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**RELEASE PROCESS FOR NON-REAL PROPERTY  
CONTAINING RESIDUAL RADIOACTIVE MATERIAL\***

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**ABSTRACT**

It is DOE's objective to operate its facilities and to conduct its activities so that radiation exposures to members of the public are maintained within acceptable limits and exposures to residual radioactive materials are controlled. To accomplish this, DOE has adopted Order DOE 5400.5; "Radiation Protection of the Public and the Environment," and will be promulgating 10 CFR Part 834 to codify and clarify the requirements of DOE 5400.5. Under both DOE 5400.5 and 10 CFR Part 834, radioactively contaminated DOE property is prohibited from release unless specific actions have been completed prior to the release. This paper outlines a ten-step process that, if followed, will assist DOE Operations and contractor personnel in ensuring that the required actions established by Order DOE 5400.5 and 10 CFR Part 834 have been appropriately completed prior to the release for reuse or recycle of non-real property (e.g., office furniture, computers, hand tools, machinery, vehicles and scrap metal). Following the process will assist in ensuring that radiological doses to the public from the released materials will meet applicable regulatory standards and be as low as reasonably achievable (ALARA).

**INTRODUCTION**

DOE owns numerous facilities where production, research, development and other operations and activities involving radioactive materials and radiation are carried out. It is DOE's objective to operate its facilities and to conduct its activities so that radiation exposures to members of the public are maintained within acceptable limits and exposures to residual radioactive materials are controlled. To accomplish this, DOE has adopted Order DOE 5400.5, "Radiation Protection of the Public and the Environment," and will be promulgating 10 CFR Part 834 to codify and clarify the requirements of DOE 5400.5. Under both DOE 5400.5 and 10 CFR Part 834, all contaminated DOE property is prohibited from release unless release limits for concentrations of residual radioactive material have been developed and approved by DOE, and the following actions are taken to protect the public and environment:

1. The property is appropriately surveyed/measured to identify and characterize its radiological condition;
2. Property surfaces or interior have been determined to meet release limits for concentrations of residual radioactive material;
3. Required documentation is completed; and
4. The owner or recipient of the property is appropriately notified of the radiological status of the property and the availability of required documentation.

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This paper outlines a ten-step process that, if followed, will assist DOE Operations and contractor personnel in ensuring that the required actions listed above have been appropriately completed prior to the release for reuse or recycle of non-real property (e.g., office furniture, computers, hand tools, machinery, vehicles and scrap metal), and that radiological doses to the public from the released materials will meet applicable regulatory standards and be as low as reasonably achievable (ALARA). However, it should be noted that the process does not apply to wastes released for disposal, released soils, liquid discharges, radon emissions, or released real property.

An overview of the process is presented in Figure 1. A detailed description of the process, along with supporting information and examples, is documented in the "Handbook for Controlling Release for Reuse or Recycle of Property Containing Residual Radioactive Material" (Ref. 1), which is available from EM-43.

### **STEP 1 - CHARACTERIZE AND DESCRIBE NON-REAL PROPERTY PROPOSED FOR RELEASE.**

When a DOE facility or activity believes that non-real DOE property should be released for reuse or recycle, the property must be radiologically characterized and described in order to qualify it for release. For this purpose, a written radiological history based on process knowledge should be developed. If DOE or DOE contractor personnel can certify based on this radiological history that property proposed for release is neither radioactive nor radiologically contaminated, then Order DOE 5820.2A and 10 CFR Part 834 do not apply and the property can be released after preparing appropriate documentation. If the property cannot be certified as being neither radioactive nor radiologically contaminated, then it falls into one of two categories: (1) known to be contaminated or previously contaminated; or (2) possibly contaminated, but with no direct evidence of contamination.

Property known to be contaminated or previously contaminated must be comprehensively surveyed prior to release to demonstrate compliance with release limits. If such limits already exist when the property is proposed for release, then the survey protocols approved with the limits should be used. If applicable release limits have not been previously approved, then commonly accepted survey protocols can be used to characterize the property for the purpose of developing release limits. It should be recognized, however, that in these circumstances, it may be necessary to re-survey the property later, after release limits have been approved.

Possibly contaminated property requires at least confirmatory/verification surveys to show whether detectable contamination is present. In the absence of detectable contamination, property of this type can be released after documenting the survey results in accordance with applicable, site-specific procedures. If contamination is detected, then the property must be comprehensively surveyed as described above either to demonstrate compliance with applicable release limits, or to provide a basis for developing release limits.

A detailed physical property description must also be prepared (along with the radiological description) in order to support development of release limits, and/or in order to demonstrate that existing release limits are applicable. The nature of the physical property description will differ depending on whether release limits are, or will be, applicable to an individual release of property (e.g., one-time sale of reusable copper wire) or categories of property (e.g., scrap metal or office machines) that will be routinely released over time.

## STEP 2 - DETERMINE WHETHER RELEASE LIMITS EXIST.

If existing limits apply to and are appropriate for property proposed for release, then the process for release is shortened because development of new limits is unnecessary. However, if release limits do not exist, are not applicable, or are inappropriate, new limits must be developed using the ALARA process.

There are two types of release limits: authorized and supplemental. Authorized limits are limits on the concentrations of residual radioactive material on the surfaces of, or within (internal to), property that have been developed using the ALARA process, given the anticipated use of the property (either restricted or unrestricted). Authorized limits must be approved by DOE and are used for purposes of evaluating whether property that contains residual radioactive material should be released from DOE control.

Supplemental limits are also DOE-approved limits on concentrations of residual radioactive material developed using the ALARA process. Generally, every reasonable effort must be made to minimize the use of supplemental limits. However, supplemental limits might be warranted if it is determined that the scenarios or assumptions used to establish otherwise applicable authorized limits do not apply to property identified for release. Supplemental limits may be more or less restrictive than the otherwise applicable authorized limits.

When considering whether release limits exist, DOE and DOE contractor personnel should be aware that Order DOE 5400.5 and 10 CFR Part 834 allow the use of surface activity levels given in the table entitled "Surface Activity Guidelines" as published in "Response to Questions and Clarification of Requirements and Processes: DOE 5400.5, Section II.5 and Chapter IV Implementation (Requirements Relating to Residual Radioactive Material)" (Ref. 2) as authorized limits only after ALARA process requirements have been met. Therefore, the activity levels given in the Surface Activity Guidelines table *should not* be treated as existing authorized limits until ALARA process requirements are fulfilled.\*

## STEP 3 - DEFINE RELEASE LIMITS NEEDED.

If release limits do not exist for property proposed for release, or existing limits that would otherwise be applicable are not appropriate, then authorized limits or supplemental limits must be developed. The specifications of such limits may vary depending on (1) the physical and radiological characteristics of the property proposed for release, (2) whether the release will be a one-time release of property of a particular type, or routine releases over time of property within a category, and (3) whether or not restrictions will be placed on the property following release. The specifications of authorized limits must indicate the contaminants of concern (e.g., U-238, U-235, Pu-240, Ra-226), the allowable levels of contamination, the types of contamination to which the limits apply (e.g., surface (fixed or removable) or volumetric), the

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\* While DOE has reviewed the surface contamination levels in the Surface Activity Guidelines table and determined that they are protective, the level of protection is not necessarily uniform. Hence, although qualitative, or at most semi-quantitative, review will satisfy ALARA process requirements, the level of detail should be commensurate with the potential maximum dose associated with the release. At the contamination levels in the Surface Activity Guidelines table, radionuclides such as Th-232, Ra-226 and natural uranium have the potential to cause maximum doses up to a few millirem per year, while I-129, Th-230 and Sr-90 have the potential to cause maximum doses of much less than 0.1 mrem/yr. Based on this, release of property containing residual radioactive material at the values in the Surface Activity Guidelines table for the latter radionuclides justify very minimal ALARA review.

category of materials to which the limits apply (e.g., office equipment, small tools, construction machinery, vehicles, debris), and any restrictions to be placed on the use of property following release.

#### **STEP 4 - DEVELOP RELEASE LIMITS.**

If release limits must be developed, Order DOE 5400.5 and 10 CFR Part 834 require that the ALARA process be used. The ALARA process is an optimization process intended to identify from among several alternatives that are reasonably expected to meet regulatory dose limits, one alternative that would reduce radiation exposures to levels that are as low as practicable, taking into account economic, social, environmental, technological and public policy factors, with the goal of maximizing total benefits. The means by which a DOE contractor or operating organization implements the ALARA process at a DOE facility where activities routinely involve radiation or radioactive materials must be addressed by the organization's ALARA program. Therefore, DOE and DOE contractor personnel will need to consult their site-specific ALARA program to identify procedural requirements for conducting the ALARA process.

As a general principle, the ALARA process for developing release limits will include four aspects: (1) defining alternatives; (2) analyzing alternatives; (3) selecting a proposed alternative; and (4) documenting results.

#### **Defining Alternatives**

The alternatives to be studied as part of the ALARA process for developing release limits should include alternatives involving not only release of the materials that require management, but also disposal and storage. Storage and disposal alternatives should be included so that the alternatives optimization study can be used to evaluate whether release represents the optimal materials management alternative under the circumstances, as well as to select optimal release limits if it does. Multiple alternatives involving release should be considered, as appropriate, to allow analysis of more than one option for release limits. For example, in a case involving removable surface contamination on tools and equipment, several alternatives could be formulated using different possibilities for decontamination prior to release (such as 5000 disintegrations/min; 2000 disintegrations/min; 1000 disintegrations/min or 100 disintegrations/min). Additionally, it might be appropriate in certain circumstances to consider an alternative involving release limits that would place restrictions on the use of released property after release to reduce radiation exposure of members of the public. For example, release limits applicable to scrap steel might include a restriction allowing release only if the steel will be recycled into rebar. Sometimes, it may be appropriate to consider an alternative that combines disposal, storage and/or release. For example, release limits could require that property be stored prior to release, until radioactive decay reduces activity levels on or within the property to specified amounts.

#### **Analyzing Alternatives**

The level of effort expended on analyzing alternatives in a particular case should be commensurate with the complexity of the circumstances surrounding the proposed release, the potential for reducing dose by implementing different alternatives and the cost variations among alternatives. However, there are many uncertainties associated with making judgements about these potentialities. Therefore, it is crucial that qualified professionals be responsible and that they consult and follow applicable DOE ALARA guidance, which includes:

1. DOE Assistant Secretary for Environment, Safety and Health, Office of Environmental Policy and Assistance (EH-41) (formerly Office of Environmental Guidance [EH-23]), "DOE Guidance on the Procedures in Applying the ALARA Process for Compliance with DOE 5400.5 (Interim Guidance)," (March 1991).
2. DOE Assistant Secretary for Environment, Safety and Health, Office of Environmental Policy and Assistance (EH-41) (formerly Office of Environmental Guidance [EH-23]), "ALARA Implementation Guide for Compliance with 10 CFR Part 834," (1996).

The following discussion pertains specifically to determining how much effort should be expended to quantify costs and doses and to balance various factors for the purpose of selecting the optimal alternative for releasing non-real property for reuse or recycle. It is not intended to apply to released soils, liquid discharges, radon emissions, released real property, or wastes released for disposal, all of which may have special considerations different than those associated with reuse or recycle.

Regarding cost, an effort should always be made to consider full life-cycle costs, including packaging, storage, transportation, management of secondary wastes, et cetera. Financial benefits should not be overlooked, including direct proceeds from sale of property for reuse or recycle and reduced costs of managing the property on-site. Additionally, it is important to estimate the costs of all alternatives using an equivalent scope (i.e., give each alternative a similar end point, such as the point at which the property leaves DOE control and no further expenses regarding it will be incurred). The effort expended to reduce uncertainties in cost estimates should depend on the sensitivity of the optimization study to changes in costs. In any event, it is vital to use credible assumptions and thoroughly document all such assumptions.

In order for any materials management alternative involving release of property for reuse or recycle to be viable, it must be verified that projected doses to the public caused by the postulated release are reasonably expected to comply with the DOE primary dose limit for exposed members of the public (i.e., 100 mrem/yr from all sources and pathways). To simplify the verification process, 10 CFR Part 834 establishes a presumption of compliance with the primary dose limit if a demonstration shows that doses to the public caused by DOE sources alone are projected to not exceed 30 mrem in a year under actual and likely use scenarios for released property. Often, this demonstration can be made by conducting simplified, conservative dose evaluations. If such "screening" evaluations project dose to the maximally exposed individual member of the public from DOE releases to be a few millirem or less (assuming an actual and likely use scenario) and collective dose from DOE releases to be less than 10 person-rem from annual releases (assuming an average or typical use scenario), then the alternative can be considered viable. Also, with these results, the doses calculated by the "screening" evaluations would be acceptable for use in the optimization study. However, if the "screening" evaluations predict collective dose from annual DOE releases to be greater than 100 person-rem, or dose to the maximally exposed individual from DOE releases to be on the order of 30 mrem in a year, then additional, more sophisticated, dose calculations probably should be made. Any alternative for which the projected dose to the maximally exposed individual member of the public from DOE sources exceeds 30 mrem in a year based on dose calculations for the actual and likely use scenario should be excluded from further consideration in the alternative optimization study. Any alternative for which the projected dose to the maximally exposed individual member of the public exceeds the primary dose limit under any scenario must be excluded. It is DOE's goal to establish release limits that will control exposures such that members of the public receive anticipated doses of less than a few millirem in a year above background.

If the differences among doses and costs associated with alternatives (i.e., different release limits) will most likely be small, a detailed balancing effort may not be warranted in the optimization study. In such cases, the choice of the optimal alternative may depend largely on societal factors. Similarly, if the differences in doses among the alternatives will clearly be large, while the differences in costs will clearly be small, or vice versa, the choice of the optimal alternative may be obvious, making detailed analysis unjustified. However, a detailed balancing effort will probably be needed when the alternatives are likely to exhibit significant variations of dose, cost or societal factors. Additionally, if releases under postulated alternatives would result in individual doses that are a significant fraction of the primary dose limit (i.e., 30 mrem/yr or more) or in a collective dose in excess of 100 person-rem from annual releases, a rigorous analysis, including coordination with appropriate parties such as the local community, is expected in order to satisfy ALARA process requirements. Coordination with the Nuclear Regulatory Commission and Agreement States is expected under all circumstances.

### **Selecting a Proposed Alternative**

Selection of a proposed set of release limits should be based on the results of the optimization study, which must balance not only doses and costs, but also other nonradiological factors. As discussed above the optimization study may be dominated by consideration of doses and costs. However, if the differences among doses and costs associated with alternatives will most likely be small, nonradiological factors may play a significant role in selecting the optimal alternative. In any event, whenever possible, if a quantitative comparison of doses and costs is being performed, appropriate nonradiological factors should also be quantified and incorporated into the comparison. However, since many nonradiological factors cannot be quantified, the optimization study will often have to qualitatively address those factors.

Some examples of nonradiological factors that could influence selection of the preferred release limits include:

- Environmental pollution consequences of reuse and recycle compared with recovering and processing raw materials and manufacturing new property;
- Waste minimization objectives;
- Environmental justice considerations;
- Transportation effects;
- Nonradiological environmental permitting issues;
- Effects on ecological resources;
- Nonradiological worker hazards;
- Resource conservation objectives; and
- Public interest.

### **Documenting Results**

Because the ALARA process is often iterative and involves making extensive assumptions based on professional judgements, care must be taken to carefully document the decision process and assumptions. One element of the ALARA program that DOE activities are required by Order DOE 5400.5 and 10 CFR Part 834 to establish is a process for documenting ALARA decisions. Therefore, when developing release limits, the generic process for documenting ALARA decisions should be consulted, keeping in mind the information that must be included with each application for approval of release limits (see Step 5).

## **STEP 5 - COMPILE AND SUBMIT APPLICATION FOR RELEASE LIMITS TO RESPONSIBLE DOE OPERATIONS OFFICE.**

An application for approval of authorized or supplemental release limits must be submitted for review and approval to the DOE Operations Office having direct responsibility for oversight of the activity proposing the release. As part of the approval process, the Operations Office will consult with other DOE organizations, such as the Headquarters lead program office and the Headquarters Office of Environment, Safety and Health (EH).

### **Authorized Limits**

Applications for DOE approval of authorized limits must contain the following information:

1. The nature of the property to which the proposed limits will apply and its potentially restricted or unrestricted use;
2. The potential collective dose to the exposed population and the dose to those individual members of the public most likely to receive the highest dose in the actual and likely use scenario and the worst plausible use scenario;
3. The cost and impact of actions necessary to reduce levels of residual radioactive material and the dose reduction resulting from these actions;
4. Other factors that relate to the ALARA process and the approval decisions;
5. The limits requested for residual radioactive contaminants, including any restrictions on release;
6. The measurement protocols and evaluation techniques proposed to determine compliance with contamination limits; and
7. The mechanism(s) by which DOE will reasonably assure that restrictions on release will be enforced.

Additionally, the application should be accompanied by an executive summary that: (1) indicates the proposed release limits for which approval is sought, including contaminant concentration levels and any restrictions on release; (2) summarizes the broad scope of the process for the release of common material from various DOE activities at the site; and (3) identifies any unusual site-specific issues.

### **Supplemental Limits**

An application for supplemental release limits should contain information similar to that presented in an application for authorized limits and should be structured like an application for authorized limits. In addition, the application must include an adequately documented justification for the decision that existing authorized limits are not appropriate. If the proposed supplemental limits include restrictions on release, the documentation must show clearly that the authorized limits cannot reasonably be achieved and that restrictions are necessary and will protect members of the public. The application must present the mechanism(s) by which DOE will reasonably assure that restrictions on release will be enforced.

## **STEP 6 - IMPLEMENT APPROVED LIMITS.**

Release limits can be implemented in a manner consistent with existing site procedures once approval has been received from the DOE Operations Office. However, since the Operations Office approval requires coordination with the DOE Headquarters lead program office and the Headquarters Office of Environment Safety and Health, issuance of the approval must await completion of the consultation process.

## **STEP 7 - DOCUMENT APPROVED LIMITS IN THE PUBLIC RECORD.**

Approved release limits must be made part of the public record. As a matter of policy, DOE's Office of Environmental Management (EM) has recommended that DOE sites establish public participation programs (Ref. 3). As a result of developing such programs, many DOE sites have established public information repositories and/or public reading rooms. Almost all sites have designated a public liaison. The public liaison should identify the most appropriate method for making the approved release limits and the supporting documentation available in the public record.

## **STEP 8 - CONDUCT SURVEYS/MEASUREMENTS.**

Property to be released must be surveyed, or measurements must be made, either to verify that surface and internal residual radioactive material concentrations are less than applicable release limits, or to verify whether radioactivity can be detected on possibly contaminated property. Previously conducted surveys/measurements can be used when documentation sufficient to meet Order DOE 5400.5 and 10 CFR Part 834 requirements exists. To show compliance with release limits, the documentation must include survey protocols and survey results. To show the absence of detectable radioactivity, the documentation should show that surveys were completed in accordance with existing site-specific procedures and should include survey results.

As part of normal operations, DOE activities will usually have already developed a Quality Assurance/Quality Control (QA/QC) program and procedures for conducting radiological surveys/measurements that can be applied to surveys and measurements required for this step of the release process for non-real property containing residual radioactive material.

## **STEP 9 - DETERMINE WHETHER PROPERTY MEETS RELEASE LIMITS.**

The documented results of surveys/measurements should be compared with applicable release limits to determine whether property proposed for release meets the limits. The results of this determination must be documented. Property that has been demonstrated to meet applicable release limits can be released for reuse or recycle provided that all other release requirements have been met. Property shown to contain no detectable radioactivity can be released for any purpose after survey results have been documented in accordance with applicable site-specific procedures.

If existing authorized limits apply and are not met, an evaluation should be made of whether supplemental limits would be appropriate. If so, the justification should be documented, and step 3 should be revisited to begin the process for developing supplemental limits. If supplemental limits would not be appropriate, the property cannot be released for reuse or recycle. Hence, an alternative management approach would have to be pursued.

## **STEP 10 - RELEASE PROPERTY.**

Before property can be released, it must be verified that the four conditions imposed by Order DOE 5400.5 and 10 CFR Part 834 have been met as follows:

1. The property has been appropriately surveyed/measured to identify and characterize its radiological condition;

2. Property surfaces or interior have been determined to meet release limits for concentrations of residual radioactive material;
3. Required documentation has been completed as follows:
  - a. Description of property
  - b. Radiological history of property
  - c. Criteria for release and bases for the criteria (i.e., applicable release limits)
  - d. Restrictions on property use or disposition following release and explanation of the mechanism(s) by which DOE will reasonably ensure enforcement of the restrictions
  - e. Description of property surveys/measurements
  - f. Quantity and disposition of waste from any decontamination effort
  - g. Recipient of property, its destination, or its disposition; and
4. The owner or recipient of the released property has been appropriately notified of the radiological status of the property and the availability of required documentation.

Additionally, responsible DOE or DOE contractor personnel must ensure compliance with other applicable laws, regulations and policies that may apply. The following list suggests some sources of other requirements. This list is not intended to be comprehensive, however. Therefore, it will be necessary to determine exactly which laws, regulations and policy statements are pertinent on a site-specific basis.

1. National Environmental Policy Act (NEPA)
2. Resource Conservation and Recovery Act (RCRA)
3. Federal Property Management Regulations (FPMR)
4. DOE Property Management Regulations (PMR)
5. DOE Acquisition Regulations (DEAR)
6. DOE Personal Property Letter (PPL) 970-3 (Mar. 25, 1996, "Control of 'High-Risk' Personal Property")

## CONCLUSION

The ten-step process described in this paper is presented in detail with supporting information and examples in the "Handbook for Controlling Release for Reuse or Recycle of Property Containing Residual Radioactive Material" (Ref. 1). It is designed to assist in ensuring that the requirements of Order DOE 5400.5, "Radiation Protection of the Public and the Environment," and of 10 CFR Part 834, which codifies and clarifies DOE 5400.5, are met. While the ten-step process does not cover all regulatory and policy requirements that may apply, and its scope is limited to non-real property destined for reuse or recycle, it should provide a tool that DOE and DOE contractor personnel responsible for managing radioactively contaminated materials can use to expand the available management options for many such materials.

## REFERENCES

1. U.S. Department of Energy, Assistant Secretary of Environmental Management, "Handbook for Controlling Release for Reuse or Recycle of Property Containing Residual Radioactive Material," (1997)
2. Assistant Secretary for Environment, Safety and Health, Office of Environmental Policy and Assistance (EH-41), Memorandum regarding "Response to Questions and Clarification of Requirements and Processes: DOE 5400.5, Section II.5 and Chapter IV Implementation (Requirements Relating to Residual Radioactive Material)," (November 17, 1995).
3. U.S. Department of Energy, "Public Participation Guidance for Environmental Restoration and Waste Management," (March 1993).

[PLACE FIG. 1 HERE]

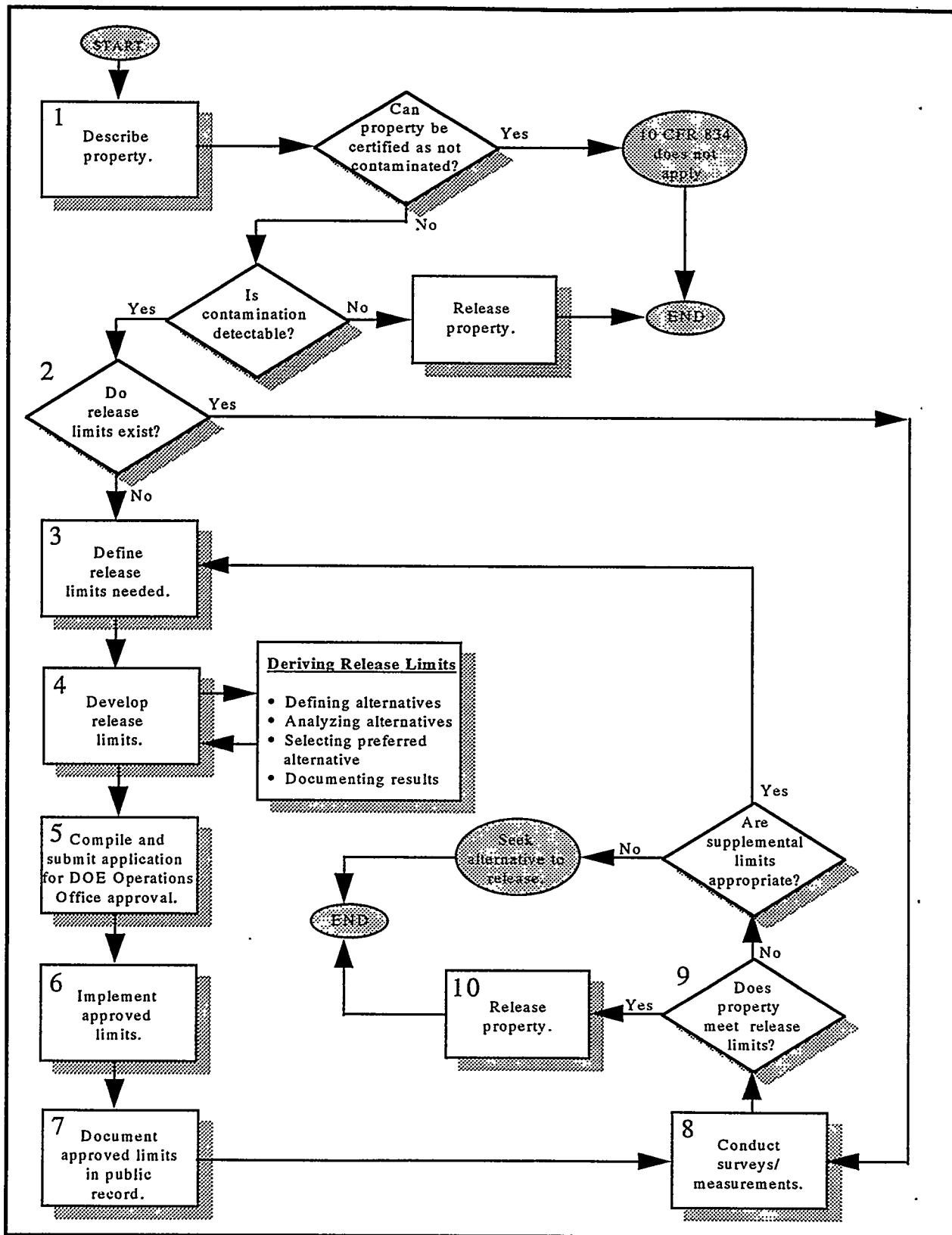


Figure 1: Release Process For DOE Non-Real Property Containing Residual Radioactive Material