

## NRC's Durable Long-Term Control System to Sustain Site Protection

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**Abstract** – *The U.S. Nuclear Regulatory Commission (NRC) regulates the decommissioning and license termination of commercial nuclear facilities under the License Termination Rule (LTR) in 10 CFR 20, Subpart E. Although NRC prefers license termination with unrestricted use, it recognizes that a few licensees may not be able to meet the requirements for unrestricted release; thus, institutional controls to restrict the future use of the site could be approved. NRC and licensee experience during the past few years has shown that arranging the required legally enforceable institutional controls and independent third party agreements has not been successful. As a result NRC evaluated the issues and developed new policy options to resolve the issues. One of these issues is the concern about long-term effectiveness of institutional controls that would be required to restrict future site use. Currently, all the decommissioning sites that are considering restricted use have radionuclides with long half lives such as uranium or thorium, and, therefore, would need long-term controls. Concerns were raised when the LTR was developed and continue to be raised today, that restrictions on future land use cannot be enforced indefinitely into the future, and therefore, might become ineffective. This paper addresses this concern by describing how protection is sustained by a total system of multiple controls and assurances that provides defense in depth. This durable system consists of six elements: legally enforceable institutional controls; engineered barriers; monitoring and maintenance; independent third party oversight; sufficient funding; and “dose caps”, or maximum limits on exposure if institutional controls fail. In addition, involvement by the affected parties, including the local community, could contribute to the durable system.*

### I. INTRODUCTION

In 1997, the U.S. Nuclear Regulatory Commission (NRC) promulgated the License Termination Rule (LTR) in 10 CFR 20 Subpart E that provides the criteria for decommissioning commercial nuclear facilities licensed by NRC and terminating the license [1]. These regulations establish two final states for license termination: unrestricted use and restricted use. Although NRC prefers unrestricted use, it was recognized that it might be unreasonable or not possible for some sites to meet the unrestricted use criteria because, for example, there may be net public or environmental harm or because the cost of site cleanup and waste disposal to achieve unrestricted use would be excessive. Therefore, the restricted use option was also included in the LTR.

NRC and licensee experience during the past few years has shown that arranging the required legally enforceable institutional controls and independent third party agreements, required by the LTR for the restricted use option, has not been successful. As a result, NRC evaluated the issues and developed new policy options to resolve the issues. One of these issues is the concern about long-term effectiveness of institutional controls that would be required to restrict future site use. Currently, all of the decommissioning sites that are considering

restricted use have radionuclides with long half lives such as uranium or thorium, and, therefore, would need long-term controls.

In the Statement of Considerations for the LTR, the Commission recognized that requiring absolute proof that institutional controls would endure over long periods of time would be difficult, and the Commission did not intend to require this of licensees. Rather, the Statement of Considerations explained that institutional controls should be established with the objective of lasting 1000 years to be consistent with the time-frame used for calculations, and these controls would be expected to remain effective into the foreseeable future. However, the LTR also included added assurances that the public would be protected. Therefore, protection of public health and safety is provided by a total system of controls and assurances that is durable and provides defense-in-depth. The durable system described in this paper is based on the requirements of the LTR, descriptions in the Statement of Considerations for the LTR, new policy options for institutional controls described in the LTR Analysis (SECY-03-0069) and the Regulatory Issue Summary (RIS) for the LTR Analysis in RIS 2004-08, and decommissioning guidance in NUREG-1757. [1,2,3,4]

## II. DISCUSSION OF THE DURABLE SYSTEM FOR PROTECTION

NRC's durable system for protection consists of six elements: legally enforceable institutional controls; engineered barriers; monitoring and maintenance; independent third party oversight; sufficient funding; and upper limits on dose (i.e., "dose caps") if institutional controls fail. In addition, potential involvement by State and local governments and the community can add to the process. Each of these elements is described below, including how it contributes to protection, how it sustains protection for the duration needed, and what entity is responsible.

### *II.A. Legally Enforceable Institutional Controls*

Legally enforceable institutional controls are required by the LTR. Institutional controls are administrative/legal mechanisms such as deed restrictions, permits, zoning, government ownership, or even an NRC long-term control (LTC) license. Institutional controls can also include physical controls such as fences, signs, markers, or vegetation.

Institutional controls are intended to protect the public health and safety by preventing adverse site access and land uses so that the LTR dose criterion of 0.25 mSv (25 mrem) per year is not exceeded. Limiting exposure time or preventing groundwater or agricultural uses can prevent adverse exposure pathways to people.

NRC's risk-informed, graded approach is used to select the appropriate grade or type of institutional control, based on duration and magnitude of the hazard, so that restrictions are appropriately targeted using risk insights. Dose assessments are used to tailor site-specific restrictions to avoid adverse land uses. [5]

Durable institutional controls, such as government ownership or control, could be used for higher risk sites with longer duration or higher magnitude hazards, to provide additional assurance of sustaining protection over the time period needed. Under new NRC policy, two options are available to provide durable institutional controls using either a NRC LTC license or a legal agreement and restrictive covenant where NRC would have a monitoring and enforcing role (SECY-03-0069 and RIS 2004-08).

Maintaining institutional controls is the responsibility of the owner or contractor to the owner, referred to as the custodian. The custodian also is responsible for conducting five-year reviews for higher risk sites to ensure the institutional controls are in place and continue to function. These reviews would include on-site

inspections to verify that prohibited adverse activities are not being conducted. The custodian would also maintain records and make them available to the public.

Institutional controls are also required by the LTR to be legally enforceable by an entity other than the custodian (e.g., local government, courts) that has the authority to enforce the particular type of institutional control. This entity would need to be identified and potential corrective actions described in the event the controls fail. Sustaining protection is also addressed by having legal opinions of the State or locality submitted to NRC to demonstrate that the institutional controls can be enforced and will be binding on future owners.

### *II.B. Engineered Barriers*

Engineered barriers are man-made structures and can be a variety of types such as disposal cells, erosion protection covers, or cover layers to prevent or divert infiltration. These barriers are typically used to control adverse natural processes, such as erosion, that might expose contamination or infiltration of water that could cause release and migration of contaminants. Engineered barriers can also be designed to inhibit adverse human intrusion such as excavation and removal of cover material or contaminants.

The LTR does not require use of engineered barriers or specific designs that should be used, but the Statement of Considerations for the LTR recognizes that engineered barriers might be needed for sites with long-lived radionuclides. The LTR's performance-based approach allows flexibility for a licensee to determine if engineered barriers are needed to meet the LTR dose criteria and what contribution to performance might be needed considering how the barriers might degrade over time.

Although engineered barriers are not institutional controls, they can be used to supplement institutional controls and contribute to protection. In some cases, protection can be sustained for long time periods by using robust designs that do not rely on ongoing active maintenance. For example, erosion protection covers designed for up to 1000 years that have been used for uranium mill tailings sites may also have use at some decommissioning sites.

### *II.C. Monitoring and Maintenance*

The site would be maintained by the custodian in accordance with the institutional controls. Monitoring and maintenance consists of identifying potential problems with institutional controls or engineered barriers and taking appropriate corrective actions to maintain the performance of the institutional controls or engineered

barriers. Typically, monitoring could include a variety of activities such as visual surveillance or using instruments for radiological monitoring of surface or groundwater. Monitoring could also be used to detect indicators of potential future problems or measuring natural processes that could eventually impact the performance of the total system, unless corrected. Maintenance would include corrective actions to prevent adverse processes such as intrusion of covers by plants or burrowing animals, or repair of fences and signs.

#### *II.D. Independent Third Party Oversight*

The LTR requires an independent third party to provide oversight to assure that the custodians' controls are performed and corrective actions are taken, as needed, to sustain the controls and maintenance. The independent third party also would act as a backup to the custodian to assume and carry out the responsibilities for control and maintenance, if needed. The independent third party could be a government entity, or even NRC (under its new policy for the LTC license or legal agreement) if other government entities do not accept this responsibility.

#### *II.E. Sufficient Funding*

The LTR requires that sufficient financial assurance be established to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of the site. A trust fund, or other financial assurance mechanism, would be established independent from the custodian and managed by a trustee. Sufficient funds would need to be placed into the trust fund to produce an annual income that is sufficient to cover: 1) the annual average costs of controls, maintenance, and monitoring, if needed; 2) independent third party oversight costs; and 3) trustee fees and expenses. Thus, the fund balance would be sustained over time and not depleted because the annual costs of controls and maintenance are provided by the annual interest income.

#### *II.F. Dose Caps if Institutional Controls Fail*

Because it is not possible to preclude the failure of controls, the LTR also requires that remediation be conducted so that there would be a maximum value, or "cap" on the dose if the institutional controls are no longer in effect. Compliance with the dose cap would prevent exposures in excess of the public dose limit of 1 mSv (100 mrem) per year or 5 mSv (500 mrem) per year under certain rare circumstances. These dose caps act as a safety net if institutional controls fail and, therefore, sustain protection by providing defense in depth.

### III. CONCLUSIONS

NRC's regulations for decommissioning sites allow for use of institutional controls to restrict future use of the site and provide protection of public health and safety. NRC recognizes the concerns about sustaining effective institutional controls over the long term and has developed a durable system of controls and assurances to provide sustained protection and defense in depth. Each of the six elements that make up the durable system help sustain protection.

### REFERENCES

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4. U.S. Nuclear Regulatory Commission, "Consolidated NMSS Decommissioning Guidance," NUREG- 1757, Vol. 1-3, U.S. Nuclear Regulatory Commission, Washington, D.C., 2003.
5. R.L. Johnson, "U.S. Nuclear Regulatory Commission Experience Implementing a Risk-Informed Graded Approach for Institutional Controls to Restrict Site Use", *Proceedings for Waste Management 05 Symposia*, 2005.