

# **NRC STAFF OPTIONS ANALYSIS FOR APPROPRIATENESS OF ALLOWING INTENTIONAL MIXING OF CONTAMINATED SOIL UNDER THE LICENSE TERMINATION RULE**

## **1. INTRODUCTION**

This attachment presents the results of the U.S. Nuclear Regulatory Commission (NRC) staff options analysis for allowing intentional mixing of contaminated soil<sup>1</sup> under the license termination rule (LTR). First, the staff analyzed the possible ways that a licensee could intentionally mix soil to lower its concentration and recommended which of these scenarios should be considered further in the analysis. Next, the staff evaluated the different options for meeting some of, or all, the LTR release criteria, using the scenarios that were carried forward from the first analysis and recommended an option for allowing intentional mixing. Lastly, the staff evaluated the different ways that the preferred option for allowing intentional mixing could be implemented under the current LTR, and recommended regulatory tools for implementing its recommendations.

The options evaluated were based on the experiences, information, relevant issues, other considerations, and discussions presented in Attachment 2. Attachment 2 contains the following information:

Relevant experiences and information from rules, orders, guidance, position papers, correspondence, and technical documents from the NRC (Section 2.1), the U.S. Department of Energy (Section 2.2), the U.S. Environmental Protection Agency (Section 2.3), the U.S. Army Corps of Engineers - Formerly Utilized Sites Remedial Action Program (Section 2.4), other domestic sources, such as low-level radioactive waste disposal facility documentation (section 2.5), and international sources (section 2.6);

An evaluation (Section 3) of significant issues based on the LTR Analysis provided to the Commission in SECY-03-0069, and the information and experiences discussed in Section 2 of the attachment; and

An evaluation (Section 4) of other considerations that are relevant to the mixing issue.

## **2. EVALUATION OF SCENARIOS FOR MIXING CONTAMINATED SOILS**

### **2.1 Identification and Description of Scenarios**

To conduct a thorough analysis of the options for the appropriateness of allowing intentional mixing of contaminated soil to meet the LTR release criteria, the staff first identified and evaluated options for the potential scenarios under which a licensee could blend contaminated soil for the purposes of meeting the release criteria of the LTR and for successfully terminating the facility license. The goal that would be achieved under the following intentional mixing

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<sup>1</sup> Staff attempted to define contaminated and clean soil for this paper, but found it too cumbersome at this point in the process - see discussion in Section 3.3

scenarios is that contaminated soil that exceeds the release criteria of the LTR will be purposefully mixed in a way that: (a) the resultant contaminated soil meets the release criteria, or (b) which facilitates license termination, (for example, by permitting soil to be sent offsite because it meets the waste acceptance criteria (WAC) of an offsite disposal facility). The following scenarios to achieve this goal were identified:

2.1.1 Scenario 1 - Mixing so that the total area of contamination (footprint) and the volume of contaminated material remaining onsite following license termination is reduced. There are two ways in which this could be accomplished:

Scenario 1a - Mixing contaminated soil having a higher level of concentration with contaminated soil having a lower level of concentration to obtain soil with a concentration in between that meets the WAC of an offsite disposal facility.

Scenario 1b - Mixing contaminated soil with clean soil to obtain soil having a lower concentration that meets the WAC of an offsite disposal facility. This method results in a greater total volume of homogenized contaminated soil, but it is not left onsite.

2.1.2 Scenario 2 - Mixing in place so that LTR release criteria are met and the footprint of contamination remaining following license termination is not increased. There are three ways in which this could be accomplished:

Scenario 2a - Mixing contaminated soil having a higher level of concentration with contaminated soil having a lower level of concentration to obtain soil with a concentration in between. The mixtures would be replaced into the areas from where it was excavated.

Scenario 2b - Mixing contaminated soil with clean soil to obtain soil having a lower concentration. To keep the footprint of contamination from increasing while accommodating the higher volume of soil, this method would involve burying the resulting lower-concentration material in a configuration that is deeper than the excavated material (deeper trench or in a mound that is higher than the original surface layer).

Scenario 2c - Consolidating and blending several zones of contaminated soil with varying levels of contamination into one zone of contamination that has a lowered concentration that meets the LTR criteria. The footprint of the remaining contaminated zone is less than the total of the footprints of the unconsolidated areas of the various zones of contamination. This scenario could include consolidation over some previously uncontaminated areas. This scenario could also include burying the resulting lower-concentration material in a trench or mound configuration to ensure a smaller footprint.

2.1.3 Scenario 3 - Mixing in place so that LTR release criteria are met and the footprint of contamination remaining following license termination is increased. There are three ways in which this could be accomplished:

Scenario 3a - Spreading contaminated soil having a higher level of concentration over a larger area to obtain a lower soil concentration. This method would mean that uncontaminated areas would be covered by a layer of contaminated soil and then mixed (or covered over) to result in the lower concentration.

Scenario 3b - Mixing contaminated soil with clean soil to obtain soil having a lower concentration and spreading it over a larger surface area. If this method were used, it could result in a reduced depth of disposal to accommodate the larger volume of contaminated soil.

Scenario 3c - Consolidating and blending several zones of contaminated soil with varying levels of contamination into one zone of contamination that has a lowered concentration that meets the LTR criteria. The footprint of the remaining contaminated zone is greater than the total of the footprints of the unconsolidated zones of contamination. This scenario would include consolidation over relatively large uncontaminated areas, but could reduce depth of contamination dramatically.

Variations on any of the approaches in Scenarios 2 or 3 could involve covering the mixed lower-concentration soil with a significant layer of clean soil [e.g., 1 meter (3 feet)] on top, or other design considerations used in cell designs for radioactive or hazardous waste.

Several of the scenarios could be used in combination to meet the goal for intentional mixing to meet LTR criteria; however, they will be evaluated independently.

## 2.2 Evaluation of Scenarios

Based on the experiences, information, and considerations presented in Attachment 2, these scenarios are evaluated to determine if some of the scenarios should be eliminated from further analysis.

### 2.2.1 Eliminate Scenarios that Result in Increasing the Footprint of Contamination Following License Termination.

The “Statement of Considerations” for the final LTR rule notes a preference for reducing the area of contamination for sites where licenses are being terminated, especially for sites that might be released with restrictions. The summary of positive environmental impacts from decontamination and decommissioning activities expressed in the GEIS on Decommissioning of Nuclear Facilities includes the possibility that land which could be used for another purpose can be returned to the public domain. The NRC and DOE both have detailed policies and guidance on radiation protection that require or advise that radiological operations should be conducted in

a manner that controls the spread of radioactive materials because this is a primary way to minimize exposures to the material.

Staff recognizes that some scenarios that involve increasing the footprint of contamination can result in final contamination levels that are in compliance with the criteria of the LTR. However, staff believes that other considerations, such as the preference for reducing the area of contamination and consistency with guidance for operations where spreading of radioactive materials should be controlled, are as important as facilitating license termination.

Therefore, staff finds that scenarios for intentional mixing that would result in increasing the footprint of contamination remaining after license termination are also undesirable and are not considered further in the analysis. These are Scenarios 3a and 3c.

## 2.2.2 Eliminate Scenarios Where Clean Soil Is Used.

The International Atomic Energy Agency Safety Series document No. 111-F considers one of the basic principles of radioactive waste management to be, "generation of radioactive waste shall be kept to the minimum practicable." This basic principle is reflected in the NRC's analysis presented in the Generic Environmental Impact Statement (GEIS) on the LTR, which includes this conclusion:

"There should be specific attention given to design features and procedures that facilitate decommissioning the site, reduce the amount of radioactive waste, and minimize the overall public risk associated with decommissioning."

Based on this conclusion in the GEIS, 10 CFR 20.1406 requires licensees to design their facilities and implement radiological contamination control procedures to minimize contamination of the facility, facilitate decommissioning, and minimize the generation of radioactive waste.

Previously, the NRC issued a policy statement on volume reduction in which it is stated that NRC considers it desirable that licensees reduce the volume of low-level radioactive waste generated. NRC also issued an Information Notice (IN 94-23) informing licensees subject to Resource Conservation and Recovery Act (RCRA) regulations of the guidance issued by the U.S. Environmental Protection Agency on waste minimization certifications. IN 94-23 advises licensees to review the information for applicability to their activities and consider appropriate actions to minimize generation of hazardous, radioactive, and mixed waste.

Similarly, the basic philosophies of hazardous waste management in the U.S. are based on the findings of the Congress, documented in RCRA (42 U.S.C. §6902), where the national policy of the U.S. is stated that the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. The Congress also espoused a similar national policy in the Pollution Prevention Act (42 U.S.C. § 13101), stating that pollution should be prevented or reduced at the source whenever feasible.

Staff recognizes that some scenarios that involve the use of clean soil can result in final contamination levels that are in compliance with the criteria of the LTR, and that the use of clean soil may achieve more regulatory flexibility, and allow for more sites to use intentional

mixing. However, staff believes that other considerations, such as minimizing the generation of waste, and not utilizing clean materials in a process solely to achieve waste management goals, are as important as facilitating license termination.

Therefore, consistent with the basic philosophy in radioactive waste management that is reflected in NRC policy and requirements, and with hazardous waste management and pollution prevention policies reflected in national legislative policy, scenarios for intentional mixing that involve the use of clean soil are not desirable. This is because they would involve increasing the volume of contaminated materials requiring management, and contaminating previously clean soil for the purposes of meeting waste management goals, contrary to waste minimization and pollution prevention goals and principles.

However, the use of the clean soil in consolidating zones of contamination as described in scenario 2c could be acceptable since it is practical and efficient to involve those areas of soil in the remedial action in complying with the desire to not increase the footprint of contamination, and because the overall dose from the materials following mixing would be the same or less than the dose calculated from the heterogeneous distribution of the contaminated soils for this consolidation scenario. Other scenarios involving the use of clean soil remain undesirable because they would involve the use of clean soil from outside the zone of contamination that would otherwise not be involved in the scheme for remediation.

Therefore, scenarios 1b, 2b, and 3b, are removed from further analysis, as well as scenario 3a, if contaminated soil were mixed into the uncontaminated soil. (Note: Scenario 3a is already undesirable due to preference for not increasing the footprint of contamination)

### 2.3 Recommended Scenarios for Mixing of Contaminated Soils

The staff concludes the remaining scenarios are acceptable for performing further analysis as reasonable options if intentional mixing of contaminated soil were allowed for meeting the LTR release criteria. The remaining scenarios do not conflict with and, in the case of Scenario 1a, are consistent with current practice, as reflected by the NRC staff approval of mixing to meet WAC of an offsite disposal facility. The remaining scenarios do not otherwise represent poor environmental stewardship or disfavored waste management practices by increasing the footprint of contamination remaining following license termination or by using clean soil in the mixing process. Therefore, staff recommends that the following scenarios for mixing of contaminated soils be considered acceptable and carried forward into the rest of the options analysis:

- Scenario 1a - Mixing contaminated soil having a higher level of concentration with contaminated soil having a lower level of concentration, to obtain soil with a concentration in between, that meets the WAC of an offsite disposal facility.
- Scenario 2a - Mixing contaminated soil having a higher level of concentration with contaminated soil having a lower level of concentration, to obtain soil with a concentration that allows the release criteria of the LTR to be met, that is replaced in the areas from where it was excavated.

Scenario 2c - Consolidating and blending several zones of contaminated soil with varying levels of contamination into one zone of contamination that has a lowered concentration that meets the LTR criteria. The footprint of the remaining contaminated zone is the same or less than the footprint of the unconsolidated areas of the various zones of contamination. In this scenario, mixing the soil between the various zones of contamination in achieving the final consolidated zone would be acceptable.

Scenario 1a/2ac- A combination of scenarios 1a, 2a and/or 2c, where some contaminated soil is mixed, packaged, and shipped to an offsite disposal facility, and some is left for disposal in place at the site, in the acceptable configurations.

The conditions that resulted in the scenarios being eliminated (use of clean soil and increasing the footprint of the contaminated zone) are carried forward as limitations on whether to allow the use of intentional mixing.

### 3. EVALUATION OF OPTIONS FOR ALLOWING INTENTIONAL MIXING OF CONTAMINATED SOIL UNDER THE LTR

#### 3.1 Identification and Description of Options

There are several options to consider concerning whether to allow the intentional mixing of contaminated soil under the LTR. The staff has identified the following options for additional evaluations. In Options 3 through 5, mixing to meet the LTR is allowed.

##### 3.1.1 Option 1) Do not allow intentional mixing for any purpose (Prohibit).

In this option, the Commission would reconsider the ongoing practice of allowing mixing on a case-by-case basis, and forbid the use of intentional mixing to meet any waste management or license termination goals, including LTR release criteria.

##### 3.1.2 Option 2) Maintain the current practice of allowing intentional mixing to meet WAC and for other limited waste disposal situations, on a case-by-case basis.

In this option, the Commission would maintain the current practice of allowing staff approval of the intentional mixing on a case-by-case basis to meet the WAC<sup>2</sup> for offsite disposal facilities and for other limited waste disposal situations (e.g., under 10 CFR 20.2002), but would not allow intentional mixing to meet the LTR release criteria for contamination left onsite at decommissioning sites.

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<sup>2</sup> Current practice (see Attachment 2) allows for similar waste streams (e.g., contaminated soil) to be blended to meet WAC and mixing to be considered in waste characterization activities, such as classifying a disposal container using concentration averaging. However, it does not allow waste classification to be changed intentionally by mixing (for example, blending Class C and Class A waste streams to result in a Class B low-level waste). These practices stem from guidance written in support of the promulgation of 10 CFR Part 61. Option 2 will maintain these practices, although staff has not focused on their continued appropriateness given changes to low-level waste disposal since Part 61 was finalized.

[Note: In Options 3 through 5, only the scenarios for intentionally mixing that the staff recommends as acceptable from the previous discussion (i.e., clean soil should not be used and the footprint of contamination should not be increased), are being considered].

3.1.3 Option 3) Allow intentional mixing to meet LTR release criteria in limited circumstances, in addition to the Option 2 current practice.

In this option, the Commission would maintain the current practice, as described in Option 2, and also allow the intentional mixing of contaminated soil to meet the release criteria of the LTR on a case-by-case basis. The staff would limit the circumstances (e.g., funding limits disposal alternatives) under which the use of intentional mixing would be considered in development of implementation tools for this option.

3.1.4 Option 4) Allow intentional mixing to meet LTR release criteria with restrictions on use, in all cases, in addition to the Option 2 current practice.

In this option, the Commission would approve a policy that allows for the intentional mixing of contaminated soil for license termination, but with the limitation that it can only be under the LTR restricted (10 CFR 20.1403) or alternate (10 CFR 20.1404) release criteria, in addition to continuing the current practice described in Option 2. In this option, a site proposing to use intentional mixing to achieve contamination levels required in the LTR would be released only with restrictions on future access and use by the institutional controls required of LTR restricted release requirements. (There would not be any limiting circumstances, such as limited funding, under which the staff would consider the use of mixing).

3.1.5 Option 5) Allow intentional mixing to meet LTR unrestricted and restricted release criteria, in all cases, in addition to the Option 2 current practice.

In this option, in addition to the current practice described in Option 2, the Commission would approve a policy that allows for the intentional mixing of contaminated soil for sites to meet any LTR release criteria, without any limitations.

3.2 Evaluation of Options

Considering the scenarios for mixing carried forward from the previous options analysis, the options for allowing intentional mixing are evaluated below.

3.2.1 Option 1 - Do Not Allow Intentional Mixing for any Purpose (Prohibit).

Pros

Would likely result in a positive reaction with the public and other stakeholders who are opposed to the nuclear industry and uses of radioactive materials.

Is somewhat consistent with the other U.S. regulatory agencies<sup>3</sup> that do not have policies that allow for or prohibit intentional mixing of soil contaminated with radioactivity to meet waste management goals, and that prohibit mixing of hazardous waste with soil to avoid treatment.

Is somewhat consistent with guidance of international organizations and policies and statements in documentation from other countries that discourage (but do not prohibit) intentional mixing to meet waste management goals.

Requires only minor NRC staff resources to implement (i.e., notification to staff of prohibition).

### Cons

Is inconsistent with current NRC practice to approve blending to meet WAC, and for special disposals, on a case-by-case basis.

Is likely to foster a negative reaction with licensees because NRC is not adding to the options for solutions to complex decommissioning sites and is prohibiting an option for waste management that has already been used.

Additional National Environmental Policy Act (NEPA) review for this option will be needed.

Could introduce additional issues into the Commission considerations for setting policies on controlling the release of materials ("clearance") and other matters being evaluated where intentional mixing has been discussed.

Is not consistent with the Commission's emphasis on risk-informed and performance-based regulation.

Ignores potential cost savings that could be a benefit in some situations where blending could be used for license terminations and to meet waste management goals that are otherwise consistent with protecting public health and safety and the environment.

### 3.2.2 Option 2 - Maintain the Current Practice of Allowing Intentional Mixing to Meet WAC and for Other Limited Waste Disposals, on a Case-By-Case Basis.

### Pros

Is consistent with current NRC practice to approve blending to meet WAC, and for special disposals, on a case-by-case basis.

Even though mixing was not included in the GEIS, this option will not require additional NEPA review. (Separate NEPA review and analyses is done as part of the case-by-case WAC or limited disposal approval process).

Since it is continuation of current practice, this option is not likely to elicit much negative reaction from the public and other stakeholders who are opposed to the nuclear industry and

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<sup>3</sup> The U.S. Environmental Protection Agency and the U.S. Department of Energy



uses of radioactive materials (unless it is perceived as an invitation for licensees to submit more requests for approvals for mixing under the current practices).

Is the most consistent with the practices of other U.S. regulatory agencies, that, despite not having policies that allow for intentional mixing of soil contaminated with radioactivity to meet waste management goals, and that prohibit mixing of hazardous waste with soil to avoid treatment, have occasionally allowed blending to meet regulatory goals for waste management, under limited circumstances.

Is consistent with statements in international guidance documents that advise if intentional mixing is to be used to meet waste management goals, the appropriate regulatory agency should review and approve its use.

Does not require NRC staff or contractor resources to implement.

### Cons

This option might foster a negative reaction with licensees and other interested stakeholders such as waste disposal sites because NRC is not adding to the options for solutions to complex decommissioning sites (except where mixing to meet offsite disposal WAC is approved and contributes to the solution).

Is only partly consistent with the Commission's emphasis on risk-informed and performance-based regulation, as it does not allow for consideration of intentional mixing for contaminated soil left onsite that meet the performance-based dose criteria of the LTR.

Could introduce additional issues into the Commission considerations for setting policies on clearance and other matters being evaluated (but maybe not as much as the other options, which would all result in changes in existing practices).

Ignores potential cost savings that could be a benefit in some situations where blending could be used for license terminations that are otherwise consistent with protection of public health and safety and the environment.

### 3.2.3 Option 3 - Allow Intentional Mixing to Meet LTR Release Criteria In Limited Circumstances, in Addition to the Option 2 Current Practice.

#### Pros

Is consistent with current NRC practice to approve blending to meet WAC and for special disposals, on a case-by-case basis.

Provides an opportunity for another option for resolving complex decommissioning sites, and other decommissioning sites (if limiting circumstances are met).

Allows consideration of potential cost savings that could be a benefit in some situations where blending could be used for license terminations consistent with protection of public health and safety and the environment.

Even though mixing was not included in the GEIS, this option will not require additional NEPA analysis. NEPA analyses are already done as part of the approval process for a Decommissioning Plan (DP) at a decommissioning site.

This option will probably be looked on favorably by licensees and other stakeholders such as waste disposal sites because NRC is adding to the options for solutions to complex decommissioning sites.

Is still consistent with the practices of other U.S. regulatory agencies that have occasionally allowed blending to meet regulatory goals for waste management, under limited circumstances.

Is consistent with statements in international guidance documents that advise if intentional mixing is to be used to meet waste management goals, the appropriate regulatory agency should review and approve its use.

Consistent with the Commission's emphasis on risk-informed and performance-based regulation.

Includes opportunity for stakeholder involvement in the decision to use intentional mixing during review of the DP for the site.

NRC has the expertise to adequately handle the small number of case-by-case determinations that are anticipated and would not need to dedicate major staff or contractor resources towards development of guidance focused on general principles required for this option.

### Cons

Even though it is continuation of current practice, adding intentional mixing to methods for meeting the release criteria of the LTR is likely to elicit some negative reaction from the public and other stakeholders opposed to the nuclear industry and uses of radioactive material.

Requires implementation documentation to be developed, and it will focus only on general principles rather than details required for consideration of all cases.

Is likely to introduce additional issues into the Commission considerations for setting policies on clearance and other matters being evaluated where intentional mixing has been discussed.

Is somewhat inconsistent with policies and statements in documentation from other countries that discourage intentional mixing to meet waste management goals.

May be less likely to result in an additional option for cleaning up a complex decommissioning site than if a policy to generally allow intentional mixing is approved.

Although some examples of mixing by other agencies were found, there are few cases that are similar to the scenarios evaluated in this paper, where radioactive contaminated soils are mixed to meet a regulatory goal.

3.2.4 Option 4 - Allow Intentional Mixing to Meet LTR Release Criteria with Restrictions on Use, in All Cases, in Addition to the Option 2 Current Practice.

Pros

Is consistent with current NRC practice to approve blending to meet WAC and for special disposals, on a case-by-case basis, as this would establish policy under which these are approved.

This option would elicit a positive reaction from licensees and other stakeholders such as waste disposal sites because NRC is adding to the options for solutions to finish decommissioning sites.

Requires institutional controls for sites using intentional mixing as part of decommissioning.

Has potential to allow for an additional option for terminating complex decommissioning sites using the restricted release criteria, especially where funding shortfalls is a problem.

Includes opportunity for stakeholder involvement in the decision to use intentional mixing during review of the DP for the site.

Even though mixing was not included in the GEIS, this option will not require additional NEPA analysis. NEPA analyses are already done as part of the approval process for a DP at a decommissioning site.

Implementation documentation developed would include details for consideration and approval of all cases for release with restrictions, rather than be focused on general principles only.

Allows consideration of potential cost savings that could be a benefit in some situations where blending could be used for license terminations consistent with protection of public health and safety and the environment.

Negative reaction (see Cons for this option) of public and other stakeholders opposed to the nuclear industry and uses of radioactive materials may be reduced because of the additional institutional controls required for termination under restricted release.

Cons

Is inconsistent with policies and statements in documentation from other countries that discourage intentional mixing to meet waste management goals.

Is likely to introduce additional issues into the Commission considerations for setting policies on clearance and other matters being evaluated where intentional mixing has been discussed.

Would require dedication of significant staff resources and expense of outside contractor expertise to develop detailed guidance required for approvals under this option.

Would likely elicit a negative reaction from the public and other stakeholders opposed to the nuclear industry and uses of radioactive materials.

Is inconsistent with other U.S. regulatory agencies that do not have policies that allow for intentional mixing of soil contaminated with radioactivity to meet waste management goals, and that prohibit mixing of hazardous waste with soil to avoid treatment.

Is only partly consistent with the Commission's emphasis on risk-informed and performance-based regulation, since it does not allow for using intentional mixing to meet the unrestricted release criteria of the LTR.

3.2.5. Option 5 - Allow Intentional Mixing of Soils to Meet LTR Unrestricted and Restricted Release Criteria, in All Cases, in Addition to the Option 2 Current Practice.

Pros

Provides for options to address complex decommissioning sites under both restricted and unrestricted release criteria.

Provides for opportunities for cost savings at sites where blending could be used for license termination consistent with protection of public health and safety and the environment.

Is consistent with current NRC practice to approve blending to meet WAC and for special disposals, on a case-by-case basis, as this would establish policy under which these are approved.

Implementation documentation developed would include details for consideration and approval of all cases for release with restrictions, rather than be focused on general principles only.

Even though mixing was not included in the GEIS, this option will not require additional NEPA analysis. NEPA analyses are already done as part of the approval process for a DP at a decommissioning site.

This option would elicit a positive reaction from licensees and other stakeholders such as waste disposal sites because NRC is adding to the options for solutions to finish decommissioning sites.

Is a good application of a risk-informed, performance-based regulatory approach since many options to meet waste management regulatory goals are approved.

Includes opportunity for stakeholder involvement in the decision to use intentional mixing during review of the DP for the site.

Cons

Is inconsistent with policies and statements in documentation from other countries that discourage intentional mixing to meet waste management goals.

Is inconsistent with other regulatory agencies that do not have policies that allow for intentional mixing of soil contaminated with radioactivity to meet waste management goals, and that prohibit mixing of hazardous waste with soil to avoid treatment.

Would require dedication of significant staff resources and expense of outside contractor expertise to develop detailed guidance required for approvals under this option.

Is likely to introduce additional issues into the Commission considerations for setting policies on clearance and other matters being evaluated where intentional mixing has been discussed.

### 3.3 Recommended Option for Allowing Intentional Mixing to Meet LTR Criteria

The staff recognizes that allowing intentional mixing to meet the release criteria of the LTR is not specifically evaluated in the GEIS supporting the rulemaking, and would need additional generic or site-specific NEPA analysis. Since staff is committed to doing individual NEPA analysis for each facility under the LTR, evaluating any intentional mixing proposals in a site-specific NEPA analysis can be accomplished.

The staff also recognizes that stakeholder involvement is necessary to fully evaluate intentionally mixing contaminated soil and to address all public concerns and questions. Using a case-by-case approval approach, the Commission can fully evaluate public concerns and questions for each application of intentional mixing for sites applying any of the LTR release criteria and approve or disapprove the approach on its merits, rather than using criteria and guidance developed from evaluation of a generic situation.

Staff acknowledges that there are advantages of the required stakeholder involvement and other requirements for sites terminating licenses under the LTR restricted (and alternate) release criteria, and considered limiting the situations under which intentional mixing would be allowed to sites terminating licenses under those LTR criteria. However, staff also recognizes there may be real cost and health-impact advantages for a site terminating under unrestricted release if intentional mixing were used. Such sites could be unnecessarily eliminated from consideration if the limiting condition were used.

Staff notes that the considerations for policy development currently ongoing on several issues related to the LTR discussed in Attachment 2, including "Clearance," and "Unimportant Quantities of Source Material" are controversial and have already required long-term efforts and many resources, and may continue to be problematic. Staff is concerned that all of the options under consideration for intentional mixing could introduce additional issues into the decisions on these other policy matters. Since the staff analysis indicates that intentional mixing may only be a significant option at a handful of sites, complications with more broadly applicable policies, such as on "Clearance," can be minimized by evaluating intentional mixing on a case-by-case basis, for the limited number of sites that might propose it.

The staff also brought up the issue of dilution in SECY-01-0194, which discussed a decommissioning site's (AAR Manufacturing Inc.'s) proposal to use unimportant quantities of source material [defined in 10 CFR 40.13(a)] as a decommissioning criteria. The staff noted that if decommissioning is based on the percent of source material rather than a dose standard,

a question arises as to whether it is permissible to reduce the concentration of source material in contaminated soils by adding clean soil to it. SECY-01-0194 noted that dilution of source material to levels below the unimportant quantity threshold was not prohibited in the Atomic Energy Act, as amended, or in NRC regulations. The denial of the AAR proposal was based principally on the belief that the LTR release criteria are appropriate dose criteria for decommissioning, and that the criteria for unimportant quantities were not an appropriate safety and health protection criteria for leaving radioactive materials onsite. The decision to deny the use of the unimportant quantities criteria as a decommissioning criteria did not address the question of allowing concentrations to be lowered by adding clean soil.

Staff believes that the current practice of approving special disposals and options such as blending to meet WAC in a limited number of case-by-case situations continues to work and provides for public health and safety and protection of the environment. The staff believes that only a very limited number of sites (approximately four to six) of all complex decommissioning sites could benefit substantially from an implementation of intentional mixing. Therefore, allowing a case-by-case consideration for these limited number of sites is consistent with current Commission policy and is a more efficient use of resources than evaluation of a generic situation involving intentional mixing and using the results to develop criteria and guidance.

Staff is also of the view that case-by-case consideration of allowing mixing at the time of license termination is preferable to issuing a generic policy that allows intentional mixing at license termination in all cases because a generic policy could be a disincentive to current licensees to maintain best waste management practices. For example, a licensee might be less inclined to address a soil contamination situation (i.e., a spill) appropriately at the time it occurs if the option of mixing contaminated soil to meet the LTR criteria were already available to them.

Therefore, the staff recommends that the following option be used to allow the intentional mixing of contaminated soil to meet the release criteria of the LTR and to facilitate license terminations.

Option 3 - Allow Intentional Mixing to Meet LTR Release Criteria In Limited Circumstances, on a Case-By-Case Basis, in Addition to the Current Practice.

Staff recognizes that to accomplish case-by-case decisions on any licensee proposals to use intentional mixing to meet WAC, or to meet the release criteria for the LTR, staff must define the limiting circumstances under which the use of mixing might be considered; the information that must be developed by the licensee and submitted to NRC, on a case-by-case basis; and the decision bases and criteria that the staff will use to make acceptance and approval determinations.

Based on the discussions provided in this analysis and in Attachment 2, the staff proposes to only consider case-by-case approval of intentional mixing under the following limitation:

- Any proposed mixing is part of an overall approach to the site cleanup, which includes application of the ALARA principle and considers only cases where it can be demonstrated that removal of the soil would not be reasonably achievable.

The staff also proposes to only approve case-by-case uses of intentional mixing under the following conditions:

- The resultant footprint of the area containing the contaminated soil following license termination should be equal to or smaller than the footprint of the zones of contamination that are present before decommissioning work begins; and
- Clean soil, from outside the footprint of the area containing the contaminated soil, should not be mixed with contaminated soil to lower concentrations.

Also, based on the discussions provided in this analysis and in Attachment 2, the following issues need to be addressed, which will lead to additional conditions and criteria for approvals on a case-by-case basis:

- The early involvement of stakeholders in development of the regulatory implementation tools and actions for implementing the preferred option, and in the case-by-case reviews;
- How the recommended scenarios would be applied in an actual case (e.g., how the operation of mixing would be performed, confirmatory surveys by NRC) and whether there are any exceptions or special scenarios that would be considered;
- The definitions of clean and contaminated soil, footprint, and zone of contamination;
- How the decision applies to slag and other non-uniform (or non-soil like) materials for which intentional mixing could be used as part of a solution at decommissioning sites, the extent that homogeneity must be achieved by mixing and how this is measured, the characteristics of the mixture that might be important, such as whether it could separate and create zones of high contamination, and how to determine that clean soil (i.e., soil unaffected by licensee activities) is not being used in mixing;
- The final configuration of the site if contaminated soil mixing is allowed (e.g., the design of the final contamination zone; whether any additional controls (thicker caps) are necessary, consolidation of contaminated areas);
- The additional requirements or controls necessary for sites proposing to release under restricted or alternate release criteria using intentional mixing;
- The decision criteria for determining whether mixing of contaminated soil is allowable at a specific site, that include consideration of cost, stakeholder views, environmental impacts, health impacts to the public and workers, (including as low as is reasonably achievable), and alternatives that are available;
- Other technical information that would impact the decision, such as the site location, the amount of land and soil involved in using the mixing option, and the impact of future erosion and on the groundwater;

- Information and analysis that should be included in a DP that includes intentional soil mixing for NRC review and approval;
- Information and analysis that should be included for acceptance of mixed contaminated soil at an offsite disposal facility.

#### 4. EVALUATION OF IMPLEMENTATION OPTIONS FOR ALLOWING INTENTIONAL MIXING OF CONTAMINATED SOIL UNDER THE LTR

##### 4.1 Identification of Options

Consistent with evaluations in SECY-03-0069, the staff considered the full range of regulatory tools including: rulemaking, guidance, inspection procedures, enforcement policy, and informational tools such as a Regulatory Information Summary (RIS) for implementing the preferred option for allowing intentional mixing of contaminated soil for meeting the release criteria of the LTR under limited circumstances, on a case-by-case basis.

##### 4.2 Evaluation of Options

Assuming the preferred option for allowing intentional mixing, staff believes the existing regulatory requirements for release of sites under the LTR provide the necessary safety and health and environmental protection, and that no specific provisions concerning the waste handling or processing need to be added. Since no prohibitions on dilution appear in any other NRC requirements, staff sees no reason to propose changes to the LTR with rulemaking to implement the preferred option.

Staff concludes that the appropriate implementation actions for the preferred option for allowing intentional mixing is either regulatory guidance, a RIS, or both. Staff notes that it will be issuing a RIS and revised guidance for the other LTR evaluations in SECY-03-0069, as directed in the Staff Requirements Memorandum (SRM) from the Commission on SECY-03-0069.

##### 4.3 Recommended Implementation Actions

The staff recommends that the option for allowing intentional mixing of contaminated soil to meet the release criteria in limited circumstances, on a case-by-case basis, be included in the RIS prepared for the LTR evaluations. This issue will be presented in the RIS in a manner that allows for public input and comment, as will be done for other issues in the RIS, in accordance with the SRM on SECY-03-0069.

The staff also recommends, after the results of the public input and comment on the RIS, including guidance for review and approval of intentional mixing to meet the release criteria of the LTR in the revised guidance that will be prepared and issued on the other subjects evaluated in SECY-03-0069. The guidance would include: (a) more information on the limiting circumstances under which staff would consider intentional mixing, (b) determine decision criteria on which the staff will base approval decisions; (3) address the issues identified above; and (d) resolve public questions and comments submitted on the RIS, as appropriate.



## 5. SUMMARY OF RECOMMENDATIONS

Based on the results of the options analysis, the staff makes the following recommendations concerning the intentional mixing of contaminated soil for meeting the release criteria of the LTR.

### 5.1 Recommended Allowable Scenarios for Mixing

The staff recommends that intentional mixing of contaminated soil be restricted to the following scenarios at sites implementing the LTR release criteria:

Mixing contaminated soil having a higher level of concentration with contaminated soil having a lower level of concentration, to obtain soil with a concentration in between, that meets the WAC of an offsite disposal facility.

Mixing contaminated soil having a higher level of concentration with contaminated soil having a lower level of concentration, to obtain soil with a concentration that allows the release criteria of the LTR to be met, that is replaced in the areas from where it was excavated.

Consolidating and blending several zones of contaminated soil with varying levels of contamination into one zone of contamination that has a lowered concentration that meets the LTR criteria. The footprint of the remaining contaminated zone is less than the total of the footprints of the unconsolidated areas of the various zones of contamination.

A combination of these, where some contaminated soil is mixed, packaged, and shipped to an offsite disposal facility, and some is left for disposal in place at the site, in the acceptable configurations.

### 5.2 Recommended Options for Allowing Mixing to Meet the Release Criteria of the LTR

The staff recommends that:

The current practice of allowing mixing to meet waste acceptance criteria of offsite disposal facilities and for other limited disposals be continued and intentional mixing to meet LTR release criteria in limited circumstances, on a case-by-case basis, be allowed.

### 5.3 Recommended Implementation Actions

The staff recommends the following actions be undertaken to implement the preferred option:

The issue be summarized and included in the RIS that will be prepared for all of the results of the LTR Analysis, in a manner that allows for public input and comment.

Guidance on the issue be included in the revised guidance that will be prepared on restricted release, on site disposal, and selecting realistic scenarios, consistent with direction in the SRM on SECY-03-0069