

Since transfer of responsibilities to DOE stewardship programs, no violations or failures have occurred. The City properly obtained DOE approval for construction of storm water retention ponds and a parkway, in consultation with State regulators. Site ICs and requirements for postclosure care are published in a site management plan. Requirements include regular contact with owners.

Issue: When ICs for a site are specifically stated in the deed that conveys the land to a large organization, the information on the restrictions may not reach the specific office with responsibility for maintaining and developing the property.

Lessons Learned: The responsible steward must ensure that affected parties are aware of and observe restrictions. This retains knowledge of restrictions within the responsible organizations—individuals have memories, organizations may not. Active measures are required to establish and maintain institutional knowledge.

Informational ICs Using Facilities at the Weldon Spring, Missouri, and Fernald, Ohio, Sites

DOE established museums at the Weldon Spring and Fernald sites to present site information to stakeholders and preserve knowledge of historical site activities and current conditions. DOE conducts regular outreach programs and has site records available to the public. To increase the utility of these facilities, DOE also presents information on local ecology, and site restoration includes demonstrational planted areas, informational kiosks, and walking trails. DOE retained ownership of the land containing disposal areas and the museums.

Issue: Information about site radiological conditions must be preserved to ensure that only appropriate land uses will occur. Also, communities can be invested in land that is under DOE control, and the story of the stakeholders' sacrifices and contributions to the national defense missions is important. Community acceptance is enhanced when information about site history and site conditions are highly visible and/or readily accessible.

Lessons Learned: Highly visible and/or readily accessible information and access to reuse of remediated sites can inform stakeholders about site conditions and reassure the community that the sites are protective.

Figure 6. Presenting Information About the Weldon Spring, Missouri, Site to School Children at the Interpretive Center

Figure 7. Fernald, Ohio, Site Visitors Center

Monticello, Utah, CERCLA Site

The Monticello Mill Tailings Site is listed on the National Priorities List (NPL), and EPA is the lead regulator. In remediating the Monticello site, DOE applied supplemental standards to areas where uranium mill tailings contamination was left in place because the cost of remediation exceeded the benefit for contamination that posed no unacceptable risk, or remediation would cause excessive environmental damage, in accordance with Subpart C of 40 CFR 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings." Occurrences include tailings left beneath roads and utilities, contamination left in piñon-juniper forested areas, and contamination in creek sediments. Supplemental standards applications were developed that characterized the residual contamination and assessed risk to human health and the environment. A site management plan is in place, and DOE maintains staff at the site to conduct regular surveillance and monitoring of the supplemental standards areas, add new characterization data to site records, and support 5-year protectiveness evaluations. DOE stores contaminated materials excavated from the supplemental standards areas in a temporary storage facility at the site and ships it to the Grand Junction disposal site for disposal as material accumulates. Mesa County, Colorado, and NRC agreed to allow waste from Monticello to be disposed of in the UMTRCA Title I disposal facility. Several instances of residents moving sediments in the Montezuma Creek restrictive easement area have occurred, but the violations were quickly discovered, protectiveness was evaluated, and owners were advised of the restrictions on their property. DOE maintains regular contact with city and state officials to stay informed of pending activities in supplemental standards areas.

Issue: If residual contaminated materials remain at a site where constant maintenance or construction occurs, active management is necessary to ensure that affected parties are not exposed to or disperse residual contaminated materials.

Lessons Learned: An effective program of postclosure care, including ICs management, requires the coordination and cooperation of DOE and multiple parties. ICs must be actively managed to remain effective, and all participants in site stewardship, including local, state, and federal officials, landowners, and other affected and interested parties, must actively participate in maintaining protectiveness.

9.4 Change of Land Use

Hamilton, Ohio, FUSRAP Site

DOE remediated this site under FUSRAP in 1995. The LMS contractor first viewed the site in 2006, shortly after assuming responsibility for completed FUSRAP sites, and found that it was adjacent to areas undergoing redevelopment to commercial use. FUSRAP staff reviewed final site conditions and confirmed that radiological conditions conform to levels that allow unrestricted use and unlimited exposure. In 2011, a former FUSRAP worker noticed the remediated building was being demolished. No action was required as there are no concerns about future land use at this site.

Figure 8. The Site Owner at the Hamilton, Ohio, Site Demolished a Portion of the Remediated Site Building in October 2012

Issue: Over time, land use can change at a remediated site. If residual radioactive contamination remains, an ongoing program of active ICs management and monitoring is required to ensure that land use changes are known, and any potential impacts can be assessed and addressed.

Lessons Learned: Radiological contaminants at LM sites remain hazardous in perpetuity, and a reasonable anticipated future land use cannot be expected to remain unchanged for the duration of the hazard. If a site is remediated to conditions that are not safe for certain uses, surveillance is required to ensure that the owners do not redevelop the property for an unsafe use.

FUSRAP Supplemental Limits Sites

Residual radiological contamination was left in place in inaccessible locations at eight FUSRAP sites. The residual contamination includes dust contaminated with uranium and contaminated buried utilities. These occurrences pose no risk if land use does not change, but as structures are demolished and land is redeveloped, the materials must be managed for proper disposal.

Seymour, Connecticut, and Adrian, Michigan, FUSRAP Sites

At the Seymour FUSRAP site, contamination was left in place in buried drain lines beneath a remediated building. Adjacent property has been redeveloped for commercial use and municipal offices and facilities, and there is likely redevelopment pressure on the property containing the supplemental limits area. While dose modeling demonstrates there is no unacceptable risk to construction workers accessing the buried drains, future land use scenarios did not consider disposal requirements for the supplemental limits material. A similar situation exists at the

Adrian FUSRAP site, where contaminated material was left in place under supplemental limits in utility chases beneath an industrial building. Eventually the building will be demolished, and the contaminated material will become accessible and will require management for proper disposal.

Because approval of supplemental limits constitutes regulatory acceptance of residual contamination, no ICs were implemented on the supplemental limits sites before LM assumed responsibility for the sites. However, the need to manage residual contamination left in place under supplemental limits once it becomes accessible was not addressed. As a consequence of redevelopment, the physical conditions that controlled exposure and allowed approval of supplemental limits are invalidated. In a comprehensive risk assessment of FUSRAP sites, LM identified the need to manage residual materials as hazardous waste once they become accessible (many municipal landfills have a "no added radiation" rule for accepting waste). LM is working to establish ICs at the supplemental limits sites to ensure that LM is informed of activities that will allow access to supplemental limits material. LM conducts regular surveillance at these sites to monitor land use and ensure that residual radioactive contamination is managed properly if it becomes accessible. LM is investigating mechanisms that will inform future owners of the supplemental limits occurrences and the need to contact LM if redevelopment is planned.

Issue: Without a plan to monitor ICs to ensure that no site conditions have changed, it is possible that LM will not know of plans that can potentially create a complete exposure pathway or result in improper handling of residual contamination.

Lessons Learned: LM must have complete site documentation and understand site conditions and risks at the time of transition. An appropriate LTS&M program must be established for the sites to maintain protectiveness. The program may entail implementation of ICs. If ICs are part of a remedy, they must be fully implemented before transition of site responsibilities to LM.

New Brunswick, New Jersey, FUSRAP site

DOE completed remediation at the New Brunswick site and dispositioned it for redevelopment in 2006. A condition for regulatory closure of the site was that DOE place a deed notice on a portion of the property that contained elevated levels of arsenic in soil. The deed notice establishes a restriction on excavation in the contaminated soil area. In accordance with state regulations, DOE inspects the site at least biennially and submits a report to the state regulator and the owner demonstrating the site remains protective.

Issue: DOE has a mission of beneficial reuse but has responsibility for residual contamination for as long as it remains at unsafe levels. DOE must ensure that beneficial reuse of the land will not conflict with required restrictions and that the restrictions are established in real property instruments. Also, DOE had to comply with state regulations to achieve regulatory closeout in order to allow the property to be reused. State regulations establish a mechanism for restricting land use that is not protective; in this case, disturbing the area containing elevated arsenic concentrations in soil.

Lessons Learned: Before disposition of remediated property, LM must confirm site conditions and invoke appropriate ICs to ensure protectiveness. ICs should be developed in coordination with regulators to expand awareness of site conditions and use restrictions and reduce the risk of harm.

9.5 Site Surveillance and Monitoring ICs

Durango, Colorado, UMTRCA Title I Disposal Site
The Durango disposal site had been a gathering place for college students from nearby Ft. Louis College. DOE frequently replaced No Trespassing signs at the site that were damaged by gunshots, and often disposed of trash and debris. The access gate was hardened to protect the lock, yet the gate was bent by someone trying to open it, presumably with a truck. During an annual inspection, DOE found tire tracks on the rock-covered side slope of the disposal cell. DOE has limited presence at this remote site, resulting in a location where students and locals could vandalize site structures without surveillance. DOE asked the county sheriff to increase patrols past the site and installed guard rails and a new gate along the right-of-way boundary.

Figure 9. Damage at the Durango Site

Issue: At many remote LM sites that may only have one or two inspections or sampling events per year, there can be violations of ICs that would only be discovered during one of the infrequent site visits.

Lessons Learned: Evidence of disregard for postings and access controls should be addressed promptly and decisively; the public may assume that inaction indicates lack of control and lack of concern on the part of the steward(s). Surveillance may need to be increased, often with the help of local officials or residents, and access controls may need to be enhanced.

Rulison and Rio Blanco, Colorado, Sites
In 1969 and 1973 at the Rulison and Rio Blanco sites, respectively, the U.S. Atomic Energy Commission detonated nuclear devices several thousands of feet below ground surface to

stimulate natural gas production. LM assumed responsibility for these sites from another DOE program office. The land around the Rulison site is privately owned, and DOE maintains a 40-acre IC restricting subsurface disturbance around surface ground zero, the surface location directly above the detonation. At the Rio Blanco site, DOE withdrew 360 acres surrounding the site and prohibits drilling within the land under its jurisdiction. Oil and gas development in the region has resulted in increased drilling near both sites. The Colorado Oil and Gas Conservation Commission established a 3-mile zone around each site, and DOE reviews drilling permits for locations within the zone to ensure that the proposed wells do not threaten containment of radioactive material within the detonation cavity. The State requires a hearing for applications to drill within 0.5 mile of surface ground zero. DOE monitors gas produced from nearby wells, groundwater, and surface water for radioactivity. Surface plaques describe the sites and the drilling restrictions.

Issue: Oil and gas permitting is an example of land and resource rights that include numerous parties, such as the surface landowner, the mineral rights owner and lessee (if the mineral rights are leased), and those with authority to regulate activities that may impact site or resource protectiveness. ICs that restrict resource development may require compensation to the owner.

Lessons Learned: LM needs to work with all the parties and establish processes to keep all parties informed of activities near the site and prevent harm from residual contamination.

9.6 ICs in Site Transition

Split Rock, Wyoming, UMTRCA Title II Site
As of September 2013, the Split Rock site has not transitioned to LM for LTS&M. However, binding provisions are in place that will prevent use of and exposure to contaminated groundwater should the plume migrate beyond the DOE ownership boundary. The licensee modeled the extent of the groundwater plume and acquired groundwater use restrictions on the affected property. DOE will implement a program of regular surveillance and property owner notification to preserve knowledge of the restrictions. The restrictions and the surveillance program requirements are presented in the LTSP, and the effectiveness of the restrictions will be evaluated annually.

Issue: DOE must restrict access to contamination that will be left in place or that may migrate offsite.

Lessons Learned: For a transitioning site, ICs should be fully implemented and operating successfully before DOE assumes responsibility for the site.

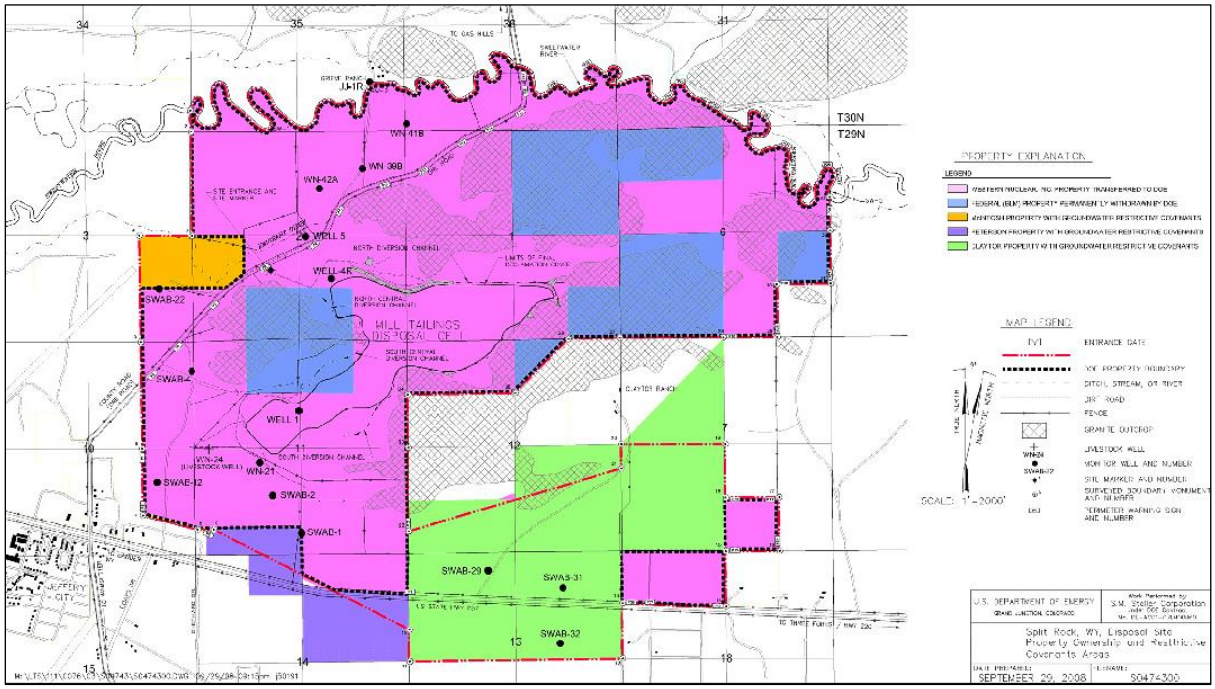

Figure 10. Split Rock, Wyoming, Site, Showing Ownership and IC Boundaries, All Contained Within the Long-Term Surveillance Boundary

Maybell West, Colorado UMTRCA Title II Site

The Maybell West, Colorado Site is a 180- acre site comprised of 160 acres of land withdrawn from the BLM and 20 acres of fee land transferred from the licensee. Federal ownership of the impacted surface and subsurface estates is considered to be the most enduring IC. The surface and subsurface estates are separate in Colorado, so an owner may have one set of rights without the other. Regulations for an UMTRCA Title II transition state that the licensee "must demonstrate a good faith effort to obtain such the subsurface rights, and must, in the event that certain rights cannot be obtained, provide notification in public land records of the fact that the land is being used for the disposal of radioactive material and is subject to either an NRC general license or specific license prohibiting the disruption and disturbance of tailings" (10 CFR 40, Appendix A, Criterion 11). The licensee of the Maybell site was only able to obtain 18 percent of the outstanding mineral interests and therefore, created deed annotations for the properties with third party mineral interests.

Issue: There will be site transitions where the licensee will be unable to secure all of the subsurface interests.

Lessons Learned: If subsurface minerals cannot be purchased prior to site transition, the only option may be a deed notice to let mineral owners know their obligations if they choose to exercise their rights to the mineral estate. While this may appear problematic, the regulatory requirements for NRC licensing are deemed to be extremely onerous to exercise rights on 20 acres of land.

Canonsburg, Pennsylvania, UMTRCA Title I Disposal Site
The Commonwealth of Pennsylvania acquired the mill site at Canonsburg under UMTRCA authority. A portion of the site that was not needed for disposal was sold at public auction. Because thorium-230 remained at depth beneath the unneeded portion in two survey grids, DOE coordinated with Commonwealth officials to insert restrictions in the conveyance instrument to ensure that future land use was protective. Restrictions included limiting excavation depths and mitigating the potential for radon in occupied or habitable structures. The restrictions run with the land. DOE inspects the former processing site annually in conjunction with the disposal site inspection.

Issue: Records of site radiological conditions must be preserved to define acceptable land uses. All interested parties must be identified and informed.

Lessons Learned: Reuse options must be informed by an assessment of risk and the ability to implement effective use restrictions.

Wayne, New Jersey, FUSRAP Site
The Wayne site was listed on the NPL and was remediated by USACE. DOE conveyed this property to Wayne Township in 2006 before regulatory closure (deletion from the NPL) was complete. Through the quitclaim deed, DOE imposed groundwater use restrictions on the new owner and reserved sole discretion to remove the restrictions upon regulatory closure. The deed also stipulated that the property was to be used for recreational purposes only. The site was deleted from the NPL in 2012, and DOE is currently generating a rescission of the use restrictions to be recorded in the public record of the site.

Issue: DOE needed a mechanism to allow disposition to proceed before regulatory closure occurred, while maintaining protectiveness at the site.

Lessons Learned: Land use can change, and land use assumptions are invalid for the long periods during which residual contamination remains hazardous. Land use should be "locked in" through real property instruments if certain land uses are not protective.

9.7 Lack of ICs Tracking System

Many of the ICs required for LM include a provision that LM must be notified of actions that have the potential to impact site protectiveness or that may create concerns with stakeholders at sites with residual contamination. When approached by a party affected by ICs, LM needs to be able to access all site restrictions and make a determination about the proposed activity. In the absence of a formalized tracking system to record decisions about acceptable actions at a site or to document violations of ICs, it is possible that LM could lose knowledge of decisions about site activities or lose the ability to monitor activities at a site that may be adverse to DOE's interests.

Issue: Without an ICs tracking system, there is no central repository for information to provide LM site managers with the complete picture of applicable restrictions affecting their sites. Further, there is no repository for the history of the ICs decisions, violations, and follow-on actions that were taken.

Lessons Learned: Having the complete picture of required and DOE-imposed restrictions, of all the ICs in place, and of the history of effectiveness of the ICs at a site allows the LM site manager to make informed decisions that maintain protectiveness and ensure stakeholder confidence in LM's stewardship of the sites.

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11.0 Glossary

Chain of title—A history of the chronology of conveyances, judgments, and encumbrances that affect title to real property from the time that land was granted or as far back as records are available.

Consent decree—A legal document, approved by a judge, that formalizes a settlement reached between EPA and responsible parties through which responsible parties will conduct all or part of a cleanup action at a Superfund site, cease or correct actions or processes that are polluting the site environment, or otherwise comply with an EPA-initiated enforcement action. The consent decree describes the actions the responsible parties will take.

Conveyance—Transfer of title to property (any variety of deed, such as quitclaim or warranty) or an interest in property, such as an easement. Any conveyance can include restrictions on land use or activities.

Covenant (environmental)—A promise by a landowner made to another party to do or to refrain from doing certain actions. ECs used under LM are often implemented by state environmental entities under state statutes. They fully describe the restrictions that apply to specific parcels of property, are recorded in county records, and are binding on all future landowners. They contain provisions for notification, modification, and termination.

Deed notice—Commonly a non-enforceable, purely informational instrument within a deed or recorded with a deed that alerts anyone performing a title search to important information about a parcel of property. For LM's purposes, deed notices provide background information about former site activities and steps that might be taken should contamination be encountered on the property. **Note:** In some states, a deed notice may be enforceable and may be considered to be the mechanism of choice to convey ICs.

Deed restriction—The restrictions in any proprietary conveyance. This term is widely used even if the conveyance document is not a deed.

Easement—A right that allows the holder to use the property of another for a specific purpose. An "affirmative" (or easement) allows entrance to another's property (e.g., ingress, egress). For the purposes of ICs, a "negative" or "restrictive" easement imposes limits on how the owner of the property or other estate, such as minerals, can use the property or estate.

Governmental control—ICs implemented and maintained by a governmental entity other than one performing or regulating the cleanup actions (e.g., zone ordinance, land use zoning).

ICs Management Plan—A voluntary LM plan to detail site-specific elements of ICs. The ICMP is not considered a regulatory document, but it may be submitted to regulators for informational purposes.

Institutional controls—Instruments, notices, and engineered controls that help minimize the potential for human exposure to contamination, maintain security, or protect the integrity of a remedy. They may be layered to ensure adequate segregation of contamination and protection of resources.

Instrument—General term used for a legal real property document that conveys land or an interest in land.

Layering—Use of different types of ICs at the same time to enhance awareness and protectiveness.

Overlay zone—A set of zoning regulations that supplement (i.e., overlay) those of the underlying district. Developments within an overlay zone must comply with the requirements of both zones, or the more restrictive of the two. Overlay zones are typically used for large areas or for areas owned by multiple landowners, and are used to address issues such as widespread contamination in groundwater.

Personal property—Items that can be moved or are not permanently affixed to or part of real property, including equipment, signs, and vehicles. Personal property includes those items that can be moved without seriously damaging the value of either the real property or the items themselves.

Proprietary control—ICs created pursuant to state or tribal law to prohibit activities that may compromise an approved remedy; often a restrictive easement or a control based on a model of the Uniform Environmental Covenants Act (e.g., EC).

Real property (real estate)—Land and rights in land (such as easements and rights-of-way), improvements to the land (such as roads and wells), utility distribution systems, and those things attached to the land. The chief characteristics of real property are immobility and tangibility. This comprises land and all things of a permanent and substantial nature affixed thereto, whether natural (trees and natural resources) or manmade (roads and buildings).

Run with the land—A term signifying that an instrument (in the case of ICs, a proprietary control) will bind all subsequent owners to the conditions contained in the instrument.

Site management plan—The plan or document that is accepted by the applicable regulator that provides the detail of how a site will be managed to maintain compliance and protectiveness. This plan may be identified as an LTSP, LTS&M Plan, or a Site Operations Plan. Larger sites may develop a specific plan for ICs, such as the *Comprehensive Legacy Management and Institutional Controls Plan, Volume II-Institutional Controls Plan* developed for the Fernald, Ohio, Site.

Uniform Environmental Covenants Act—A model state legislation that addresses the use of proprietary controls as ICs, most often ECs. It may be used to reduce the legal and management complications and common law impediments associated with ICs.

Attachment 1

Examples of Sitewide ICs
(Table B-1 from DOE Guidance 454.1)

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APPENDIX B. EXAMPLES OF SITE-WIDE INSTITUTIONAL CONTROLS

Categories of Institutional Control	Types of Institutional Controls	Objective	Protects
Warning Notices	Signs, monuments	• Provide visual identification and warning of hazardous or sensitive areas. • Provide information on restrictions, access information, contact information and emergency information. • Limit or restrict access to the site, or portions of the site.	• DOE employees • DOE contractors • Site visitors • Inadvertent intruders • Future generations
Entry and Access Restrictions	Procedural and Security Requirements for Access	• Control human access to hazardous or sensitive areas or property. • Ensure adequate training for those who enter hazardous or sensitive areas. • Avoid disturbance and exposure to hazardous waste. • Provide a basis for the enforcement of access restrictions.	• DOE employees • DOE contractors • Site visitors • Inadvertent intruders
	Fencing	• Restrict or prevent unauthorized access to hazardous or sensitive areas. • Provide protective barriers to standard industrial hazards. • Provide visual warnings.	• DOE employees • DOE contractors • Site visitors • Inadvertent intruders
	Physical Barriers	• Restrict or prevent unauthorized access to hazardous or sensitive areas.	• DOE employees • DOE contractors • Site visitors • Inadvertent intruders
Resource-and Land-Use Management	Land-Use and Real Property Controls, Notifications and Restrictions	• Ensure that use of the land is compatible with any hazards that exist. • Ensure that any changes in use of the land are adequately assessed before being allowed. • Ensure that the record of the property documents restrictions that will apply beyond change in ownership or management of the property. • Assure that any changes in property ownership or control, or oversight will be communicated to the appropriate parties and required notifications will be provided.	• DOE employees • DOE contractors • Site visitors • Future generations • Non-DOE entities using DOE land • Environmental receptors
	Excavation Permits	• Avoid unplanned disturbance or infiltration. • Inform and protect workers regarding potential exposure to hazardous waste. • Avoid the creation of potential pathways for the migration of hazardous waste.	• DOE employees • DOE contractors • Non-DOE entities using DOE land
	Ground Water Controls	• Ensure proper use of ground water • Ensure early detection of contaminant movement • Detect leaks	• DOE employees • DOE contractors • Site visitors • Future generations • Non-DOE entities using DOE land
	Government Ownership	• Limit or restrict access to the site, or portions of the site. • Restrict or prevent unauthorized access to hazardous or sensitive areas.	• DOE employees • DOE contractors • Site visitors • Future generations • Environmental receptors
Site Information Management	Administrative Support, Archives and Libraries	• Maintain and provide access to information on the location and nature of contamination	• DOE employees • DOE contractors • Site visitors • Future generations

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Attachment 2

Planning Checklist for ICs

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During the planning phase, the following items are considered and documented in the site records:

Site Name:_____

Institutional Controls Checklist for Protection of Human Health and Environment		
Action	**Complete**	**Documentation**
Description of media and contaminants exceeding UU/UE criteria (media, contaminants, concentration data)		
Standards/guidelines/benchmarks used for screening		
Site-specific risk assessment assumptions, if applicable		
Expected future land use/end state		
Consequences if no ICs		
Surface restrictions required		
Subsurface restrictions required		
Duration required for each restriction		
Criteria for release of each restriction, if applicable		
Map(s) with extent and distribution of media exceeding UU/UE criteria		
Map(s) showing extent of IC boundaries		
Surveillance, monitoring, and maintenance requirements and frequency		
How are violations detected?		
How will IC effectiveness be measured?		
Reporting requirements		
Requirements for notification of violation		
Frequency of review of adequacy of ICs		
Institutional Controls Checklist for Protection of Engineered Control or Other Resource		
Action	**Complete**	**Documentation**
Description of feature requiring protection, including performance requirements of key components (e.g., permeability of cover material)		
Map/as-built showing location and construction information		
Expected future land use/end state		
Consequences if no ICs		
Surface restrictions required		
Subsurface restrictions required		
Duration of ICs		
Map(s) showing extent of IC boundaries		
Frequency of Inspection		
How are violations detected?		
How will IC effectiveness be measured?		
Monitoring requirements		
Reporting requirements		
Requirements for notification of violation		
Frequency of review of adequacy of ICs		

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