

# **Consolidated Guidance About Materials Licenses**

Program-Specific Guidance About  
Well Logging, Tracer, and Field Flood  
Study Licenses

Final Report

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# **Consolidated Guidance About Materials Licenses**

## **Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses**

### **Final Report**

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## ABSTRACT

This technical report contains information intended to provide program-specific guidance and assist applicants and licensees in preparing applications for materials licenses for well logging, tracer, and field flood studies. In particular, it describes the types of information needed to complete U.S. Nuclear Regulatory Commission (NRC) Form 313, "Application for Materials License." This document describes both the methods acceptable to the NRC license reviewers in implementing the regulations and the techniques used by the reviewers in evaluating the application to determine if the proposed activities are acceptable for licensing purposes.

### **Paperwork Reduction Act Statement**

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## FOREWORD

The U.S. Nuclear Regulatory Commission's (NRC's) NUREG-1556 technical report series provides a comprehensive source of reference information about various aspects of materials licensing and materials program implementation. These reports, where applicable, describe a risk-informed, performance-based approach to licensing consistent with the current regulations. The reports are intended for use by applicants, licensees, license reviewers, and other NRC personnel. The NUREG-1556 series currently includes the following volumes:

Volume No.	Volume Title
1	Program-Specific Guidance About Portable Gauge Licenses
2	Program-Specific Guidance About Industrial Radiography Licenses
3	Applications for Sealed Source and Device Evaluation and Registration
4	Program-Specific Guidance About Fixed Gauge Licenses
5	Program-Specific Guidance About Self-Shielded Irradiator Licenses
6	Program-Specific Guidance About 10 CFR Part 36 Irradiator Licenses
7	Program-Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope Including Electron Capture Devices and X-Ray Fluorescence Analyzers
8	Program-Specific Guidance About Exempt Distribution Licenses
9	Program-Specific Guidance About Medical Use Licenses
10	Program-Specific Guidance About Master Materials Licenses
11	Program-Specific Guidance About Licenses of Broad Scope
12	Program-Specific Guidance About Possession Licenses for Manufacturing and Distribution
13	Program-Specific Guidance About Commercial Radiopharmacy Licenses
14	Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses
15	Guidance About Changes of Control and About Bankruptcy Involving Byproduct, Source, or Special Nuclear Materials Licenses
16	Program-Specific Guidance About Licenses Authorizing Distribution to General Licensees
17	Program-Specific Guidance About Special Nuclear Material of Less Than Critical Mass Licenses
18	Program-Specific Guidance About Service Provider Licenses
19	Guidance for Agreement State Licensees About NRC Form 241 "Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction, or Offshore Waters" and Guidance for NRC Licensees Proposing to Work in Agreement State Jurisdiction (Reciprocity)
20	Guidance About Administrative Licensing Procedures
21	Program-Specific Guidance About Possession Licenses for Production of Radioactive Material Using an Accelerator

The current document, NUREG–1556, Volume 14, Revision 1, “Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses,” is intended for use by applicants, licensees, and NRC staff. This revision provides a general update to the previous information contained in NUREG–1556, Volume 14, dated June 2000.

This report takes a risk-informed, performance-based approach to licensing the use of sources in well logging, tracer, and field flood study applications. A team composed of staff from NRC headquarters, NRC regional offices, and Agreement States prepared this document, drawing on their collective experience in radiation safety in general and as specifically applied to well logging, tracer, and field flood study operations.

NUREG–1556, Volume 14, Revision 1, is not a substitute for NRC or Agreement State regulations. The approaches and methods described in this report are provided for information only. Methods and solutions different from those described in this report may be acceptable if they include a basis for the staff to make the determinations needed to issue or renew a license.

The comments received during the public comment period for NUREG–1556, Volume 14, Revision 1, were summarized and addressed in a document that can be located on the NRC’s Agencywide Documents and Management System (ADAMS) under ML18023B550. Access to ADAMS is available on the public Web site at: <https://www.nrc.gov/reading-rm/adams.html>. The comments received by NRC included general corrections, comments on training, and comments on safety culture.

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## ABBREVIATIONS

ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act
ALARA	as low as is reasonably achievable
ALI	annual limit on intake
ANSI	American National Standards Institute
bkg	background
Bq	becquerel
CDE	committed dose equivalent
CEDE	committed effective dose equivalent
CFR	Code of Federal Regulations
Ci	curie
cpm	counts per minute
DFP	decommissioning funding plan
DIS	decay-in-storage
DOT	U.S. Department of Transportation
dpm	disintegrations per minute
DTS	drill-to-stop
DU	depleted uranium
EA	environmental assessment
ECS	energy compensation source
FA	financial assurance
FR	Federal Register
ft	foot
GM	Geiger-Mueller
GBq	gigabecquerel
Gy	Gray
h	hour
IN	information notice
LLEA	local law enforcement agency
LLW	low level radioactive waste
LSA	low specific activity
LWD	logging while drilling
MBq	megabecquerel
MC	manual chapter
$\mu$ Ci	microcurie
mCi	millicurie
MDA	minimum detectable activity
mR	milliroentgen
mrem	millirem
$\mu$ R	microRoentgen
$\mu$ Sv	microSievert
mSv	milliSievert
MWD	measurement while drilling
NCRP	National Council on Radiation Protection and Measurements
NIST	National Institute of Standards and Technology
NMSS	Office of Nuclear Material Safety and Safeguards
NRC	U.S. Nuclear Regulatory Commission
NSTS	National Source Tracking System
NSTTR	National Source Tracking Transaction Report

NVLAP	National Voluntary Laboratory Accreditation Program
OGC	Office of the General Counsel
OMB	Office of Management and Budget
OSL	optically stimulated luminescence
Q	quality factor
PII	Personally Identifiable Information
RG	regulatory guide
RIS	regulatory issue summary
RQ	reportable quantities
RSO	radiation safety officer
RSRM	risk significant radioactive material
SA	State Agreement
SI	International System of Units
SSD	sealed source and device
std	standard
Sv	Sievert
$T_{1/2}$	radioactive material half-life
TAR	technical assistance request
TEDE	total effective dose equivalent
TVD	True Vertical Depth
TI	transportation index
TLD	thermoluminescent dosimeters
U.S.C.	United States Code
yr	year

# 1 PURPOSE OF REPORT

This NUREG provides guidance to an applicant in preparing a well logging, tracer, and field flood study license application as well as U.S. Nuclear Regulatory Commission (NRC) staff with the criteria for evaluating the corresponding license application. Chapter 8 of this NUREG, “Contents of an Application,” identifies the information needed to complete NRC Form 313, “Application for Materials License,” (see Appendix A of this NUREG) for the use of sealed byproduct materials in well logging and unsealed byproduct materials in tracer and field flood study applications. The information collection requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) Parts 19, 20, 21, 30, 32, 39, 40, 51, 70, and NRC Form 313 have been approved under the Office of Management and Budget (OMB) Control Numbers 3150-0044, 3150-0014, 3150-0035, 3150-0130, 3150-0017, 3150-0001, 3150-0020, 3150-0021, 3150-0009, and 3150-0120.

Byproduct material, as defined in 10 CFR 30.4, “Definitions,” depleted uranium, as defined in 10 CFR 40.4, “Definitions,” and special nuclear material, as defined in 10 CFR 70.4, “Definitions,” are used for a variety of purposes to include well logging and tracer applications involving both single or multiple well bores; conventional well logging and tracer operations; and, in some cases, research and development. Examples include the following applications:

- Sealed sources are used in cased and uncased boreholes.
- Tracer materials are used in single well applications.
- Tracer materials are used in multiple well applications (field flood study) for enhanced recovery of oil and gas wells.
- Sealed sources are used for calibration of applicant’s radiation survey instruments and well logging tools.
- Sealed sources and tracer materials are used in the research and development of new techniques and equipment.

The format within this NUREG for each item of technical information is as follows:

- Regulations—references the regulations applicable to the item
- Criteria—outlines the criteria used to evaluate the applicant’s response
- Discussion—provides additional information about the topic
- Response from Applicant—provides suggested response or responses, offers the option of an alternative reply, or indicates that no response is needed on that topic during the licensing process

Notes and references are self-explanatory and may not be found for each item on NRC Form 313. Sentences in this NUREG containing “must” and “will” are usually associated with NRC regulations. If these sentences are not tied to a regulatory requirement, they likely refer to a license condition or other obligation associated with the license. See NUREG-1556, Volume 20, “Consolidated Guidance About Materials Licenses: Guidance About Administrative Licensing Procedures,” for further information on license conditions.

NRC Form 313 does not have sufficient space for applicants to provide full responses to Items 5 through 11, as indicated on the form. Applicants should address those items on separate sheets of paper and submit them along with the completed NRC Form 313. For the convenience and streamlined handling of well logging, tracer, or field flood study applications, Appendix B of this NUREG, "Suggested Format for Providing Information Requested in Items 5 through 11 of NRC Form 313," may be used to provide supporting information. Appendix C of this NUREG also contains a checklist for the completion of a license application for well logging, tracer, or field flood study applications. Appendices D through R contain additional information on various radiation safety topics.

Appendix D of this NUREG provides specific guidance for licensing field flood activities.

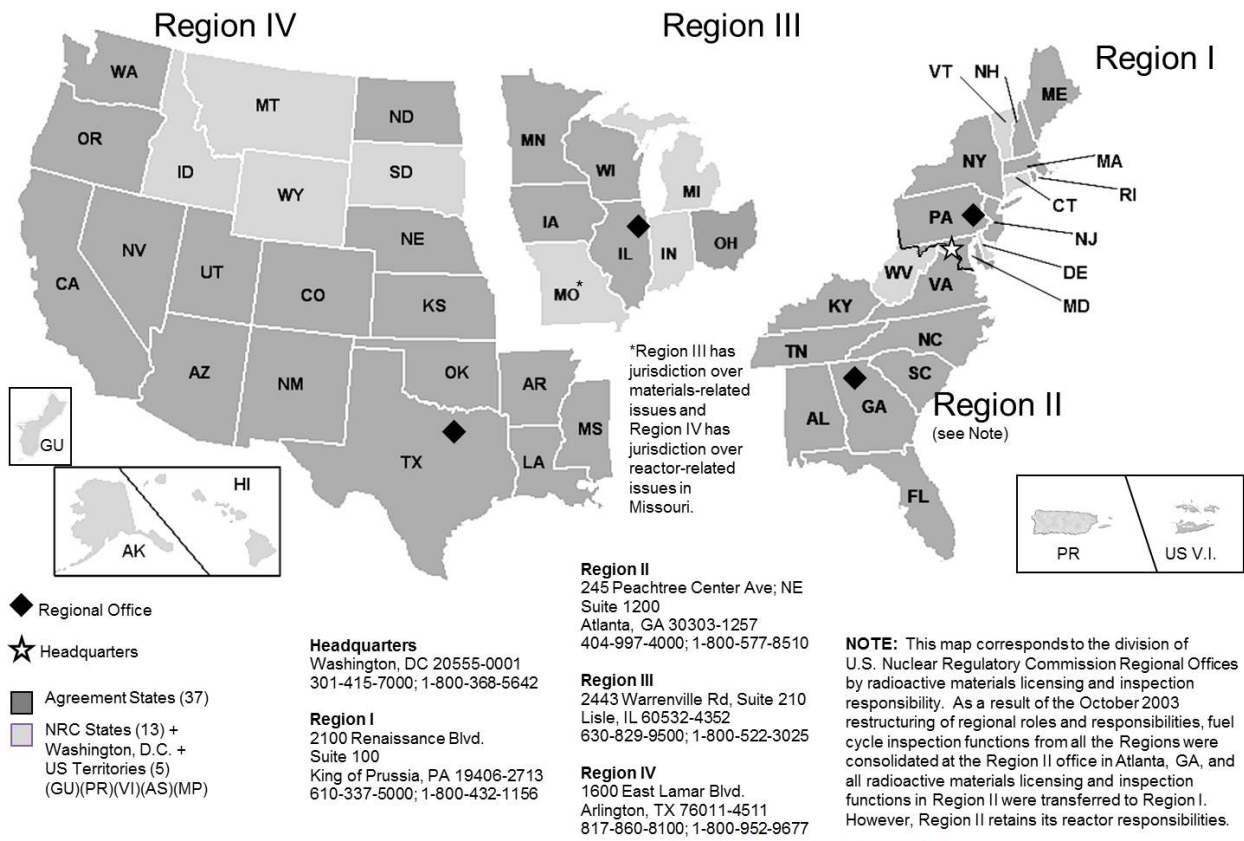
In this NUREG, "dose" or "radiation dose" means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent (TEDE), as defined in 10 CFR Part 20, "Standards for protection against radiation." To describe units of radiation exposure or dose, rem and its International System of Units equivalent, Sievert (Sv) (1 rem = 0.01 Sv), are used. This is done because 10 CFR Part 20 sets dose limits in terms of rem (Sv), rather than rad (Gray). When the radioactive material emits beta and gamma rays, 1 roentgen is assumed to equal 1 rad, which is assumed to equal 1 rem. For alpha and neutron-emitting radioactive material, 1 rad is not equal to 1 rem. Determination of dose equivalent (rem) from absorbed dose (rad) from alpha particles and neutrons requires the use of an appropriate quality factor (Q) value. These Q values are used to convert absorbed dose (rad) to dose equivalent (rem). Tables 1004(b).1 and .2 in 10 CFR 20.1004, "Units of radiation dose," address the Q values for alpha particles and neutrons.

## 2 AGREEMENT STATES

### 2.1 Jurisdiction Determination

Certain States, called Agreement States (see Figure 2–1), have entered into agreements with the U.S. Nuclear Regulatory Commission (NRC) that give them the authority to license and inspect byproduct, source, and special nuclear materials, in quantities not sufficient to form a critical mass, which are used or possessed within their borders. Any applicant, other than a Federal entity, who wishes to possess or use licensed material in one of these Agreement States should contact the responsible officials in that State for guidance on preparing an application. These applications should be filed with State officials, not with the NRC. In areas under exclusive Federal jurisdiction within an Agreement State, NRC continues to be the regulatory authority.

<sup>1</sup>Locations of NRC Offices and Agreement States



**Figure 2–1. U.S. Map: Locations of NRC Offices and Agreement States**

In the special situation of work at federally controlled sites in Agreement States, it is necessary to ascertain the jurisdictional status of the area to determine whether the NRC or the Agreement State has regulatory authority. These areas can also include Tribal lands of federally recognized Indian Tribes.<sup>2</sup>

The NRC has regulatory authority over land determined to be “exclusive Federal jurisdiction,” while the Agreement State may have jurisdiction over nonexclusive Federal jurisdiction land. Applicants are responsible for determining, in advance, the jurisdictional status of the specific areas where they plan to conduct licensed operations. Additional guidance on determining jurisdictional status is found in the Office of Nuclear Material Safety and Safeguards (NMSS) procedures in the State Agreement (SA) series, SA-500, “Jurisdiction Determination,” which is available at <https://scp.nrc.gov/>. Once on the Web site, use the link for “NMSS Procedures” in the left-hand column under “Resources & Tools.”

Table 2–1 provides a quick way to evaluate whether the NRC or an Agreement State has regulatory authority.

<b>Applicant and Proposed Location of Work</b>	<b>Regulatory Agency</b>
Federal agency regardless of location (except that the U.S. Department of Energy and, under most circumstances, its prime contractors are exempt from licensing, in accordance with Title 10 of the <i>Code of Federal Regulations</i> (10 CFR) 30.12, “Persons using byproduct material under certain Department of Energy and Nuclear Regulatory Commission contracts;” also, see 10 CFR 40.11, and/or 10 CFR 70.11, if applicable)	NRC
Non-Federal entity in non-Agreement State, District of Columbia, U.S. territory, or possession, or in offshore Federal waters	NRC
Federally recognized Indian Tribe or Tribal member on Indian Tribal land	NRC
Non-Federal entity on federally recognized Indian Tribal land	NRC <sup>3</sup>
Federally recognized Indian Tribe or Tribal member outside of Indian Tribal land in Agreement State	Agreement State
Non-Federal entity in Agreement State	Agreement State <sup>4</sup>
Non-Federal entity in Agreement State at federally controlled site <b>not</b> subject to exclusive Federal jurisdiction	Agreement State <sup>4</sup>

<sup>2</sup>For the purposes of this guidance, an “Indian Tribe” is defined as an Indian or Alaska Native tribe, band, nation, pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian Tribe, pursuant to the Federally Recognized Indian Tribe List Act of 1994. A list of federally recognized tribes is available at [www.bia.gov](http://www.bia.gov).

<sup>3</sup>The NRC can exercise jurisdiction as the regulatory authority on Tribal land of a federally recognized Indian Tribe. Section 274b. Agreements do not give States the authority to regulate nuclear material in these areas. However, there may be States that exercise regulatory authority over these areas based on treaties or agreements with specific tribes. Companies owned or operated by federally recognized Indian Tribe members or non-Indians that wish to possess or use licensed material on Tribal lands should contact the appropriate NRC regional office to determine the jurisdictional status of the Tribal lands and identify the appropriate regulatory agency for licensing and reciprocity.

<sup>4</sup>Section 274m. of the Atomic Energy Act (AEA) withholds to the NRC regulatory authority over radioactive materials covered under the Section 274b. agreements when the activity can affect the Commission’s authority to protect the common defense and security, to protect restricted data, or guard against the loss or diversion of special nuclear material. (This is an uncommon situation that NRC usually evaluates on a case-by-case basis.) Individuals or companies wishing to possess or use licensed material should contact the licensee to determine the jurisdictional status for specific AEA radioactive materials they intend to possess or use.



<b>Applicant and Proposed Location of Work</b>	<b>Regulatory Agency</b>
Non-Federal entity in Agreement State at federally controlled site subject to exclusive Federal jurisdiction	NRC
Non-Federal entity in Agreement State using radioactive materials (except industrial radiography) directly connected with Part 50 or 52 reactor operations or needed during the construction, and pre-operational phases of a reactor	NRC
Non-Federal entity in Agreement State using radioactive materials <b>not</b> directly connected with Part 50 or 52 reactor operations or needed during the construction and preoperational phases of a reactor.	Agreement State <sup>4</sup>

**Reference:** A current list of Agreement States (including names, addresses, and telephone numbers of responsible officials) is available at <https://scp.nrc.gov>. A request for the list can also be made to an NRC regional office.

## **2.2 Reciprocal Recognition of Specific Licenses**

Performing licensed activities in other jurisdictions is possible through reciprocal recognition of specific licenses (i.e., reciprocity). Agreement States have reciprocity provisions that permit NRC licensees to perform licensed activities under circumstances when an Agreement State is the regulatory authority (see Section 2.1). NRC licensees and Agreement State licensees are subject to the regulations of the regulatory authority, as indicated in Section 2.1. To ensure compliance with an Agreement State’s reciprocity requirements, licensees are advised to request authorization from the appropriate Agreement State radiation control program office well in advance of the scheduled use of licensed material.

Agreement State licensees that wish to conduct licensed activities in areas under NRC jurisdiction must either obtain a specific NRC license or file for reciprocity with the appropriate NRC regional office for the Agreement State that issued their license. Failure to file for reciprocity or obtain a specific NRC license before working in areas under NRC jurisdiction can result in NRC enforcement action, which may include civil penalties. The reciprocity filing must be renewed annually.

Specific guidance regarding NRC licensees filing for reciprocity in Agreement States and Agreement State licensees filing for reciprocity with the NRC or another Agreement State are provided in NUREG-1556, Volume 19, “Consolidated Guidance About Materials Licenses: Guidance for Agreement State Licensees About NRC Form 241, “Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction, or Offshore Waters” and Guidance for NRC Licensees Proposing to Work in Agreement State Jurisdiction (Reciprocity).”



### 3 MANAGEMENT RESPONSIBILITY

The U.S Nuclear Regulatory Commission (NRC) recognizes that effective management of radiation safety programs is vital to achieving safe, secure, and compliant operations. Consistent compliance with NRC regulations provides reasonable assurance that licensed activities will be conducted safely and that effective management will result in increased safety, security, and compliance.

“Management,” as used in this volume, refers to the processes for conduct and control of a radiation safety program and to the individuals who are responsible for those processes and who have *authority to provide necessary resources* to achieve regulatory compliance.

#### 3.1 Commitments and Responsibilities

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 30.32(c), 40.31(b), and 70.22(d), each application must be signed by the applicant or licensee or a person duly authorized to act for and on behalf of the applicant or licensee. If it is not clear whether the application was signed by someone duly authorized to act for and on behalf of the applicant or licensee, NRC license reviewers may ask for additional assurances that the individual who signed the application is duly authorized to act for and on the behalf of the applicant or licensee. The signature on an application acknowledges the applicant’s or licensee’s commitments and responsibilities, including the following:

- Ensure radiation safety, security, and control of radioactive materials and compliance with regulations.
- Ensure that radiation safety records and all information provided to the NRC are complete and accurate (10 CFR 30.9, 40.9, and 70.9, “Completeness and accuracy of information”).
- Affirm the licensee’s knowledge about the contents of the license and application.
- Compliance with current NRC and U.S. Department of Transportation (DOT) regulations; the licensee’s operating, emergency, and security procedures; and NRC license commitments.
- Commitment to provide adequate resources (including space, equipment, personnel, time, and, if needed, contractors) to the radiation protection program to ensure that the public and workers are protected from radiation hazards and compliance with regulations is maintained.
- Commitment to report defects, noncompliance, or reportable events in accordance with regulations.
- Selection and assignment of a qualified individual to serve as the radiation safety officer (RSO) for licensed activities and confirmation that the RSO has independent authority to stop unsafe operations and will be given sufficient time to fulfill radiation safety duties and responsibilities.
- Commitment to ensure that radiation workers have adequate training.

- Prevention of discrimination of employees engaged in protected activities and commitment to provide information to employees about the employee protection provisions (10 CFR 30.7, 40.7, and 70.7, “Employee protection”).
- Commitment to provide information to employees about deliberate misconduct provisions in (10 CFR 30.10, 40.10, and 70.10 “Deliberate misconduct”).
- Commitment to obtain the NRC’s prior written consent before transferring control of the license (see Section 9.1, “Timely Notification of Transfer of Control,” of this NUREG).
- Notification of the appropriate NRC Regional Administrator, in writing, immediately following the filing of a petition for voluntary or involuntary bankruptcy [10 CFR 30.34(h), 40.41(f), 70.32(a)(9)], as discussed further in Section 8.2.1, “Notification of Bankruptcy Proceedings,” of this NUREG.

For information on NRC inspection, investigation, enforcement, and other compliance programs, see the current version of the NRC’s Enforcement Policy and Inspection Procedures available in the NRC’s online library, under “Document Collections,” at <https://www.nrc.gov/reading-rm.html>.

### **3.2 Safety Culture**

Individuals and organizations performing regulated activities are expected to establish and maintain a positive safety culture commensurate with the safety and security significance of their activities and the nature and complexity of their organizations and functions. This applies to all licensees, certificate holders, permit holders, authorization holders, holders of quality assurance program approvals, vendors and suppliers of safety-related components, and applicants for a license, certificate, permit, authorization, or quality assurance program approval, subject to NRC authority.

“Nuclear safety culture” is defined in the NRC’s safety culture policy statement (76 FR 34773; June 14, 2011) as “the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment.” Individuals and organizations performing regulated activities bear the primary responsibility for safely handling and securing these materials. Experience has shown that certain personal and organizational traits are present in a positive safety culture. A trait, in this case, is a pattern of thinking, feeling, and behaving that emphasizes safety, particularly in goal-conflict situations (e.g., production versus safety, schedule versus safety, and cost of the effort versus safety). Refer to Table 3–1 for the traits of a positive safety culture from NRC’s safety culture policy statement.

Organizations should ensure that personnel in the safety and security sectors have an appreciation for the importance of each, emphasizing the need for integration and balance to achieve both safety and security in their activities. Safety and security activities are closely intertwined. While many safety and security activities complement each other, there may be instances in which safety and security interests create competing goals. It is important that consideration of these activities be integrated so as not to diminish or adversely affect either; thus, mechanisms should be established to identify and resolve these differences. A safety culture that accomplishes this would include all nuclear safety and security issues associated with NRC-regulated activities.

The NRC, as the regulatory agency with an independent oversight role, reviews the performance of individuals and organizations to determine compliance with requirements and commitments through its existing inspection and assessment processes. However, NRC's safety culture policy statement and traits are not incorporated into the regulations. Safety culture traits may be inherent to an organization's existing radiation safety practices and programs. For instance, during the daily visual inspection of logging equipment, a well logging supervisor identifies damaged threads on a well logging tool, removes the defective tool from service, and notifies management so the tool can be repaired or replaced. The requirement for daily visual inspections of logging equipment may correspond with the safety culture trait specified in Table 3-1 as "Personal Accountability" (all individuals take personal responsibility for safety). However, licensees should be aware that this is just an example and should consider reviewing their radiation safety programs in order to develop and implement a safety culture commensurate with the nature and complexity of their organizations and functions.

Refer to Appendix R of this NUREG for the NRC's safety culture policy statement. More information on NRC activities relating to safety culture can be found at: <https://www.nrc.gov/about-nrc/safety-culture.html>.

<b>Table 3-1. Traits of a Positive Safety Culture</b>		
<b>Leadership Safety Values and Actions</b>	<b>Problem Identification and Resolution</b>	<b>Personal Accountability</b>
Leaders demonstrate a commitment to safety in their decisions and behaviors.	Issues potentially impacting safety are promptly identified, fully evaluated, and promptly addressed and corrected commensurate with their significance.	All individuals take personal responsibility for safety.
<b>Work Processes</b>	<b>Continuous Learning</b>	<b>Environment for Raising Concerns</b>
The process of planning and controlling work activities is implemented so that safety is maintained.	Opportunities to learn about ways to ensure safety are sought out and implemented.	A safety conscious work environment is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination.
<b>Effective Safety Communications</b>	<b>Respectful Work Environment</b>	<b>Questioning Attitude</b>
Communications maintain a focus on safety.	Trust and respect permeate the organization.	Individuals avoid complacency and continuously challenge existing conditions and activities in order to identify discrepancies that might result in error or inappropriate action.



## 4 APPLICABLE REGULATIONS

It is the applicant's or licensee's responsibility to obtain and have available up-to-date copies of applicable regulations, to read and understand the requirements of each of these regulations, and to comply with each applicable regulation. The following parts of Title 10 of the *Code of Federal Regulations* (10 CFR) contain regulations applicable to well logging, tracer, and field flood studies. Some of these parts are specific to one type of license, while others are general and will apply to many, if not all, licensees.

The current versions of these 10 CFR regulations can be found under the "Basic References" link at the U.S. Nuclear Regulatory Commission's (NRC's) online library at <https://www.nrc.gov/reading-rm.html>. For viewing in a browser, the following list includes direct links to the rules:

- [10 CFR Part 2](#) "Agency Rules of Practice and Procedure"
- [10 CFR Part 19](#) "Notices, Instructions and Reports to Workers: Inspection and Investigations"
- [10 CFR Part 20](#) "Standards for Protection Against Radiation"
- [10 CFR Part 21](#) "Reporting of Defects and Noncompliance"
- [10 CFR Part 30](#) "Rules of General Applicability to Domestic Licensing of Byproduct Material"
- [10 CFR Part 32](#) "Specific Domestic Licenses to Manufacture or Transfer Certain Items Containing Byproduct Material"
- [10 CFR Part 33](#) "Specific Domestic Licenses of Broad Scope for Byproduct Material"
- [10 CFR Part 37](#) "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material"
- [10 CFR Part 39](#) "Licenses and Radiation Safety Requirements for Well Logging"
- [10 CFR Part 40](#) "Domestic Licensing of Source Material"
- [10 CFR Part 70](#) "Domestic Licensing of Special Nuclear Material"
- [10 CFR Part 71](#) "Packaging and Transportation of Radioactive Material"
- [10 CFR Part 110](#) "Export and Import of Nuclear Equipment and Material"
- [10 CFR Part 150](#) "Exemptions and Continued Regulatory Authority in Agreement States and in Offshore Waters under Section 274"
- [10 CFR Part 170](#) "Fees for Facilities, Materials, Import and Export Licenses, and Other Regulatory Services under the Atomic Energy Act of 1954, as Amended"

- [10 CFR Part 171](#) “Annual Fees for Reactor Licenses and Fuel Cycle Licenses and Materials Licenses, Including Holders of Certificates of Compliance, Registrations, and Quality Assurance Program Approvals and Government Agencies Licensed by the NRC”

Copies of the above documents may be obtained by calling the Government Publishing Office Customer Contact Center toll-free at 866-512-1800, in Washington, DC; calling 202-512-1800; or ordering online at <https://bookstore.gpo.gov>.

In addition, 10 CFR Parts 1 through 199 can be found on the NRC’s Web site at <https://www.nrc.gov/reading-rm/doc-collections/> under “Regulations (10 CFR).”

NRC regulations and amendments also can be accessed from the “NRC Library” link on the NRC’s public Web site at <https://www.nrc.gov>. Regulations are periodically amended, and the NRC (as well as all other Federal agencies) is required to publish notice of such amendments in the *Federal Register*.



## 5 HOW TO FILE

### 5.1 Application Preparation

Applicants for a materials license should do the following:

- Use the most recent guidance in preparing an application.
- Complete U.S. Nuclear Regulatory Commission (NRC) Form 313 (Appendix A of this NUREG), Items 1 through 4, 12, and 13, on the form itself. A link to the form is available at <https://www.nrc.gov/reading-rm/doc-collections/forms/>.
- Complete NRC Form 313, Items 5 through 11, on supplementary pages or use Appendix B of this NUREG.
- Provide sufficient detail for the NRC to determine that the equipment, facilities, training, experience, and radiation safety program are adequate to protect health and safety and minimize danger to life and property.
- For each separate sheet other than NRC Form 313 and Appendix B pages, as applicable, identify and cross-reference submitted information to the item number on the application or the topic to which it refers.
- Avoid submitting proprietary information and personally identifiable information. If submitted, proprietary, personal privacy, security-related, and other sensitive information should be clearly identified according to Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390, “Public inspections, exemptions, requests for withholding” (see Chapter 6, “Identifying and Protecting Sensitive Information”).

### 5.2 Where to File

Applicants wishing to possess or use licensed material in any State, U.S. territory, or U.S. possession subject to NRC jurisdiction must file an application with the NRC regional office for the locale in which the material will be possessed or used. Figure 2–1 identifies the NRC’s four regional offices and their respective areas for licensing purposes and the Agreement States. Note that all materials applications are submitted to Regions I, III, or IV. All applicants for materials licenses located in the Region II geographical area should send their applications to Region I.

In general, applicants wishing to possess or use licensed material in Agreement States must file an application with the Agreement State and not with the NRC. However, if work will be conducted at federally controlled sites, or federally recognized Indian Tribal lands, in Agreement States, applicants must first determine the jurisdictional status of the land in order to determine whether the NRC or the Agreement State has regulatory authority. See Chapter 2, “Agreement States,” for additional information.

### **5.3 Paper Applications**

Paper applications received by the NRC are scanned through an optical character reader and converted to an electronic format. To ensure a smooth transfer to an electronic format, applicants should do the following:

- Submit all documents, typed, on 8½ × 11-inch or legal-sized paper that will feed easily into a document scanner.
- Choose typeface designs that are sans serif, such as Arial, Helvetica, or Futura.
- Use 11-point or larger font.
- Avoid stylized characters, such as script or italics.
- Ensure that the print is clear and sharp.
- Ensure that there is high contrast between the ink and paper (black ink on white paper is best).

Applications should be signed by the applicant, licensee, or a person duly authorized as required by 10 CFR 30.32(c), 40.31(b), and 70.22(d) (see Section 8.13, "Certification").
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### **5.4 Electronic Applications**

Applications may be submitted in electronic form via the NRC's Electronic Information Exchange, or CD-ROM. Detailed guidance on making electronic submissions can be obtained by visiting the NRC's Web site at <https://www.nrc.gov/site-help/e-submittals.html>. The guidance discusses, among other topics, the formats the NRC can accept, the use of electronic signatures, and the treatment of nonpublic information.

## 6 IDENTIFYING AND PROTECTING SENSITIVE INFORMATION

All licensing applications, except for portions containing sensitive information, will be made available for review in the U.S. Nuclear Regulatory Commission (NRC) Public Document Room and electronically at the NRC Library. For more information on the NRC Library, visit <https://www.nrc.gov>.

The applicant or licensee should identify, mark, and protect sensitive information against unauthorized disclosure to the public. License applications that contain sensitive information should be marked as indicated in the list that follows in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390 before the information is submitted to the NRC. Key examples are as follows:

- **Proprietary Information and Trade Secrets:** If it is necessary to submit proprietary information or trade secrets, follow the procedure in 10 CFR 2.390(b). Failure to follow this procedure could result in disclosure of the proprietary information to the public or substantial delays in processing the application. Appendix Q of this NUREG provides a checklist for requests for withholding proprietary information from public disclosure.
- **Personally Identifiable Information:** Personally identifiable information (PII) about employees or other individuals should not be submitted unless specifically requested by the NRC. Examples of PII are social security number, home address, home telephone number, date of birth, and radiation dose information. If PII is submitted, a cover letter should clearly state that the attached documents contain PII, and the top of every page of a document that contains PII should be clearly marked as follows: “Privacy Act Information—Withhold under 10 CFR 2.390.” For further information, see Regulatory Issue Summary (RIS) 2007-04, “Personally Identifiable Information Submitted to the U.S. Nuclear Regulatory Commission,” dated March 9, 2007, and Information Notice (IN) 2013-22, “Recent Licensing Submittals Containing Personally Identifiable Information,” dated November 15, 2013, which can be found on the NRC’s Generic Communications Web page under “Regulatory Issue Summaries” and “Information Notices,” respectively at <https://www.nrc.gov/reading-rm/doc-collections/gen-comm/>.
- **Security-Related Information:** Following the events of September 11, 2001, the NRC changed its procedures to avoid the release of information that terrorists could use to plan or execute an attack against facilities or citizens in the United States. As a result, certain types of information are no longer routinely released and are treated as sensitive unclassified information. For example, certain information about the quantities and locations of radioactive material at licensed facilities, and associated security measures, are no longer released to the public. Therefore, a cover letter should clearly state that the attached documents contain sensitive security-related information, and the top of every page of a document that contains such information should be clearly marked: “Security-Related Information—Withhold under 10 CFR 2.390.” For the pages having security-related sensitive information, an additional marking should be included (e.g., an editorial note box) adjacent to that material. For further information, see RIS 2005-31, Rev. 1, “Control of Security-Related Sensitive Unclassified Non-Safeguards Information Handled by Individuals, Firms, and Entities Subject to NRC Regulation of the Use of Source, Byproduct, and Special Nuclear Material,” dated December 26, 2017, which can be found on the NRC’s Generic Communications Web page under “Regulatory Issue Summaries” at <https://www.nrc.gov/reading-rm/doc-collections/gen-comm/>.

Additional information on procedures with any updates is available at <https://www.nrc.gov/reading-rm/sensitive-info.html>.

The regulations list various forms of information that can be protected from public disclosure. These include

- trade secrets and commercial or financial information
- interagency or intra-agency memoranda or letters that would not be available by law to a party other than an agency in litigation with NRC
- certain records or information compiled for law enforcement purposes
- geological and geophysical information and data, including maps, or information concerning wells
- personnel, medical, and other information, the disclosure of which would constitute a clearly unwarranted invasion of personal privacy

In 10 CFR 2.390, NRC specifies the procedures and requirements for persons to submit sensitive information to NRC so that it may be properly protected from disclosure. This regulation is available electronically on the NRC Web site at <https://www.nrc.gov/reading-rm/doc-collections/cfr>.

Except for personal privacy information, which is not subject to the affidavit requirement, if NRC determines that the application or affidavit is deficient (i.e., does not contain the required information as outlined in 10 CFR 2.390), the applicant will be notified that additional information is needed and that the review will continue when the required information is received.

If the request is denied, in whole or in part, NRC will give the applicant the option of withdrawing the information or application, as permitted in 10 CFR 2.390. If the applicant decides not to withdraw the information or application, NRC will notify the applicant in writing that the request for withholding has been denied and that NRC will disregard any references concerning the proprietary status of the information.

Any part of a license application or information provided by a licensee or applicant that the NRC determines should be withheld from public disclosure will be handled in accordance with Management Directive 12.6, "NRC Sensitive Unclassified Information Security Program," and the licensee or applicant will be notified in writing that NRC plans to honor the request. Management Directive 12.6 is available electronically on the NRC Web site at <https://www.nrc.gov/reading-rm/doc-collections/management-directives/>.

Anyone submitting a request to withhold information from public disclosure should thoroughly review 10 CFR 2.390 and be familiar with its requirements and limitations.

Withholding from public inspection will not affect the right, if any, of persons properly and directly concerned to inspect the documents. If the need arises, NRC may send copies of this information to NRC consultants working in that area. NRC will ensure that the consultants have signed the appropriate agreements for handling proprietary information.

If the basis for withholding this information from public inspection should change in the future, such that the information could then be made available for public inspection, the licensee or applicant should promptly notify the NRC. The licensee or applicant also should understand that NRC may have cause to review this determination in the future (e.g., if the scope of a Freedom of Information Act request includes the information in question. In all review situations, if NRC makes a determination adverse to the above, the licensee or applicant will be notified in advance of any public disclosure. Anyone submitting commercial or financial information they believe to be privileged, confidential, or a trade secret must remember that the NRC's policy is to achieve an effective balance between legitimate concerns for the protection of competitive positions and the right of the public to be fully apprised of the basis for, and the effects of, licensing or rulemaking actions. It is within NRC's discretion to withhold such information from public disclosure.



## 7 APPLICATION AND LICENSE FEES

Each application for which a fee is specified must be accompanied by the appropriate fee. Refer to Title 10 of the *Code of Federal Regulations* (10 CFR) 170.31, "Schedule of fees for materials licenses and other regulatory services, including inspections, and import and export licenses," to determine the amount of the fee. The U.S. Nuclear Regulatory Commission (NRC) will not issue a license until the fee is received. Consult 10 CFR 170.11, "Exemptions," for information on exemptions from these fees. Once the technical review of an application has begun, no fees will be refunded. Application fees will be charged regardless of the NRC's disposition of an application or the withdrawal of an application.

Most NRC licensees are also subject to annual fees; refer to 10 CFR 171.16, "Annual fees: Materials licensees, holders of certificates of compliance, holders of sealed source and device registrations, holders of quality assurance program approvals, and government agencies licensed by the NRC." Consult 10 CFR 171.11 for information on exemptions from annual fees and 10 CFR 171.16(c) on reduced annual fees for licensees that qualify as "small entities." Note, that in order to pay reduced fees, a licensee that qualifies as a "small entity" must provide proper certification of this status to the NRC each year along with its annual fee payment.

Direct all questions about the NRC's fees or completion of Item 12 of NRC Form 313 to the Office of the Chief Financial Officer at NRC Headquarters in Rockville, Maryland, 301-415-7554. Information about fees may also be obtained by calling NRC's toll-free number, 800-368-5642, extension 415-7554. The e-mail address is [Fees.Resource@nrc.gov](mailto:Fees.Resource@nrc.gov).





## 8 CONTENTS OF AN APPLICATION

The following information applies to the indicated items on U.S. Nuclear Regulatory Commission (NRC) Form 313 (Appendix A of this NUREG).

All items in the application should be completed in enough detail for the NRC to determine whether the proposed equipment, facilities, training and experience, and radiation safety and security program satisfy regulatory requirements and are adequate to protect public health and safety and minimize danger to life and property. Consideration should be given, when developing the application, to the concepts of keeping exposure as low as is reasonably achievable (ALARA), minimizing contamination, and maintaining control of radioactive materials.

Title 10 of the *Code of Federal Regulations* (10 CFR) 20.1101(b) states, "The licensee shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA)." Regulatory Guide 8.10, Rev. 2, "Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as Is Reasonably Achievable," discusses the ALARA concept and philosophy. The application should document ALARA considerations, including establishing administrative action levels and monitoring programs.

10 CFR 20.1406, "Minimization of contamination," requires applicants for licenses to describe how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste. As with ALARA considerations, applicants should address these concerns for all aspects of their programs.

The application should include information on how the licensee will implement the security requirements in 10 CFR 20.1801, "Security of stored material," and 10 CFR 20.1802, "Control of material not in storage."

All information submitted to the NRC during the licensing process may be incorporated as part of the license and will be subject to review during inspection.

### 8.1 Item 1: License Action Type

Item 1 of NRC Form 313 states the following:

This is an application for (check appropriate item):

Type of Action	License No.
<input type="checkbox"/> A. New License	Not Applicable
<input type="checkbox"/> B. Amendment	XX-XXXXXX-XX
<input type="checkbox"/> C. Renewal	XX-XXXXXX-XX

Check Box A for a new license request. Note that a precicensing visit may be required prior to issuance of the license. Also note that an initial security review may be conducted in accordance with NRC Inspection Manual Chapter 2800, "Material Inspection Program," before issuance of the license.

Check Box B for an amendment to an existing license and provide the license number.

Check Box C for a renewal of an existing license and provide the license number. See “License Amendments and Renewals” in Chapter 9 of this NUREG.

## **8.2 Item 2: Name and Mailing Address of Applicant**

List the legal name of the applicant’s corporation or other legal entity with direct control over use of the radioactive material. A division or department within a legal entity may not be a licensee. An individual may be designated as the applicant only if the individual is acting in a private capacity and the use of the radioactive material is not connected with employment in a corporation or other legal entity. Provide the mailing address where correspondence should be sent. A post office box number is an acceptable mailing address.

Notify the NRC of changes in mailing address. These changes do not require a fee.

**Note:** The NRC must be notified and the transfer approved before control of the license is transferred (see Section 9.1, “Timely Notification of Transfer of Control”). The NRC must also be notified when bankruptcy proceedings have been initiated (see Section 8.2.1, “Notification of Bankruptcy Proceedings”).

### **8.2.1 Notification of Bankruptcy Proceedings**

**Regulation:** 10 CFR 30.34(h), 10 CFR 40.41(f)(1), 10 CFR 70.32(a)(9)(i)

**Criteria:** Immediately following the filing of a voluntary or involuntary petition for bankruptcy by or against a licensee, the licensee must notify the appropriate NRC Regional Administrator in writing, identifying the bankruptcy court in which the petition was filed and the date of filing.

**Discussion:** Even though a licensee may have filed for bankruptcy, the licensee remains subject to all applicable NRC requirements. The NRC must be notified when licensees are in bankruptcy proceedings in order to determine whether all licensed material is accounted for and adequately controlled and whether there are any public health and safety concerns (e.g., contaminated facility). The NRC shares the results of its determinations with other involved entities (e.g. trustee), so that health and safety issues can be resolved before bankruptcy actions are completed, and the NRC may request that the U.S. Department of Justice represent the NRC’s interests in the bankruptcy proceeding.

**Response from Applicant:** None is required at the time of application for a new license. Licensees must immediately notify the NRC in writing, following the filing of a voluntary or involuntary petition for bankruptcy by or against the licensee.

**Reference:** See NUREG–1556, Volume 15, “Consolidated Guidance About Materials Licenses: Guidance About Changes of Control and About Bankruptcy Involving Byproduct, Source, or Special Nuclear Materials Licenses.”

## **8.3 Item 3: Address(es) Where Licensed Material Will Be Used or Possessed**

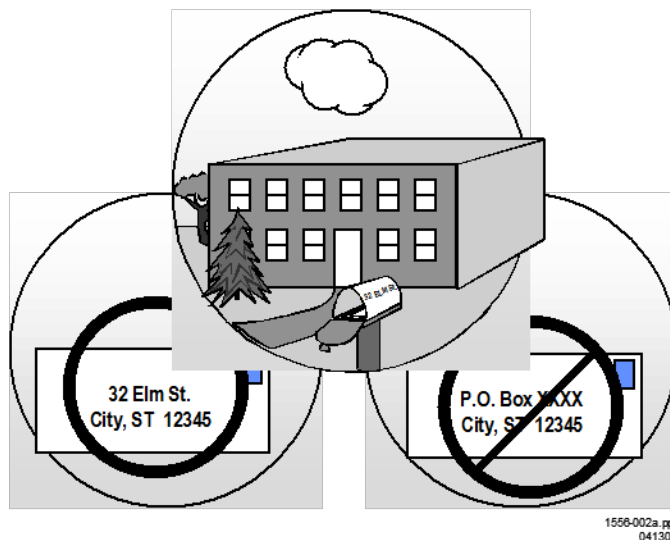
Specify the street address, city, and State or other descriptive address {e.g., Highway 10, 5 miles [8 kilometers] east of the intersection of Highway 10 and State Route 234, Anytown,

State} for each facility at which licensed material will be used or stored. The descriptive address should be sufficient to allow an NRC inspector to find the facility location. A post office box address is not acceptable (see Figure 8-1). In addition, applicants are encouraged to provide global positioning system coordinates, as appropriate, for each permanent storage or use facility located in a remote area. If devices will not be stored at a dispatch site, the applicant should indicate this. The applicant should also state whether a location will be used to perform well logging operations or only for storage of sources and devices.

A license amendment is required before receiving, using, or storing licensed material at an address or location not already listed on the license.

An NRC license does not relieve a licensee from complying with other applicable Federal, State, or local regulations (e.g., local zoning requirements).

To conduct operations at temporary job sites (i.e., locations where work is conducted for limited periods of time), the address may be stated as “temporary job sites anywhere in the United States where the NRC maintains jurisdiction.” See Table 2-1 to determine the appropriate regulatory jurisdiction.



**An acceptable location of use or possession specifies street address, city, state, and zip code and does not include a post office box number.**

### Figure 8–1. Location of Use or Possession

If an applicant submits documents that give the exact location of use and storage for any amount of radioactive material, the applicant should mark these documents as “Security-Related Information—Withhold under 10 CFR 2.390.” See Chapter 6, “Identifying and Protecting Sensitive Information,” for more details.

**Note:** As discussed in Section 8.5.3, “Financial Assurance and Recordkeeping for Decommissioning,” licensees must maintain permanent records describing where licensed material was used or stored while the license was in effect. This is important for making future determinations about the release of these locations for unrestricted use (e.g., before the license is terminated). Acceptable records are sketches, written descriptions of the specific locations or

room numbers where licensed material is used or stored, and any records of leaking radioactive sources or other unusual occurrences involving the possible spread of contamination in or around the licensee's facilities.

#### **8.4 Item 4: Person To Be Contacted About This Application**

Identify the individual who can answer questions about the application, and include a telephone number where the individual may be contacted as well as business cell phone numbers and e-mail addresses. This individual, usually the radiation safety officer (RSO), will serve as the point of contact during the review of the application. If this individual is not a full-time employee of the licensed entity, his or her position and relationship to the licensee should be specified. The NRC should be notified if the person assigned to this function changes or if his or her telephone number, cell phone number, or e-mail address changes. Notification of a contact change is only provided for informational purposes and would not be considered an application for license amendment, unless the notification involves a change in the contact person who is also the RSO.

As indicated on NRC Form 313 (see Appendix A of this NUREG), Items 5 through 11 should be submitted on separate sheets of paper. Applicants may use Appendix B of this NUREG for this purpose and should note that using the suggested wording of responses and committing to use the model procedures in this NUREG will facilitate the NRC's review.

#### **8.5 Item 5: Radioactive Material**

**Regulations:** 10 CFR 30.3, 10 CFR 30.18, 10 CFR 30.32(g), 10 CFR 30.32(i), 10 CFR 30.33(a)(2), 10 CFR 32.210, 10 CFR 39.13, 10 CFR 40.3, 10 CFR 40.13, 10 CFR 40.22, 10 CFR 40.25, 10 CFR 70.3, 10 CFR 70.17,

**Criteria:** An application for a specific license will be approved if the requirements of 10 CFR 30.33, "General requirements for issuance of specific licenses," and 10 CFR 39.13, "Specific licenses for well logging," are met. In addition, licensees will be authorized to possess and use only those sealed sources and devices that are specifically approved or registered by the NRC or an Agreement State.

**Discussion:** The applicant should list each requested radionuclide by its element name and mass number (e.g., cesium-137), specify whether the material will be acquired and used in unsealed or sealed form, and list the maximum activity requested [include units milliSieverts/Sieverts (mSv/Sv), millicuries/curies (mCi/Ci)]. Table 8-1, "Types of Radioactive Materials," below provides examples of the different types of radioactive materials. Some, not all, are addressed in this NUREG.

**Note:** Additional safety equipment and precautions are required when handling and using unsealed free-form volatile radioactive materials. (Volatile means that a liquid becomes a gas at a relatively low temperature when the sealed container within which the liquid is stored is left open to the environment.)

**Table 8–1. Types of Radioactive Material**

Type of Material	Covered by this NUREG	Examples
Byproduct material, as defined in 10 CFR 20.1003	Yes	H-3, C-14, Na-22, S-35, Sc-46, Ca-45, Fe-55, Co-57, Co-58, Co-60, Ni-63, Zn-65, Br-82, Sr-85, Sr-90, Ag-110m, I-125, Sb-124, I-131, Xe-133, Cs-137, La-140, Ir-192, Au-198, Am-241, discrete sources of Ra-226
Source material	Yes	uranium, depleted uranium
Special nuclear material	Yes	Pu-238/Be sealed source
Naturally occurring radionuclides	No	Ra-226 (nondiscrete sources), Th-232, Th-natural

Maximum activity should be specified in megabecquerels (MBq) [(mCi)] or gigabecquerels (GBq) [(Ci)] for each radionuclide. Applicants should include in the maximum activity requested, the total estimated inventory planned for use in NRC jurisdictions, including licensed material in storage and maintained as radioactive waste. The requested maximum activity for any radionuclide should be commensurate with the applicant’s needs and facilities for safe handling. Applicants, when establishing the maximum activity being requested for radioactive materials with half-lives greater than 120 days, should review the requirements for submitting a certification for financial assurance for decommissioning. These requirements are discussed in Section 8.5.3, “Financial Assurance and Record Keeping for Decommissioning.” NUREG–1757, Volume 3, “Consolidated Decommissioning Guidance: Financial Assurance, Recordkeeping, and Timeliness” provides additional guidance on the requirements for financial assurance for decommissioning and the recordkeeping requirements related to decommissioning.

Applicants requesting an authorization to use volatile radioactive material must provide appropriate facilities, handling equipment, and radiation safety procedures for using such material.

If a dose evaluation indicates, because of a release of radioactive materials, that the potential dose to a person off-site would exceed 0.01 Sieverts (Sv) [1 rem] effective dose equivalent or .05 Sv [5 rems] to the thyroid, an emergency plan for responding to a release should be included with the application [10 CFR 30.32(i)]. For example: 370 GBq [10 Ci] of iodine-131 is a quantity requiring an emergency plan.

Licensees should consult with the proposed supplier, manufacturer, or distributor to ensure that requested sources and devices, where applicable, are compatible with and conform to the sealed source and device designations registered with the NRC or an Agreement State.

A safety evaluation of sealed sources and devices is performed by the NRC or an Agreement State before authorizing a manufacturer (or distributor) to distribute them to specific licensees. The safety evaluation is documented in a Sealed Source and Device (SSD) registration certificate. SSD registration certificates may be obtained through the device manufacturer or vendor. Applicants must provide the manufacturer's name and model number for each requested SSD (e.g., instrument calibrator) registration certificate so that the NRC can verify that each, when applicable, has been evaluated in an SSD registration certificate.

### 8.5.1 Sealed Radioactive Material

**Regulation:** 10 CFR 20.2207, 10 CFR 30.32(g), 10 CFR Part 37, 10 CFR 39.41, 10 CFR 39.53

**Criteria:** Any sealed source used for well logging that contains more than 3.7 MBq [100 microcuries ( $\mu\text{Ci}$ )] of byproduct or special nuclear material and is used downhole in well bores of gas wells, oil wells, or in mineral deposits, must satisfy the requirements of 10 CFR 39.41, "Design and performance criteria for sources."

Sealed sources used for well logging should have an SSD registration certificate designating the use of the sealed source for "well logging."

Licensees must also protect aggregated Category 1 and Category 2 quantities of radioactive material, as defined in 10 CFR 37.5, from theft, diversion, and sabotage.

**Discussion:** The NRC or an Agreement State performs a safety evaluation of sealed sources before authorizing a manufacturer or distributor to distribute sources to specific licensees. The safety evaluation is documented in an SSD registration certificate.

Applicants must provide the manufacturer's name and model number for each requested sealed source. This information is necessary to ensure that each sealed source requested in the application is evaluated and approved by the NRC or an Agreement State, included in an SSD registration certificate, approved under the provisions granted by the NRC in 10 CFR 39.41, or is identified on an NRC or Agreement State license and authorized for well logging. Applicants should consult with the proposed suppliers or vendors to ensure that sealed sources, and if applicable, devices, conform to information contained in SSD registration certificates. Licensees should ensure that their uses of sealed sources, and, if applicable, associated equipment, are in accordance with registration certificates. Licensees may not make any changes to the sealed source, device, or source/device combination that would alter the description or specifications from those indicated in the respective registration certificates, without obtaining NRC's prior permission in a license amendment. Applicants may elect to obtain copies of applicable SSD registration certificates from the manufacturer for future reference. If the manufacturer and distributor are no longer in service, a copy of the SSD registration certificate may be requested from the NRC or the issuing Agreement State.

For sealed sources used for well logging applications, NRC licenses only authorize possession of individual sealed sources approved for well logging. To allow flexibility, licenses do not authorize specific sealed source/well logging tool combinations. Applicants should consult with the manufacturer of the sealed sources before using associated equipment (e.g., well logging tools, transport containers, handling tools). Conferring with the vendor or manufacturer before use helps ensure that the associated equipment selected is compatible with sealed sources requested in the application.

Applicants must provide the manufacturer's name and model number for each requested energy compensation source. Energy compensation sources are small sealed sources, with an activity not exceeding 3.7 MBq [100 µCi], used within a logging tool to provide a reference standard to maintain the tool's calibration when in use. These sources are not required to meet the design and performance criteria in 10 CFR 39.41.

The regulations in 10 CFR Part 37 apply to licensees that possess an aggregated "Category 1 quantity of radioactive material" or "Category 2 quantity of radioactive material." These terms are defined in 10 CFR 37.5, and the radionuclides referenced in these 10 CFR 37.5 definitions are listed in Appendix A to 10 CFR Part 37. See Section 8.10.17, "Security Program for Category 1 and Category 2 Radioactive Material," of this NUREG for more information on the applicability and requirements of 10 CFR Part 37.

**Response from Applicant:**

- Complete the table in Appendix B of this NUREG to support the request for byproduct, source, or special nuclear material used in well logging operations and radioactive materials used for purposes other than well logging (e.g., radiation survey instrument calibrators).

**AND**

- Include the following information to support the request for each sealed source:
  - Identify each radionuclide (element name and mass number) that will be used in each sealed source within the NRC's jurisdiction.
  - Provide the manufacturer's or distributor's name and model number for each sealed source and, if applicable, device requested.
  - Confirm that the activity per source and maximum activity in each device will not exceed the maximum activity listed on the approved certificate of registration issued by the NRC or by an Agreement State.
  - Confirm that each sealed source, device, and source and device combination is registered as an approved sealed source or device by the NRC or an Agreement State, and will be possessed and used in accordance with the conditions specified in the registration certificate. Provide the SSD registration certificate number, if available.
  - Identify each sealed source or energy compensation source by the manufacturer's name, model number, radionuclide (element name and mass number), maximum activity per source, and total activity requested.
  - Identify any sealed sources or corresponding devices not used in well logging that contain byproduct, special nuclear, or source material, and specify the manufacturer's name, model number, and radionuclide (element name and mass number). Examples of such devices are calibration devices used for radiation survey instruments and pocket dosimeters, and sources used above ground for calibrating well logging tools.

- Identify the manufacturer’s name and model number of depleted uranium sinker bars.

**Note:** An applicant should contact the device or source manufacturer or vendor for information on SSD registration certificates.

**8.5.2 Unsealed (Tracer) Radioactive Material**

**Regulation:** 10 CFR 30.32(i), 10 CFR 30.33, 10 CFR 30.72, 10 CFR 39.2, 10 CFR 39.13

**Criteria:** An application for a license will be approved if the requirements of 10 CFR 30.33, “General requirements for issuance of specific licenses,” and 10 CFR 39.13, “Specific licenses for well logging,” are satisfied.

**Discussion:** Each authorized radionuclide tracer is listed on the NRC license by its element name, chemical and/or physical form, maximum amount authorized (possession limit), and the maximum amount of each radionuclide (identified by physical or chemical form) used in each type of tracer study requested. The following definitions are provided to clarify single and multiple well tracer operations addressed in this NUREG:

- **Tracer Materials:** Radionuclides in liquid, solid, or gas form that are injected into single well bores or underground reservoirs to monitor the movement of fluids or gases. Tracer studies involve a single well and require the use of an electronic well logging tool to detect the radionuclides injected into the well.
- **Field Flood Studies or Enhanced Oil and Gas Recovery Studies:** Tracer studies involving multiple wells where one or more radionuclides are injected and multiple oil or gas samples containing radioactive material are collected from each of the wells to determine the direction and rate of flow through the formation. Field flood tracer operations would not normally involve the use of an electronic well logging tool to detect the radionuclides in the well.
- **Labeled Frac Sands:** Radionuclide(s) in liquid or solid forms that is (are) chemically bonded to glass or resin beads and injected into a single well in a density-controlled solution. Frac sand operations require the use of an electronic well logging tool to assess the amount of radionuclide(s) remaining in the underground reservoir formation. Refer to Section 8.10.13.4 for additional information.

<b>Table 8-2. Types of Radioactive Materials Used in Field Flood Studies and Single Well Tracer Operations</b>	
<b>Field Flood or Enhanced Oil And Gas Recovery Study Applications Tracers Used In Multiple Wells</b>	
Gas	H-3, Kr-85, C-14, I-131, Br-82
Liquid	H-3, C-14, Na-22, S-35, Ca-45, Co-60, Ni-63, Zn-65, Sr-85, Sc-46, Sr-90, Ag-110m, I-125, I-131, La-140, Ir-192



<b>Table 8-2. Types of Radioactive Materials Used in Field Flood Studies and Single Well Tracer Operations</b>	
<b>Well Logging Tracer Applications Tracers Used In A Single Well</b>	
Gas	Br-82, I-131, I-125
Liquid	Fe-59, I-125, I-131, Sb-124, Au-198, Ag-110m
Labeled Frac Sand	Sc-46, Br-82, Ag-110m, Sb-124, Ir-192

**Note:** Some licensees who inject labeled frac sands into a well may use portable/fixed gauging devices containing radioactive sealed sources (e.g., flow density gauges) that are used to measure the amount of solution that is being pumped into a well. The possession and use of these gauging devices may be authorized either under the terms of a specific license or a general license.

- If the applicant is proposing to use specific licensed gauges then follow the licensing guidance described in NUREG–1556, Volume 4, “Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Fixed Gauge Licenses,” and include this information with the well logging license application.
- If the applicant is proposing to use general licensed devices, then refer to 10 CFR 31.5, “Certain detecting, measuring, gauging, or controlling devices and certain devices for producing light or an ionized atmosphere,” to identify the regulatory requirements that need to be met. One such requirement is the registration and payment of a fee for certain generally licensed devices.

**Response from Applicant:**

- For unsealed nonvolatile and volatile (e.g., iodine-125, iodine-131, hydrogen-3, bromine-82) tracer materials
  - Provide element name with mass number, chemical and/or physical form, and maximum requested possession limit.
  - Provide information for volatile materials, if known, on the anticipated rate of volatility or dispersion. This information may be obtained from the tracer material vendor, supplier, or manufacturer.
  - Identify each chemical and/or physical form (e.g., liquid, gas, or labeled frac sands) requested for each type of tracer study.
  - Specify the maximum amount of each radionuclide tracer that will be used in each type of tracer study by its physical or chemical form. Identifying the forms as “any” is unacceptable.
  - Specify the maximum amount of each radionuclide tracer material that will be possessed at any one time. Possession limits should also include any materials that may be stored as waste.

- Specify the purpose for which each radionuclide will be used.
- Provide an Emergency Plan (if required)
  - Emergency plans are not routinely required for tracer materials with half-lives of less than 120 days and for quantities authorized in well logging and tracer licenses. See Regulatory Guide 3.67 for additional guidance on developing emergency plans.

Applicants should refer to 10 CFR 30.32(i) and 30.72, Schedule C, “Quantities of radioactive materials requiring consideration of the need for an emergency plan for responding to a release,” to determine the quantities of radioactive material requiring an emergency plan for responding to a release of radioactive materials. In addition, 30.32(i) provides the information required to develop an Emergency Plan.

### 8.5.3 Financial Assurance and Record Keeping for Decommissioning

**Regulations:** 10 CFR 30.34(b), 10 CFR 30.35, 10 CFR 30.36, 10 CFR 30.51, 10 CFR 70.22(a)(9), 10 CFR 70.25, 10 CFR 70.36, 10 CFR 70.38, 10 CFR 70.51

**Criteria:** Well logging licensees authorized to possess sealed sources or unsealed byproduct material with a half-life greater than 120 days and in excess of the limits specified in 10 CFR 30.35, “Financial assurance and recordkeeping for decommissioning,” must provide evidence of financial assurance for decommissioning.

Well logging licensees authorized to possess sealed sources containing special nuclear material with a half-life greater than 120 days and in excess of the limits specified in 10 CFR 70.25, “Financial assurance and recordkeeping for decommissioning,” must provide evidence of financial assurance for decommissioning.

In addition, each decommissioning funding plan must contain a cost estimate for decommissioning and a means for adjusting the decommissioning cost estimate periodically over the life of the facility. Cost estimates must be adjusted at intervals not to exceed 3 years, in accordance with 10 CFR 30.35(e) and 10 CFR 70.25(e).

The regulations in 10 CFR 30.35(g) require each licensee to maintain, in an identified location, decommissioning records related to facilities where licensed material is used, stored, or dispatched, regardless of the material half-life, until the site or any area, is released for unrestricted use. Decommissioning records described above are not required at temporary jobsites. Under 10 CFR 30.51(f) and 10 CFR 70.51(a), before terminating the license, licensees must transfer records important to decommissioning required by 10 CFR 30.35(g) and 70.25(g), to the appropriate NRC regional office.

Additionally, under 10 CFR 30.35(g) and 10 CFR 70.51(b), before licensed activities are transferred or assigned in accordance with 10 CFR 30.34(b) and 70.36, licensees must transfer records important to decommissioning to the new proposed licensee.

**Discussion:** The NRC’s primary objective is to ensure that decommissioning will be carried out with minimum impact on the health and safety of the public, occupationally exposed individuals, and the environment. NRC regulations, when applicable, require the applicant to provide Certification of Financial Assurance (FA) or a Decommissioning Funding Plan (DFP). This is to

provide reasonable assurance that, after the technical and environmental components of decommissioning are carried out, unrestricted use of the facilities is possible at the termination of licensed activities. These regulatory requirements specify that a licensee either set aside funds for decommissioning activities or provide a guarantee through a third party that funds will be available. Methods of certification of financial assurance for decommissioning accepted under 10 CFR 30.35 and 10 CFR 70.25 may include the following:

- surety bond
- prepayment of trust fund
- statement of intent (in the case of Federal, State, or local government licensees)
- letter of credit
- self or parent company guaranty
- an external sinking fund

Before a license is issued, applicants are required to submit the Certification of Financial Assurance or a DFP when requesting authorization to possess any sealed or unsealed radioactive material with a half-life greater than 120 days and exceeding the limits in 10 CFR 30.35 or 10 CFR 70.25. Criteria for determining whether an applicant must submit a DFP or has an option of submitting either a DFP or FA are described in 10 CFR 30.35 and 10 CFR 70.25.

There are two parts to 10 CFR 30.35 and 10 CFR 70.25: financial assurance that applies to some licensees and record keeping that applies to *all* licensees.

Licensing guidance for demonstrating compliance with financial assurance, recordkeeping, and timeliness criteria is described in NUREG-1757, Volume 3, "Consolidated Decommissioning Guidance: Financial Assurance, Recordkeeping, and Timeliness." The applicant or licensee should refer to this document and provide the requested information if financial assurance is required based on the proposed maximum possession limits that will be listed in the license.

Table 8-3 provides a partial list of sealed and unsealed radionuclides with half-lives greater than 120 days and the corresponding limits in excess of which an FA or a DFP is required. However, it is the NRC's experience that most well logging, tracer, and field flood study licensees use only a few of these radionuclides. The most frequently used radionuclides with a half-life greater than 120 days that require financial assurance in unsealed form are hydrogen-3, carbon-14, and silver-110 metastable, and for sealed sources, americium-241. Radionuclides with a half-life greater than 120 days are listed in Column 1. Column 2 lists the corresponding possession limits of radionuclides requiring FA. Column 3 lists the corresponding possession limits of unsealed radionuclides requiring the submittal of a DFP. These limits apply when only one of these radionuclides is possessed.

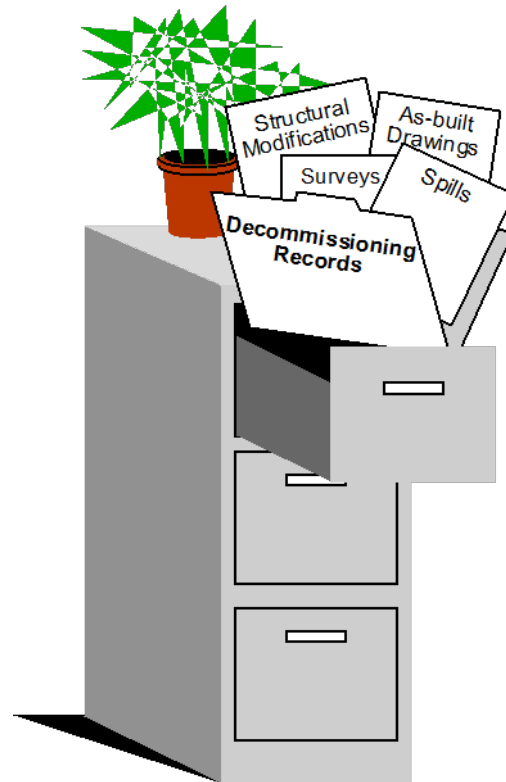
Applicants can use the data from Table 8-3 to determine if FA is required and the amount that is required when more than one of these radionuclides is requested.

<b>Table 8-3. Commonly Used Licensed Materials Requiring Financial Assurance and Decommissioning Funding Plan</b>		
<b>Column 1: Radionuclide</b>	<b>Column 2: Limit for FA (millicuries*)</b>	<b>Column 3: Limit for DFP (millicuries*)</b>
Unsealed Materials		
H-3	1,000	100,000
C-14	100	10,000
Ag-110m	1	100
Sealed Materials		
Am-241	100,000	10,000,000
Pu-239	100,000	10,000,000
Cf-252	100,000	10,000,000
Ra-226	100,000	10,000,000
Cs-137	100,000,000	10,000,000,000
*1 millicurie = 37 MBq		

The following unsealed radionuclides with a half-life less than or equal to 120 days used in well logging, tracer, and field flood studies, need not be considered for financial assurance purposes. Examples of these radionuclides include iodine-131, scandium-46, bromine-82, zirconium-95, antimony-124, iridium-192, and gold-198.

NUREG-1757, Volume 3, contains approved wording for each mechanism authorized by the regulation to guarantee or secure funds. The requirements for maintaining records important to decommissioning, including the type of information required, are stated in 10 CFR 30.35(g) and 10 CFR 70.25(g). All licensees are required to maintain these records in an identified location until the site is released for unrestricted use (see Figure 8-2). In the event that the licensed activities are transferred to another person or entity, these records will be transferred to the new licensee before transferring the licensed activities. The new licensee is responsible for maintaining these records until the license is terminated. Before the license is terminated, these records will be transferred to the NRC.

Licensees must maintain permanent records on locations where licensed materials are used or stored while the license is in force. These permanent records are important for making future determinations about the release of these locations for unrestricted use (e.g., before the license is terminated). Acceptable permanent records include but are not limited to: sketches, written descriptions of specific locations where radioactive material is used or stored, and records of any leaking sealed sources, tracer material spills, contaminated waste storage areas, burial sites, or other unusual occurrences involving the spread of contamination in or around the licensee's facilities or field stations, and decommissioning cost estimates and funding method. See 10 CFR 30.35(g) and 10 CFR 70.25(g). Permanent decommissioning records described above are not required for temporary job site locations.



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**Figure 8-2. Types of Records That Must be Maintained for Decommissioning**

The regulations in 10 CFR 30.35(g) and 10 CFR 70.51(b)(3) require that records important to decommissioning are

- transferred to the new proposed licensee before licensed activities are transferred or assigned, according to 10 CFR 30.34(b) and 10 CFR 70.36, respectively

**AND**

The regulations in 10 CFR 30.35(g) and 10 CFR 70.25(g) require that records important to decommissioning are

- transferred to the appropriate NRC regional office before the license is terminated, according to 10 CFR 30.51(f) and 10 CFR 70.51(a)(3), respectively

**Response from Applicants:**

- State the following: “Pursuant to 10 CFR 30.35(g) and 10 CFR 70.25(g) and 10 CFR 70.51(b)(3), as appropriate, we will maintain records important to decommissioning and will transfer these records to an NRC or Agreement State licensee before licensed activities are transferred or assigned, in accordance with 10 CFR 30.34(b) and 10 CFR 70.36, as appropriate. Furthermore, pursuant to 10 CFR 30.51(f) and 10 CFR 70.51(a)(3), as appropriate, we will forward the records required by 10 CFR 30.35(g) and 10 CFR 70.25(g), as appropriate, to the appropriate NRC regional office before the license is terminated.

**AND**

- If financial assurance or a decommissioning funding plan is required, submit the required documents following the guidance described in NUREG–1757, Volume 3.

## **8.6 Item 6: Purpose(s) for Which Licensed Material Will Be Used**

**Regulations:** 10 CFR 30.33(a)(1), 10 CFR 39.41, 10 CFR 39.45, 10 CFR 39.47, 10 CFR 39.49, 10 CFR 39.51, 10 CFR 39.63, 10 CFR 51.21, 10 CFR 51.22, 10 CFR 40.25, 10 CFR 70.22(a)(2)

**Criteria:** An application for a license will be approved if the proposed activity is authorized by the Atomic Energy Act of 1954, as amended. The applicant must specify the purpose for which each radionuclide or sealed source listed in Item 5 is to be used, as well as specifying the type of wells in which each type of material will be used (e.g., oil, gas, mineral, geophysical). In addition, the licensee should describe the type of mineral or geophysical logging to be conducted (e.g., coal, salt domes). Sealed sources used in well logging devices must be used only for the purposes for which they were designed, in accordance with the manufacturer's and distributor's written recommendations and instructions, as specified in an approved SSD registration certificate, unless otherwise authorized in the license. The licensee should specify the manufacturer and model number of each device.

**Discussion:** The applicant's request to use sealed sources and radionuclides in well logging, tracer, and field flood studies should clearly specify the purpose for which each type of material will be used. Applicants should include a description that is sufficiently detailed to allow the NRC to determine the potential for exposure to occupationally exposed individuals or members of the public.

**Note:** Traditionally, only Federal or State authorities have been authorized to conduct logging in potable water wells in fresh water aquifers. Approval to conduct these operations requires that applicants justify the need and to provide assurance that sealed sources, in case of accidental loss in a potable water zone, could be recovered.

Applicants requesting authorization to perform any of the hazardous operations listed below should clearly indicate their intent and provide specific instructions for conducting such activities in their operating and emergency procedures:

- removing a sealed source from a source holder of a logging tool and maintenance on sealed sources or holders
- using destructive techniques to remove a stuck sealed source from a source holder
- opening, repairing, or modifying any sealed source
- knowingly injecting licensed radioactive tracer material into a fresh water aquifer
- using a sealed source in a well without a surface casing to protect fresh water aquifers

Applicants may use the format given in Table 8-4 or Appendix B of this NUREG to provide the requested information.

**Table 8-4. Sample Format for Providing Information About Requested Radionuclides**

<b>Radionuclide</b>	<b>Chemical/Physical Form</b>	<b>Maximum Possession Limit</b>	<b>Proposed Use</b>
Americium-241	Sealed neutron source (XYZ Inc., Model 10)	Provide the maximum activity per individual source and total possession limit for each source model.	Oil, gas, and mineral logging
Cesium-137	Sealed source (Acme Inc., Model 36)	Provide the maximum activity per individual source and total possession limit for each source model	Oil, gas, and mineral logging
Hydrogen-3	Gas, titanium tritide neutron generator tube (ABC Inc., Model 3)	Provide the maximum activity per individual tube and total possession limit for each tube model.	Neutron activation logging in oil and gas wells in downhole accelerator
Iodine-131	Gas	Include the maximum activity per injection and the total activity to be possessed. <sup>1</sup>	Subsurface tracer operations
Iodine-131	Liquid	Include the maximum activity per injection and the total activity to be possessed. <sup>1</sup>	Subsurface tracer operations
Iridium-192	"Labeled" frac sand	Include the maximum activity per injection and the total activity to be possessed. <sup>1</sup>	Subsurface tracer operations

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<sup>1</sup>When providing the information above, the maximum amounts of radioactive material possessed as unsealed radioactive material should include the radioactive materials to be used for the licensed purpose as well as any material possessed as waste or for decay-in-storage.

<b>Radionuclide</b>	<b>Chemical/Physical Form</b>	<b>Maximum Possession Limit</b>	<b>Proposed Use</b>
Cobalt-60	Metal wire	Include the maximum activity per individual unit and the total activity to be possessed. <sup>1</sup>	Pipe joint collar markers, subsidence markers, depth determination
Silver-110m	Liquid	Include the maximum activity per injection and the total activity to be possessed. <sup>1</sup>	Field flood tracer studies
Depleted Uranium (DU)	Sinker Bars	Include the total kilograms of DU to be possessed.	Sinker weights (concentrated mass)

Applicants should note that authorization granted by the NRC to use licensed material in tracer or field flood studies does not relieve them of their responsibilities to comply with any other applicable Federal, State, or local regulatory requirements.

**Response from Applicant:** For each sealed source and radionuclide requested in the application, state the purpose for the licensed material using the following list:

- Oil and gas well logging
- Mineral well logging
- Geophysical well logging
- Tracer studies in single wells
- Field flood or enhanced recovery studies in multiple wells

**OR**

Specify the purposes for which the sources and device(s) will be used other than those included in the manufacturer's recommendations, and as specified on the SSD registration certificate.

**AND**

- If applicable, provide a statement that, "We plan to perform the following activities in **fresh water** aquifers:
  - Tracer studies
  - Well logging using sealed sources
  - Well logging using neutron generator"



## **8.7 Item 7: Individual(s) Responsible for the Radiation Safety Program and Their Training and Experience**

### **8.7.1 Radiation Safety Officer**

**Regulations:** 10 CFR 20.1101, 10 CFR 30.33(a)(3), 10 CFR Part 37, 10 CFR 40.25, 10 CFR 70.22(a)(6), 10 CFR 70.23(a)(2)

**Criteria:** Though there are no specific training requirements, RSOs must have adequate training and experience to implement the radiation safety program. In the past, the NRC has found successful completion of one of the following to be evidence of adequate training and experience:

- well logging course for users and RSOs, with hands-on experience with equipment and sources
- equivalent course that meets the logging supervisor criteria specified in Appendix F of this NUREG

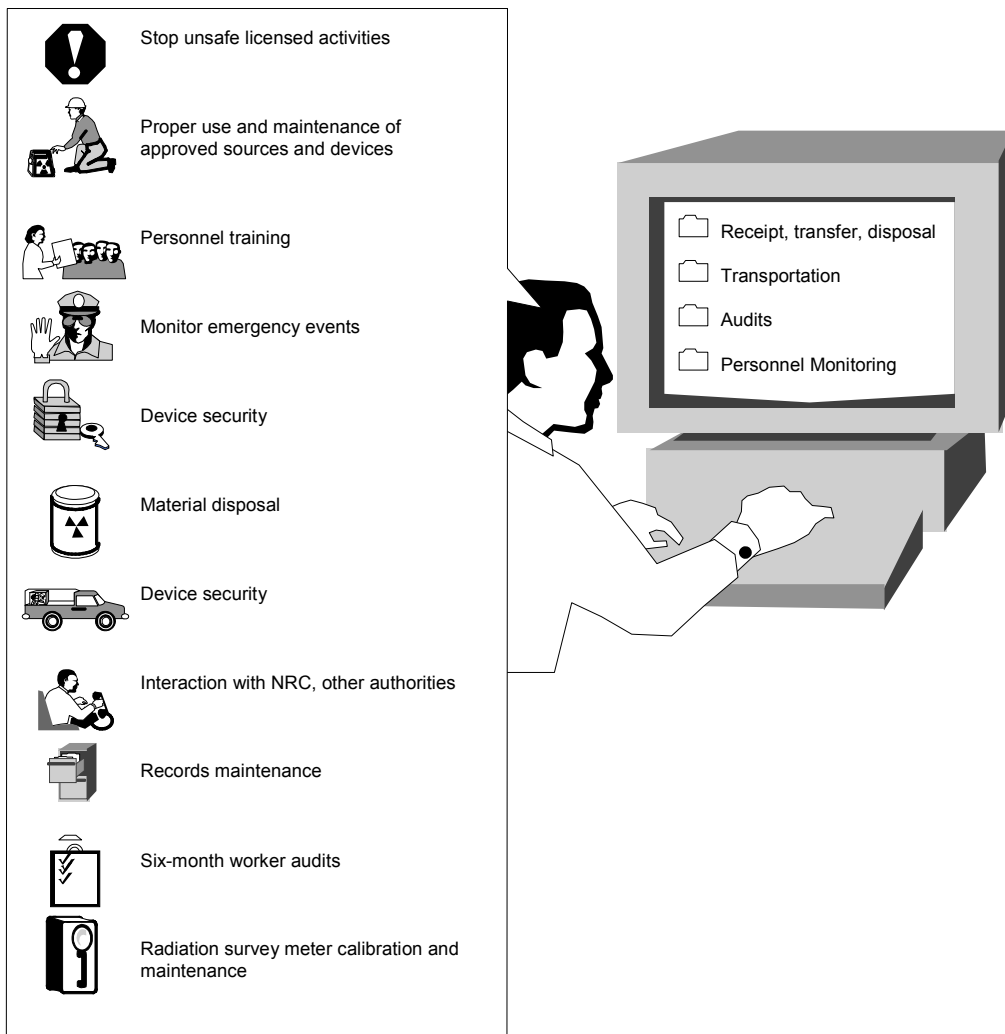
**Discussion:** The person responsible for the radiation protection program is the RSO. The RSO is the key to overseeing and ensuring safe and secure operation of the licensee's radiation safety program. The RSO should have independent authority to stop operations that he or she considers unsafe. He or she should have sufficient time, support, and commitment from management to fulfill certain duties and responsibilities to ensure that radioactive materials are used in a safe and secure manner. This management support includes resource allocation. For licensees possessing an aggregated Category 1 or Category 2 quantity of radioactive material, the RSO should participate in the development and implementation of a security program for radioactive material in accordance with 10 CFR Part 37. A "Category 1 quantity of radioactive material" and a "Category 2 quantity of radioactive material" are defined terms in 10 CFR 37.5, and the radionuclides referenced in these 10 CFR 37.5 definitions are listed in Appendix A to 10 CFR Part 37. The RSO is typically listed as the point of contact for NRC and licensee communications in Item 4 of the NRC Form 313 (see Section 8.4 of this NUREG). Appendix P of this NUREG also provides a model Delegation of Authority, which should be used to further emphasize the agreement on duties and responsibilities of the RSO by management and the designated RSO. The RSO may delegate certain day-to-day tasks of the radiation protection program to other responsible individuals (potential designees). For example, a large well logging firm with multiple field stations or temporary job sites may appoint individuals designated as "site RSOs" who assist the RSO and are responsible for the day-to-day activities at the field stations or temporary job sites. Licensees may also appoint other individuals who may "step in" as an emergency contact when the RSO is unavailable. Designees should have the same management support and decision-making authority as the RSO necessary to manage daily program activities. Please note that only the primary RSO is named on an NRC license.

**Note:** Notify the NRC and obtain a license amendment before making changes in the designation of the RSO listed on the license. Applicants should review the regulations for specific program areas that have specific requirements regarding changes in the RSO.

Typical RSO duties are illustrated in Figure 8-3. The NRC requires the name of the RSO on the license to ensure that licensee management has always identified a responsible, qualified person and that the named individual knows of his or her designation as RSO. The NRC will request a copy of an organizational chart showing the RSO (and other designated responsible

individuals) to demonstrate that he or she has sufficient independence and direct communication with responsible management officials.

To be considered eligible for the RSO position, the applicant must submit for NRC review the specific training and experience of the proposed RSO and detail his or her duties and responsibilities. The proposed RSO should have had a minimum of 1 year of experience in the conduct of a radiation safety program of comparable size and scope; or formal training in the establishment and maintenance of a radiation protection program. This should be a course specifically designed to provide training in managing and implementing a radiation safety program; a basic radiation safety course is not acceptable. Acceptable training programs would be a classroom course typical of those provided through universities or commercial training facilities. The RSO is expected to coordinate the safe use of licensed materials and to ensure compliance with the applicable requirements of the 10 CFR (e.g., Parts 19, 20, 21, 30, 39). The RSO should possess a thorough knowledge of management policies, company administrative and operating procedures, and safety procedures related to protection against radiation exposures.



**Figure 8-3. RSO Responsibilities—Typical Duties and Responsibilities of the RSO**

**Response from Applicant:** Provide the following:

- Provide the name of the proposed RSO who will be responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures.

**AND**

- Demonstrate that the RSO has sufficient independence and direct communication with responsible management officials by providing a copy of an organization chart with positions demonstrating day-to-day oversight of the radiation safety activities.

**AND**

- Provide documentation demonstrating that the proposed RSO is qualified by training and experience (e.g., certificate of completion of a well logging RSO or authorized user's course or an equivalent course that meets the logging supervisor criteria specified in Appendix F of this NUREG).

**OR**

- Provide alternative information demonstrating that the proposed RSO is qualified by training and experience (e.g., Board Certification by the American Board of Health Physicists; completion of a bachelor's or master's degree in the sciences with at least 1 year of experience in the conduct of a radiation safety program of comparable size and scope; or formal training in the establishment and maintenance of a radiation protection program).

**OR**

- Provide alternative information demonstrating that the proposed RSO is qualified by training and experience (e.g., listed by name as an authorized user or the RSO on an NRC or Agreement State license that requires a radiation safety program of comparable size and scope).

## **8.8 Item 8: Training for Logging Supervisors and Logging Assistants**

**Regulations:** 10 CFR 19.12, 10 CFR 19.13, 10 CFR 30.33, 10 CFR 37.43, 10 CFR 39.2, 10 CFR 39.13, 10 CFR 39.61, 10 CFR 70.23(a)(2)

**Criteria:** Well logging supervisors and well logging assistants must have adequate training and experience as outlined in 10 CFR 19.12, "Instruction to workers," 10 CFR 30.33(a)(3), and 10 CFR 39.61, "Training." Although persons engaged in field flood studies operations are not specifically addressed in 10 CFR Part 39, "Licenses and radiation safety requirements for well logging," NRC staff has historically accepted classroom training for tracer studies to be an appropriate guide for individuals engaged in field flood studies.

Any licensee that possesses an aggregated Category 1 or Category 2 quantity of radioactive material (as defined in 10 CFR 37.5) must implement a training program for those individuals implementing the security program.

## Discussion:

- Logging supervisor is an individual who uses licensed material or provides personal supervision in the use of licensed material at a temporary jobsite and who is responsible to the licensee for assuring compliance with the requirements of the Commission's regulations and the conditions of the license.
- Logging assistant is any individual who, under the personal supervision of a logging supervisor, handles sealed sources or tracers that are not in logging tools or shipping containers or who performs radiation surveys required by 10 CFR 39.67.
- Personal supervision means guidance and instruction by a logging supervisor, who is physically present at a temporary jobsite, who is in personal contact with logging assistants, and who can give immediate assistance.

Formal training and testing requirements, performance requirements, annual refresher training, and annual audit requirements for logging supervisors and logging assistants are outlined in 10 CFR 39.61.

Refer to Appendix F of this NUREG as an aid in determining the specific training requirements for logging supervisors, logging assistants, and individuals authorized to conduct field flood study/tracer applications. The applicant must submit a description of its training program for logging supervisors, logging assistants, and individuals authorized to conduct field flood study applications in accordance with 10 CFR 39.13.

Because 10 CFR Part 39 contains different requirements for logging supervisors and logging assistants, applicants must include training programs for each category. When describing the training programs for these positions, include the sequence of events from the time of hiring through the designation of individuals as logging supervisors or logging assistants. Experienced logging supervisors who have worked for another well logging, tracer, or field flood study licensee should receive formal instruction similar to that given to prospective logging assistants.

Instructors who provide classroom training to individuals in the principles of radiation and radiation safety should have knowledge and understanding of these principles beyond those obtainable in a course similar to the one given to prospective logging supervisors. Individuals who provide instruction in the hands-on use of well logging and handling equipment should be qualified logging supervisors with at least 1 year of experience in performing well logging operations or should possess a thorough understanding of the operation of well logging and handling equipment (e.g., a manufacturer's service representative).

A safety review (audit) of the job performance of each logging supervisor and logging assistant ensures that the Commission's regulations, license requirements, and the licensee's operating and emergency procedures are followed. The audit must include observation of the performance of each logging supervisor annually [10 CFR 39.13(d)]. The audit may include observation of each logging assistant as part of the annual safety review (10 CFR 39.13, "Specific licenses for well logging"). Audits should be conducted during an actual well logging operation. If a logging supervisor or logging assistant has not participated in a well logging operation for more than 12 months since the last safety review, an audit should be conducted the first time the individual engages in well logging operations.

In accordance with 10 CFR Part 37, any licensee that possesses an aggregated Category 1 or Category 2 quantity of radioactive material must implement a training program in accordance with 10 CFR 37.43, "General security program requirements," and specifically, must comply with 10 CFR 37.43(c), "Training," to ensure that those individuals who may have a responsibility to implement portions of the security program possess and maintain the knowledge, skills, and abilities to carry out their assigned duties and responsibilities effectively. Additionally, in accordance with 10 CFR 37.43(c)(3), refresher training must be provided at a frequency not to exceed 12 months and when significant changes have been made to the security program. For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG-2155, "Implementation Guidance for 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material." Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG-2166, "Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material."

**Please note, under 10 CFR Part 37, security plans are not to be submitted to the NRC, but may be subject to review and inspection.**

#### **Response from Applicant:**

- Submit the training program to be given to new logging supervisors and logging assistants.
- Provide a copy of a typical examination and the correct answers to the examination questions. Indicate the passing grade.
- Specify the qualifications of the instructors for radiation safety principles and describe their experience with well logging activities. If training will be conducted by someone outside the applicant's organization, identify the course by title, provide the name, address, and telephone number of the company providing the training, and provide a course outline (if available).
- Describe the field (practical) examination that will be given to prospective logging supervisors and logging assistants.
- Describe the annual refresher training program, including topics to be covered and how the training will be conducted.
- Submit a description of the program for annual safety reviews of the job performance of each well logging supervisor as described in 10 CFR 39.13(d).

**Note:** The NRC suggests using the checklist in Appendix G of this NUREG as a source of potential areas to review during the field (practical) examination.

### **8.9 Item 9: Facilities and Equipment**

**Regulations:** 10 CFR 20.1101(b), 10 CFR 20.1301, 10 CFR 20.1406, 10 CFR 20.1703, 10 CFR 20.1801, 10 CFR 20.1802, 10 CFR 30.33(a)(2), 10 CFR 30.35(g), 10 CFR Part 37, 10 CFR 37.5, 10 CFR 37.49, 10 CFR 37.53, 10 CFR 39.31(b)(1), 10 CFR 39.45(a), 10 CFR 39.71, 10 CFR 40.32(c), 10 CFR 70.23(a)(3)

**Criteria:** Facilities and equipment must be adequate to protect health, minimize danger to life or property, minimize the possibility of contamination, and keep exposure to occupationally exposed workers and the public ALARA. Facilities and equipment must also provide enhanced physical protection of aggregated Category 1 and Category 2 quantities of radioactive material, as defined in 10 CFR 37.5.

**Discussion:** Applicants must demonstrate that proposed facilities and equipment provide adequate storage capabilities, ensure that appropriate shielding is available to protect the health and safety of the public and employees, keep exposures to radiation and radioactive materials ALARA, and minimize the possibility of contamination from the uses, types, and quantities of radioactive materials requested.

Applicants may delay completing facilities and acquiring equipment until after the application review is completed and the licensee is issued, in case changes are required as a result of the application review. In all cases, the applicant cannot possess or use licensed material until after the facilities are completed in accordance with the license, equipment is procured, and a precicensing assessment has been performed by the NRC.

A field station is a facility where licensed material may be stored or used and from which equipment may be dispatched.

A temporary jobsite is a location where well logging operations are conducted and where material may be stored, other than the locations of use authorized on the license. Well logging equipment cannot be dispatched from a temporary jobsite to perform work at a different temporary jobsite. If equipment is dispatched from a temporary jobsite, then the location must be authorized as a field station on the license.

**Note:** Diagrams, drawings, or sketches should provide exact locations of materials or depict specific locations of safety or security equipment. Dimensions or a scale should be included. Each drawing or sketch should be marked as “Security-Related Information—Withhold under 10 CFR 2.390.” See Chapter 6 “Identifying and Protecting Sensitive Information” of this NUREG for more information.

In accordance with 10 CFR Part 37, any licensee that possesses an aggregated Category 1 or Category 2 quantity of radioactive material must, among other things,

- implement the physical protection requirements in 10 CFR Part 37 for material in use and storage, at both permanent and temporary jobsites; and
- in accordance with 10 CFR 37.49, be able to monitor, detect without delay, assess, and respond to any unauthorized entries into security zones, including those surrounding mobile devices, and immediately detect any unauthorized removal of Category 1 quantities of radioactive material from the security zone. (Monitoring and detection systems may include, among other methods, monitored video surveillance systems and electronic devices for intrusion detection alarms.)
- for mobile devices containing Category 1 or Category 2 quantities of radioactive material, have two independent physical controls to secure the material from unauthorized removal when the device is not under direct control and constant surveillance in accordance with 10 CFR 37.53. “Mobile device” is defined in 10 CFR 37.5.

For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG–2155, “Implementation Guidance for 10 CFR Part 37, “Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material.”” Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG–2166, “Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material.”

**Please note, under 10 CFR Part 37, security plans are not submitted to the NRC, but may be subject to review and inspection.**

**Response from Applicant:**

- Submit a diagram, drawing, or sketch of the proposed facility, identifying areas where radioactive materials, including radioactive wastes, will be used or stored.
  - Drawings should show, where applicable, adjacent buildings, boundary lines, security fences, and lockable storage areas.
  - Illustrate area(s) where explosive, flammable, or other hazardous materials may be stored.
  - Drawings should also show the relationship and distance between restricted areas and adjacent unrestricted areas.
  - Drawings should specify shielding materials (e.g., concrete, lead) and means for securing radioactive materials from unauthorized removal.
- Submit a drawing or sketch of the proposed tracer material storage facilities, including rooms, buildings, below ground bunker storage areas, or containers used for storage of both tracer and tracer waste materials, if appropriate. Specify the types and amount of shielding materials (e.g., concrete, lead) and means for securing tracer materials from unauthorized removal.

- Describe items such as protective clothing (e.g., rubber gloves, coveralls, respirators, and face shields), auxiliary shielding, absorbent materials, injection equipment, secondary containers for waste water storage for decontamination purposes, and plastic bags for storing contaminated items, which will be available at well sites when using tracer materials.
- Describe proposed laundry facilities, if applicable, used for contaminated protective clothing. Specify how the contaminated waste water from the laundry machines or sinks is disposed. Operating and emergency procedures should address decontamination of the laundry area and equipment.
- Describe proposed decontamination facilities for trucks, tracer injection tools, or other equipment contaminated by tracer materials, if applicable. Specify how the contaminated waste water for these decontamination facilities is disposed. Operating and emergency procedures should address decontamination of these types of equipment and facilities.
- Describe, if applicable, equipment for “repackaging” gaseous, volatile, or finely divided tracer material. Most tracer users do not repackage materials and acquire their injections in precalibrated amounts or “ready-to-use” forms. However, should an applicant request the ability to repackage tracer, volatile, or finely divided material, consider the following equipment when repackaging tracer materials: sinks, trays with absorbent material, glove boxes, fume hoods with charcoal filtration, filtered exhaust, special handling equipment including special tools, rubber gloves, etc.
- State the physical location(s) where the NRC regulatory required records will be stored and available for review during NRC inspections.

**Reference:** For further information on facility design, see Chapter 4 of NCRP Report No. 127, “Operational Radiation Safety Program.”

## **8.10 Item 10: Radiation Safety Program**

**Regulations:** 10 CFR 20.1101, 10 CFR 30.33, 10 CFR 39.13, 10 CFR 40.32, 10 CFR 70.31, 10 CFR 70.32

**Criteria:** A radiation safety program must be established in accordance with 10 CFR 20.1101 and submitted to the NRC as part of the application. The program must be commensurate with the scope and extent of activities for the use of licensed materials in well logging, tracer, and field flood study operations.

Each applicant must develop, document, and implement a radiation protection program containing the following elements:

- steps to keep radiation exposures ALARA
- description of equipment and facilities adequate to protect personnel, the public, and the environment
- commitment that licensed activities will be conducted by individuals qualified by training and experience



- written operating and emergency procedures or an outline or summary of the procedures that includes the important radiation safety aspects of the procedures
- program for the annual inspection of the job performance of well logging personnel
- description of organizational structure and individuals responsible for ensuring implementation of the radiation safety program
- records management

**Discussion:** The specific components of an applicant's radiation safety program are detailed in the subsections found under this section. Some of these subsections will not require the applicant to submit information as part of an application but simply provide the applicant with guidance to comply with a specific NRC requirement.

### **For Field Flood Studies**

Applicants who plan to conduct well logging operations using sealed sources, tracer materials, or tracer materials in field flood study operations are required to submit for NRC approval their Operating and Emergency procedures or, optionally, to provide either an outline or summary of each procedure that includes the important radiation safety aspects of each individual procedure. Radiation safety programs including tracer materials must assure that they address these additional concerns:

- methods or procedures for preventing the release of contaminated material, equipment, or vehicles to unrestricted use from tracer or field flood study operations
- radiation safety procedures and the well logging supervisors' responsibilities unique to tracer and field flood study operations
- tracer and field flood study equipment, techniques, and corresponding radiation safety procedures associated with use of tracer materials.
- information on the appropriate handling, control/security and disposal of any unused tracer materials.
- commitment that the licensee will implement a security, control, and accountability program for radioactive materials located at field stations and temporary job sites.

**Note:** Appendix D of this NUREG includes a description of procedures for using tracer materials in field flood study operations.

**Response from Applicant:** The applicant is required to establish and submit its radiation protection program. Each bulleted item listed above should be addressed, as applicable, to the licensed activities requested.

### **8.10.1 Well Owner or Operator Agreements**

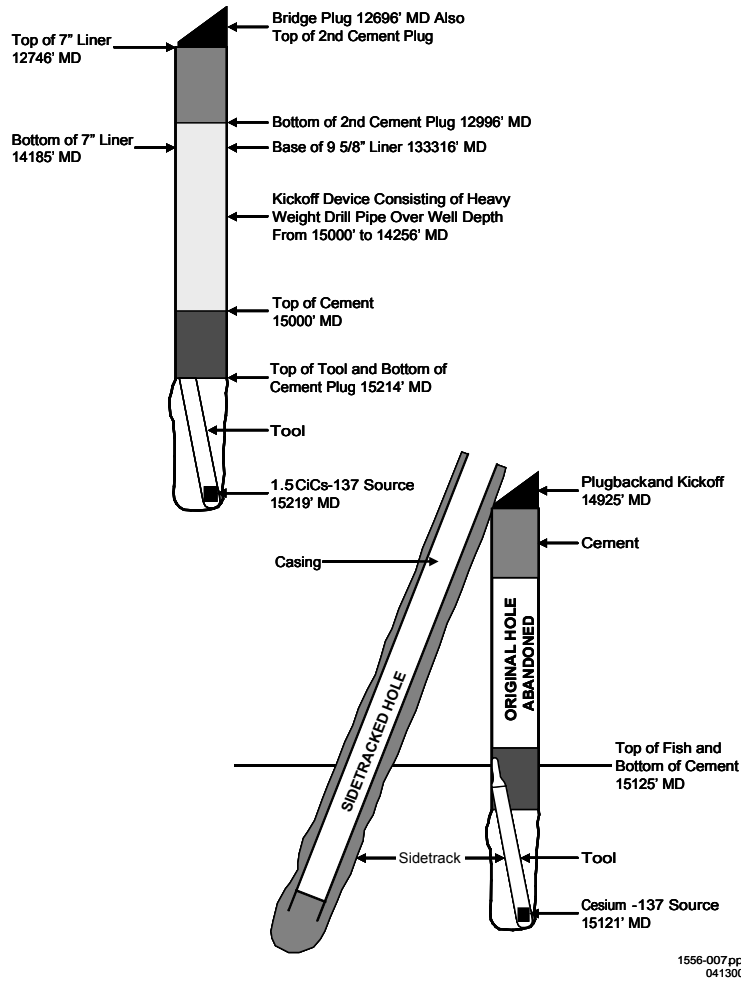
**Regulations:** 10 CFR 39.15(a), 10 CFR 39.15(d), 10 CFR 39.55(b), 10 CFR 39.69(c), 10 CFR 39.77(c), 10 CFR 39.77(d)

**Criteria:** Well logging conducted with a sealed source or with unsealed material should only be performed if a written agreement with the employing well owner or operator is executed prior to the start of well logging operations.

**Discussion (sealed sources):** Well logging operations conducted using sealed sources are performed only after a written agreement is executed with the employing well owner or operator. A master service agreement may be established when a well owner or operator possesses multiple wells. Written agreements must identify a responsible party for ensuring that the following steps will be taken if a source becomes lodged in a hole:

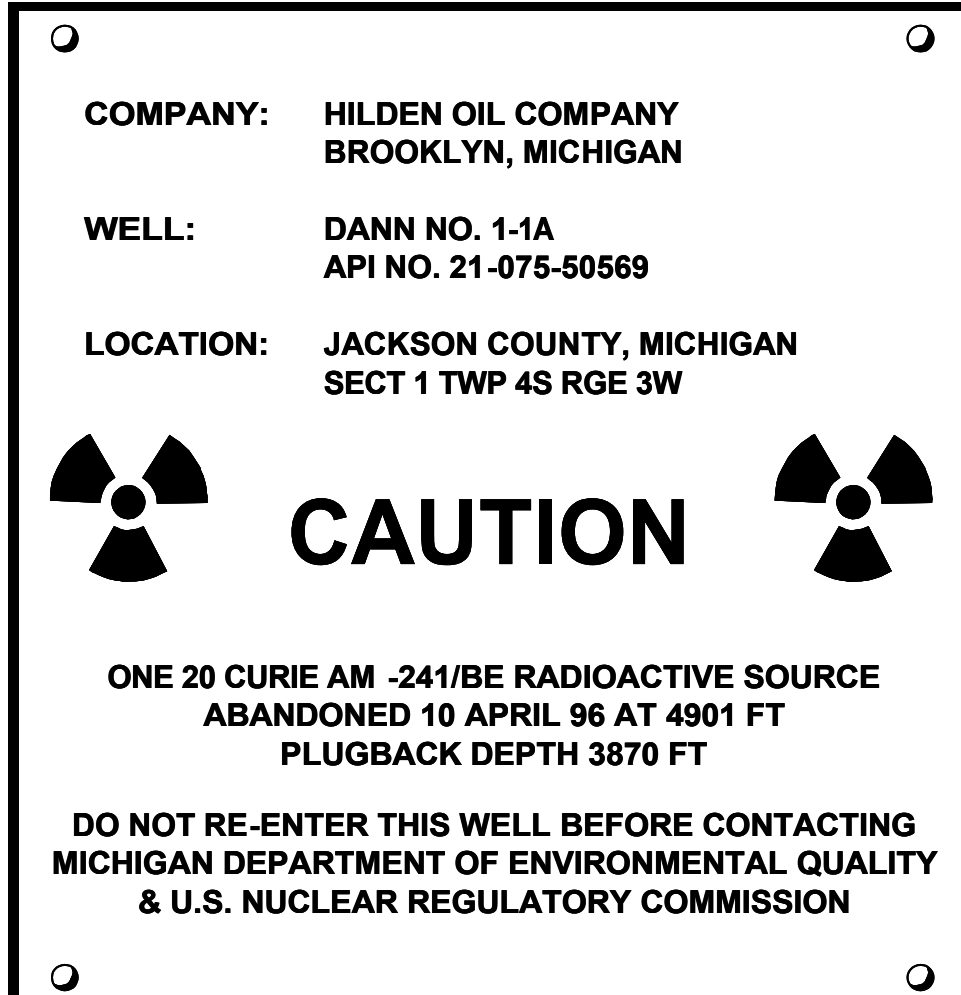
- A reasonable effort will be made to recover the source, following current industry standards and safe practices.
- A person will not attempt to recover a lodged sealed source in a manner that, in the licensee's opinion, could result in its rupture.
- During efforts to recover a sealed source, a licensee must continuously monitor the circulating fluids in the well bore, as required in 10 CFR 39.69(c).
- Contaminated equipment, personnel, or environment must be decontaminated prior to release, as required in 10 CFR 39.15(a)(4) and 10 CFR 39.69.
- If a sealed source is classified by the licensee as irretrievable after reasonable efforts at recovery have been expended, the following must be implemented within 30 days, as shown in Figure 8-3 and required under 10 CFR 39.15(a)(5):
  - The source must be immobilized and sealed in place with a cement plug.
  - The licensee must provide a means to prevent inadvertent intrusion on the source, unless the source is not accessible to any subsequent drilling operations.
  - The licensee must install a permanent identification plaque at the surface of the well, unless mounting of a plaque is not practical. Figure 8-5 provides an example diagram of a permanent identification plaque. The information that should be included are the following:
    - (1) the word "CAUTION"
    - (2) the radiation symbol
    - (3) the date the source was abandoned
    - (4) the name of the well owner or well operator, as appropriate
    - (5) the well name and well identification number(s) or other designation
    - (6) the True Vertical Depth (TVD) and surface Global Positioning System coordinates, especially for horizontal drilling source abandonment
    - (7) the sealed source's radionuclide and activity [in standard and International System of Units (SI) units]

- (8) the depth the source was abandoned and depth to the top of the plug
- (9) an appropriate warning, such as "DO NOT RE-ENTER THIS WELL"
- (10) a statement of the Federal or State authorities to contact if additional well entrance is required



**Figure 8-4. Features of a Typical Source Abandonment**

Notify the appropriate NRC regional office by telephone when it is apparent that a well logging source has become stuck and is declared irretrievable, and obtain NRC approval to implement abandonment procedures. However, the NRC is aware that in some circumstances, such as high well pressures that could lead to fires or explosions, the delay required to obtain NRC approval to abandon the well may introduce an immediate threat. ***Under such circumstances, immediate abandonment may proceed without prior NRC approval, if a delay could cause an immediate threat to public health and safety.*** The NRC would then be notified as soon as possible after the abandonment. See 10 CFR 39.77(c)(1) and (d).



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**Figure 8-5. Permanent Identification Plaque**

**Note:** A written agreement is not required if the licensee and well owner or operator are part of the same corporate structure or otherwise similarly affiliated. However, all other requirements described in 10 CFR 39.15(a)(1) through (a)(5) must still be met. See 10 CFR 39.15(d).

- If the requirement for a written agreement does not apply to the applicant or licensee, then applicant should include a statement in the application that the applicant or licensee will only log holes where the well owner or operator is part of the corporate structure or otherwise similarly affiliated, and the applicant or licensee should describe the corporate affiliation.

**Response from Applicant:** Provide the following:

A statement that: "We will obtain a written agreement that meets the requirements specified in 10 CFR 39.15 prior to well logging: (i) with a sealed source; (ii) with a neutron generator exceeding 30 Ci; or (iii) with a neutron generator in a well without a surface casing, and will provide an example of an agreement to the NRC."

**Discussion (unsealed material):** Well logging operations conducted using unsealed material should be performed only after a written agreement is executed with the employing well owner or operator. A master service agreement may be established when a well owner or operator possesses multiple wells. Written agreements should identify a responsible party for ensuring that the following steps will be taken when there is a sandout or well return:

- Implement operating, emergency, and disposal procedures for dealing with sandouts and well returns.
- The radiation monitoring required in 10 CFR 39.69(a) will be performed; and
- If the environment, any equipment, or personnel are contaminated with licensed material, they should be decontaminated before release from the site or release for unrestricted use.
- If there are well returns after a tracer study has been performed, immediate notification by the well owner or operator to the licensee.

**Response from Applicant:** Provide the following:

A statement that: "We will provide written instructions to the customer when conducting well logging using unsealed material that describes those subjects listed in the "Discussion" (unsealed material) portion of Section 8.10.1, "Well Owner or Operator Agreements" in NUREG-1556, Volume 14, Revision 1, "Consolidated Guidance about Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Licenses."

### **8.10.2 Audit and Review Program**

**Regulations:** 10 CFR 20.1101, 10 CFR 20.2102, 10 CFR 37.33, 10 CFR 37.55

**Criteria:** Licensees must review the content and implementation of their radiation protection and access authorization programs annually to ensure the following:

- compliance with NRC and U.S. Department of Transportation (DOT) regulations (as applicable) and the terms and conditions of the license
- occupational doses and doses to members of the public are ALARA (10 CFR 20.1101, "Radiation protection programs")
- records of audits and other reviews of program content and implementation are maintained for 3 years after the record is made

Licensees that are subject to the requirements in 10 CFR Part 37 must annually review their access authorization program and security program.

**Discussion:**

Appendix E of this NUREG contains a suggested annual audit program that is specific to well logging and tracer operations and is acceptable to the NRC. Because all areas indicated in Appendix E may not be applicable to every licensee and all items may not need to be addressed during each audit, licensees may wish to develop a program-specific audit checklist.

Currently, the NRC's emphasis on inspections is to perform actual observations of work in progress. As a part of their audit programs, applicants and licensees should consider including the use of performance based audits, which can include unannounced observations of well logging in the field.

The NRC encourages licensee management to conduct performance-based reviews by observing work in progress, interviewing staff, and spot-checking required records. As a part of the audit program, applicants and licensees should consider performing unannounced audits of well logging and tracer operations to observe whether radiation safety procedures are being followed.

It is essential that once problems are identified, comprehensive corrective actions are taken in a timely manner. Information Notice (IN) 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," dated May 1, 1996, provides guidance on this subject. Licensees are encouraged to contact the NRC for guidance if there is any uncertainty about a reporting requirement. The NRC routinely reviews licensee's records to verify whether appropriate corrective actions were implemented in a timely manner to prevent recurrence. It is in the best interest of the licensee to identify potential violations of regulatory requirements and take necessary steps to correct them. The NRC can opt to exercise discretion and may elect not to cite the licensee for these violations if prompt and effective corrective actions are implemented. The NRC's Enforcement Policy may be found online at <https://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>. The Enforcement Manual may be found online at <https://www.nrc.gov/about-nrc/regulatory/enforcement/guidance.html>. For examples of the NRC's use of discretion in issuing a notice of violation, refer to the most recent version of NRC's enforcement documents at <https://www.nrc.gov/reading-rm/doc-collections/enforcement/>.

With regard to audit records, 10 CFR 20.2102 requires, in part, that licensees maintain records of "audits and other reviews of program content and implementation" for 3 years after the record is made. The NRC has found audit records that contain the following information to be acceptable: date of audit, name of person(s) who conducted audit, persons contacted by the auditor(s), areas audited, audit findings, corrective actions, and follow-up.

In accordance with 10 CFR Part 37, any licensee that possesses an aggregated Category 1 or Category 2 quantity of radioactive material must, among other things,

- in accordance with 10 CFR 37.33, review its access authorization programs at least annually to confirm compliance with the requirements of Subpart B of 10 CFR Part 37 and ensure that comprehensive actions are taken to correct any noncompliance that is identified; and
- in accordance with 10 CFR 37.55, review its security program at least annually to confirm compliance with the requirements of Subpart C of 10 CFR Part 37 and ensure that comprehensive actions are taken to correct any noncompliance that is identified.

For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG-2155, "Implementation Guidance for 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material." Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG-2166, "Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material."

**Please note, under 10 CFR Part 37, security plans are not submitted to the NRC, but may be subject to review and inspection.**

**Response from Applicant:** No response required. The licensee's program for auditing its radiation safety and security programs may be reviewed during inspections.

**References:** The current version of the NRC's Enforcement Policy is included on the NRC's Web site at <https://www.nrc.gov/about-nrc/regulatory/enforcement.html>. IN 96-28, dated May 1, 1996, can be found on the NRC's Generic Communications Web page under Information Notices at <https://www.nrc.gov/reading-rm/doc-collections/gen-comm/>.

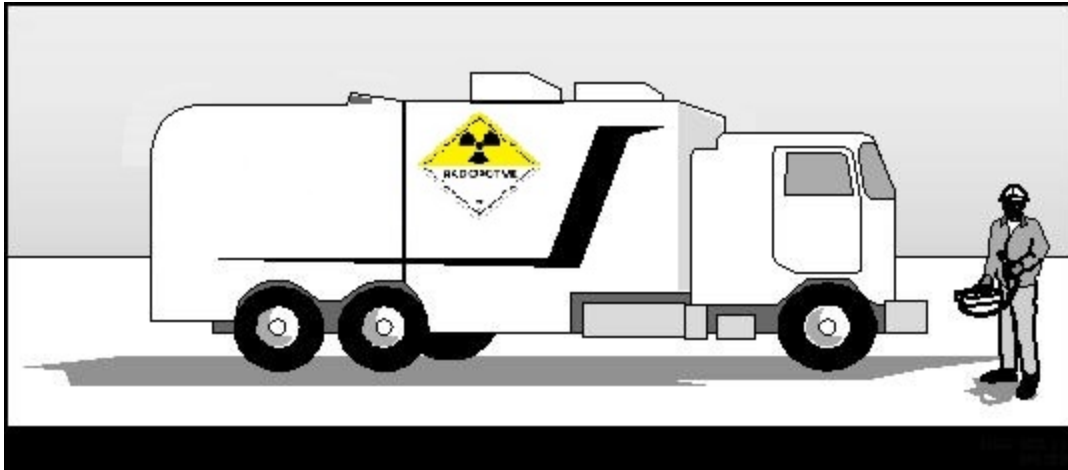
### 8.10.3 Radiation Monitoring Instruments

**Regulations:** 10 CFR 20.1501, 10 CFR 20.2103(a), 10 CFR 30.33(a)(2), 10 CFR 39.33, 10 CFR 40.32(c), 10 CFR 70.23(a)

**Criteria:** Licensees must possess radiation monitoring instruments that are necessary to protect health and minimize danger to life or property. Instruments used for quantitative radiation measurements must be calibrated for the radiation that is measured at least every 6 months. For the purposes of this document, radiation survey instruments are defined as any device used to measure the radiological conditions at a licensed facility, field station, or temporary job site.

**Discussion:** For well logging and tracer operations, radiation survey instruments must be capable of measuring beta and gamma radiation at intensities ranging from 1 microSievert ( $\mu\text{Sv}$ ) [0.1 millirem (mrem)] per hour (/h) through at least 500  $\mu\text{Sv}$  [50 mrem]/h. Licensees shall also have available calibrated and operable radiation detection instruments sensitive enough to detect the low radiation and contamination levels that could be encountered if a sealed source ruptured. Licensees must possess operable and calibrated radiation detection/measurement instruments to perform the following, as necessary:

- package radiation surveys
- vehicle radiation surveys
- tracer material radiation contamination surveys of equipment, vehicles, personnel, and sites
- prescreening of sealed source leak tests
- unrestricted area dose rate measurements



**Figure 8-6. Types of Radiation Surveys**

*There are many different types of radiation surveys performed by well logging, tracer, and field flood studies licensees.*

The choice of instrument should be appropriate for the type of radiation to be measured and for the type of measurement to be taken (e.g., count rate, dose rate). Applications should include descriptions of the instrumentation available for use and instrumentation that applicants intend to purchase prior to starting licensed activities. The description should include type of instrument and probe and the instrument's intended purpose.

NRC regulations require that survey instruments used for quantitative measurements be calibrated periodically. Calibrations requiring the use of radioactive sources should be performed by an instrument manufacturer or persons, specifically authorized by the NRC or an Agreement State unless the applicant specifically requests this authorization. Applicants seeking authorization to perform radiation survey instrument calibrations will need to submit procedures for review. Appendix H of this NUREG provides information about instrument specifications and model calibration procedures. Regardless of whether an applicant is authorized to calibrate radiation survey meters or contracts an authorized firm to perform calibrations, the licensee must retain records of the calibration of instruments and equipment used for quantitative radiation measurements for 3 years after the record is made, in accordance with 10 CFR 20.2103(a).

**Response from Applicant:** Provide one of the following:

- A description of the instrumentation (as described in the "Discussion" portion of this section) that will be used to perform required radiation surveys and a statement that:



“We will use instruments that meet the radiation monitoring instrument specifications published in Appendix H of NUREG–1556, Volume 14, Revision 1, “Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses.” We reserve the right to upgrade our radiation survey instruments as necessary.”

**OR**

- A description of the instrumentation (as described in the “Discussion” portion of this section) that will be used to perform required radiation surveys and a statement that: “We will use instruments that meet the radiation monitoring instrument specifications published in Appendix H of NUREG–1556, Volume 14, Revision 1, “Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses.” Additionally, we will implement the model radiation survey meter calibration program published in Appendix H of NUREG–1556, Volume 14, Revision 1. We reserve the right to upgrade our radiation survey instruments as necessary.”

**OR**

- A description of alternative equipment and procedures for ensuring that appropriate radiation monitoring equipment will be used during licensed activities and that proper calibration and calibration frequency of radiation survey equipment will be performed. Further, the statement, “We reserve the right to upgrade our radiation survey instruments as necessary,” should be added to the response.

**Note:** Alternative responses will be reviewed using the guidance in this section.

#### **8.10.4 Material Receipt and Accountability**

**Regulations:** 10 CFR 20.1801, 10 CFR 20.1802, 10 CFR 20.1906, 10 CFR 20.2207, 10 CFR 30.34(e), 10 CFR 30.35(g), 10 CFR 30.41, 10 CFR 30.51, 10 CFR 37.49, 10 CFR 37.71, 10 CFR 37.75, 10 CFR 37.77, 10 CFR 39.37, 10 CFR 40.36(f), 10 CFR 70.25(g), 10 CFR 70.42

**Criteria:** Licensees with licensed material must do the following:

- Retain records of receipt of licensed material as long as the material is possessed, and for 3 years following transfer or disposal of the material.
- Retain records of each transfer of licensed material for 3 years after each transfer.
- Retain records of each disposal of licensed material until the NRC terminates the license that authorizes disposal of the material.
- Update transactions in the National Source Tracking System (NSTS), including performing annual inventory reconciliation, if applicable.
- Conduct physical inventories of licensed materials at intervals not to exceed 6 months (or some other interval justified by the applicant and approved by the NRC) to account for all sealed sources, tracer materials, and depleted uranium in accordance with applicable license condition(s).

- Retain inventory records for 3 years from the date of the inventory.
- Before transferring aggregated Category 1 or Category 2 quantities of radioactive material listed in Appendix A to 10 CFR Part 37, use NRC's license verification system to verify that the recipient licensee is authorized to possess the radioactive material.
- Preplan, coordinate, and provide advance notification of shipment of Category 1 quantities of radioactive material and coordinate shipment of Category 2 quantities of radioactive material listed in Appendix A to 10 CFR Part 37.

**Discussion:** As illustrated in Figure 8-7, licensed materials must be tracked from the time of receipt to disposal in order to ensure accountability at all times; to identify when licensed material may be lost, stolen, or misplaced; and to ensure that possession limits listed on the license are not exceeded. Physical inventories, which must be conducted semiannually in accordance with 10 CFR 39.37, should account for all licensed material (i.e., location where the material is stored, physical verification of the presence of the material, and accountability of the material by the use of material receipt and transfer records). For aggregated Category 1 and Category 2 quantities of radioactive material, licensees must, according to 10 CFR 37.49(a)(1), continuously monitor and detect, without delay, all unauthorized entries into security zones. Additionally, for Category 1 quantities of radioactive material, 10 CFR 37.49(a)(3)(i) requires immediate detection of any attempted unauthorized removal of the radioactive material from the security zone. For Category 2 quantities of radioactive material, 10 CFR 37.49(a)(3)(ii) requires weekly verification through physical checks, tamper indicating devices, use, or other means to ensure that the radioactive material is present.

Licensees are required under 10 CFR 20.1801 and 10 CFR 20.1802 to secure radioactive materials from unauthorized removal or access while in storage in controlled or unrestricted areas and to control and maintain constant surveillance over licensed material that is in a controlled or unrestricted area and is not in storage. Applicants should establish policies and procedures for ensuring accountability of licensed materials at all times.

Receipt, inventory, transfer, and disposal records must be maintained for the times specified in Table 8-5. Typically, these records contain the following types of information:

- radionuclide and activity (in units of becquerels or curies) of byproduct material in each sealed source and tracer material on hand (including waste), and depleted uranium in sinker bars
- manufacturer's or distributor's name, model number, and serial number of each sealed source containing byproduct material
- manufacturer's or distributor's name, model number, and serial number of each device containing depleted uranium or byproduct material
- location (e.g., permanent facility, field station, temporary jobsite) of each sealed source and device, tracer material, and depleted uranium in sinker bars
- date of the inventory, and name with signature of individual performing inventory
- for materials transferred or disposed, the date of the transfer or disposal, the name and license number of the recipient, and a description of the affected radioactive material

(e.g., radionuclide, activity, manufacturer's or distributor's name and model number, serial number)

**Note:** Physical inventory records may be combined with leak test records.

<b>Type of Record</b>	<b>How Long Record Must Be Maintained</b>
Receipt	For as long as the material is possessed and for 3 years following the transfer or disposal of the material
Inventory	For 3 years from the date of the inventory
Transfer	For 3 years after each transfer unless a specific requirement dictates otherwise
Disposal	Until the NRC terminates the license
Important to Decommissioning*	Until the site is released for unrestricted use

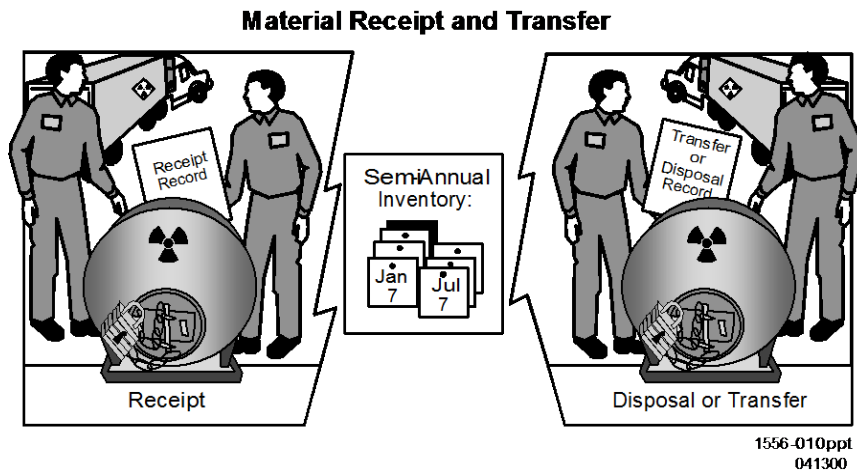
\*See Section 8.5.3, "Financial Assurance and Recordkeeping for Decommissioning," for more details.

**Note:** Licensees who receive, transfer, and dispose of nationally tracked sources (i.e., sealed sources containing a quantity equal or greater than Category 1 or Category 2 levels of any radioactive material listed in Appendix E to 10 CFR Part 20, "Standards for protection against radiation") must complete and submit to the NSTS a National Source Tracking Transaction Report by the close of the next business day after the transaction has occurred in accordance with 10 CFR 20.2207(f). In addition, licensees must reconcile the inventory of nationally tracked sources possessed by the licensee against that licensee's data in NSTS. This reconciliation must be conducted during the month of January in each year. Licensees must submit to the NSTS confirmation that the data in NSTS is correct by January 31 of each year. Additional information regarding the NSTS may be found on the NRC public Web site at <https://www.nrc.gov/security/byproduct/ismp/nsts.html>.

Category 1 and Category 2 sources listed in Appendix E to 10 CFR Part 20 (i.e., nationally tracked sources) must be tracked in the NSTS in accordance with 10 CFR 20.2207. The regulations in 10 CFR 20.2207 require that each licensee that manufactures, transfers, receives, disassembles, or disposes of a nationally tracked source shall complete and submit a National Source Tracking Transaction Report (NSTTR) to the NRC. The NSTTRs are maintained in the NSTS, a secure computer system that tracks Category 1 and Category 2 nationally tracked sources from the time they are manufactured or imported through the time of their disposal or export, or until the source activity decays to below Category 2.

There are additional security requirements for shipment and transfer of a Category 1 and Category 2 quantity of radioactive material listed in Appendix A to 10 CFR Part 37. Prior to transferring Category 1 or Category 2 quantities of radioactive material, licensees must use NRC's license verification system (or contact the licensing authority) to verify that the recipient licensee is authorized to possess the radioactive material. Licensees that ship Category 1 or Category 2 quantities of radioactive material must preplan and coordinate such shipments in accordance with 10 CFR 37.75. Shipments of Category 1 quantities are also subject to the 10 CFR 37.77 advance notification requirements. For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG-2155, "Implementation Guidance for 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material." Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG-2166, "Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material."

**Please note, under 10 CFR Part 37, security plans are not submitted to the NRC, but may be subject to review and inspection.**



**Figure 8-7. Material Receipt and Accountability**

*Licensees must retain records of receipt, transfer, and disposal in accordance with the retention period described in 10 CFR 30.51, "Records." Licensees must conduct semi-annual physical inventories and must retain inventory records for 3 years from the date of the inventory in accordance with 10 CFR 39.37, "Physical inventory."*

**Response from Applicant:** Provide the following:

- A statement that: "Physical inventories will be conducted and documented at intervals not to exceed 6 months, to account for all licensed material (sealed sources, tracer materials, and unused or waste materials) and depleted uranium received and possessed under the license."

**AND**

- A statement that: "We will develop, implement, and maintain procedures for ensuring accountability of licensed materials at all times."

AND

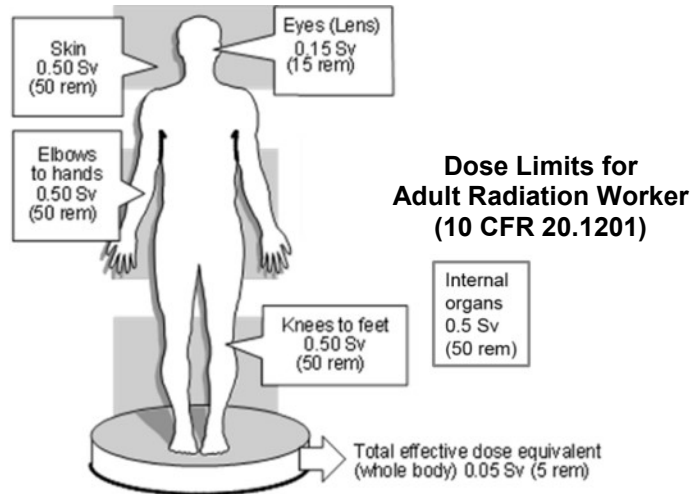
- If applicable, provide a statement that: “We will comply with the National Source Tracking System (NSTS) reporting requirement as described in 10 CFR 20.2207.”

### 8.10.5 Occupational Dose

**Regulations:** 10 CFR 19.13, 10 CFR 20.1201, 10 CFR 20.1202, 10 CFR 20.1203, 10 CFR 20.1204, 10 CFR 20.1207, 10 CFR 20.1208, 10 CFR 20.1501, 10 CFR 20.1502, 10 CFR 20.2104, 10 CFR 20.2106, 10 CFR Part 20 Appendix B, 10 CFR 39.65

**Criteria:** According to 10 CFR 39.65, “Personnel monitoring,” logging supervisors and logging assistants must wear personnel dosimeters [processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor] during the handling or use of licensed radioactive material. This requirement applies to personnel using dosimeters for whole body measurements. Appendix I of this NUREG provides guidance for determining if individuals other than the RSO, logging supervisors, or logging assistants require dosimetry.

- Bioassay services required in a license must be provided to individuals using tracer materials in subsurface studies if required by the license.



TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE) = THE EFFECTIVE DOSE EQUIVALENT (FOR EXTERNAL EXPOSURES) + THE COMMITTED EFFECTIVE DOSE EQUIVALENT (FOR INTERNAL EXPOSURES)

**Figure 8-8. Annual Dose Limits for Adult Radiation Workers**

**Discussion:** The annual dose limits for adult radiation workers are shown in Figure 8-8. Note that in accordance with 10 CFR 20.1207, the annual occupational dose limits for minors are 10 percent of the annual dose limits specified for adult workers. Also, 10 CFR 20.1208 requires the licensee to ensure that the dose equivalent to the embryo/fetus during the entire pregnancy, due to the occupational exposure of a declared pregnant woman, does not exceed 0.5 rem [5 mSv].

The use of individual monitoring devices for external dose is required, pursuant to 10 CFR 20.1502(a), for:

- adults who are likely to receive an annual dose from sources external to the body in excess of any of the following (each evaluated separately):
  - 5 mSv [0.5 rem] deep-dose equivalent
  - 15 mSv [1.5 rems] eye dose equivalent
  - 50 mSv [5 rems] shallow-dose equivalent to the skin
  - 50 mSv [5 rems] shallow-dose equivalent to any extremity
- minors who are likely to receive an annual dose from sources external to the body in excess of any of the following (each evaluated separately):
  - 1.0 mSv [0.1 rem] deep-dose equivalent
  - 1.5 mSv [0.15 rem] eye dose equivalent
  - 5 mSv [0.5 rem] shallow-dose equivalent to the skin
  - 5 mSv [0.5 rem] shallow-dose equivalent to any extremity
- declared pregnant women who are likely to receive a dose from radiation sources external to the body during the entire pregnancy in excess of 1.0 mSv [0.1 rem] deep-dose equivalent
- individuals entering a high or very high radiation area

If an adult radiation worker is likely to receive in a year a dose greater than 10 percent of any applicable limit, monitoring for occupational exposure is required. Monitoring is required for minors and declared pregnant women as shown in the criteria section. The licensee should perform an evaluation of the dose the individual is likely to receive prior to allowing the individual to receive the dose. This evaluation need not be made for every individual; evaluations can be made for employees with similar job functions or work areas.

Licensees should also perform prospective evaluations of the doses that may be received by occupationally exposed minors and declared pregnant women. As with individual adult workers, licensees must supply and require the use of individual monitoring devices to monitor external exposures and monitor the occupational intake of radioactive material when the results of prospective dose evaluations exceed the doses specified in 10 CFR 20.1502.

If this prospective evaluation shows that an adult individual's dose is not likely to exceed 10 percent of any applicable limit, there are no recordkeeping or reporting requirements in regard to the individual's exposure. For individuals who have received doses at other facilities in the current year, the previous dose need not be considered in this prospective evaluation. Only dose that could be received at the facility performing the evaluation need be considered when determining the need for monitoring, and associate recordkeeping and reporting. If it was determined that monitoring was not required and a subsequent evaluation shows that the 10 percent threshold has or will be exceeded, the dose received when monitoring was not provided should be estimated, recorded, and reported. These estimates can be based on any combination of work location radiation monitoring or survey results, monitoring results of individuals in similar work situations, or other estimates to produce a "best estimate" of the actual dose received.

Licensees should use NRC Form 4, “Cumulative Occupational Dose History,” and NRC Form 5, “Occupational Dose Record for a Monitoring Period,” to record individual dose. If monitoring is not required to demonstrate compliance with all limits but is required relative to one or more specific limits, the licensee should enter “N/A” for “not applicable” in the blocks on NRC Form 4, “Cumulative Occupational Dose History,” and NRC Form 5, “Occupational Dose Record for a Monitoring Period,” to indicate the areas for which monitoring was not required (e.g., extremity or skin doses). Where monitoring was provided but not measurable, the licensee should enter “ND” for “not detectable.”

If the prospective evaluation shows that the individual adult is likely to exceed 10 percent of an applicable limit, then monitoring is required—regardless of the actual dose received. If air sampling or bioassay is required, discussion of air sampling or bioassay should provide enough detail so that the NRC staff is assured that appropriate steps will be taken to manage and monitor such exposure. Licensees must provide individual radiation exposure data to each worker as required by 10 CFR 19.13.

Individuals who perform nonroutine operations, such as installation, initial radiation survey, repair, maintenance of components, and disposal of sealed sources are more likely than workers who only engage in routine activities to exceed the limits in 10 CFR 20.1502(a). Applicants must provide dosimetry (whole body and perhaps extremity monitors) to individuals who perform nonroutine operations or must perform a prospective evaluation demonstrating that unmonitored individuals who perform nonroutine operations are not likely to receive radiation doses in excess of the limits in 10 CFR 20.1502(a).

The licensee may not permit any individual to act as a logging supervisor or logging assistant unless, at all times during the handling of licensed radioactive material, each individual wears on the trunk of the body a personnel dosimeter that is processed and evaluated by an NVLAP-accredited processor and is sensitive to the types of radiation to which the individual is exposed. If neutron sources or neutron producing equipment are to be used, a commitment to provide neutron-sensitive dosimetry devices is required. If film badges are used, they should be replaced at least monthly, and other personnel dosimeters [e.g., thermoluminescent dosimeters (TLDs) or optically stimulated luminescence dosimeters (OSLs)] should be replaced at least quarterly. Reference: The National Institute of Standards and Technology (NIST) maintains a directory of laboratories that are NVLAP-accredited at <http://ts.nist.gov/standards/scopes/dosim.htm>.

For purposes of internal dosimetry, the licensee may be required to provide bioassay services when individuals work with unsealed radioactive material. Bioassays or air sampling are required if working with quantities, chemical and physical forms, and activities that make it likely that the radionuclide will be ingested, inhaled, or absorbed, resulting in an intake in excess of 10 percent of the applicable annual limit on intakes (ALIs) in Table 1, Columns 1 and 2, of Appendix B to 10 CFR Part 20. One ALI results in a committed effective dose equivalent (CEDE) of 5 rems or a committed dose equivalent (CDE) of 50 rems.

When using individually packaged “ready to use” quantities of iodine-131 tracer materials in well logging operations, bioassays are required for individuals using more than 50 mCi at any one time, or using a total of 50 mCi within any 5-day period. Guidance on bioassay programs for iodine-131, including the levels and types of handling for which bioassays are indicated, is provided in Regulatory Guide 8.20, Revision 2, “Applications of Bioassay for Radioiodine.” When handling tritium (H-3) exceeding 3.7 GBq [0.1 Ci] or gaseous H-3 exceeding 3700 GBq [100 Ci], bioassays are required. Guidance on bioassay programs for tritium is provided in Regulatory Guide 8.32, “Criteria for Establishing a Tritium Bioassay Program.” Copies of Regulatory Guides may be obtained from the NRC’s Web site at <https://www.nrc.gov/reading-rm/doc-collections/req-guides/occupational-health/rq>.

Bioassay services are available and provided by local hospitals, universities, or other vendors specifically approved by an NRC or Agreement State license to provide such services.

For additional guidance about methodologies for determination of internal occupational dose and summation of occupational dose, refer to Table 8-6.

Regulatory Guide 8.7, Revision 4	Instructions for Recording and Reporting Occupational Radiation Exposure Data
Regulatory Guide 8.9, Revision 1	Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program
Regulatory Guide 8.20, Revision 2	Applications of Bioassay for Radioiodine
Regulatory Guide 8.25, Revision 1	Air Sampling in the Workplace
Regulatory Guide 8.32	Criteria for Establishing a Tritium Bioassay Program
Regulatory Guide 8.34	Monitoring Criteria and Methods to Calculate Occupational Radiation Doses
Regulatory Guide 8.35, Revision 1	Planned Special Exposures
Regulatory Guide 8.36	Radiation Dose to the Embryo/Fetus
ANSI N13.30-2011	Performance Criteria for Radiobioassay
Information Notice 2000-10	Recent Events Resulting in Extremity Exposures Exceeding Regulatory Limits

**Additional Reference for Further Reading:**

U.S. Department of Energy G 441.1-1C, Change 1, “Radiation Protection Programs Guide,” July 8, 2011.



## Response from Applicant:

Provide the following:

- Provide a statement that: “The required personnel dosimeters (e.g., film badge, TLD, OSL) will be processed and evaluated by an NVLAP-accredited entity, will be exchanged at the required frequency, and will be assigned to and worn by well logging supervisors and logging assistants.”

**AND**

- Provide a statement that: “We will develop, maintain, and implement a bioassay program when using unsealed radioactive tracer materials as recommended in NRC Regulatory Guide 8.20, “Applications of Bioassay for Radioiodine,” 8.32, “Criteria for Establishing a Tritium Bioassay Program,” or other appropriate NRC Regulatory Guide.”

**OR**

- In lieu of developing a bioassay program, provide a commitment that the applicant will contract with a vendor for bioassay services, and confirm that the vendor is licensed or otherwise authorized by the NRC or an Agreement State to provide required bioassay services.

**OR**

- In lieu of developing a bioassay program, provide a commitment that the applicant will not allow any individual to use more than (i) 1.85 GBq [50 mCi] of iodine-131 at any one time or in any 5-day period at field stations or at temporary job sites, (ii) or more than 3.7 GBq [0.1 Ci] of H-3, or (iii) more than 3700 GBq [100 Ci] of gaseous H-3.

### **Notes:**

- Alternative responses will be evaluated using the guidance in this section.
- Some licensees choose to provide personnel dosimetry to their workers for reasons other than compliance with NRC requirements (e.g., to respond to worker requests or to maintain records of personal exposure).

### **8.10.6 Public Dose**

**Regulations:** 10 CFR 20.1003, 10 CFR 20.1101, 10 CFR 20.1301, 10 CFR 20.1302, 10 CFR 20.1801, 10 CFR 20.1802, 10 CFR 20.2107

**Criteria:** Licensees must do the following:

- Ensure that licensed materials will be used, transported, stored, and disposed of in such a way that members of the public will not receive more than 1 mSv [100 mrem] in a year, and the dose in any unrestricted area will not exceed 0.02 mSv [2 mrem] in any 1 hour from licensed operations.

- Ensure that air emissions of radioactive material to the environment, excluding radon-222 and its daughters, will not result in exposures to individual members of the public in excess of 0.1 mSv [10 mrem] in a year from those emissions.
- Control and maintain constant surveillance of licensed materials when in use and not in storage.
- Secure stored licensed materials from access, removal, or use by unauthorized personnel.

**Discussion:** Public dose is defined in 10 CFR 20.1003 as “the dose received by a member of the public from exposure to radiation or to radioactive material released by a licensee, or to any other source of radiation under the control of a licensee.” Public dose excludes occupational dose, or doses received from background radiation and medical procedures. Whether the dose to an individual is an occupational dose or a public dose depends on the individual’s assigned duties. It does not depend on the area (restricted, controlled, or unrestricted) where the individual is when he or she receives the dose.

Members of the public include persons who work in or may occupy locations where licensed material is used or stored. Employees whose assigned duties do not include the use of licensed material and work in the vicinity where it is used or stored are also included as members of the public. Public dose is controlled, in part, by ensuring that licensed material is secured (e.g., located in a locked area) to prevent unauthorized access or use. Well logging sealed sources and tracer materials are usually restricted by controlling access to the keys needed to gain access to storage locations, including downhole storage bunkers.

Public dose is also affected by the choice of storage and use locations at the field stations and at temporary job sites. Licensed material must be located so that the resulting public dose in an unrestricted area (e.g., an office or the exterior surface of an outside wall) does not exceed 1 mSv [100 mrem] in a year or 0.02 mSv [2 mrem] in any 1 hour. Applicants should use the concepts of controlling time, distance, and shielding when choosing storage and use locations. Decreasing the time that an individual is exposed, increasing the distance from the radioactive material, and adding shielding that is appropriate for the specific type of radiation (e.g., brick, concrete, lead, hydrogenous materials) will reduce the radiation exposure.

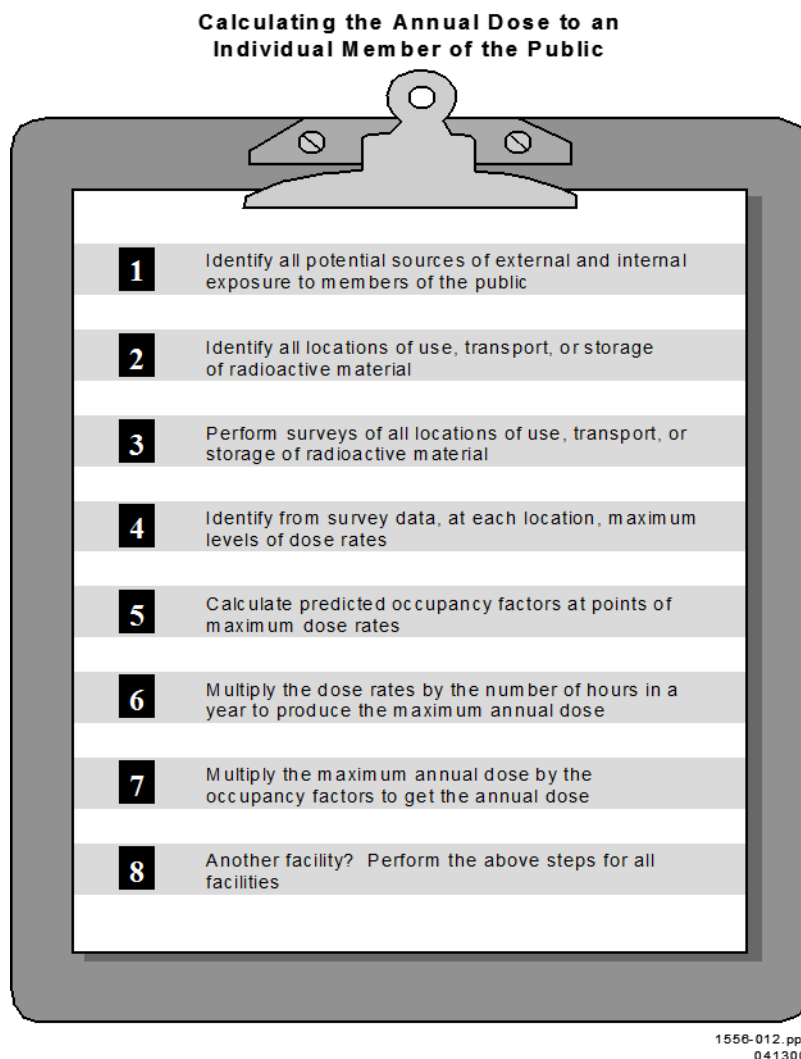
Information provided by the manufacturer or vendor on anticipated radiation levels of sealed sources and tracer materials, both inside their respective transport containers and outside the transport container at given distances, is the type of information needed to make public dose calculations. Licensees may assess radiation levels (both neutron and gamma contribution) located in adjacent areas to radioactive material either by making calculations or by using a combination of direct measurements and calculations. After obtaining anticipated radiation levels or by making direct radiation measurements using an appropriate radiation survey instrument, an applicant can use the “inverse square” law, occupancy factors, and shielding design to evaluate the effect on the public and use this information to determine operating and emergency procedures for using radioactive materials. See Appendix J of this NUREG for an example demonstrating that individual members of the public will not receive doses exceeding the allowable public limits.

Figure 8-9 shows the steps to calculate the annual dose to an individual member of the public.

There are many possible internal dose pathways that contribute to the total effective dose equivalent (TEDE). The TEDE can, however, be broken down into three major dose pathway groups:

- (i) airborne radioactive material (e.g., inhalation)
- (ii) waterborne radioactive material (e.g., ingestion)
- (iii) external radioactive exposure (e.g., source)

The licensee should review these major pathways and decide which are applicable to its operations.



**Figure 8-9. Steps Used to Calculate Public Dose**

If, after making an initial public dose evaluation, a licensee changes the conditions used for the evaluation (e.g., relocates radioactive material within a designated storage area, increases the amount of radioactive materials in storage, changes the frequency radioactive material is in use, or changes the occupancy of adjacent areas), the licensee must perform a new evaluation to ensure that the public dose limits are not exceeded and take corrective action, if required.

Licensees should design a monitoring program to ensure compliance with 10 CFR 20.1302(b). The extent and frequency of monitoring will depend upon each licensee's specific needs.

Under 10 CFR 20.2107, "Records of dose to individual members of the public," licensees must maintain records sufficient to demonstrate compliance with the dose limits for members of the public until the Commission terminates the license. Refer to Appendix I of this NUREG for additional guidance regarding compliance with the recordkeeping requirements.

**Response from Applicant:** No response is required from the applicant in a license application, but compliance will be examined during inspection. During NRC inspections, licensees must be able to provide documentation, demonstrating by measurement or calculation, that the total effective dose equivalent to the individual member of the public likely to receive the highest dose from licensed operations is less than 1 mSv [100 mrem] in a year, and any unrestricted area does not exceed 0.02 mSv [2 mrem] in any 1 hour. See Appendix J of this NUREG for examples of methods to demonstrate compliance.

### 8.10.7 Operating and Emergency Procedures

**Regulations:** 10 CFR 20.1406, 10 CFR 20.1906, 10 CFR 20.2201, 10 CFR 20.2202, 10 CFR 20.2203, 10 CFR 21.21(a), 10 CFR 30.50, 10 CFR 37 (Subpart B), 10 CFR 37.21(a), 10 CFR 37.45, 10 CFR 37.49, 10 CFR 39.13, 10 CFR 39.33(b), 10 CFR 39.43, 10 CFR 39.63, 10 CFR 39.67, 10 CFR 39.69, 10 CFR 39.77, 10 CFR 40.60, 10 CFR 70.50

**Criteria:** The licensee must develop, implement, and maintain operating and emergency procedures or submit a summary of the procedures that addresses the important radiation safety aspects of each procedure to the NRC as part of the application package. Additionally, if well logging and tracer personnel perform specific operations such as leak-testing, semi-annual inspection and maintenance of equipment, and removal and replacement of a sealed source "O" ring, appropriate procedures and instructions for these operations should be included in the applicant's operating and emergency procedures.

Licensees that possess an aggregated Category 1 or Category 2 quantity of radioactive material, listed in Appendix A to 10 CFR Part 37, must also establish, implement, and maintain an access authorization program; coordinate, to the extent practicable, with local law enforcement authorities, for responding to threats to the licensee's facility; and be able to monitor, detect without delay, assess, and respond to any unauthorized entries into security zones.

Each licensee must develop, implement, and maintain operating and emergency procedures that address scenarios likely to be encountered. Operating and emergency procedures' elements must include the items outlined in 10 CFR 39.63, "Operating and emergency procedures." The following is provided as a checklist of important items to consider:

- instructions for handling and using licensed materials, including sealed sources in wells, without surface casing for protecting fresh water aquifers

- instructions for maintaining security during storage, transportation, and use, including temporary job sites
- instructions to keep licensed material under control and under immediate surveillance during use
- steps to take to keep radiation exposures ALARA
- steps to maintain accountability during use (including during emergency situations)
- steps to control access to work sites
- steps to take and whom to contact when an emergency occurs
- instructions for using remote handling tools when handling sealed sources and radioactive tracer material, except low-activity calibration sources
- methods and occasions for conducting radiation surveys, including surveys for detecting contamination, as required by 10 CFR 39.67(c) through (e)
- procedures to minimize personnel exposure during routine use and in the event of an incident, including exposures from inhalation and ingestion of licensed tracer materials
- methods and occasions for locking and securing stored licensed materials
- procedures for personnel monitoring, including bioassays, and the use of personnel monitoring equipment
- procedures for transportation of licensed materials to field stations or temporary job sites; packaging of licensed materials for transport in vehicles; placarding of vehicles when needed; and physically securing licensed materials in transport vehicles during transportation to prevent accidental loss, tampering, or unauthorized removal
- procedures for picking up, receiving, and opening packages containing licensed materials, in accordance with 10 CFR 20.1906, "Procedures for receiving and opening packages"
- instructions for the use of tracer materials, including how to decontaminate the environment, equipment, and personnel
- instructions for maintaining records in accordance with the regulations and the license conditions
- steps for the inspection and maintenance of sealed sources, source holders, logging tools, injection tools, source handling tools, storage containers, transport containers, and uranium sinker bars, as required by 10 CFR 39.43, "Inspection, maintenance, and opening of a source or source holder"
- procedures for making required notifications to the NRC due to events (see Appendix K of this NUREG)

- procedures for identifying and reporting to NRC defects and noncompliance, as required by 10 CFR 21.21(a)
- actions to be taken if a sealed source is lodged in a well, as required by 10 CFR 39.15 and 39.77 (Refer to Appendix K of this NUREG for guidance on reporting requirements.)
- procedures and actions to be taken if a sealed source is ruptured, including actions to prevent the spread of contamination and minimize inhalation and ingestion of licensed materials and actions to obtain suitable radiation survey instruments, as required by 10 CFR 39.33(b) (Refer to Appendix O of this NUREG for some key elements that should be addressed in the procedures.)
- instructions for the proper storage and disposal of radioactive waste
- procedures for laundering contaminated clothing and for decontaminating equipment and vehicles
- procedures to be followed in the event of uncontrolled release of radioactive tracer material to the environment, including notification of the RSO, the NRC, and other Federal and State agencies

Written documentation of the procedures written above should be retained for review during inspection.

**Discussion:** The purpose of operating and emergency procedures is to provide well logging and tracer personnel, including field flood study personnel, with specific guidance for all operations they will perform. Each topic of importance should be included in the operating and emergency procedures and need not be presented in order. Instructions for nonroutine operations, for example, inspection and maintenance of well logging and tracer equipment or conducting calibration of radiation survey instruments, should be included as separate appendices in the application.

Operating and emergency procedures need not specify a particular make and model of radiation survey instrument. Procedures should provide sufficient guidance and instruction for each specific type of well logging or associated equipment. For example, the applicant may submit a single operating procedure for using sealed sources, tracer materials, and radionuclides used in field flood operations, provided the unique variances in each operation are addressed in the application.

Operating and emergency procedures or a summary of the procedures that addresses the important radiation safety aspects of each must be submitted to the NRC for review as a part of the application in accordance with 10 CFR 39.13(c). See 10 CFR 39.63 for important radiation safety aspects that need to be included in operating and emergency procedures.

**Note:** The procedures required by 10 CFR 39.63, "Operating and emergency procedures," are not substitutes for the DOT requirements in 49 CFR Part 172, Subpart G—Emergency Response Information. Licensees must comply with the appropriate US DOT regulations, as applicable, including those involving Emergency Response Information, if needed when transporting radioactive material.

In accordance with 10 CFR Part 37, any licensee that possesses an aggregated Category 1 or Category 2 quantity of radioactive material must, among other things,

- in accordance with 10 CFR 37.21(a), establish, implement, and maintain its access authorization program in accordance with the requirements of 10 CFR Part 37, Subpart B;
- in accordance with 10 CFR 37.45, coordinate with their local law enforcement agency (LLEA) for responding to threats to a licensee's facility; and
- in accordance with 10 CFR 37.49, be able to monitor, detect without delay, assess, and respond to any unauthorized entries into security zones, including those surrounding mobile devices.

For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG-2155, "Implementation Guidance for 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material." Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG-2166, "Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material."

**Please note, under 10 CFR Part 37, security plans are not submitted to the NRC, but may be subject to review and inspection.**

#### **Response from Applicant:**

Submit written operating and emergency procedures that address the important radiation safety aspects, as described in 10 CFR 39.63, "Operating and emergency procedures."

**OR**

Provide an outline or summary of the operating and emergency procedures that include the important radiation safety aspects of the procedures.

#### **8.10.8 Leak Tests**

**Regulations:** 10 CFR 30.53, 10 CFR 39.13(f), 10 CFR 39.35, 10 CFR 40.63, 10 CFR 70.56

**Criteria:** The NRC requires testing of sealed sources containing greater than 3.7 MBq [100 µCi] of beta/gamma or 0.37 MBq [10 µCi] of alpha radioactive material in order to determine whether there is any radioactive leakage from sealed sources in accordance with 10 CFR 39.35. Requirements for leak tests are based on the type of radiation (beta/gamma/alpha) escaping from the inner capsule. Licensees must maintain records of leak test results in accordance with license conditions or, if applicable, NRC regulations.

**Discussion:** The NRC or an Agreement State may authorize manufacturers, consultants, and other organizations to either perform the entire leak-test sequence for other licensees or provide leak-test kits to licensees. In the latter case, the licensee is expected to take the leak-test sample according to the device manufacturer's and the kit supplier's instructions. The licensee returns the sample to the leak test service provider for evaluation and reporting results. Leak test samples should be collected at the most accessible area where contamination would accumulate if the sealed source were leaking. The NRC or an Agreement State may, in a license condition, specifically authorize well logging licensees to conduct the entire leak test

sequence themselves. Measurement of the leak-test sample is a quantitative analysis requiring that instrumentation used to analyze the sample be capable of detecting 185 Bq [0.005 µCi] of radioactivity. See 10 CFR 39.35(b).

Sealed sources will be leak tested at intervals not to exceed 6 months. Energy Compensation Sources will be leak tested at intervals not to exceed 3 years, unless exempted under 10 CFR 39.35(e).

**Response from Applicant:** Provide either of the following:

- A statement that: “Leak tests sample collection and analysis will be performed by an organization authorized by the NRC or an Agreement State to provide leak testing services to other licensees. Leak tests may be collected by the licensee, using a leak test kit supplier’s instructions. Such leak test kits will be supplied by an organization authorized by the NRC or an Agreement State to provide leak testing services.”

**OR**

- A statement that: “Leak test sample collection and analysis will be done by the applicant.” Provide the information in Appendix L of this NUREG supporting a request to perform leak test sample collection and sample analysis and either state that “The applicant will follow the model procedures in Appendix L of NUREG–1556, Volume 14, Revision 1, “Consolidated Guidance about Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Licenses”, or submit alternative procedures.

**Note:** Requests for authorization to perform leak testing and sample analysis will be reviewed on a case-by-case basis and, if approved, NRC staff will authorize via a license condition. Alternative procedures will be evaluated against Appendix L criteria.

### **8.10.9 Maintenance**

**Regulations:** 10 CFR 39.31, 10 CFR 39.43, 10 CFR 39.49, 10 CFR 39.63

**Criteria:** The licensee will have written procedures for visually inspecting and for maintaining source holders, logging tools, injection tools, source handling tools, storage and transport containers, and uranium sinker bars in an operable condition, including labeling. If equipment problems are found, the equipment must be withdrawn from service until repaired. Records of this inspection program are required. See 10 CFR 39.43.

**Discussion:** Each licensee will have a program to visually check source holders, tools, containers, and sinker bars for defects prior to each use to ensure that the equipment is in good working order and that required labeling is present. If defects are found, the equipment must be removed from service until repaired and a record made of the defect and the repairs made. Licensees will conduct a visual inspection semiannually to ensure that no physical damage to equipment is visible and the required labeling is present. Licensees must establish a program for the routine maintenance of source holders, logging tools, inspection tools, source handling tools, storage containers, transport containers, injection tools, and uranium sinker bars. If defects are found during the visible inspection or during the routine maintenance, the equipment must be removed from service until repaired and a record made of the defect and any repairs



made prior to returning the equipment for use. These records must be retained for 3 years after the defect is found.

Nonroutine and special maintenance (e.g., change of O-rings on sealed sources or removal of a stuck sealed source, in a manner that could potentially damage or rupture the source) can only be performed by those licensees that have specifically received authorization from the NRC or an Agreement State.

**Response from Applicant:** No response required in the section. Applicants must include in subsequent sections its program for inspection and maintenance of logging equipment and include the program with the Operating and Emergency Procedures.

### **8.10.9.1 Maintenance Prior to Use**

**Regulations:** 10 CFR 39.31, 10 CFR 39.43(a), 10 CFR 39.49, 10 CFR 39.63

**Criteria:** The licensee must have written procedures for visually inspecting and maintaining source holders, logging tools, injection tools, source handling tools, storage and transport containers, and uranium sinker bars for defects prior to use. See 10 CFR 39.43(a) and 10 CFR 39.63. This visual inspection is necessary to ensure that the equipment remains in good working condition and is labeled as required.

**Discussion:** Regulations in 10 CFR 39.43(a) require that source holders, tools, containers, and sinker bars be checked visually for defects prior to each use to ensure that the equipment is in good working condition and is labeled as required. Labeling requirements are specified in 10 CFR 39.31, "Labels, security, and transportation precautions," and 10 CFR 39.49, "Uranium sinker bars." Instructions in the operating procedures provided to personnel must clearly reflect the regulatory requirement—visual inspections are performed prior to each use. After the inspection, record the date, inspector, equipment involved, any defects found, and repairs made. Equipment that fails the inspection must be removed from service and returned only after it is successfully repaired.

The licensee must develop, implement, and maintain procedures for visually inspecting and maintaining source holders, tools, and containers.

**Response from Applicant:**

Provide the following:

- A statement that: "Before each use, visual inspections will be conducted and records maintained in accordance with 10 CFR 39.43(a), to ensure that well logging equipment is in good working condition and is labeled as required."

**AND**

- Submit the procedure(s) for conducting visual inspections.

### **8.10.9.2 Semi-Annual Visual Inspection and Routine Maintenance**

**Regulations:** 10 CFR 21.21, 10 CFR 39.31, 10 CFR 39.43(a), 10 CFR 39.43(b), 10 CFR 39.49, 10 CFR 39.63

**Criteria:** In accordance with 10 CFR 39.43 and 10 CFR 39.63, licensees must have written procedures for semiannual visual and routine maintenance of source holders, logging tools, injection tools, source handling tools, storage and transport containers, and uranium sinker bars to ensure that the labeling required by 10 CFR Part 39 is legible and that no physical damage to the equipment is visible. Requirements in 10 CFR 21.21, "Notification of failure to comply or existence of a defect and its evaluation," require, in part, that licensees adopt appropriate procedures to notify the NRC of any equipment that is defective or could result in a substantial safety hazard.

**Discussion:** The licensee will conduct visual inspections and perform routine maintenance activities on source holders, tools, containers, and sinker bars to ensure that the labeling required by 10 CFR 39.31, "Labels, security, and transportation precautions," for sealed sources and 10 CFR 39.49 for uranium sinker bars is legible, and that no physical damage is visible. If defects are found, the equipment must be removed from service, and a record must be made, listing: the defects, inspection and maintenance operations performed, and the actions taken to correct the defects. Instructions for conducting these activities must be included as part of the operating and emergency procedures required under 10 CFR 39.63. Instructions should be tailored to the licensee's specific program and to the equipment possessed and used.

Licensee staff should report all defects to the appropriate and designated licensee management official. The licensee management official will report defects to the NRC, in accordance with 10 CFR 21.21. All personnel involved in the identification of defects should be trained in the proper communication of such findings within the licensee's organizational structure and reporting to the NRC commensurate with their position.

**Response from Applicant:**

- A statement that: "Semiannual visual inspections and routine maintenance will be conducted and records maintained in accordance with 10 CFR 39.43(b), to ensure that required labeling is legible and that no physical damage is visible."

**AND**

- Submit the procedure(s) for conducting semiannual visual inspections and routine maintenance.

**8.10.9.3 Maintenance Requiring Special Authorization**

**Regulations:** 10 CFR 39.43(c), 10 CFR 39.43(d), 10 CFR 39.43(e)

**Criteria:** Certain maintenance procedures on sealed sources or holders that contain sealed sources are prohibited, unless a written procedure has been approved and the licensee is specifically authorized by the NRC or an Agreement State to perform these operations.

**Discussion:** In accordance with 10 CFR 39.43, activities that are prohibited, unless a written procedure has been reviewed and approved by the NRC or an Agreement State, include

- removing a sealed source from a source holder or logging tool
- preventive maintenance activities on sealed sources or holders that may be necessary when using certain types of logging tools, including removing and replacing O-rings (see Figure 8-10 below)
- removing a sealed source that is stuck in a source holder or logging tool by drilling, cutting, or chiseling (e.g., any situation where tools are required to remove the stuck source)
- opening, repairing, or modifying any sealed source

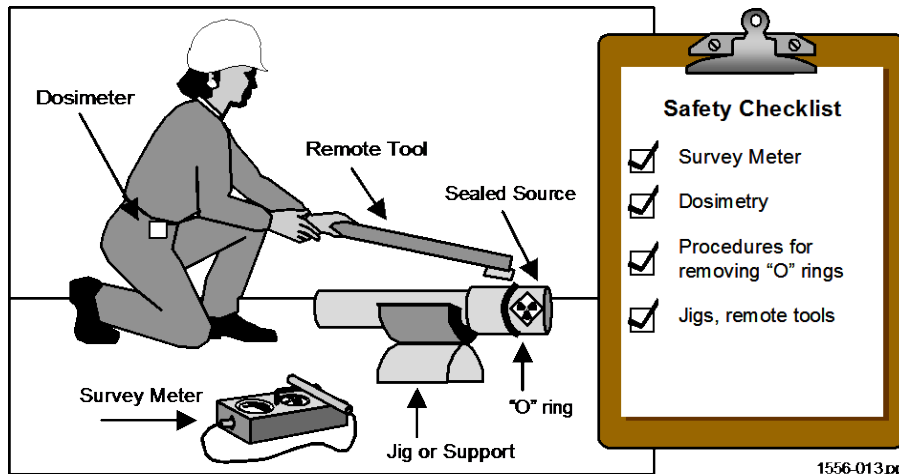


Figure 8-10. Maintenance, Cleaning, and O-ring Replacement

**Response from Applicant:**

- A statement that: "Activities described in 10 CFR 39.43(c) and (d) will not be conducted unless detailed written procedures have been approved by the NRC."

**OR**

- Submit detailed procedures for any activities described in 10 CFR 39.43(c) and (d), including radiation safety precautions that individuals will be expected to follow when performing these tasks and the minimum qualifications of these individuals. Each different task must be described. Should a procedure require the removal of the sealed source from the holder before performing any maintenance on the holder, applicants should describe the removal procedures.

**Note:** Equipment manufacturers can provide information concerning maintenance and source removal procedures. In some cases, certain maintenance operations should only be performed by the manufacturer or individuals who are licensed by the NRC or an Agreement State to provide these services. See 10 CFR 39.43(e).

### 8.10.10 Transportation

**Regulations:** 10 CFR 20.1101, 10 CFR 30.41, 10 CFR 30.51, 10 CFR Part 37 (Subpart D), 10 CFR 39.31, 10 CFR 40.51, 10 CFR 40.61, 10 CFR 70.41, 10 CFR 70.42, 10 CFR 71.5, 10 CFR 71.12, 10 CFR 71.14, 10 CFR 71.37, 10 CFR 71.38, 10 CFR 71.47, 10 CFR Part 71 (Subpart H), 49 CFR Parts 171-178

**Criteria:** Licensees and applicants must develop, implement, and maintain safety programs for transport of radioactive material to ensure compliance with NRC and DOT regulations. In accordance with 10 CFR Part 37 (Subpart D), licensees must also preplan, coordinate and provide advance notification of the shipment of Category 1 quantities of radioactive material and coordinate the shipment of Category 2 quantities of radioactive material.

**Discussion:** Figure 8-11 illustrates some often-overlooked DOT requirements. During an inspection, NRC uses the provisions of 10 CFR 71.5, "Transportation of licensed material," and a Memorandum of Understanding with DOT to examine and enforce transportation requirements applicable to well logging, tracer, and field flood study licensees. Appendix M of this NUREG contains a list of major DOT regulations and provides sample shipping documents, placards, and labels.

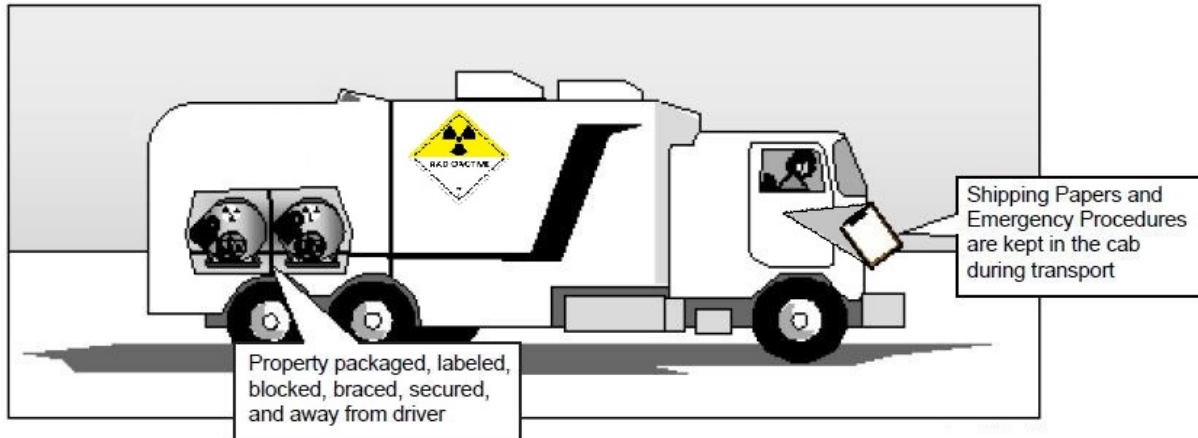
Instructions to personnel should not reference DOT requirements. Information should be extracted, paraphrased, and placed into the instructions so that personnel know exactly what they are expected to do. The following items should be covered in instructions to personnel:

- Labeling containers appropriately (i.e., when to use labels Radioactive White I, Radioactive Yellow II, or Radioactive Yellow III).
- Securing well logging, tracer, and field flood study radiological equipment within the transporting vehicle. The instructions should specify how to prevent the equipment from moving during transport, referred to as blocking and bracing.
- Preparing shipping papers. The instructions should specify that the papers must be completed before transporting the licensed material and must be accessible in the driver's compartment at all times. Placarding both sides, the front and the back of the vehicle, with "RADIOACTIVE" placards if the package being transported requires a Radioactive Yellow III label. If the vehicle requires placarding and the package radiation levels exceed 2 mSv/h [200 mrem/h] or the transport index exceeds 10, the exterior surfaces and passenger compartment of the vehicle must be surveyed to ensure that the radiation levels do not exceed 0.02 mSv/h [2 mrem/h] from any exterior surface and 0.02 mSv/h [2 mrem/h] in the passenger compartment. See 10 CFR 71.47. Include instructions to personnel on the measures to take if the radiation level exceeds 0.02 mSv/h [2 mrem/h] in the passenger compartment (e.g., adding more shielding or repositioning the exposure device within the vehicle). If an exposure device is transported in an overpack, the procedures should include instructions that the overpack must be properly marked with the shipping name and identification number, labeled (e.g., Radioactive White I or Radioactive Yellow II), and marked when required with a statement that indicates the inner package complies with prescribed specifications.

Licensees should consider the safety of all individuals who may either handle or come into contact with transport containers or packages containing licensed material. The primary consideration in packaging licensed material should be to ensure that the package integrity is

not compromised during transport and that the radiation levels or removable contamination levels at the package surfaces meet the regulatory requirements of 10 CFR 71.47, “External radiation standards for all packages,” and 49 CFR 173.443, “Contamination control.” In all cases, ALARA concerns are addressed prior to, during, and after transporting any radioactive material.

**Note:** Licensees shipping radioactive waste for disposal must prepare appropriate documentation as specified in 10 CFR Part 20 and Appendix M of this NUREG.



**Figure 8-11. Transportation**

*Licensees often transport their equipment and radioactive materials, including sealed sources and tracer materials, to and from job sites and must ensure compliance with DOT regulations.*

Licensees shipping or transferring a Category 1 or Category 2 quantity of radioactive material are subject to the 10 CFR Part 37, Subpart D (“Physical Protection in Transit”). For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG–2155, “Implementation Guidance for 10 CFR Part 37, “Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material.”” Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG–2166, “Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material.”

**Please note, under 10 CFR Part 37, security plans are not submitted to the NRC, but may be subject to review and inspection.**



**Figure 8-12. Transport Container**

**Response from Applicant:** Submit operating and emergency procedures for transporting well logging sealed sources containing radioactive material, and field flood and tracer radioactive materials.

**References:** The most recent version of “A Review of Department of Transportation Regulations for Transportation of Radioactive Materials” can be obtained at [https://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/RAM\\_Regulations\\_Review\\_12-2008.pdf](https://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/RAM_Regulations_Review_12-2008.pdf) or at <https://www.dot.gov>.

#### **8.10.11 Minimization of Contamination**

**Regulations:** 10 CFR 20.1406, 10 CFR 39.33(a), 10 CFR 39.35(d), 10 CFR 39.67(c)-(e), 10 CFR 39.69

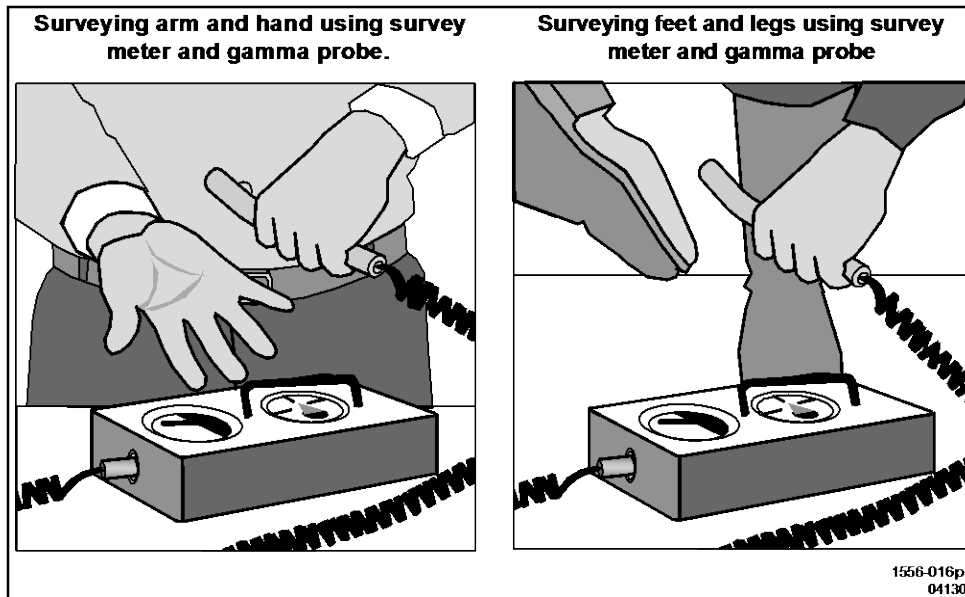
**Criteria:** Applicants for new licenses must describe how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.

**Discussion:** All applicants for new licenses should consider the importance of designing and operating their facilities so as to minimize the amount of radioactive contamination generated at the site during its operating lifetime and the generation of radioactive waste during decontamination. When submitting new applications, applicants should consider the following with regards to minimization of contamination by tracer material or sealed sources:

- implementation of and adherence to good health physics practices while performing operations
- minimization of distance to areas, to the extent practicable, where licensed materials are used and stored
- maximization of radiation survey frequency, within reason, to enhance detection of contamination
- segregation of radioactive material in waste storage areas
- segregation of sealed sources and tracer materials to prevent cross-contamination
- separation of radioactive material from explosives
- separation of potentially contaminated areas from clean areas by barriers or other controls
- control of frac sands, resins, and other proppants in the event of a “sand/washout”

Sealed sources and devices that are approved by the NRC or an Agreement State and located and used according to their respective SSD registration certificates usually pose minimal risk of contamination. Well logging applicants usually do not need to address these issues as a separate item since they are included in responses to other items of the application. Leak tests performed as specified in 10 CFR 39.35, “Leak testing of sealed sources,” should identify defective sources. Leaking sources must be withdrawn immediately from use and decontaminated, repaired, or disposed of in accordance with the disposal requirements in Subpart K of 10 CFR Part 20. See 10 CFR 39.35. These steps minimize the spread of contamination and reduce radioactive waste associated with decontamination efforts. Other efforts to minimize radioactive waste do not apply to well logging programs using only sealed sources and devices that have not leaked.

Special authorization must be granted by the NRC to applicants to decontaminate a facility contaminated by a leaking sealed source or contaminated by unsealed material with a half-life greater than 120 days. See 10 CFR 30.36(g). Approval granted in a license by the NRC or an Agreement State to provide these specialized services minimizes the spread of contamination and reduces radioactive waste associated with decontamination efforts.



**Figure 8-13. Personnel Radiation Surveys**

**Response from Applicant:**

- The applicant does not need to provide a response to this item if the applicant provides responses to the following sections of this NUREG that meet the “Response from Applicant” criteria from those sections: 8.5.1, “Radioactive Material—Sealed Radioactive Material;” 8.5.2, “Radioactive Material—Unsealed (Tracer) Radioactive Material;” 8.9, “Facilities and Equipment;” 8.10.8, “Radiation Safety Program—Leak Tests;” 8.10.7, “Radiation Safety Program—Operating and Emergency Procedures;” 8.10.13, “Radiation Safety Program—Subsurface Tracer Studies;” and 8.11, “Waste Management.”

**OR**

- The applicant should submit its procedures to conduct decontamination of a facility contaminated by a leaking sealed source or contaminated by unsealed material with a half-life greater than 120 days.

**8.10.12 Sealed Sources**

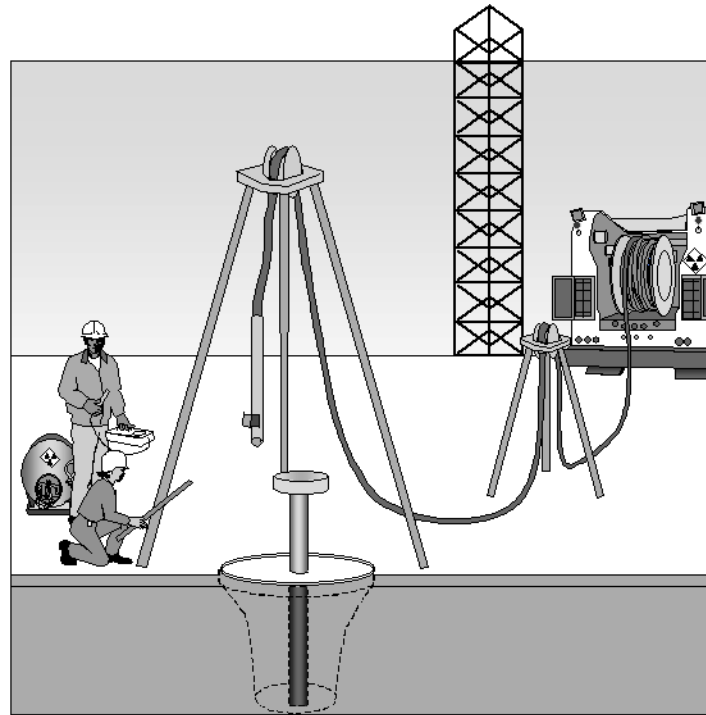
**8.10.12.1 Use of Sealed Sources in Drill-To-Stop (Wireline) Operations**

**Regulations:** 10 CFR 39.13, 10 CFR 39.63

**Criteria:** Applicants must develop and follow instructions to be used by logging personnel when using licensed sealed radioactive sources in drill-to-stop (DTS) well logging operations.



Unlike measurement while drilling (MWD) or logging while drilling (LWD) operations where well logging operations occur concurrent with the drilling operations, DTS well logging operations require that all drilling operations cease and that parts of the drilling apparatus, including all of the drill stem, be removed to provide access to the well bore. The well logging tool containing one or more sealed sources is then lowered into the well bore to obtain information about the well or adjacent oil, gas, mineral, groundwater, or geological formations.



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**Figure 8-14. Drill-to-Stop Well Logging Operations**

**Discussion:** Operating and Emergency procedures that cover the use of sealed sources in DTS well logging operations must be developed and implemented in accordance with 10 CFR 39.63.

Applicants who request authorization to use sealed sources in DTS well logging operations in well bores without a surface casing should describe the procedures to be followed necessary to ensure that a sealed source does not become lodged in the well bore. Examples of pre-logging actions that should be included in the procedures are:

- obtain specific knowledge of the borehole conditions from the drilling team or company
- run a caliper log to show the hole is open or to find problem areas
- run a tool without a radioactive source to show it can be freely removed
- place a temporary casing in sections of the hole causing problems

DTS well logging activities should include procedures for using appropriate remote handling tools for handling sealed sources. The applicant must ensure that a handling tool is

compatible with a particular sealed source in accordance with manufacturers/distributors instructions and that operating and emergency procedures reflect the correct tool/source configuration.

**Response from Applicant:**

- Submit operating and emergency procedures for conducting DTS well logging operations. Procedures must address radiation safety aspects when conducting DTS well logging operations.

**8.10.12.2 Use of Sealed Sources in Measurement While Drilling or Logging While Drilling Well Logging Operations**

**Regulations:** 10 CFR 39.13, 10 CFR 39.63

**Criteria:** Applicants must develop and follow procedures to be used by logging personnel when using licensed sealed radioactive sources in MWD or LWD well logging operations.

MWD or LWD well logging operations occur during the drilling of the well bore and do not require that the drill stem or other equipment be removed from the well. MWD or LWD requires that the well logging tool containing one or more sealed sources be located above the drilling stem to obtain information about the well or adjacent oil, gas, mineral, groundwater, or geological formations while the well drilling operation continues uninterrupted. Both MWD and LWD activities can be conducted at the same time drilling operations are occurring. Downhole recorded data from MWD or LWD sensors is transmitted to the surface through the use of mud telemetry.

**Discussion:** Operating and Emergency procedures that cover the use of sealed sources in MWD or LWD well logging operations must be developed and implemented in accordance with 10 CFR 39.63.

Instructions in MWD and LWD well logging activities should include procedures for using appropriate remote handling tools for handling sealed sources. The applicant must ensure that a handling tool is compatible with a particular sealed source in accordance with manufacturers/distributors instructions, and that operating and emergency procedures reflect the correct tool/source configuration.

**Response from Applicant:**

- Submit operating and emergency procedures for conducting MWD and LWD well logging activities. Procedures must address radiation safety aspects when conducting MWD and LWD well logging operations.

**8.10.12.3 Energy Compensation Sources**

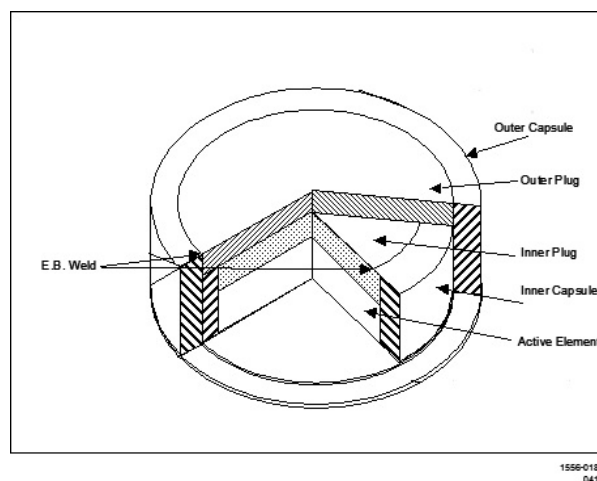
**Regulations:** 10 CFR 39.2, 10 CFR 39.13, 10 CFR 39.15, 10 CFR 39.35, 10 CFR 39.37, 10 CFR 39.39, 10 CFR 39.41, 10 CFR 39.51, 10 CFR 39.53, 10 CFR 39.63, 10 CFR 39.77

**Criteria:** Energy compensation sources (ECSs) used in well logging operations are small sealed sources each containing less than or equal to 3.7 MBq [100 µCi] of byproduct material.

ECSs are used as reference or calibration standards for stabilizing and calibrating conventional, LWD, or MWD well logging tools.

**Discussion:** ECSs are small sealed sources with an activity not exceeding 3.7 MBq [100  $\mu$ Ci] used within a logging tool to provide a reference standard to maintain the tool's calibration when in use. See 10 CFR 39.2. As a result, ECSs are:

- exempt from leak testing requirements if the ECS contains less than or equal to 3.7 MBq [100  $\mu$ Ci] each; however, sealed sources greater than 3.7 MBq [100  $\mu$ Ci] that are used for calibration of well logging tools are not exempt from leak testing requirements and must be tested at intervals not to exceed 3 years. See 10 CFR 39.35.
- exempt from abandonment requirements described in 10 CFR 39.77, "Notification of incidents and lost sources; abandonment procedures for irretrievable sources," when only ECSs less than or equal to 3.7 MBq [100  $\mu$ Ci] remain in the abandoned tool in a well with surface casing for protecting fresh water aquifers; however, for wells without surface casings, the abandonment requirements of 10 CFR 39.77 and 10 CFR 39.53, "Energy compensation source," apply to ECSs less than or equal to 3.7 MBq [100  $\mu$ Ci]. Abandonment requirements are also discussed in Section 8.10.1 of this NUREG.
- exempt from the design and performance criteria for well logging sources as described in 10 CFR 39.41.
- exempt from the monitoring requirements in 10 CFR 39.69 during source recovery operations when only ECSs less than or equal to 3.7 MBq [100  $\mu$ Ci] remain in a well logging tool that is lodged in a well with a surface casing for protecting fresh water aquifer however, in wells without a surface casing to protect fresh water aquifers, see 10 CFR 39.53 for applicable requirements.
- not exempt from the requirements to conduct a physical inventory and to maintain records of use. See 10 CFR 39.37, 39.39 and 39.53. Requirements established in other parts of NRC regulations (e.g., 10 CFR Part 20, 10 CFR Part 30) are still applicable to possession and use of byproduct material contained in ECSs.



**Figure 8-15. Double Encapsulated ECS Sealed Source**

**Response from Applicant:**

- Submit a statement that “We will test ECSs requiring leak tests at intervals not to exceed 3 years and we will conduct physical inventories of ECSs at least every 6 months. We will maintain physical inventory and material use records in accordance with 10 CFR 39.37, “Physical Inventory,” and 10 CFR 39.39 “Records of material use.”

**8.10.12.4 Use of Sealed Sources and/or Neutron Generators in Fresh Water Aquifers**

**Regulations:** 10 CFR 39.55, 10 CFR 39.63

**Criteria:** The licensee is prohibited from using sealed sources or neutron generators in fresh water aquifers unless the licensee requests and receives written permission from the NRC.

**Discussion:** Use of radioactive materials in fresh water aquifers is a prohibited activity unless specifically authorized by the NRC. Authorization to use sealed sources or neutron generators in fresh water aquifers requires that operating and emergency procedures include the following pre-logging instructions, at a minimum:

- obtain specific knowledge of the borehole conditions from the drilling team or company
- run a caliper log to show the hole is open or to find the problem area
- run a tool without a radioactive source to show it can be freely removed
- place a temporary casing in sections of the hole causing problems

**Response from Applicant:**

A statement that: “We will not use sealed sources and/or neutron generators for conducting well logging operations in fresh water aquifers.”

**OR**

Submit step-by-step operating and emergency procedures for conducting well logging activities using sealed sources and/or neutron generators in fresh water aquifers that meet the criteria in Section 8.10.12.4 of NUREG–1556, Volume 14, Revision 1; 10 CFR 39.55, “Tritium neutron generator target source,” and 10 CFR 39.63, “Operating and emergency procedures.”

**8.10.13 Subsurface Tracer Studies**

**Regulations:** 10 CFR 39.45, 10 CFR 51.60, 10 CFR 51.22

**Discussion:** The use of subsurface tracers in well logging activities may include the injection of licensed radioactive tracers in single wells, field flood studies involving secondary and tertiary recovery applications, freshwater aquifers, and hydraulic frac-tagging operations. The injection of tracers in field flood studies may be an activity that requires a licensee to prepare an environmental report, in accordance with 10 CFR 51.60, for the NRC to perform an environmental assessment or environmental impact statement. The injection of tracers into a single well may be excluded from requiring an environmental assessment or environmental impact statement in accordance with 10 CFR 51.22. Licensees wanting to inject licensed tracers into freshwater aquifers must be specifically authorized to do so by the NRC. See 10 CFR 39.45(b).

### 8.10.13.1 Tracer Studies in Single Well Applications

**Regulations:** 10 CFR 39.45, 10 CFR 39.63, 10 CFR 51.22

**Criteria:** Applicants must develop, implement, and maintain safety programs for the use of unsealed material for tracer studies in single wells.

**Discussion:** Applicants' operating and emergency procedures should address the following items:

- methods and occasions for conducting radiation surveys
- methods and occasions for locking and securing tracer materials
- personnel monitoring and the use of personnel monitoring equipment
- transportation to temporary job sites and field stations, including the packaging and placing of tracer materials in vehicles, placarding of vehicles, and securing of tracer materials during transportation
- procedures for minimizing exposure to members of the public and occupationally exposed individuals in the event of an accident
- maintenance of records at field stations and temporary job sites
- use, inspection, and maintenance of equipment (e.g., injector tools, remote handling tools, transportation containers)
- procedures to be used for picking up, receiving, and opening packages containing radioactive material
- decontamination of the environment, equipment, and personnel
- notifications of proper personnel in the event of an accident
- procedures for handling, control, security, and disposal of any unused tracer materials

**Response from Applicant:**

A statement that: "We will not perform tracer studies in single well applications."

**OR**

A statement that: "We will perform tracer studies in single well applications and have submitted step-by-step operating and emergency procedures for conducting tracer studies in single well applications that meet the criteria in Section 8.10.13.1 of NUREG-1556, Volume 14, Revision 1, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses," 10 CFR 39.45, and 10 CFR 39.63."

### **8.10.13.2 Field Flood and Secondary Recovery Applications (Tracer Studies in Multiple Wells)**

**Regulations:** 10 CFR 39.45, 10 CFR 39.63, 10 CFR 51.21, 10 CFR 51.22, 10 CFR 51.30, 10 CFR 51.45, 10 CFR 51.60, 10 CFR 51.66

**Criteria:** Applicants must develop, implement, and maintain safety programs for the use of unsealed material for tracer studies in multiple wells (field flood studies). Refer to Appendix D of this NUREG in developing step-by-step instructions for tracer personnel in performing field flood tracer studies for multiple wells.

For field flood study activities where licensed material is intentionally released into the environment involving secondary and tertiary oil and gas recovery, the applicant must provide an environmental report under the provisions of 10 CFR 51.60(b)(1)(vi). The environmental report must be prepared in accordance with the requirements in 10 CFR 51.45, "Environmental report." Authorizing an applicant to conduct field flood studies for multiple wells would require NRC's assessment of an environmental report and development of an environmental assessment or environmental impact statement. The environmental review is performed following the guidance in NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs."

**Discussion:** Applicants should address the following when requesting field flood and secondary recovery applications:

- agreement with well operator or owner
- field flood study project design
- preinjection phase of the field flood project
- injection phase
- postinjection phase
- emergency procedures
- reporting and recordkeeping requirements
- waste management
- methods and occasions for conducting radiation surveys
- methods and occasions for locking and securing tracer materials
- personnel monitoring and the use of personnel monitoring equipment
- transportation to temporary job sites and field stations, including the packaging and placing of tracer materials in vehicles, placarding of vehicles, and securing tracer materials during transportation

- procedures for minimizing exposure to members of the public and occupationally exposed individuals in the event of an accident
- maintenance of records at field stations and temporary job sites
- use, inspection, and maintenance of equipment (e.g., injector tools, remote handling tools, transportation containers)
- procedures to be used for picking up, receiving, and opening packages containing radioactive material
- decontamination of the environment, equipment, and personnel
- notifications of proper personnel in the event of an accident

See Appendix D of this NUREG for additional information on developing a program for conducting field flood studies and enhanced recovery of oil and gas wells.

Field flood study applicants are charged at full cost fee based on the professional staff time expended as described in footnote e.3 to 10 CFR 170.31, "Schedule of fees for materials licenses and other regulatory services, including inspections, and import and export licenses." Individuals planning activities of this nature should contact the NRC well in advance of scheduled use.

**Note:** The NRC's completion of an environmental assessment, based on the level of complexity, can require several months to review, approve, and publish the results of the assessment.

**Response from Applicant:**

- A statement that: "Field flood studies using tracer materials will not be conducted."

**OR**

- A statement that: "Field flood studies using tracer materials will be conducted and we have submitted step-by-step procedures and information required in Section 8.10.13.2 and Appendix D, "Field Flood Studies/Enhanced Recovery of Oil and Gas Wells" of NUREG-1556, Volume 14, Revision 1, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses.""

**8.10.13.3 Tracer Studies in Fresh Water Aquifers**

**Regulations:** 10 CFR 39.45, 10 CFR 51.21, 10 CFR 51.22, 10 CFR 51.30, 10 CFR 51.32, 10 CFR 51.45, 10 CFR 51.60, 10 CFR 51.66

**Criteria:** Applicants must develop, implement, and maintain a safety program for using tracer materials in fresh water aquifers. Licensees may not knowingly inject licensed material into a fresh water aquifer unless specifically authorized to do so by the NRC.

**Discussion:** The NRC, in accordance with 10 CFR 39.45(b), prohibits the intentional injection of licensed tracer material into a fresh water aquifer unless the individual is specifically authorized by the Commission to perform this activity.

For field flood studies where the applicant intends to intentionally inject licensed tracer material into a fresh water aquifer involving secondary and tertiary oil and gas recovery, the applicant must provide an environmental report under the provisions of 10 CFR 51.60(b)(1)(vi). The environmental report must be prepared in accordance with the requirements in 10 CFR 51.45, "Environmental report." Subsequently, the NRC will perform an environmental review in accordance with the guidance in NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs."

Field flood study applicants are charged at full cost fee based on the professional staff time expended as described in footnote e.3 to 10 CFR 170.31, "Schedule of fees for materials licenses and other regulatory services, including inspections, and import and export licenses." Individuals planning activities of this nature should contact the NRC well in advance of scheduled use.

**Note:** The NRC's completion of an environmental assessment, based on the level of complexity, can require several months to review, approve, and publish.

**Response from Applicant:**

- A statement that: "We will not knowingly inject tracer material into a fresh water aquifer."

**OR**

- A statement that: "We request authorization to inject tracer material into a fresh water aquifer involving secondary and tertiary oil and gas recovery and have submitted our reasons for performing the study and procedures to safeguard the public, licensee personnel, and the environment, and will provide an environmental report containing the information outlined in 10 CFR 51.45, "Environmental report."

#### **8.10.13.4 Frac-tagging Operations**

**Regulations:** 10 CFR 39.45, 10 CFR 39.63, 10 CFR 51.21, 10 CFR 51.22, 10 CFR 51.30, 10 CFR 51.45, 10 CFR 51.60, 10 CFR 51.66

**Criteria:** The term frac-tagging operations refers to the use of radionuclides in liquid or solid forms (tracer material) that are chemically bonded to glass or resin beads and injected into a single well in a density-controlled solution during hydraulic fracturing operations. Applicants should develop, implement, and maintain safety programs for the use of radionuclides in liquid or solid forms during frac-tagging operations.

**Discussion:** Hydraulic fracturing (also known as fracking or frac operations) is a well-stimulation technique in which underground geologic formations are fractured by a hydraulically pressurized mixture made of (i) fracking fluid (gel, foam, or water); (ii) proppant (particles of crush-resistant materials such as high-purity quartz sand, known as frac sand, or man-made ceramics); and (iii) chemical constituents in additives. This high-pressure fluid mixture is injected into a wellbore to create fractures in the deep geologic formations through which oil and gas will flow more freely. When the hydraulic pressure is removed from the well, the proppants



hold the fractures open. Typically, licensed radioactive material with a half-life of 120 days or less (mixed with frac sand or chemically bonded to man-made ceramics) is added to the fluid mixture and pumped downhole to allow a licensee to determine if a fracturing operation, which is designed to maximize oil and gas production, is complete as planned. After well stimulation, a gamma ray detection tool is lowered into the well to identify the extent of the fracturing. Man-made ceramic proppant used in frac-tagging operations have the capability of fixing the radioactive material (solid) within the matrix of the ceramic bead or on the surface of the bead. The bead containing the radioactive material is nonwater soluble and nonacid soluble. Licensees using man-made or ceramic beads should compare the crush strength of the ceramic beads against the depth that the beads are going to be injected during frac-tagging operations. The probability of beads being crushed increases after exceeding their crush resistance limit, which could result in contamination of fluids within the well. For this reason, flowback on the well needs to be monitored to detect potential contamination of fluids.

**Response from Applicant:**

- A statement that: “We will not perform frac-tagging operations.”

**OR**

- A statement that: “We will perform frac-tagging operations and have submitted step-by-step operating and emergency procedures that include the following:
  - Receiving, controlling, and handling tracer material during well injections.
  - Handling, controlling and disposing of any unused tracer materials.
  - Securing, maintaining control, and posting of areas involved with frac-tagging operations using radioactive materials.
  - Containment and/or decontamination of a spill or “sandout” (or “fluid reversal”) involving tracer material during frac sand operations. The procedure includes, among other items, radiation surveys, licensee contact information, steps to be taken by the licensee and the client in the event that a “sandout” (or “fluid reversal”) occurs when the licensee has already left the client’s site, and steps to be taken by the licensee and the client to evaluate flowback or production wastes for the presence of tracer material.
  - Disposal of radioactive materials resulting from frac-tagging operations (such as a sandout, fluid reversal, or flowback) at (i) a licensed low level radioactive waste disposal facility; (ii) decay-in-storage using holding tanks and subsequent unrestricted release; or (iii) a request for alternate waste disposal under 10 CFR 20.2002, “Method for obtaining approval of proposed disposal procedures.” The procedure includes a description of who will be responsible for the disposal of radioactive materials resulting from frac-tagging operations occurring at client’s facilities, and the method for making a determination of the concentration of licensed material (picocuries/gram) in these operations.
  - Actions to be taken in the event of an explosion, leak and contamination event, and the incapacitation of a lone well logging supervisor.”

#### **8.10.14 Radioactive Collar and Subsidence or Depth Control Markers**

**Regulations:** 10 CFR 30.71, 10 CFR 39.47, 10 CFR 39.37

**Criteria:** Radioactive markers usually used as pipe collar markers include, for example, wires, tape, and nails. Applicants can use radioactive markers only where each individual marker contains quantities of licensed material not exceeding the quantities identified in 10 CFR 30.71, "Schedule B." See 10 CFR 39.47. Radioactive markers must be physically inventoried semi-annually as specified in 10 CFR 39.37.

**Discussion:** Operating and emergency procedures should include a commitment that radioactive markers can be used only where each individual marker contains quantities of licensed material not exceeding the quantities identified in 10 CFR 30.71. However, licensees are not restricted to using only one marker, and may use multiple markers in each pipe joint, provided each individual marker (e.g., wires, tape, nails) is not greater than the quantities identified in 10 CFR 30.71. Additionally, provisions must be included in the operating and emergency procedures to ensure that radioactive markers undergo physical inventories semi-annually, as specified in 10 CFR 39.37.

**Note:** Subsidence or depth control markers that use quantities greater than those authorized by 10 CFR 39.47, "Radioactive markers," must be approved through an exemption request under 10 CFR 39.91.

#### **Response from Applicant:**

A statement that: "We will only use radioactive markers where each individual marker contains only quantities of licensed material not exceeding the exempt quantities identified in 10 CFR 30.71, Schedule B."

#### **8.10.15 Neutron Accelerators Using Licensed Material**

**Regulations:** 10 CFR 20.1001(b), 10 CFR 20.1301, 10 CFR 20.1302, 10 CFR 20.1601, 10 CFR 20.1602, 10 CFR 39.55, 10 CFR 39.63

**Criteria:** Applicants authorized to use a neutron generator (particle accelerator) containing a tritium source should include operating and emergency procedures for the proper handling and use of the accelerator targets or tubes containing radioactive materials. Because the neutron radiation produced from particle accelerators containing byproduct materials is categorized as machine-produced radiation, the radiation being emitted from a neutron accelerator is subject to individual State's, not NRC, regulatory authority. However, the dose received by an individual from machine-produced radiation is additive to the dose received from NRC-regulated materials when assessing total occupational dose to an individual in accordance with 10 CFR 20.1001(b). Therefore, the potential dose that an occupational worker can receive from this type of activity is regulated by the NRC. Applicants proposing to use neutron generators in Agreement State jurisdiction should contact the appropriate State for additional information.

**Discussion:** Neutron generators (accelerators) are used in the well logging industry as a source of neutrons. Most accelerators use tritium gas sealed in a glass tube or plated on a target or disc. Neutron generator target sources, in most instances, contain less than 110 GBq [30 Ci] of tritium.

Neutron generator tubes are not required to satisfy all the requirements for well logging sealed sources. See 10 CFR 39.55. As a result, neutron generator tubes containing less than 1,110 GBq [30 Ci] of tritium are exempt from:

- abandonment requirements
- leak test requirements
- the performance requirements of sealed sources used in well logging operations

Neutron generator tubes (i) containing greater than 1,110 GBq [30 Ci] of tritium or (ii) that are used in a well without surface casing to protect fresh water aquifers, are subject to the requirements of 10 CFR Part 39, except 39.41.

Neutron accelerators (particle accelerator) generate about 14 MeV neutrons when high voltage is applied to the generator. In addition, short-lived activation products are formed when the neutrons being produced by the accelerator interact with the metallic components of the generator. In accordance with 10 CFR 39.63, applicants using a neutron generator must include operating and emergency procedures that address prevention of exposure to radiation emitted from short-lived neutron activation products and procedures that address contamination. Specifically, the procedures should:

- state that the high voltage being applied to the generator must be turned off at a certain depth before the generator is brought to the surface, and that the generator must remain downhole for a specific amount of time, as specified by the manufacturer, to allow for the decay of short-lived activated products
- instruct individuals in the handling of contamination resulting from the routine use, initial installation, replacement, or accidental damage of the targets or glass tubes
- state the methods and occasions for conducting radiation surveys

Applicants requesting to use neutron generators must state if the generators are going to be calibrated by an NRC or Agreement State licensee who is specifically authorized to conduct this type of activity. If the applicant desires to conduct calibration of neutron generators, procedures describing facilities, specialized equipment and tools, and personnel training specific for this type of activity must be submitted for NRC review.

Applicants should refer to 10 CFR 39.55, "Tritium neutron generator target sources," for applicable requirements for using neutron generators.

**Response from Applicant:**

- A statement that: "We will not use neutron generators (accelerators) in our well logging operations."

**OR**

- A statement that: "We will use neutron generators (accelerators) in accordance with the guidance in Section 8.10.15 of NUREG-1556, Volume 14, Revision 1, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses" and will provide step-by-step operating and emergency procedures for NRC review. Calibration of neutron generators will be

performed by an NRC or Agreement State licensee that is specifically authorized to conduct this activity.”

**OR**

- A statement that: “We will use neutron generators (accelerators) in accordance with the guidance in Section 8.10.15 of NUREG–1556, Volume 14, Revision 1, “Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses” and will provide step-by-step operating and emergency procedures for NRC review. We will perform calibration of neutron generators and will provide step-by-step procedures for conducting calibration of neutron generators for NRC review.”

### **8.10.16 Depleted Uranium Sinker Bars**

**Regulations:** 10 CFR 39.37, 10 CFR 39.43(b), 10 CFR 39.49, 10 CFR 39.67, 10 CFR 40.25, 10 CFR 40.51

**Criteria:** Depleted uranium sinker bars may be distributed under either a general license or a specific license. Most well logging licensees acquire depleted uranium sinker bars under the provisions of 10 CFR 40.25, “General license for use of certain industrial products or devices,” and then file Form NRC 244, “Registration Certificate—Use of Depleted Uranium under General License.” Specifically licensed material must be physically inventoried and visually inspected for labeling and physical damage in accordance with 10 CFR 39.37 and 10 CFR 39.43.

#### **Discussion: Depleted Uranium Sinker Bars Authorized Under *General License*:**

Certain devices are authorized by the NRC for distribution to persons who are generally licensed for the use of certain industrial products or devices containing depleted uranium for the purpose of providing a concentrated mass in a small volume. Uranium sinker bar devices can be acquired by the users under the provisions of 10 CFR 40.25 without obtaining a specific license from the NRC; however, when acquired under the provisions of a general license, individuals must file Form NRC 244. Generally licensed sinker bars are exempt from 10 CFR Parts 19, 20, and 21. Regulatory requirements that apply to such devices possessed under a general license are stated in 10 CFR 40.25. While operating under the provision of a general license for these types of devices, general licensees must

- not introduce uranium sinker bars into a chemical, physical, or metallurgical treatment or process, except as a treatment for restoration of any plating or covering
- not abandon uranium sinker bars
- transfer or dispose of them only to individuals or entities authorized under the provisions of 10 CFR 40.51, “Transfer of source or byproduct material”
- notify NRC within 30 days of the transfer of depleted uranium sinker bars

#### **Depleted Uranium Sinker Bars Authorized Under a *Specific License*:**

While operating under the provision of a specific license for these types of devices, specific licensees must, in accordance with 10 CFR 39.37, 10 CFR 39.43, and 10 CFR 39.49:

- physically inventory the uranium sinker bars at intervals not to exceed 6 months
- visually inspect before use for proper labeling, “CAUTION—RADIOACTIVE DEPLETED URANIUM” and “NOTIFY CIVIL AUTHORITIES (or COMPANY NAME) IF FOUND,” and at intervals not to exceed 6 months
- visually inspect for physical damage and conduct routine maintenance at intervals not to exceed 6 months
- remove bars from use if found defective, until repaired or disposed
- record date, equipment, inspection and maintenance performed, defects found, and actions taken to correct the defect, if defects are found (records must be retained for 3 years)

**Response from Applicant:**

- A statement that: “We will not use depleted uranium sinker bars in our well logging operations.”

**OR**

- A statement that: “Depleted uranium sinker bars will be obtained under the provisions of a general license per 10 CFR 40.51, “Transfer of source or byproduct material” and registration form NRC Form 244 will be filed, as required.”

**OR**

- A statement that: “Depleted uranium sinker bars will be obtained under a specific license.” Include the specific number of kilograms of material being requested.

**AND**

- A statement that: “Uranium sinker bars will be possessed and inspected as specified in Section 8.10.16 in NUREG–1556, Volume 14, Revision 1, “Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses.”

**8.10.17 Security Program for Category 1 and Category 2 Radioactive Materials**

**Regulations:** 10 CFR Part 37

**Criteria:** Licensees must ensure the security of Category 1 and Category 2 radioactive material.

**Note:** The regulations in 10 CFR Part 37 apply to licensees that possess an aggregated Category 1 or Category 2 quantity of radioactive material. The specific radionuclides subject to 10 CFR Part 37 requirements are listed in Table 1 of Appendix A to 10 CFR Part 37.

**Discussion:**

Requirements in 10 CFR Part 37, “Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material”

In accordance with 10 CFR Part 37, licensees that possess aggregated Category 1 or Category 2 quantities of radioactive material must establish, implement, and maintain an access authorization program (Subpart B) and a security program (Subpart C) to ensure physical protection of the radioactive material.

Table 1 of Appendix A, “Category 1 and Category 2 Radioactive Materials,” to 10 CFR Part 37, lists Category 1 and Category 2 threshold quantities of radioactive material. The applicant should refer to this table to determine whether its proposed activities would be subject to the 10 CFR Part 37 requirements.

Before giving individuals unescorted access to Category 1 or Category 2 quantities of radioactive material (as defined in 10 CFR 37.5), licensees must conduct background investigations of these individuals, to determine that they are trustworthy and reliable, in accordance with 10 CFR 37.25.

In accordance with 10 CFR 37.41(b), licensees must establish a security program designed to monitor and, without delay, detect, assess, and respond to any actual or attempted unauthorized access to Category 1 or Category 2 quantities of radioactive material.

Per 10 CFR Part 37, Subpart D, licensees must provide for physical protection of Category 1 or Category 2 quantities of radioactive materials in transit. These requirements apply to licensees delivering such material to a carrier for transport, as well as cases in which licensees are transporting such material. Please note that the Subpart D requirements applicable to the transport of Category 1 quantities of radioactive material are more stringent than those applicable to Category 2 quantities.

Applicants and licensees are required to implement the 10 CFR Part 37 security requirements before they take possession of an aggregated Category 1 or Category 2 quantity of radioactive material.

Any licensee that has not previously been made subject to the provisions of 10 CFR Part 37, Subpart C shall notify the NRC regional office specified in 10 CFR 30.6 in writing at least 90 days before aggregating radioactive material to a quantity that equals or exceeds the Category 2 threshold. Pursuant to 10 CFR 37.43(b), as part of the security program, the licensee must develop and maintain written procedures that document how the requirements of Subpart C will be met. These written procedures may be subject to NRC review and inspection.

For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG–2155, “Implementation Guidance for 10 CFR Part 37, “Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material.”” Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG–2166, “Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material.”

**Response from Applicant:** No response is required from an applicant or licensee. Compliance with access authorization and security program requirements may be reviewed during NRC inspections.

## **8.11 Item 11: Waste Management**

10 CFR 20.1301, 10 CFR 20.1904, 10 CFR 20.2001, 10 CFR 20.2002, 10 CFR 20.2003, 10 CFR 20.2004, 10 CFR 20.2005, 10 CFR 20.2006, 10 CFR 20.2007, 10 CFR 20.2108, 10 CFR Part 20, Appendices B and G, 10 CFR 30.41, 10 CFR 30.51, 10 CFR 37.11(c), 10 CFR 40.51, 10 CFR 40.61, 10 CFR 70.42, 10 CFR 70.51

**Criteria:** Radioactive waste must be disposed of in accordance with regulatory requirements and license conditions or transferred to an authorized recipient. Authorized recipients are the original manufacturer, distributor, a commercial firm licensed by the NRC or an Agreement State to accept radioactive waste from other persons, or in the case of sealed sources, transferred to another specific licensee authorized to possess the licensed material (i.e., a transferee's license specifically authorizes the same radionuclide, chemical or physical form, and in most instances, the same use). Records of transfer and waste disposal must be maintained. See 10 CFR 20.2108, 10 CFR 30.51, 10 CFR 40.61, and 10 CFR 70.51.

Before transferring any radioactive material, including radioactive waste, a licensee must verify that the recipient is properly authorized to receive the specific type of material using one of the methods described in 10 CFR 30.41, "Transfer of byproduct material." In addition, all packages containing radioactive waste must be prepared and shipped in accordance with NRC and DOT regulations.

**Discussion:** Radioactive waste generated when conducting licensed activities may include: sealed sources, used or unused radioactive tracer materials, and unusable items contaminated with radioactive tracer materials (e.g., absorbent paper, gloves, and bottles).

Unsealed radioactive waste must be stored in strong, tight containers (e.g., thick plastic bags, boxes, barrels) to prevent the spread of contamination, and sealed sources should be stored in their corresponding transport containers or in a downhole storage bunker until their disposal. The integrity of the radioactive waste containers must be assured, and the containers, while in storage, must have the appropriate warning label specified in 10 CFR 20.1904. Radioactive waste must be secured against unauthorized access or removal. See 10 CFR 20.1801. Depending on the radioactive half-life of the material, NRC regulations require disposal of well logging sealed sources and tracer materials generated at licensees' facilities by one or more of the following methods:

### **Tracer Material with a Half-Life of 120 Days or Less:**

- decay-in-storage (DIS)
- transfer to an authorized recipient
- release into sanitary sewerage
- release in effluents to unrestricted areas, other than into sanitary sewerage
- incineration
- any alternate method specifically approved by the NRC

### **Tracer Material with a Half-Life Greater Than 120 Days:**

- transfer to an authorized recipient
- release into sanitary sewerage
- release in effluents to unrestricted areas, other than into sanitary sewerage

- incineration
- extended interim storage
- any alternate method specifically approved by the NRC

**Sealed Sources with a Half-Life of 120 Days or Less:**

- transfer to an authorized recipient
- DIS
- any alternate method specifically approved by the NRC

**Sealed Sources with a Half-Life Greater Than 120 Days:**

- transfer to an authorized recipient
- any alternate method specifically approved by the NRC

Licensees may choose any one or more of these methods to dispose of their radioactive waste. The NRC's experience indicates that most well logging tracers are stored or disposed of by a combination of methods, transfer to an authorized recipient and DIS being the most frequently used. Applicants requesting authorization to dispose of radioactive tracer waste by incineration should first refer to model waste management procedures in NUREG-1556, Volume 11 and contact the appropriate regional office of the NRC for guidance. Applicants should note that compliance with NRC regulations does not relieve them of their responsibility to comply with any other applicable Federal, State, or local regulations. Some types of radioactive waste used in tracer operations and in "labeled frac sands" may include additional chemical hazards. This type of waste is designated as "mixed waste" and requires special handling and disposal.

Applicants should describe in detail their program for management and disposal of radioactive waste, including mixed waste, if applicable. A waste management program should include procedures for handling waste; specify the requirements for safe and secure storage; and describe how to characterize, minimize, and dispose of all types of radioactive waste, including, where applicable, mixed waste. Appropriate training should be provided to waste handlers. Regulations 10 CFR 30.51, 10 CFR 40.51, and 10 CFR 70.51 require, in part, that licensees maintain all appropriate records of disposal of radioactive waste. The U.S. Environmental Protection Agency issued guidance for developing a comprehensive program to reduce hazardous waste that, in many instances, may also include radioactive waste as a contaminant. The NRC transmitted these guidelines to licensees in IN 94-23, "Guidance to Hazardous, Radioactive, and Mixed Waste Generators on the Elements of a Waste Minimization Program," dated March 1994. NRC Regulatory Issue Summary 2011-09, "Available Resources Associated with Extended Storage of Low-Level Radioactive Waste," also contains useful information. Applications should include, where appropriate for the types of waste involved, provisions for monitoring and segregating waste materials (e.g., radioactive from nonradioactive, short from long half-life, liquid from solid waste).

**Disposal by Decay-in-Storage**

The NRC has concluded that materials with half-lives of less than or equal to 120 days are appropriate for DIS. The holding time of the waste should be based on the radionuclide(s), half-life, and the activity present when the waste was placed into storage. Such waste may be disposed of as ordinary trash if radiation surveys of the waste indicate that radiation levels are indistinguishable from background. The surveys should be performed with an appropriate radiation detection meter set on its most sensitive scale in a low background area and without



any interposed shielding. In accordance with 10 CFR 20.1904(b), all radiation labels must be defaced or removed from containers and packages prior to disposal as ordinary trash. If the decayed waste is compacted, all labels that are visible in the compacted mass must also be defaced or removed. Applicants must maintain accurate records of such disposals.

Appendix N of this NUREG provides a model procedure for DIS.

Applicants should assure that adequate space and facilities are available for the storage of such waste. Licensees can minimize the need for storage space if the waste is segregated according to half-life. Waste containing radionuclides with half-lives 120 days or less may be segregated and stored in a container and allowed to decay based on the longest-lived radionuclide in the container and the activity present in the waste. Waste management procedures should include (i) methods of segregating waste by half-lives of 120 days or less from those with half-lives greater than 120 days; (ii) methods of surveying waste prior to disposal to confirm that waste above background levels is not inadvertently released; and (iii) maintenance of records of disposal. Disposal records for DIS should include the date when the waste was put in storage for decay, date of disposal, and results of the final radiation survey taken prior to disposal to ordinary trash. For reference, a model procedure for disposal of radioactive waste by DIS, which incorporates the above guidelines, is provided in Appendix N of this NUREG.

### **Release into Sanitary Sewerage**

Licensees considering disposal by release to the sanitary sewerage system must comply with the requirements of 10 CFR 20.2003. 10 CFR 20.2003, "Disposal by release into sanitary sewerage," authorizes disposal of radioactive waste by release into sanitary sewerage if each of the following conditions is met:

- Material is readily soluble (or is easily dispersible biological material) in water.
- Quantity of licensed material or other radioactive material that the licensee releases into the sewer in one month divided by the average monthly volume of water released into the sewer does not exceed the concentration specified in 10 CFR Part 20, Appendix B, Table 3.
- If more than one radionuclide is released, use the sum of the ratios between the monthly discharge of a radionuclide and the corresponding limit in 10 CFR Part 20, Appendix B, Table 3.
- The sum of such ratios for all of the radionuclides in a mixture may not exceed "1" (i.e., unity).
- Total quantity of licensed material and other radioactive material released into the sanitary sewerage system in a year does not exceed 185 GBq [5 Ci] of H-3, 37 GBq [1 Ci] of C-14, and 37 GBq [1 Ci] of all other radionuclides combined.

Licensees are responsible for demonstrating that licensed materials discharged into the sewerage system are indeed readily dispersible in water. NRC IN 94-07, "Solubility Criteria for Liquid Effluent Releases to Sanitary Sewerage under the Revised 10 CFR Part 20," dated January 1994, provides the criteria for evaluating solubility of liquid waste. Careful consideration should be given to the possibility of reconcentration of radionuclides that are released into the sewer. The NRC alerted licensees to the potentially significant problem of

reconcentration of radionuclides released to sanitary sewage systems in IN 84-94, "Reconcentration of Radionuclides Involving Discharges into Sanitary Sewage Systems Permitted under 10 CFR 20.303 (now 10 CFR 20.2003)," dated December 1984.

Applicants electing to use this type of disposal should provide procedures that will ensure that all releases of radioactive waste into the sanitary sewerage meet the criteria stated in 10 CFR 20.2003 and do not exceed the monthly and annual limits specified in regulations. Licensees are required to maintain accurate records of all releases of licensed material into the sanitary sewerage. A model program for disposal of radioactive waste via sanitary sewer is described in Appendix N of this NUREG.

If the licensee's facility maintains a private sewage treatment system, a septic system, or leach fields, the regulations of 10 CFR 20.2003 are not applicable for releases to these systems (see 10 CFR 20.1003, "Definitions," for the definition of "sanitary sewerage"). Applicants may make releases of liquids to private sewerage systems, septic systems, or leach fields as effluents released to unrestricted areas pursuant to 10 CFR 20.2001(a)(3) and 10 CFR 20.1302(b)(2)(i).

If liquid releases are made to a private sewage treatment system, septic system, or leach field, the sludges or other solids from these systems may become contaminated with radioactive material. Applicants should describe the monitoring planned for these systems in Item 10 of the NRC Form 313 application (see Appendix A of this NUREG). Contaminated sludges are required to be disposed of as radioactive waste using one of the methods described in this section. Applicants may obtain approval of alternative disposal methods through application to the Commission, as described in 10 CFR 20.2002, "Method for obtaining approval of proposed disposal procedures."

### **Transfer to an Authorized Recipient**

Licensees may transfer radioactive waste to an authorized recipient for disposal in accordance with 10 CFR 20.2001(a)(1). However, it is the licensee's responsibility to verify that the intended recipient is authorized to receive the radioactive waste prior to making any shipment. Waste generated at well logging and tracer facilities generally consists of low specific activity (LSA) material. The waste must be packaged in DOT-approved containers for shipment, and each container must identify the radionuclides and the amounts contained in the waste. Additionally, packages must comply with the requirements of the particular burial site's license and State requirements. Each shipment must comply with all applicable NRC and DOT requirements. In some cases, the waste handling contractor may provide additional guidance and requirements to licensees for packaging and transportation; however, the licensee is ultimately responsible for ensuring compliance with all applicable regulatory requirements.

The shipper must provide all information required by the NRC's Uniform Low-Level Radioactive Waste Manifest and transfer this recorded manifest information to the intended recipient. Each shipment manifest must include a certification by the waste generator. Each person involved in the transfer for disposal and disposal of waste, including waste generator, waste collector, waste processor, and disposal facility operator, must comply with the NRC's Uniform Low-Level Radioactive Waste Manifest and 10 CFR Part 20, Appendix G, "Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests."

## **Waste Volume Reduction**

Licensees should implement procedures to reduce the volume of radioactive waste for final disposal in an authorized low-level radioactive waste (LLW) disposal facility. These procedures include volume reduction by segregating, consolidating, compacting, or allowing certain waste to decay-in-storage. Waste compaction or other treatments can reduce the volume of radioactive waste, but such processes may pose additional radiological hazards (e.g., airborne radioactivity or increased radiation levels) to workers, members of the public, and the environment. The program should include adequate safety procedures to protect workers, members of the public, and the environment. Applicants must describe in detail waste volume reduction operations that could create a radiological hazard to licensee employees or the general public. Appendix N of this NUREG describes a model procedure for waste compaction.

## **Extended Interim Storage**

Licensees should exhaust all possible alternatives for disposal of radioactive waste and rely on onsite extended interim storage of radioactive waste only as a last resort. Disposal, rather than storage, enhances the protection of workers and the public. Licensees also may find it more economical to dispose of radioactive waste than to store it on site because as the available capacity decreases, the cost of disposal of radioactive waste may continue to increase. Other than DIS, LLW should be stored only when disposal capacity is unavailable and for no longer than necessary. NRC IN 90-09, "Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Materials Licensees," dated February 5, 1990, provides guidance to licensees for requesting an amendment to authorize extended interim storage of LLW. NRC Regulatory Issue Summary (RIS) 2008-12, "Considerations for Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Materials Licensees," dated May 9, 2008, updated this information. In addition, the NRC issued RIS 2011-09, "Available Resources Associated with Extended Storage of Low-Level Radioactive Waste," dated August 16, 2011, which refers to other helpful guidance documents.

## **Other Methods Specifically Approved by the NRC Pursuant to 10 CFR 20.2002**

Applicants may request alternate methods for the disposal of radioactive waste generated at their facilities. Such requests will be handled on a case-by-case basis and require that the applicant provide additional site-specific information. In most instances, requests for alternate methods of disposal must describe the types and quantities of waste containing licensed material, physical and chemical properties of the waste that may be important to making a radiological risk assessment, and the proposed manner and conditions of waste disposal in accordance with 10 CFR 20.2002. Additionally, the applicant must submit its analysis and evaluation of pertinent information specific to the affected environment, including the nature and location of other affected facilities, and provide an outline of its procedures to ensure that radiation doses are maintained ALARA and within regulatory limits.

**Note:** Guidance concerning alternate waste disposal procedures that involve multiple jurisdictions has been provided in the State and Tribal Communication Letter FSME-12-025, dated March 13, 2012, "Clarification of the Authorization for Alternative Disposal of Material Issued Under 10 CFR 20.2002 and Exemption Provisions in 10 CFR." (ADAMS Accession No. ML12065A038)

**Note:** Before licensed activities are transferred or assigned in accordance with 10 CFR 30.34(b), 10 CFR 40.46 or 10 CFR 70.36, if licensees are authorized to possess byproduct material with a half-life greater than 120 days in an unsealed form or special nuclear material, the licensees must, in accordance with 10 CFR 30.51(e), 10 CFR 40.61(e) or 10 CFR 70.51(b)(1) and (2), respectively, transfer the following records to the new licensee:

- records of disposal of licensed material made under
  - 10 CFR 20.2002, “Method for obtaining approval of proposed disposal procedures”
  - 10 CFR 20.2003, “Disposal by release into sanitary sewerage”
  - 10 CFR 20.2004, “Treatment or disposal by incineration”
  - 10 CFR 20.2005, “Disposal of specific wastes”
- records required by 20.2103(b)(4) of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment

Because of the difficulties and costs associated with disposal of sealed sources (e.g., sealed sources containing americium-241), applicants should preplan disposal. As part of the purchase agreement with the source supplier, applicants may want to consider including provisions for return of the sealed sources to the supplier at the end of their useful life.

In accordance with 10 CFR 37.11(c), a licensee that possesses radioactive waste that contains Category 1 or Category 2 quantities of radioactive material as defined in 10 CFR 37.5 is exempt from the requirements of 10 CFR Part 37, Subparts B, C, and D. However, any radioactive waste that contains discrete sources, ion-exchange resins, or activated material that weighs less than 2,000 kg [4,409 lbs] is not exempt from the requirements of 10 CFR Part 37. For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG-2155, "Implementation Guidance for 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material." Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG-2166, "Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material."

A licensee possessing radioactive waste that is exempt under 10 CFR 37.11(c) from the requirements of 10 CFR Part 37, Subparts B, C, and D must implement the following requirements to secure the radioactive waste:

- use continuous physical barriers that allow access to the radioactive waste only through established access control points;
- use a locked door or gate with monitored alarm at the access control point;
- assess and respond to each actual or attempted unauthorized access to determine whether an actual or attempted theft, sabotage, or diversion occurred; and
- immediately notify the LLEA and request an armed response from the LLEA upon determination that there was an actual or attempted theft, sabotage, or diversion of the radioactive waste that contains Category 1 or Category 2 quantities of radioactive material.

**Please note, under 10 CFR Part 37, security plans are not submitted to the NRC, but may be subject to review and inspection.**

**Response from Applicant:**

- A statement that: "We will use sealed and/or unsealed radioactive materials with a half-life greater than 120 days, and will transfer or dispose of the material and contaminated waste to a licensed entity authorized to receive the material."

**AND**

- A statement that: "We will use the model waste procedures published in Appendix N to NUREG-1556, Volume 14, Revision 1, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses" for disposing of radioactive materials and contaminated waste."

**OR**

- A statement that: "We will provide our procedures for waste collection, storage, and disposal by any of the authorized methods described in Section 8.11 of NUREG-1556, Volume 14, Revision 1, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses"."

**OR**

- If needed, the applicant should request authorization for extended interim storage of waste.

**OR**

- Provide proposed alternate waste disposal procedures for a method not described in Section 8.11 of this NUREG, following 10 CFR 20.2002, "Method for obtaining approval of proposed disposal procedures."

**References:** Search the NRC's public Web site at <https://www.nrc.gov> to obtain copies of

- IN 94-23, "Guidance to Hazardous, Radioactive, and Mixed Waste Generators on the Elements of a Waste Minimization Program," dated March 1994.
- IN 94-07, "Solubility Criteria for Liquid Effluent Releases to Sanitary Sewerage under the Revised 10 CFR Part 20," issued January 1994.
- IN 84-94, "Reconcentration of Radionuclides Involving Discharges into Sanitary Sewage Systems Permitted under 10 CFR 20.203 (now 10 CFR 20.2003)," issued December 1984.
- RIS 2004-17, Revision 1, "Revised Decay-In-Storage Provisions for the Storage of Radioactive Waste Containing Byproduct Material," dated September 2005.
- State and Tribal Communication Letter FSME-12-025, dated March 13, 2012, "Clarification of the Authorization for Alternative Disposal of Material Issued under 10 CFR 20.2002 and Exemption Provisions in 10 CFR" (ADAMS Accession No. ML12065A038)
- RIS 2016-11, "Requests to Dispose of Very Low-Level Radioactive Waste Pursuant to 10 CFR 20.2002," November 13, 2016.

## **8.12 Item 12: License Fees**

On NRC Form 313, enter the appropriate fee category from 10 CFR 170.31 and the amount of the fee enclosed with the application.

Direct all questions about the NRC's fees or completion of Item 12 of NRC Form 313 to the Office of the Chief Financial Officer at NRC Headquarters in Rockville, Maryland, 301-415-7554. Information about fees may also be obtained by calling NRC's toll free number, 800-368-5642, extension 415-7554. The e-mail address for fees questions is [Fees.Resource@nrc.gov](mailto:Fees.Resource@nrc.gov).

**Note:** Applicants who wish to perform field flood tracer studies should review 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions" (particularly 10 CFR 51.30, 51.60, and 51.66) for further information concerning the environmental information needed by the NRC to prepare an environmental assessment. Environmental assessments are full-cost recovery items under 10 CFR Part 170. Full cost will be determined based on the professional staff time expended multiplied by the appropriate professional hourly rate, as described in footnote e.3. to 10 CFR 170.31, "Schedule of fees for materials licenses and other regulatory services, including inspections, and import and export licenses."

### **8.13 Item 13: Certification**

A representative of the corporation or legal entity filing the application should sign and date NRC Form 313. The representative signing the application must be authorized to make binding commitments and to sign official documents on behalf of the applicant. As discussed previously in Chapter 3, "Management Responsibility," signing the application acknowledges management's commitment to and responsibility for the radiation protection program. The NRC will return all unsigned applications for proper signature.

#### **Notes:**

- It is a criminal offense to knowingly and willfully make a false statement or representation on applications or correspondence (18 U.S.C. 1001).
- When an application references commitments, those items will be incorporated into the license and therefore, will become binding and conditions to the license.





## 9 LICENSE AMENDMENTS AND RENEWALS

It is the licensee's obligation to keep the license current. If any of the information provided in the original application is to be modified or changed, the licensee must submit an application for a license amendment before the change takes place. The change is not in effect until the amendment has been issued. Also, to continue the license after its expiration date, the licensee must submit an application for a license renewal at least 30 days before the expiration date in Title 10 of the *Code of Federal Regulations* (10 CFR) [2.109(a), 30.36(a), 40.42(a), and 70.38(a)].

Applicants for license amendment or renewal should do the following:

- Use the most recent guidance in preparing an amendment or renewal request.
- Submit either a U.S. Nuclear Regulatory Commission (NRC) Form 313 or a letter requesting amendment or renewal.
- Provide the license number and docket number.
- For renewals, provide a complete and up-to-date application including all required program elements outlined in Appendix B of this NUREG. Training documentation for personnel currently listed on the license does not need to be submitted as part of the renewal application.

### 9.1 Timely Notification of Transfer of Control

**Regulation:** 10 CFR 30.34(b), 10 CFR 40.41(b), 10 CFR 40.46, 10 CFR 70.36

**Criteria:** Licensees must provide all supporting information and obtain the NRC's *prior, written consent* before transferring control of the license, also referred to as a "change of ownership" or "transferring the license."

**Discussion:** Transferring control may be the result of mergers, buyouts, or majority stock transfers. Although it is not the NRC's intent to interfere with the business decisions of licensees, it is necessary for licensees to obtain prior NRC written consent to ensure the following:

- Radioactive materials are possessed, used, or controlled only by persons who have valid NRC licenses or Agreement State licenses.
- Materials are properly handled and secured.
- Persons using these materials are capable, competent, and committed to implementing appropriate radiological controls.
- A clear chain of custody is established to identify who is responsible for disposition of records and licensed material.
- Public health and safety are not compromised by the use of such materials.
- Adequate financial assurance is provided for compliance with the applicable NRC

requirements, if required.

**Response from Applicant:** No response is required from an applicant for a new license. However, current licensees should refer to NUREG–1556, Volume 15, “Consolidated Guidance About Materials Licenses: Guidance About Changes of Control and About Bankruptcy Involving Byproduct, Source, and Special Nuclear Materials Licenses,” for more information about transfer of control (e.g., ownership.)

**Reference:** For further information, see Regulatory Issue Summary 2014-08, Revision 1, “Regulatory Requirements for Transfer of Control (Change of Ownership) of Specific Materials Licenses,” dated May 5, 2016. This RIS can be found on the NRC’s Generic Communications Web page under “Regulatory Issue Summaries” at <https://www.nrc.gov/reading-rm/doc-collections/gen-comm/>.

## 10 APPLICATIONS FOR EXEMPTIONS

**Regulations:** Title 10 of the *Code of Federal Regulations* (10 CFR) 19.31, 10 CFR 20.2301, 10 CFR 30.11, 10 CFR 39.91, 10 CFR 40.14, 10 CFR 70.17

**Criteria:** Licensees may request exemptions from U.S. Nuclear Regulatory Commission (NRC) regulations. The licensee must demonstrate that the exemption is authorized by law; will not endanger life, property, or the common defense and security, and is otherwise in the public interest. Licensees may also use existing specific exemptions outlined in the 10 CFR regulations if they meet the established criteria.

**Discussion:** Various sections of the NRC's regulations address requests for exemptions (e.g., 10 CFR 19.31, "Application for exemptions"; 10 CFR 20.2301, "Applications for exemptions"; 10 CFR 30.11, 10 CFR 40.14, 10 CFR 70.17, "Specific exemptions"; and 10 CFR 39.91 "Applications for exemptions"). These regulations state that the NRC may grant an exemption, acting on its own initiative or on an application from an interested person.

Exemptions are not intended to revise regulations or apply to large classes of licensees and are generally limited to unique situations. Requests for exemptions submitted to the NRC must identify the regulation for which the exemption is being requested and include a justification for the requested exemption.

Unless the NRC has granted an exemption in writing, licensees must comply with all applicable regulations.
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## 11 TERMINATION OF ACTIVITIES

**Regulations:** Title 10 of the *Code of Federal Regulations* (10 CFR) 10 CFR 20.1401, 10 CFR 20.1402, 10 CFR 20.1403, 10 CFR 20.1404, 10 CFR 20.1405, 10 CFR 20.1406, 10 CFR 20.2002, 10 CFR 20.2003, 10 CFR 20.2004, 10 CFR 20.2005, 10 CFR 30.34(b), 10 CFR 30.35(g), 10 CFR 30.36, 10 CFR 30.51, 10 CFR 40.36, 10 CFR 40.42, 10 CFR 40.61, 10 CFR 70.25(g), 10 CFR 70.36, 10 CFR 70.38, 10 CFR 70.51

**Criteria:** The licensee must do the following:

- Notify the U.S. Nuclear Regulatory Commission (NRC), in writing, within 60 days of the occurrence of any of the following:
  - Expiration of its license.
  - A decision to permanently cease principal activities<sup>1</sup> at the entire site.
  - For licensees subject to 10 CFR 30.36, a decision to permanently cease principal activities in any separate building or outdoor area that contains residual radioactivity such that the building or area is unsuitable for release according to NRC requirements.
  - For licensees subject to 10 CFR 40.42 or CFR 70.38, a decision to permanently cease principal activities in any separate building or outdoor area.
  - No principal activities under the license have been conducted for a period of 24 months.
  - No principal activities have been conducted for a period of 24 months in any separate building or outdoor area that contains residual radioactivity such that the building or outdoor area is unsuitable for release according to NRC requirements.
- Submit a decommissioning plan, if required by 10 CFR 30.36(g), 10 CFR 40.42(g) and/or 10 CFR 70.38(g).
- Conduct decommissioning, as required by 10 CFR 30.36(h) and (j), 10 CFR 40.42(h) and (j) and/or 10 CFR 70.38(h) and (j).
- Submit to the appropriate NRC regional office a completed NRC Form 314, "Certificate of Disposition of Materials" (or equivalent information), and information demonstrating that the premises are suitable for release for unrestricted use (e.g., results of final surveys and results of leak tests of sealed sources).

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<sup>1</sup>"Principal activities" are activities which are essential to achieving the purpose(s) for which the license was issued or amended. Storage during which no licensed material is accessed for use or disposal and activities incidental to decontamination or decommissioning are not principal activities.

- Before a license is terminated, send records important to decommissioning that are required by 10 CFR 30.35(g), 10 CFR 40.36(f) and/or 10 CFR 70.25(g) to the appropriate NRC regional office in accordance with 10 CFR 30.51(f), 10 CFR 40.61(f) and/or 10 CFR 70.51(a)(3), respectively.
- Before a license is terminated, send records of disposal of licensed material made under 10 CFR 20.2002, 10 CFR 20.2003, 20.2004, 20.2005, and the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment to the appropriate NRC regional office in accordance with 10 CFR 30.51(d), 10 CFR 40.61(d) and/or 10 CFR 70.51(a)(1) and (2), if authorized to possess byproduct material with a half-life greater than 120 days in an unsealed form and/or special nuclear material, respectively.

**Discussion:** To comply with the above criteria, before a licensee can decide whether it must notify the NRC under 10 CFR 30.36(d), 10 CFR 40.42(d) and/or 10 CFR 70.38(d), the licensee must determine whether residual radioactivity is present and, if so, whether the levels make the building or outdoor area unsuitable for release, according to NRC requirements. A licensee's determination that a facility is not contaminated is subject to verification by NRC inspection.

For guidance on the disposition of licensed material, see Section 8.11, "Waste Management" of this NUREG. For guidance on decommissioning records, see Section 8.5.3, "Financial Assurance and Recordkeeping for Decommissioning" of this NUREG.

The permanent cessation of principal activities<sup>1</sup> in an individual room or laboratory may require the licensee to notify the NRC if no other licensed activities are being performed in the building. The applicant should contact their NRC regional office for additional guidance beyond the scope of this document.

For information about requirements that apply to the timeliness of decommissioning, see Regulatory Issue Summary 2015-19, Rev. 1, "Decommissioning Timeliness Rule Implementation and Associated Regulatory Relief," dated September 27, 2016, which can be found on the NRC's Generic Communications Web page under "Regulatory Issue Summaries" at <https://www.nrc.gov/reading-rm/doc-collections/gen-comm/reg-issues/2015/>.

NUREG-1757, "Consolidated Decommissioning Guidance," contains the current regulatory guidance concerning decommissioning of facilities and termination of licenses. Licensees that have large facilities to decommission should review NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)." The computer code "DandD" offers an acceptable method for calculating screening values to demonstrate compliance with the unrestricted dose limits. Supplemental information on the implementation of the final rule on radiological criteria for license termination was published in the *Federal Register* (63 FR 64132) on November 18, 1998.

Supplemental information on the implementation of the final rule on radiological criteria for license termination also was published in the *Federal Register* on December 7, 1999, (64 FR 68395), which addresses screening values in soils for the most common radionuclides, and in the *Federal Register* on June 13, 2000, (65 FR 37186) for screening values for building surfaces and soils contaminated with radionuclides not addressed in the prior *Federal Register* notices.

**Response from Applicant:** The applicant is not required to submit a response to the NRC during the initial application. The licensee's obligations in this matter begin when the license expires or at the time the licensee ceases operations, whichever is earlier. These obligations are to undertake the necessary decommissioning activities, to submit NRC Form 314 or equivalent information, and to perform any other actions summarized in "Criteria" above.

**Reference:** NRC Form 314 is available at <https://www.nrc.gov/reading-rm/doc-collections/forms>.





**APPENDIX A**


**U.S. NUCLEAR REGULATORY COMMISSION FORM 313**



# U.S. Nuclear Regulatory Commission Form 313

Please use the most current version of this form, which may be found at:

<https://www.nrc.gov/reading-rm/doc-collections/forms/>

<b>NRC FORM 313</b> (10-2017) 10 CFR 30, 32, 33, 34, 35, 36, 37, 39, and 40	 <b>U.S. NUCLEAR REGULATORY COMMISSION</b>  <b>APPLICATION FOR                  MATERIALS LICENSE</b>	<b>APPROVED BY OMB: NO. 3150-0120</b> Estimated burden per response to comply with this mandatory collection request: 4.3 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0120), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.	<b>EXPIRES: 06/30/2019</b>		
<b>INSTRUCTIONS: SEE THE CURRENT VOLUMES OF THE NUREG-1556 TECHNICAL REPORT SERIES ("CONSOLIDATED GUIDANCE ABOUT MATERIALS LICENSES") FOR DETAILED INSTRUCTIONS FOR COMPLETING THIS FORM: <a href="http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/">http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/</a>. SEND TWO COPIES OF THE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.</b>					
<b>APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:</b> MATERIALS SAFETY LICENSING BRANCH DIVISION OF MATERIAL SAFETY, STATE, TRIBAL AND RULEMAKING PROGRAMS OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS U.S. NUCLEAR REGULATORY COMMISSION WASHINGTON, DC 20555-0001		<b>IF YOU ARE LOCATED IN:</b> ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO: MATERIALS LICENSING BRANCH U.S. NUCLEAR REGULATORY COMMISSION, REGION III 2443 WARRENVILLE ROAD, SUITE 210 LISLE, IL 60532-4352			
<b>ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:</b>  <b>IF YOU ARE LOCATED IN:</b> ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA,		<b>IF YOU ARE LOCATED IN:</b> ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MISSISSIPPI, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING,			
<b>SEND APPLICATIONS TO:</b> LICENSING ASSISTANCE TEAM DIVISION OF NUCLEAR MATERIALS SAFETY U.S. NUCLEAR REGULATORY COMMISSION, REGION I 2100 RENAISSANCE BOULEVARD, SUITE 100 KING OF PRUSSIA, PA 19406-2713		<b>SEND APPLICATIONS TO:</b> NUCLEAR MATERIALS LICENSING BRANCH U.S. NUCLEAR REGULATORY COMMISSION, REGION IV 1600 E. LAMAR BOULEVARD ARLINGTON, TX 76011-4511			
<b>PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTIONS.</b>					
1. THIS IS AN APPLICATION FOR (Check appropriate item) <input type="checkbox"/> A. NEW LICENSE <input type="checkbox"/> B. AMENDMENT TO LICENSE NUMBER _____ <input type="checkbox"/> C. RENEWAL OF LICENSE NUMBER _____		2. NAME AND MAILING ADDRESS OF APPLICANT (include zip code)			
3. ADDRESS WHERE LICENSED MATERIALS WILL BE USED OR POSSESSED		4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION  BUSINESS TELEPHONE NUMBER _____ BUSINESS CELLULAR TELEPHONE NUMBER _____  BUSINESS E-MAIL ADDRESS _____			
SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.					
5. RADIOACTIVE MATERIAL a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time		6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.			
8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.		7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.			
10. RADIATION SAFETY PROGRAM.		9. FACILITIES AND EQUIPMENT.			
12. LICENSE FEES (Fees required only for new applications, with few exceptions*) (See 10 CFR 170 and Section 170.31) *Amendments/Renewals that increase the scope of the existing license to a new or higher fee category will require a fee.		FEE CATEGORY <input type="text"/> AMOUNT ENCLOSED \$ <input type="text"/>			
<b>PER THE DEBT COLLECTION IMPROVEMENT ACT OF 1996 (PUBLIC LAW 104-134), YOU ARE REQUIRED TO PROVIDE YOUR TAXPAYER IDENTIFICATION NUMBER. PROVIDE THIS INFORMATION BY COMPLETING NRC FORM 531: <a href="https://www.nrc.gov/reading-rm/doc-collections/forms/nrc531info.html">https://www.nrc.gov/reading-rm/doc-collections/forms/nrc531info.html</a></b>					
13. CERTIFICATION. (Must be completed by applicant) THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.  THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 37, 39, AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF. WARNING - 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.					
CERTIFYING OFFICER -- TYPED/PRINTED NAME AND TITLE		SIGNATURE	DATE		
<b>FOR NRC USE ONLY</b>					
TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
			\$		
APPROVED BY				DATE	



**APPENDIX B**

**SUGGESTED FORMAT FOR PROVIDING INFORMATION REQUESTED IN  
ITEMS 5 THROUGH 11 OF NRC FORM 313**



**Suggested Format for Providing Information Requested In  
Items 5 through 11 of NRC Form 313**

Item No.	Title and Criteria	Yes	N/A	Description Attached
<b>5.</b>	<b>RADIOACTIVE MATERIAL</b>			
<b>5.1</b>	<b>Sealed Radioactive Material</b>			
	Complete the table on Pages B-3 and B-4			
	<b>AND</b>			
	Identify each radionuclide (element name and mass number) that will be used in each sealed source within the NRC's jurisdiction.	[ ]		[ ]
	Provide the manufacturer's or distributor's name and model number for each sealed source and, if applicable, device requested.	[ ]		[ ]
	Confirm that the activity per source and maximum activity in each device will not exceed the maximum activity listed on the approved certificate of registration issued by the NRC or by an Agreement State.	[ ]		[ ]
	Confirm that each sealed source, device, and source and device combination is registered as an approved sealed source or device by the NRC or an Agreement State, and will be possessed and used in accordance with the conditions specified in the registration certificate. Provide the SSD registration certificate number, if available.	[ ]		[ ]
	Identify each sealed source or energy compensation source by the manufacturer's name, model number, radionuclide (element name and mass number), maximum activity per source, and total activity requested.	[ ]		[ ]
	Identify any sealed sources or corresponding devices not used in well logging that contain byproduct, special nuclear, or source material, and specify the manufacturer's name, model number, and radionuclide (element name and mass number). Examples of such devices are calibration devices used for radiation survey instruments and pocket dosimeters, and sources used above ground for calibrating well logging tools.	[ ]		[ ]
	Identify the manufacturer's name and model number of depleted uranium sinker bars.	[ ]		[ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
5.	<b>RADIOACTIVE MATERIAL (Continued)</b>			
5.2	<p><b>Unsealed [Tracer] Radioactive Material (including both volatile and nonvolatile materials) (e.g., iodine-131, iodine-125, hydrogen-3)]</b></p> <ul style="list-style-type: none"> <li>• Provide element name with mass number, chemical and/or physical form, and maximum requested possession limit.</li> <li>• Provide information for volatile materials, if known, on the anticipated rate of volatility or dispersion. This information may be obtained from the tracer material vendor, supplier, or manufacturer.</li> <li>• Identify each chemical and/or physical form (e.g., liquid, gas, or labeled frac sands) requested for each type of tracer study.</li> <li>• Specify the maximum amount of each radionuclide tracer that will be used in each type of tracer study by its physical or chemical form. Identifying the forms as “any” is unacceptable.</li> <li>• Specify the maximum amount of each radionuclide tracer material that will be possessed at any one time. Possession limits should also include any materials that may be stored as waste.</li> <li>• Specify the purpose for which each radionuclide will be used.</li> <li>• Provide an Emergency Plan (if required)</li> <li>• Emergency plans are not routinely required for tracer materials with half-lives of less than 120 days and for quantities authorized in well logging and tracer licenses. See Regulatory Guide 3.67 for additional guidance on developing emergency plans.</li> <li>• Applicants should refer to 10 CFR 30.32(i) and 30.72, Schedule C, “Quantities of radioactive materials requiring consideration of the need for an emergency plan for responding to a release,” to determine the quantities of radioactive material requiring an emergency plan for responding to a release of radioactive materials. In addition, 30.32(i) provides the information required to develop an Emergency Plan.</li> </ul>	[]	[]	[]
		[]	[]	[]
		[]	[]	[]
		[]	[]	[]
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Well Logging Sealed Sources						
Radionuclide	Manufacturer/ Model No.			Maximum activity per source and total activity requested (mCi or Ci)		
Neutron Generators						
Radionuclide	Manufacturer/ Model No.			Maximum activity per source and total activity requested (mCi or Ci)		
Energy Compensation Sources						
Radionuclide	Manufacturer/ Model No.			Maximum activity per source and total activity requested (mCi or Ci)		
Unsealed Tracer Materials						
Radionuclide	Chemical or Physical Form			Purpose	Maximum Per Study (mCi)	Maximum Amount Requested(mCi)
	<input type="checkbox"/> Gas	<input type="checkbox"/> Liquid	<input type="checkbox"/> Labeled Frac Sands			
	<input type="checkbox"/> Gas	<input type="checkbox"/> Liquid	<input type="checkbox"/> Labeled Frac Sands			
	<input type="checkbox"/> Gas	<input type="checkbox"/> Liquid	<input type="checkbox"/> Labeled Frac Sands			
Note: Indicate the rate of volatility or dispersion for each unsealed tracer material.						

<b>Depleted Uranium</b>		
<b>Radionuclide</b>	<b>Manufacturer/ Model No.</b>	<b>Kilograms Requested</b>
Depleted Uranium (DU)		
<b>Sealed Sources Not Used in Well Logging Operations</b>		
<b>Radionuclide</b>	<b>Manufacturer/ Model No.</b>	<b>Maximum activity per source and total activity requested (mCi or Ci)</b>

Item No.	Title and Criteria	Yes	N/A	Description Attached
<p><b>5.</b></p> <p><b>5.3</b></p>	<p><b>RADIOACTIVE MATERIAL (Continued)</b></p> <p><b>Financial Assurance and Recordkeeping for Decommissioning</b></p> <ul style="list-style-type: none"> <li>• Pursuant to 10 CFR 30.35(g) and 10 CFR 70.25(g) and 10 CFR 70.51(b)(3), as appropriate, we will maintain records important to decommissioning and will transfer these records to an NRC or Agreement State licensee before licensed activities are transferred or assigned, in accordance with 10 CFR 30.34(b) and 10 CFR 70.36, as appropriate. Furthermore, pursuant to 10 CFR 30.51(f) and 10 CFR 70.51(a)(3), as appropriate, we will forward the records required by 10 CFR 30.35(g) and 10 CFR 70.25(g), as appropriate, to the appropriate NRC regional office before the license is terminated.</li> </ul> <p style="text-align: center;"><b>AND</b></p> <ul style="list-style-type: none"> <li>• If financial assurance or a decommissioning funding plan is required, we will submit the required documents following the guidance described in NUREG-1757, Volume 3.</li> </ul>	<p>[ ]</p>	<p>[ ]</p>	<p>[ ]</p>
<p><b>6.</b></p>	<p><b>PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED</b></p> <ul style="list-style-type: none"> <li>• For each sealed source and radionuclide requested in the application, state the purpose for the licensed material using the following list: <ul style="list-style-type: none"> <li>— Oil and gas well logging</li> <li>— Mineral well logging</li> <li>— Geophysical well logging</li> <li>— Tracer studies in single wells</li> <li>— Field flood or enhanced recovery studies in multiple wells</li> </ul> </li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>• Specify the purposes for which the sources and device(s) will be used other than those included in the manufacturer's recommendations, and as specified on the SSD registration certificate.</li> </ul> <p style="text-align: center;"><b>AND</b></p> <ul style="list-style-type: none"> <li>• If applicable, provide a statement that, "We plan to perform the following activities in <i>fresh water</i> aquifers: <ul style="list-style-type: none"> <li>— Tracer studies</li> <li>— Well logging using sealed sources</li> <li>— Well logging using neutron generator"</li> </ul> </li> </ul>	<p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p>	<p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p>	<p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p>

Item No.	Title and Criteria	Yes	N/A	Description Attached
7.	<p><b>INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE</b></p> <p><b>Radiation Safety Officer (RSO)</b></p> <ul style="list-style-type: none"> <li>The name of the proposed RSO who will be responsible for ensuring that the licensee's radiation protection program is implemented in accordance with approved procedures.</li> </ul> <p>Name: _____</p> <p style="text-align: center;"><b>AND</b></p> <ul style="list-style-type: none"> <li>Demonstrate that the RSO has sufficient independence and direct communication with responsible management officials by providing a copy of an organizational chart by position, demonstrating day-to-day oversight of the radiation safety activities.</li> </ul> <p style="text-align: center;"><b>AND</b></p> <ul style="list-style-type: none"> <li>Provide documentation demonstrating that the proposed RSO is qualified by training and experience (e.g., certificate of completion of a well logging RSO or authorized user's course or an equivalent course that meets the logging supervisor criteria specified in Appendix F of this NUREG).</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>Provide documentation demonstrating that the proposed RSO is qualified by training and experience (e.g., Board Certification by the American Board of Health Physicists; completion of a bachelor's or master's degree in the sciences with at least one year of experience in the conduct of a radiation safety program of comparable size and scope; or formal training in the establishment and maintenance of a radiation protection program)</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>Provide alternative information demonstrating that the proposed RSO is qualified by training and experience (e.g., listed by name as an authorized user or the RSO on an NRC or Agreement State license that requires a radiation safety program of comparable size and scope).</li> </ul>	<p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p>	<p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p>	<p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p>
8.	<p><b>TRAINING FOR LOGGING SUPERVISORS AND LOGGING ASSISTANTS</b></p> <ul style="list-style-type: none"> <li>Submit the training program to be given to new logging supervisors and logging assistants.</li> <li>Provide a copy of a typical examination and the correct answers to the examination questions. Indicate the passing grade.</li> </ul>			<p>[ ]</p> <p>[ ]</p>

Item No.	Title and Criteria	Yes	N/A	Description Attached
8.	<p><b>TRAINING FOR LOGGING SUPERVISORS AND LOGGING ASSISTANTS (Continued)</b></p> <ul style="list-style-type: none"> <li>• Specify the qualifications of the instructors for radiation safety principles and describe their experience with well logging activities. If training will be conducted by someone outside the applicant's organization, identify the course by title, provide the name, address, and telephone number of the company providing the training, and provide a course outline (if available).</li> <li>• Describe the field (practical) examination that will be given to prospective logging supervisors and logging assistants.</li> <li>• Describe the annual refresher training program, including topics to be covered and how the training will be conducted.</li> <li>• Submit a description of the program for annual safety reviews of the job performance of each well logging supervisor, as described in 10 CFR 39.13(d).</li> </ul>			<p style="text-align: center;">[ ]</p> <p style="text-align: center;">[ ]</p> <p style="text-align: center;">[ ]</p> <p style="text-align: center;">[ ]</p>
9.	<p><b>FACILITIES AND EQUIPMENT</b></p> <ul style="list-style-type: none"> <li>• Submit a diagram, drawing, or sketch of the proposed facility, identifying areas where radioactive materials, including radioactive wastes, will be used or stored. <ul style="list-style-type: none"> <li>— Drawings should show, where applicable, adjacent buildings, boundary lines, security fences, and lockable storage areas.</li> <li>— Illustrate area(s) where explosive, flammable, or other hazardous materials may be stored.</li> <li>— Drawings should also show the relationship and distance between restricted areas and adjacent unrestricted areas.</li> <li>— Drawings should specify shielding materials (e.g., concrete, lead) and means for securing radioactive materials from unauthorized removal.</li> </ul> </li> <li>• Submit a drawing or sketch of the proposed tracer material storage facilities, including rooms, buildings, below ground bunker storage areas, or containers used for storage of both tracer and tracer waste materials, if appropriate. Specify the types and amount of shielding materials (e.g., concrete, lead) and means for securing tracer materials from unauthorized removal.</li> <li>• Describe items such as protective clothing (e.g., rubber gloves, coveralls, respirators, and face shields), auxiliary shielding, absorbent materials, injection equipment, secondary containers for waste water storage for decontamination purposes, and plastic bags for storing contaminated items, which will be available at well sites when using tracer materials.</li> </ul>		<p style="text-align: center;">[ ]</p> <p style="text-align: center;">[ ]</p> <p style="text-align: center;">[ ]</p> <p style="text-align: center;">[ ]</p> <p style="text-align: center;">[ ]</p> <p style="text-align: center;">[ ]</p>	<p style="text-align: center;">[ ]</p> <p style="text-align: center;">[ ]</p> <p style="text-align: center;">[ ]</p> <p style="text-align: center;">[ ]</p> <p style="text-align: center;">[ ]</p>

Item No.	Title and Criteria	Yes	N/A	Description Attached
9.	<p><b>FACILITIES AND EQUIPMENT (Continued)</b></p> <ul style="list-style-type: none"> <li>• Describe proposed laundry facilities, if applicable, used for contaminated protective clothing. Specify how the contaminated waste water from the laundry machines or sinks is disposed. Operating and emergency procedures should address decontamination of the laundry area and equipment.</li> <li>• Describe proposed decontamination facilities for trucks, tracer injection tools, or other equipment contaminated by tracer materials, if applicable. Specify how the contaminated waste water for these decontamination facilities is disposed. Operating and emergency procedures should address decontamination of these types of equipment and facilities.</li> <li>• Describe, if applicable, equipment for “repackaging” gaseous, volatile, or finely divided tracer material. Most tracer users do not repackage materials and acquire their injections in precalibrated amounts or “ready-to-use” forms. However, should an applicant request the ability to repackage tracer, volatile, or finely divided material, consider the following equipment when repackaging tracer materials: sinks, trays with absorbent material, glove boxes, fume hoods with charcoal filtration, filtered exhaust, special handling equipment including special tools, rubber gloves, etc.</li> <li>• State the physical location(s) where the NRC regulatory required records will be stored and available for review during NRC inspections.</li> </ul>		<input type="checkbox"/>   <input type="checkbox"/>   <input type="checkbox"/>	<input type="checkbox"/>    <input type="checkbox"/>
10.	<p><b>RADIATION SAFETY PROGRAM</b></p> <p>The applicant is required to establish and submit its radiation protection program. The format used for providing information should be developed by the applicant. No specific format is required by the NRC for submitting a radiation safety program.</p> <p>The radiation safety program should include each of the following items:</p> <ul style="list-style-type: none"> <li>• steps to keep radiation exposures ALARA</li> <li>• description of equipment and facilities adequate to protect personnel, the public, and the environment</li> <li>• commitment that licensed activities will be conducted by individuals qualified by training and experience</li> <li>• written operating and emergency procedures</li> <li>• program for the annual inspection of the job performance of well logging personnel</li> <li>• description of organization structure and individuals responsible for ensuring implementation of radiation safety program</li> <li>• records management</li> </ul>			<input type="checkbox"/>

Item No.	Title and Criteria	Yes	N/A	Description Attached
10.	<p><b>RADIATION SAFETY PROGRAM (Continued)</b></p> <ul style="list-style-type: none"> <li>• methods or procedures for preventing the release of contaminated material, equipment, or vehicles to unrestricted use from tracer or field flood study operations</li> <li>• radiation safety procedures and the well logging supervisors' responsibilities unique to tracer and field flood study operations</li> <li>• tracer and field flood study equipment, techniques, and corresponding radiation safety procedures associated with the use of tracer materials</li> <li>• information on the appropriate handling, control/security, and disposal of any unused tracer materials</li> <li>• commitment that the licensee will implement a security, control, and accountability program for radioactive materials located at field stations and temporary job sites</li> </ul> <p>Appendix D of this NUREG includes a description of procedures for using tracer materials in field flood study operations.</p>			
10.1	<p><b>Well Owner or Operator Agreement</b></p> <ul style="list-style-type: none"> <li>• A statement that: "We will obtain a written agreement that meets the requirements specified in 10 CFR 39.15 prior to well logging: (i) with a sealed source; (ii) with a neutron generator exceeding 30 Ci; or (iii) with a neutron generator in a well without a surface casing, and will provide an example of the agreement to the NRC."</li> <li>• A statement that: "We will provide written instructions to the customer when conducting well logging using unsealed material that describes those subjects listed in the "Discussion" (unsealed material) portion of Section 8.10.1, "Well Owner or Operator Agreements" in NUREG-1556, Volume 14, Revision 1, "Consolidated Guidance about Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Licenses.""</li> </ul>	[]	[]	[]
		[]	[]	[]
10.2	<p><b>Radiation Safety Program Audit</b></p> <p>The applicant is not required to, and should not, submit its audit program to the NRC for review during the licensing phase. The licensee's program for auditing its radiation safety and security programs may be reviewed during inspections.</p>	Need Not Be Submitted With Application		

Item No.	Title and Criteria	Yes	N/A	Description Attached
<p><b>10. RADIATION SAFETY PROGRAM (Continued)</b></p> <p><b>10.3 Radiation Monitoring Instruments</b></p> <p>Provide one of the following</p> <ul style="list-style-type: none"> <li>• A description of the instrumentation (as described in the “Discussion” portion of Section 8.10.3, “Radiation Monitoring Instruments” of this NUREG) that will be used to perform required radiation surveys and a statement that: “We will use instruments that meet the radiation monitoring instrument specifications published in Appendix H of NUREG–1556, Volume 14, Revision 1, “Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses.” We reserve the right to upgrade our radiation survey instruments as necessary.”</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>• A description of the instrumentation (as described in the “Discussion” portion of Section 8.10.3, “Radiation Monitoring Instruments” of this NUREG) that will be used to perform required radiation surveys and a statement that, “We will use instruments that meet the radiation monitoring instrument specifications published in Appendix H of NUREG–1556, Volume 14, Revision 1 “Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses.” Additionally, we will implement the model radiation survey meter calibration program published in Appendix H of NUREG–1556, Volume 14, Revision 1. We reserve the right to upgrade our radiation survey instruments as necessary.”</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>• A description of alternative equipment and procedures for ensuring that appropriate radiation monitoring equipment will be used during licensed activities and that proper calibration and calibration frequency of radiation survey equipment will be performed. Further, the statement, “We reserve the right to upgrade our radiation survey instruments as necessary” should be added to the response.</li> </ul>		<p style="text-align: center;">[]</p> <p style="text-align: center;">[]</p> <p style="text-align: center;">[]</p>	<p style="text-align: center;">[]</p> <p style="text-align: center;">[]</p> <p style="text-align: center;">[]</p>	<p style="text-align: center;">[]</p> <p style="text-align: center;">[]</p> <p style="text-align: center;">[]</p>
<p><b>10.4 Material Receipt and Accountability</b></p> <ul style="list-style-type: none"> <li>• A statement that: “Physical inventories will be conducted and documented at intervals not to exceed 6 months, to account for all byproduct materials (sealed sources, tracer materials, and unused or waste materials) and depleted uranium received and possessed under the license.”</li> </ul>		<p style="text-align: center;">[]</p>		



Item No.	Title and Criteria	Yes	N/A	Description Attached
<p><b>10. RADIATION SAFETY PROGRAM (Continued)</b></p> <p><b>10.4 Material Receipt and Accountability (Continued)</b></p>	<p style="text-align: center;"><b>AND</b></p> <ul style="list-style-type: none"> <li>• A statement that: “We will develop, implement, and maintain procedures for ensuring accountability of licensed materials at all times.”</li> </ul> <p style="text-align: center;"><b>AND</b></p> <ul style="list-style-type: none"> <li>• If applicable, a statement that: “We will comply with the National Source Tracking System (NSTS) reporting requirement as described in 10 CFR 20.2207, ‘Reports of Transactions Involving Nationally Tracked Sources.’”</li> </ul>	<p style="text-align: center;">[]</p> <p style="text-align: center;">[]</p>	<p style="text-align: center;">[]</p>	
<p><b>10.5 Occupational Dosimetry</b></p>	<ul style="list-style-type: none"> <li>• A statement that: “Required personnel dosimeters (e.g., film badge, TLD, OSL) will be processed and evaluated by an NVLAP-accredited entity, will be exchanged at the required frequency, and will be assigned to and worn by well logging supervisors and logging assistants.”</li> </ul> <p style="text-align: center;"><b>AND</b></p> <ul style="list-style-type: none"> <li>• Provide a statement that “We will develop, maintain, and implement a bioassay program when using unsealed radioactive tracer materials as recommended in NRC Regulatory Guide 8.20, “Applications of Bioassay for Radioiodine,” 8.32, “Criteria for Establishing a Tritium Bioassay Program,” or other appropriate NRC Regulatory Guide.”</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>• In lieu of developing a bioassay program, provide a commitment that the applicant will contract with a vendor for bioassay services, and confirm that the vendor is licensed or otherwise authorized by the NRC or an Agreement State to provide required bioassay services.</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>• In lieu of developing a bioassay program, provide a commitment that the applicant will not allow any individual to use more than (i) 1.85 GBq [50 mCi] of iodine-131 at any one time or in any 5-day period at field stations or at temporary job sites, (ii) or more than 3.7 GBq [0.1 curie] of H-3 or (iii) more than 3700 GBq [100 Ci] of gaseous H-3.</li> </ul>	<p style="text-align: center;">[]</p> <p style="text-align: center;">[]</p> <p style="text-align: center;">[]</p> <p style="text-align: center;">[]</p>	<p style="text-align: center;">[]</p> <p style="text-align: center;">[]</p> <p style="text-align: center;">[]</p>	

Item No.	Title and Criteria	Yes	N/A	Description Attached
10. 10.6	<p><b>RADIATION SAFETY PROGRAM (Continued)</b></p> <p><b>Public Dose</b></p> <p>No response is required from the applicant in a license application, but compliance will be examined during inspection. During NRC inspections, licensees must be able to provide documentation, demonstrating by measurement or calculation, that the total effective dose equivalent to the individual member of the public likely to receive the highest dose from licensed operations is less than 1 mSv [100 mrem] in a year, and any unrestricted area does not exceed 0.02 mSv [2 mrem] in any 1 hour. See Appendix J of this NUREG for examples of methods to demonstrate compliance.</p>	Need Not Be Submitted With Application		
10.7	<p><b>Operating and Emergency Procedures</b></p> <p>Submit written operating and emergency procedures that address the important radiation safety aspects, as described in 10 CFR 39.63, "Operating and emergency procedures."</p> <p style="text-align: center;"><b>OR</b></p> <p>Provide an outline or summary of the operating and emergency procedures that include the important radiation safety aspects of the procedures.</p>	[ ]	[ ]	[ ]
10.8	<p><b>Leak Tests</b></p> <ul style="list-style-type: none"> <li>• A statement that: "Leak tests sample collection and analysis will be performed by an organization authorized by the NRC or an Agreement State to provide leak testing services to other licensees. Leak tests may be collected by the licensee, using a leak test kit supplier's instructions. Such leak test kits will be supplied by an organization authorized by the NRC or an Agreement State to provide leak testing services."</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>• A statement that: "Leak test sample collection and analysis will be done by the applicant." Provide the information in Appendix L of this NUREG supporting a request to perform leak test sample collection and sample analysis and either state that "The applicant will follow the model procedures in Appendix L of NUREG-1556, Volume 14, Revision 1, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Licenses", or submit alternative procedures.</li> </ul>	[ ]	[ ]	[ ]
10.9.1	<p><b>Maintenance Prior To Use</b></p> <ul style="list-style-type: none"> <li>• A statement that: "Before each use, visual inspections will be conducted and records maintained in accordance with 10 CFR 39.43(a), to ensure that well logging equipment is in good working condition and is labeled as required."</li> </ul>	[ ]	[ ]	

Item No.	Title and Criteria	Yes	N/A	Description Attached
10. 10.9.1	<b>RADIATION SAFETY PROGRAM (Continued)</b> <b>Maintenance Prior To Use (Continued)</b> <p style="text-align: center;"><b>AND</b></p> <ul style="list-style-type: none"> <li>Submit the procedure(s) for conducting visual inspections.</li> </ul>			[]
10.9.2	<b>Semiannual Visual Inspection and Routine Maintenance</b> <ul style="list-style-type: none"> <li>A statement that: "Semiannual visual inspections and routine maintenance will be conducted and records maintained in accordance with 10 CFR 39.43(b), to ensure that required labeling is legible and that no physical damage is visible."</li> </ul> <p style="text-align: center;"><b>AND</b></p> <ul style="list-style-type: none"> <li>Submit the procedure(s) for conducting semiannual visual inspections and routine maintenance.</li> </ul>	[]	[]	[]
10.9.3	<b>Maintenance Requiring Special Authorization</b> <ul style="list-style-type: none"> <li>A statement that: "Activities described in 10 CFR 39.43(c) and (d) will not be conducted unless written detailed procedures have been approved by the NRC."</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>Submit detailed procedures for any activities described in 10 CFR 39.43(c) and (d), including radiation safety precautions that individuals will be expected to follow when performing these tasks and the minimum qualifications of these individuals. Each different task must be described. Should a procedure require the removal of the sealed source from the holder before performing any maintenance on the holder, applicants should describe the removal procedures.</li> </ul>	[]	[]	[]
10.10	<b>Transportation</b> <ul style="list-style-type: none"> <li>Submit operating and emergency procedures for transporting well logging sealed sources containing radioactive material, and field flood and tracer radioactive materials.</li> </ul>			[]
10.11	<b>Minimization of Contamination</b> <ul style="list-style-type: none"> <li>The applicant does not need to provide a response to this item if the applicant provides responses to the following sections of this NUREG that meet the "Response from Applicant" criteria from those sections: 8.5.1, "Radioactive Material—Sealed Radioactive Material;" 8.5.2, "Radioactive Material—Unsealed (Tracer) Radioactive Material;" 8.9, "Facilities and Equipment;" 8.10.8, "Radiation Safety Program—Leak Tests;" 8.10.7, "Radiation Safety Program—Operating and Emergency Procedures;" 8.10.13, "Radiation Safety Program—Subsurface Tracer Studies;" and 8.11, "Waste Management."</li> </ul>	No Response is Necessary for this Section		

Item No.	Title and Criteria	Yes	N/A	Description Attached
10. 10.11	<b>RADIATION SAFETY PROGRAM (Continued)</b> <b>Minimization of Contamination (Continued)</b> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>The applicant should submit its procedures to conduct decontamination of a facility contaminated by a leaking sealed source or contaminated by unsealed material with a half-life greater than 120 days.</li> </ul>	[]	[]	[]
10.12.1	<b>Use of Sealed Sources in Drill-to-Stop (DTS) (Wireline) Well Logging Operations</b> <ul style="list-style-type: none"> <li>Submit operating and emergency procedures for conducting DTS well logging operations. Procedures must address radiation safety aspects when conducting DTS well logging operations.</li> </ul>			[]
10.12.2	<b>Use of Sealed Sources in Measurement While Drilling (MWD) or Logging While Drilling (LWD) Well Logging Operations</b> <ul style="list-style-type: none"> <li>Submit operating and emergency procedures for conducting MWD and LWD well logging activities. Procedures must address radiation safety aspects when conducting MWD and LWD well logging operations.</li> </ul>			[]
10.12.3	<b>Energy Compensation Sources (ECS)</b> <ul style="list-style-type: none"> <li>Submit a statement that “We will test ECSs requiring leak tests at intervals not to exceed 3 years and we will conduct physical inventories of ECSs at least every 6 months. We will maintain physical inventory and material use records in accordance with 10 CFR 39.37, “Physical Inventory,” and 10 CFR 39.39 “Records of Material Use.”</li> </ul>			[]
10.12.4	<b>Use of Sealed Sources and/or Neutron Generators in Fresh water Aquifers</b> <ul style="list-style-type: none"> <li>A statement that: “We will not use sealed sources and/or neutron generators for conducting well logging operations in fresh water aquifers.”</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>Submit step-by-step operating and emergency procedures for conducting well logging activities using sealed sources and/or neutron generators in fresh water aquifers that meet the criteria in Section 8.10.12.4 of NUREG–1556, Volume 14, Revision 1, “Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Licenses,” 10 CFR 39.55, and 10 CFR 39.63.”</li> </ul>	[]	[]	
10.13.1	<b>Tracer Studies in Single Well Applications</b> <ul style="list-style-type: none"> <li>A statement that: “We will not perform tracer studies in single well applications.”</li> </ul>		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
10. 10.13.1	<b>RADIATION SAFETY PROGRAM (Continued)</b> <b>Tracer Studies in Single Well Applications (Continued)</b> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>A statement that: "We will perform tracer studies in single well applications and have submitted step-by-step operating and emergency procedures for conducting tracer studies in single well applications that meet the guidance in Section 8.10.13.1 of NUREG-1556, Volume 14, Revision 1, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Licenses," 10 CFR 39.45, and 10 CFR 39.63."</li> </ul>			
10.13.2	<b>Field Flood and Secondary Recovery Applications (Tracer Studies in Multiple Wells)</b> <ul style="list-style-type: none"> <li>A statement that, "Field flood studies using tracer materials will not be conducted."</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>A statement that, "Field flood studies using tracer materials will be conducted and we have submitted step-by-step procedures and information required in Section 8.10.13.2 and Appendix D, "Field Flood Studies/Enhanced Recovery of Oil and Gas Wells" of NUREG-1556, Volume 14, Revision 1, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Licenses.""</li> </ul>	 <input type="checkbox"/>  <input type="checkbox"/>	 <input type="checkbox"/>  <input type="checkbox"/>	 <input type="checkbox"/>  <input type="checkbox"/>
10.13.3	<b>Tracer Studies in Fresh Water Aquifers</b> <ul style="list-style-type: none"> <li>A statement that: "We will not knowingly inject tracer material into a fresh water aquifer"</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>A statement that: "We request authorization to inject tracer material into a fresh water aquifer involving secondary and tertiary oil and gas recovery and have submitted our reasons for performing the study and procedures to safeguard the public, licensee personnel, and the environment, and will provide an environmental report containing the information outlined in 10 CFR 51.45, "Environmental report."</li> </ul>	 <input type="checkbox"/>  <input type="checkbox"/>	 <input type="checkbox"/>  <input type="checkbox"/>	 <input type="checkbox"/>  <input type="checkbox"/>
10.13.4	<b>Frac-Tagging Operations</b> <ul style="list-style-type: none"> <li>A statement that: "We will not perform frac-tagging operations."</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>A statement that: "We will perform frac-tagging operations and have submitted step-by-step operating and emergency procedures that include the following:</li> </ul>	 <input type="checkbox"/>  <input type="checkbox"/>	 <input type="checkbox"/>  <input type="checkbox"/>	 <input type="checkbox"/>  <input type="checkbox"/>

Item No.	Title and Criteria	Yes	N/A	Description Attached
<p><b>10.</b></p> <p><b>10.13.4</b></p>	<p><b>RADIATION SAFETY PROGRAM (Continued)</b></p> <p><b>Frac-Tagging Operations (Continued)</b></p> <ul style="list-style-type: none"> <li>— Receiving, controlling, and handling tracer material during well injections.</li> <li>— Handling, controlling, and disposing of any unused tracer materials.</li> <li>— Securing, maintaining control, and posting of areas involved with frac-tagging operations using radioactive materials.</li> <li>• Containment and/or decontamination of a spill or “sandout” (or “fluid reversal”) involving tracer material during frac sand operations. The procedure includes, among other items, radiation surveys, licensee contact information, steps to be taken by the licensee and the client in the event that a “sandout” (or “fluid reversal”) occurs when the licensee has already left the client’s site, and steps to be taken by the licensee and the client to evaluate flowback or production wastes for the presence of tracer material.</li> <li>• Disposal of radioactive materials resulting from frac-tagging operations (such as a sandout, fluid reversal, or flowback) at (i) a licensed low level radioactive waste disposal facility; (ii) decay-in-storage using holding tanks and subsequent unrestricted release; or (iii) a request for alternate waste disposal under 10 CFR 20.2002, “Method for Obtaining Approval of Proposed Disposal Procedures.” The procedure includes a description of who will be responsible for the disposal of radioactive materials resulting from frac-tagging operations occurring at client’s facilities, and the method for making a determination of the concentration of licensed material (picocuries/gram) in these operations.</li> <li>• Actions to be taken in the event of an explosion, leak and contamination event, and the incapacitation of a lone well logging supervisor.”</li> </ul>	<p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p>	<p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p>	<p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p>
<p><b>10.14</b></p>	<p><b>Radioactive Collar and Subsidence or Depth Control Markers</b></p> <ul style="list-style-type: none"> <li>• A statement that: “We will only use radioactive markers where each individual marker contains only quantities of licensed material not exceeding the exempt quantities authorized in 10 CFR 30.71, “Schedule B.”</li> </ul>	<p>[ ]</p>	<p>[ ]</p>	<p>[ ]</p>
<p><b>10.15</b></p>	<p><b>Neutron Accelerators Using Licensed Material</b></p> <ul style="list-style-type: none"> <li>• A statement that: “We will not use neutron generators (accelerators) in our well logging operations.”</li> </ul>	<p>[ ]</p>	<p>[ ]</p>	<p>[ ]</p>

Item No.	Title and Criteria	Yes	N/A	Description Attached
<p><b>10.</b></p> <p><b>10.15</b></p>	<p><b>RADIATION SAFETY PROGRAM (Continued)</b></p> <p><b>Neutron Accelerators Using Licensed Material (Continued)</b></p> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>• A statement that: “We will use neutron generators (accelerators) in accordance with the guidance in Section 8.10.15 of NUREG–1556, Volume 14, Revision 1, “Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Licenses” and will provide step-by-step operating and emergency procedures for NRC review. Calibration of neutron generators will be performed by an NRC or Agreement State licensee that is specifically authorized to conduct this activity.”</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>• A statement that: “We will use neutron generators (accelerators) in accordance with the guidance in Section 8.10.15 of NUREG–1556, Volume 14, Revision 1, “Consolidated Guidance About Materials Licenses: Program Specific Guidance About Well Logging, Tracer, and Field Flood Licenses” and will provide step-by-step operating and emergency procedures for NRC review. We will perform calibration of neutron generators and will provide step-by-step procedures for conducting calibration of neutron generators for NRC review.”</li> </ul>	<p>[ ]</p> <p>[ ]</p>	<p>[ ]</p> <p>[ ]</p>	<p>[ ]</p> <p>[ ]</p>
<p><b>10.16</b></p>	<p><b>Depleted Uranium Sinker Bars</b></p> <ul style="list-style-type: none"> <li>• A statement that: “We will not use depleted uranium sinker bars in our well logging operations.”</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>• A statement that: “Depleted uranium sinker bars will be obtained under the provisions of a general license per 10 CFR 40.51, ‘Transfer of source or byproduct material,’ and registration form NRC Form 244 will be filed, as required.”</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>• A statement that: “Depleted uranium sinker bars will be obtained under a specific license.” Include the specific number of kilograms of material being requested.”</li> </ul> <p style="text-align: center;"><b>AND</b></p> <ul style="list-style-type: none"> <li>• A statement that: “Uranium sinker bars will be possessed and inspected as specified in Section 8.10.16 of NUREG–1556, Volume 14, Revision 1, “Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Licenses.””</li> </ul>	<p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p>	<p>[ ]</p> <p>[ ]</p> <p>[ ]</p> <p>[ ]</p>	<p>[ ]</p> <p>[ ]</p> <p>[ ]</p>

Item No.	Title and Criteria	Yes	N/A	Description Attached
10. 10.17	<b>RADIATION SAFETY PROGRAM (Continued)</b> <b>Security Program for Category 1 and Category 2 Materials</b> <ul style="list-style-type: none"> <li>No response is required from an applicant or licensee. Compliance with access authorization and security program requirements may be reviewed during NRC inspections.</li> </ul>	Need Not Be Submitted With Application		
11.	<b>Waste Management</b> <ul style="list-style-type: none"> <li>A statement that: "We will use sealed and/or unsealed radioactive materials with a half-life greater than 120 days, and will transfer or dispose of the material and contaminated waste to a licensed entity authorized to receive the material." <b>AND</b></li> <li>A statement that: "We will use the model waste procedures published in Appendix N of NUREG-1556, Volume 14, Revision 1, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses," for disposing of radioactive materials and contaminated waste." <b>OR</b></li> <li>A statement that: "We will provide our procedures for waste collection, storage, and disposal by any of the authorized methods described in Section 8.11 of NUREG-1556, Volume 14, Revision 1, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses"." <b>OR</b></li> <li>If needed, the applicant should request authorization for extended interim storage of waste. <b>OR</b></li> <li>Provide proposed alternate waste disposal procedures for a method not described in Section 8.11 of this NUREG following 10 CFR 20.2002, "Method for obtaining approval of proposed disposal procedures."</li> </ul>	[]	[]	
		[]	[]	
		[]	[]	
		[]	[]	[]
		[]	[]	[]



**APPENDIX C**  
**CHECKLIST FOR LICENSE APPLICATION**



**Checklist for License Application**  
**Well Logging Application**  
**REVIEWER CHECKLIST**

Date: \_\_\_\_\_

**CONTENTS OF APPLICATION**

**ITEM 8.1 TYPE OF APPLICANT/LICENSEE**

Type of Action	License No.
<input type="checkbox"/> A. New License	Not Applicable
<input type="checkbox"/> B. Amendment	
<input type="checkbox"/> C. Renewal	

**ITEM 8.2 NAME OF APPLICANT/LICENSEE**

LEGAL NAME: \_\_\_\_\_

MAILING ADDRESS: \_\_\_\_\_

**ITEM 8.3 LOCATION OF USE**

- Address listed above
- Field Stations (Street Address, City, State, and Zip Code):
  - ( ) \_\_\_\_\_
  - ( ) \_\_\_\_\_
  - ( ) \_\_\_\_\_
- Temporary Job Sites
- See attached list

**ITEM 8.4 CONTACT PERSON**

NAME: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

**ITEMS 8.5-8.6 RADIOACTIVE MATERIAL TO BE POSSESSED/\*REQUESTED USE OF MATERIALS**

- Energy Compensation Sources (ECS)
- tracer materials
- well logging sealed sources (MWD/LWD/DTS)
- radioactive collar/subsidence/depth markers

- [ ] depleted uranium
- [ ] neutron accelerator targets
- [ ] sealed sources for use above ground for other than well logging applications

**SEALED MATERIALS**

- [ ] Identify each radionuclide (element name and mass number) that will be used in each sealed source.
- [ ] Provide the manufacturer's (distributor's) name and model number for each sealed source and, if applicable, device requested.
- [ ] Confirm that the activity per source and maximum activity in each device will not exceed the maximum activity listed on the approved certificate of registration issued by the NRC or by an Agreement State.
- [ ] Confirm that each sealed source, device, and source/device combination is registered as an approved sealed source or device by the NRC or an Agreement State.

**UNSEALED TRACER MATERIAL (Volatile & Nonvolatile)**

- [ ] Provide element name with mass number, chemical and/or physical form, and maximum requested possession limit.
- [ ] Provide information for **volatile materials**, if known, on the anticipated rate of volatility or dispersion. This information may be obtained from the tracer material vendor, supplier, or manufacturer.

<b>SEALED SOURCES</b>			
<b>Radioisotope</b>	<b>Mfg./Model No. SSD Certificate No.</b>	<b>Quantity (Curies/MBq/GBq)</b>	<b>*Use</b>

<b>UNSEALED TRACER MATERIALS</b>				
<b>Radioisotope</b>	<b>-Chemical/Physical Form -Max. Amount Used Per Injection</b>	<b>Quantity (Curies/MBq/GBq)</b>	<b>*Use</b>	<b>Volatility/Dispersion</b>

<b>*MATERIAL USE LEGEND</b>			
<b>O=Oil Well Logging</b>	<b>G=Gas Well Logging</b>	<b>M=Mineral Well Logging</b>	<b>T=Tracer Studies in single wells</b>
<b>FF=Field Flood or Enhanced Recovery Operations</b>	<b>N=Neutron Generators</b>	<b>C=Calibration Sources in above ground applications</b>	

**FINANCIAL ASSURANCE**

- Financial assurance not required
- Financial assurance required and financial assurance documents submitted for review
- Decommissioning records file established

**ITEM 8.7 RESPONSIBLE INDIVIDUALS**

**Corporate Organization Chart Submitted for Review:**

**Radiation Safety Organizational Chart Submitted for Review:**

Name(s) of responsible individual(s)

- Title(s) of individual(s)
- Training of individual(s)
- Experience (1-year minimum)

**Radiation Safety Officer Information:**

<input type="checkbox"/> Name	<input type="checkbox"/> Experience	<input type="checkbox"/> Training	<input type="checkbox"/> Independent Authority to stop unsafe operations
<input type="checkbox"/> Organizational Chart (Day-to-Day Radiation Safety Positions) provided			
<input type="checkbox"/> Alternative Training and Experience, if applicable			
<input type="checkbox"/> See Appendix for the minimum RSO duties and responsibilities			

**ITEM 8.8 TRAINING FOR WELL LOGGING SUPERVISORS AND WELL LOGGING ASSISTANTS**

**LOGGING ASSISTANT TRAINING [10 CFR 39.61(b)] and (d)**

- In-house Training:
  - Received copies of Parts 19, 20, & OE Procedures
  - Classroom instruction in Parts 19 & 20 (2-4 h)
  - Instruction in the use of licensed materials, remote handling tools, radiation survey equipment, etc. (1-2 h)
  - Successfully completed a verbal or written examination
  - Exam with key  
Minimum passing grade \_\_\_\_\_ %
  - Records maintained for 3 years (copies of quizzes and dates of oral examinations)

**LOGGING SUPERVISOR TRAINING [10 CFR 39.61(a) and (d)]**

- 10 CFR 39.61(e) Topics, by vendor  
Vendor(s) Name: \_\_\_\_\_
- Instructor's Name: \_\_\_\_\_
- Instructor's Qualifications:
- Classroom Training Conducted by Licensee (~24 h):
  - 10 CFR 39.61(e) Topics:
    - < > Fundamentals of radiation safety
    - < > Characteristics of radiation
    - < > Units of radiation dose and quantity of radiation
    - < > Hazard of exposure
    - < > Levels of radiation for licensed material
    - < > Methods of controlling radiation dose (time, distance, shielding)

- < > Radiation safety practices, including prevention of contamination, and methods of decontamination
- ( ) Radiation detection instruments:
  - < > Use
  - < > Operation
  - < > Calibration
  - < > Instrument limitations
  - < > Survey techniques
  - < > Use of personnel monitoring
- ( ) Equipment to be used:
  - < > Operation of equipment, including:
    - Source handling equipment
    - Remote handling tools
  - < > Storage, control, and disposal of licensed material
  - < > Maintenance of equipment
- ( ) Federal regulations
- ( ) Case histories
- [ ] In-house Classroom Training (~8 h):
  - ( ) 10 CFR 19, 20, & 39
  - ( ) OE Procedures (10 CFR 39.63)
  - ( ) License
  - ( ) ~8 h of classroom instruction in the above
  - ( ) Successfully completed a written examination  
Minimum passing grade \_\_\_\_ %  
Exam Key
  - ( ) In-house instructor qualifications
  - ( ) Maintain for 3 years copies of written quizzes
  - ( ) Field training
  - ( ) Field/practical exam
- [ ] On-the-job Training:
  - ( ) 3 months [520 h]
  - ( ) 1 month [160 h] mineral well logging
  - ( ) 50 tracer operations or 3 months OJT
- [ ] Logging supervisors with previous training

### **ALTERNATIVE TO DESCRIBING A TRAINING PROGRAM**

- Identify each individual to be specified on the license as logging supervisor or logging assistant
- For each individual identified, provide the following:
  - Copies of graded tests
  - Certificate of course completion
  - Details of previous well logging work experience

### **ANNUAL SAFETY REVIEW (REFRESHER TRAINING) [10 CFR 39.61(c) and (d)]**

- Description of topics covered
- Instructor name

### **ANNUAL JOB PERFORMANCE AUDIT OF WELL LOGGING SUPERVISORS [10 CFR 39.13(d)]**

- Description of the program
- Discussion of management action
- Commitment to inspect each logging supervisor at intervals not to exceed 1 year
- Inspections made on-the-job and unannounced
- Commitment that an individual who has not performed logging for more than 1 year will be inspected the first time that person engages in logging operations
- Name, training, and experience of each person who will conduct inspection

## **ITEM 8.9 FACILITIES AND EQUIPMENT**

### **Facility: For Each Field Station**

- Sketch/drawing **to scale** of the facility and all work areas where materials (tracer and/or sealed source) will be used or stored
- Identify the following, where applicable:
  - Areas where explosive, flammable, or other hazardous materials stored
  - Buildings
  - Boundary lines
  - Security fences
  - Local Lockable storage areas
  - Distance between restricted areas and adjacent unrestricted areas



- ( ) Specify in the sketch/drawing the shielding material used
- ( ) For tracer and/or sealed sources, sketch/drawing of:
  - < > Locked storage container
  - < > Underground storage bunker
  - < > Security of licensed materials

**Facility: For Tracer Authorization, Provide**

- [ ] Ready Usage ONLY of “precalibrated amounts” or “ready-to-use” forms
- [ ] Usage of OTHER than “precalibrated amounts” or “ready-to-use” forms
  - ( ) Describe equipment for “repackaging” gaseous, volatile, or finely divided tracer (field station and/or temporary job site)
    - < > Sinks
    - < > Tray with absorbent material
    - < > Glove boxes
    - < > Fume hoods with charcoal filtration
    - < > Filtered exhaust
    - < > Special handling equipment and tools
    - < > Rubber gloves, face shield, respirator, coveralls, absorbent material, plastic bags, secondary container for waste storage for decontamination purposes
- [ ] Description of injection equipment
- [ ] Bench top preparation
  - ( ) Describe laboratory areas for sample preparation
    - < > Hoods
    - < > Hood filters
    - < > Sinks
    - < > Trays with absorbent materials
    - < > Remote handling tools
    - < > Rubber gloves
- [ ] Storage provisions
  - ( ) Describe and provide a drawing of storage facilities:
  - ( ) Storage of waste materials included
  - ( ) Security provisions
  - ( ) Adequate shielding

- [ ] General safety equipment available at temporary job sites:  
[10 CFR 39.45(a)]
  - ( ) rubber gloves
  - ( ) face shield
  - ( ) respirator
  - ( ) coveralls
  - ( ) auxiliary shielding
  - ( ) absorbent material
  - ( ) secondary container for waste storage for decontamination purposes
  - ( ) plastic bags
- [ ] Description of laundry facility for contaminated clothing, etc. Description of how contaminated waste water from laundry facility will be disposed.
- [ ] Description of decontamination facilities for trucks, tracer injection tools, or other equipment contaminated by tracer materials.

**Facility: Records**

- [ ] State the physical location where NRC regulatory required records will be stored and available for review during NRC inspections.

**Facility: Security**

- [ ] If applicable, confirmation that the applicant will have in place the requirements of 10 CFR Part 37, "Physical protection of category 1 and category 2 quantities of radioactive material," for the proposed field station(s) before the NRC performs the initial security inspection.
- [ ] If applicable, confirmation that the applicant will have a program in place to monitor and, without delay, detect, assess, and respond to unauthorized access to radioactive material quantities of concern and/or devices for the proposed field station(s) before the NRC performs the initial security inspection.
- [ ] If applicable, the applicant will coordinate, to the extent practicable, with LLEA regarding a prearranged plan for assistance in response to an actual or attempted theft, sabotage, or diversion of radioactive material quantities of concern and/or devices for the proposed field station(s) before the NRC performs the initial security inspection.

**ITEM 8.10 RADIATION SAFETY PROGRAM**

**ITEM 8.10.1 AGREEMENT WITH WELL OWNER/OPERATOR [10 CFR 39.15]**

- [ ] Elements of the Agreement (sealed sources):
  - ( ) A reasonable effort be made to recover the source

- ( ) A person not attempt to recover a lodged sealed source in a manner which, in the licensee's opinion, could result in its rupture
- ( ) Radiation monitoring be conducted during recovery operations
- ( ) Contaminated equipment, personnel, or environment be decontaminated before release from site or before released for unrestricted use
- ( ) Irretrievable classified sources:
  - < > Immobilized and sealed in place
  - < > Means to prevent inadvertent intrusion on the source
  - < > Permanent identification plaque with regulatory required information per 10 CFR 39(a)(5)(iii)
- ( ) Agreement refers to 10 CFR 39.15(a)
- ( ) Blanket agreement
- ( ) Emergency Abandonment of DTS or MWD/LWD sealed sources
- ( ) Abandonment of Neutron Generator with activity **greater than** 110 GBq [30 Ci]
- ( ) Abandonment of ECSs with activity **greater than** 3.7 MBq [100 µCi]
- ( ) Elements of the Agreement (unsealed material):
- ( ) Immediately contact well owner or operator if there are well returns after a tracer study has been performed
- ( ) Implement operating and emergency procedures for dealing with sandouts and well returns
- ( ) Conduct radiation monitoring as required by 10 CFR 39.69(a)
- ( ) Decontaminate environment, equipment, or personnel before releasing site or before releasing for unrestricted use
- ( ) Implement approved procedures for disposal of sandout and well returns material

**ITEM 8.10.2 RADIATION SAFETY PROGRAM AUDIT**

- [ ] Reviewed on an annual basis
  - ( ) ALARA
  - ( ) NRC/DOT regulations and license
  - ( ) Occupational/Public Doses
- [ ] Audit program **not submitted**, but available for inspection by the NRC
- [ ] Appendix E of NUREG-1556, Volume 14, Revision 1 reviewed

**ITEM 8.10.3 RADIATION MONITORING INSTRUMENTS [10 CFR 39.33(a)]**

- [ ] 0.1-50 mR/h

- Type of instruments (GM, ion chamber, scintillation)
- Type of radiation detected ( $\alpha$ ,  $\beta$ ,  $\gamma$ , neutron)
- Availability of radiation survey instrument pursuant to 10 CFR 39.33(b)

<b>Radiation Survey Instrument</b> <ul style="list-style-type: none"> <li>• Manufacturer</li> <li>• Model No.</li> <li>• # Available</li> <li>• Type <ul style="list-style-type: none"> <li>– GMI on-chamber</li> <li>– Scintillation</li> </ul> </li> </ul>	<b>Instrument Probes</b> <ul style="list-style-type: none"> <li>• Model No.</li> </ul>	<b>Range</b> <ul style="list-style-type: none"> <li>• CPM</li> <li>• DPM</li> <li>• mr/h</li> <li>• <math>\mu</math>R/h</li> </ul>	<b>Radiation Detected</b> <ul style="list-style-type: none"> <li>• <math>\alpha</math></li> <li>• <math>\beta</math></li> <li>• <math>\gamma</math></li> <li>• neutron</li> </ul>
<b>Counting Equipment For:</b> <ul style="list-style-type: none"> <li>• Analysis of Contamination Swipes</li> <li>• Analysis of Bioassay Samples</li> </ul>		<b>Calibration Standards</b>	<b>Minimum Detectable Activity</b>
<b>Special Equipment</b> <ul style="list-style-type: none"> <li>• Air Samplers</li> <li>• Direct Reading Dosimeters</li> <li>• Condenser R meter</li> </ul>		<b># Available</b>	<b>Description</b>

**CALIBRATION OF RADIATION DETECTION INSTRUMENTS  
[10 CFR 39.33(c)]**

- 6-month calibration frequency
- In-house
- By manufacturer
- By outside firm
- Name: \_\_\_\_\_
- License No.: \_\_\_\_\_
- Calibration procedures in Appendix H of NUREG-1556, Volume 14, Revision 1 adopted
- Alternative calibration procedures for radiation detection instruments provided for NRC review

**ITEM 8.10.4 MATERIAL RECEIPT AND ACCOUNTABILITY/PHYSICAL INVENTORY  
[10 CFR 39.37]**

- Semiannual frequency
- Maintain records of receipt, transfer, and disposal in accordance with 10 CFR 30.51, "Records"
- Required Information
  - ( ) Quantity and kind of licensed material (Sealed Source/Tracer)

- Location of licensed material
- Date of inventory
- Name of individual conducting inventory
- Inventory records for sealed sources may be combined with leak test records
- National Source Tracking System (NSTS) reporting requirement

**ITEM 8.10.5 OCCUPATIONAL DOSE [10 CFR 39.65(a)]**

- TLD
- Film
- OSL-**Note:** *Exemption should be requested*
- Neutron capability
- NVLAP-Accredited
- Exchange frequency
  - < > Monthly
  - < > Quarterly

**BIOASSAYS [10 CFR 39.65(b)]**

- Procedures in RG 8.20 adopted for conducting bioassays
- Commitment not to expose any individual to 50 mCi of I-131 at a time or in any 5 days
- Commercial Service:
  - Name: \_\_\_\_\_
  - License No.: \_\_\_\_\_

**ITEM 8.10.6 PUBLIC DOSE**

- No response required
- Appendix J of NUREG-1556, Volume 14, Revision 1 reviewed

**ITEM 8.10.7 OPERATING AND EMERGENCY PROCEDURES [10 CFR 39.63]**

- Instructions for handling and using licensed materials, including sealed sources in wells, without surface casing for protecting fresh water aquifers
- Instructions for maintaining security during storage and transportation
- Instructions to keep licensed material under control and immediate surveillance during use
- Steps to take to keep radiation exposures ALARA
- Steps to maintain accountability during use

- [ ] Steps to control access to work sites
- [ ] Steps to take and whom to contact when an emergency occurs
- [ ] Instructions for using remote handling tools when installing into well logging tools or handling sealed sources when returning them to their transport containers. Although good information, instructions are not necessary when handling low-activity calibration sources and radioactive tracer materials.
- [ ] Methods and occasions for conducting radiation surveys, including surveys for detecting contamination, as required by 10 CFR 39.67(c)-(e)
- [ ] Procedures to minimize personnel exposure during routine use and in the event of an incident, including exposures from inhalation and ingestion of licensed tracer materials
- [ ] Methods and occasions for locking and securing stored licensed materials
- [ ] Personnel monitoring, including bioassays, and the use of personnel monitoring equipment
- [ ] Transportation of licensed materials to field stations or temporary job sites, packaging of licensed materials for transport in vehicles, placarding of vehicles when needed, and physically securing licensed materials in transport vehicles during transportation to prevent accidental loss, tampering, or unauthorized removal
- [ ] Procedures for picking up, receiving, and opening packages containing licensed materials, in accordance with 10 CFR 20.1906, "Procedures for receiving and opening packages"
- [ ] Instructions for the use of tracer materials, how to decontaminate the environment, equipment, and personnel
- [ ] Instructions for maintaining records in accordance with the regulations and the license conditions
- [ ] Steps for the use, inspection, and maintenance of sealed sources, source holders, logging tools, injection tools, source handling tools, storage containers, transport containers, and uranium sinker bars, as required by 10 CFR 39.43, "Inspection, maintenance, and opening of a source or source holder"
- [ ] Procedures for identifying and reporting to the NRC defects and noncompliance, as required by 10 CFR 21.21(a)
- [ ] Actions to be taken if a sealed source is lodged in a well
- [ ] Procedures and actions to be taken if a sealed source is ruptured, including actions to prevent the spread of contamination and minimize inhalation and ingestion of licensed materials and actions to obtain suitable radiation survey instruments, as required by 10 CFR 39.33(b). Key elements described in Appendix O of NUREG-1556, Volume 14, Revision 1 are addressed in the procedures.
- [ ] Instructions for the proper storage and disposal of radioactive waste

- Procedures for laundering contaminated clothing and for decontaminating equipment and vehicles
- Procedures to be followed in the event of uncontrolled release of radioactive tracer material to the environment, including notification of the RSO, NRC, and other Federal and State agencies

**ITEM 8.10.8 LEAK TESTING [10 CFR 39.35]**

- Vendor(s) Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Agreement State/NRC License No.: \_\_\_\_\_
- Leak test kit
- Leak testing conducted in-house using Appendix L of NUREG–1556, Volume 14, Revision 1 procedures
- Alternative leak testing procedures submitted for NRC review

**ITEM 8.10.9 MAINTENANCE**

- Daily visual inspection and 6-month routine maintenance*  
[10 CFR 39.43(a)-(b)]
  - source holders
  - logging tools
  - injection tools
  - source handling tools
  - storage containers
  - transport containers
  - uranium sinker bars
- Defects [10 CFR 39.43(a)]
  - Repairs made and recorded, or equipment taken out of service
  - Operation performed by logging supervisor

**SEMIANNUAL VISUAL INSPECTION AND MAINTENANCE  
[10 CFR 39.43(b)]**

- 6-month
  - Defects [10 CFR 39.43(b)]
  - Repairs made and recorded, or equipment taken out of service
  - Operation performed by logging supervisor

**REMOVAL OR MAINTENANCE ON A SEALED SOURCE OR HOLDER  
[10 CFR 39.43(c)]**

- Services performed by manufacturer
- Performed by individual licensed by Agreement State/NRC
- Performed by licensee
  - Detailed procedures for each task provided for NRC review
  - Radiation safety precautions outlined in O&E procedures

**SEALED SOURCES STUCK IN A SOURCE HOLDER [10 CFR 39.43(d)]**

- Performed by licensed equipment manufacturer
- Performed by individual licensed by Agreement State/NRC
- Performed by licensee
  - Detailed procedures for each task provided for NRC review
  - Radiation safety precautions outlined in O&E procedures

**OPENING, REPAIR, OR MODIFICATION OF SEALED SOURCES  
[10 CFR 39.43(e)]**

- Performed by Agreement State/NRC-licensed firm
- Performed by licensee
  - Detailed procedures for each task provided for NRC review
  - Radiation safety precautions outlined in O&E procedures

**ITEM 8.10.10 TRANSPORTATION**

- No response required; DOT regulations will be followed
- Appendix M of NUREG-1556, Volume 14, Revision 1 reviewed

**ITEM 8.10.11 MINIMIZATION OF CONTAMINATION [10 CFR 39.69]**

- Implementation of and adherence to good health physics practices while performing operations
- Minimization of distance to areas, to the extent practicable, where licensed materials are used and stored
- Maximization of survey frequency, within reason, to enhance detection of contamination
- Segregation of radioactive material in waste storage areas
- Segregation of sealed sources and tracer materials to prevent cross-contamination
- Separation of radioactive material from explosives



- Separation of potentially contaminated areas from clean areas by barriers or other controls
- Decontamination of a facility contaminated by a leaking source or contaminated by unsealed material with a half-life greater than 120 days will not be conducted by the licensee but instead will be conducted by an NRC or Agreement State licensee that is specifically authorized to conduct these activities.
- Request to Conduct Major Decontamination Activities of a Facility Contaminated by a Leaking Source or contaminated by unsealed material with a half-life greater than 120 days
  - Instructions to personnel on how to determine presence of contamination through surveys
  - Levels of contamination
  - Decontamination operating and emergency procedures
  - Decontamination equipment
  - Prevention of contamination of personnel during decontamination
  - How to handle contaminated waste materials
  - Resurveying of contaminated area to determine effectiveness
  - Records of survey:
    - Before
    - After
    - Contact person
- Decontamination activities will be conducted by outside sources licensed by NRC or an Agreement State to conduct these activities.

**ITEM 8.10.12 SEALED SOURCES**

**USE OF SEALED SOURCES IN DRILL-TO-STOP WELL LOGGING OPERATIONS**

- Step-by-step O&E procedures provided for NRC review
- Summary or outline addressing important aspects of O&E procedures provided for review
- For use of sealed sources in well without surface casing
  - Knowledge of borehole conditions
  - Caliper log
  - Running dummy tool log
  - Temporary casing

## **USE OF SEALED SOURCES IN MWD/LWD WELL LOGGING OPERATIONS**

- Step-by-step O&E procedures provided for NRC review
- Summary or outline addressing important aspects of O&E procedures provided for review

## **ENERGY COMPENSATION SOURCES**

- Step-by-step O&E procedures provided for NRC review
- Summary or outline addressing important aspects of O&E procedures provided for review
  - Instructions for testing ECSs requiring leak tests at intervals not to exceed 3 years
  - Instructions for conducting physical inventories of ECSs at least every 6 months
  - A system for maintaining inventory records required by 10 CFR 39.37, "Physical Inventory,"
  - A system for maintaining records of use for ECSs
- For use of ECSs in well without surface casing
  - Knowledge of borehole conditions
  - Caliper log
  - Running dummy tool log
  - Temporary casing

## **USE OF SEALED SOURCES AND/OR NEUTRON GENERATORS IN FRESH WATER AQUIFERS**

- Applicant will not use sealed sources and/or neutron generators for conducting well logging operations in fresh water aquifers
- Step-by-step O&E procedures provided for NRC review. Procedures meet the criteria in Section 8.10.12.4 of NUREG-1556, Volume 14, Revision 1; 10 CFR 39.55, "Tritium neutron generator target source;" and 10 CFR 39.63, "Operating and emergency procedures."

### **ITEM 8.10.13 SUBSURFACE TRACER STUDIES**

#### **TRACER STUDIES IN SINGLE WELL APPLICATIONS [10 CFR 39.45]**

- Methods and occasions for conducting radiation surveys
- Methods and occasions for locking and securing tracer materials
- Personnel monitoring and the use of personnel monitoring equipment
- Transportation to temporary job sites and field stations, including the packaging and placing of tracer materials in vehicles, placarding of vehicles, and securing tracer materials during transportation

- [ ] Procedures for minimizing exposure to members of the public and occupationally exposed individuals in the event of an accident
- [ ] Maintenance of records at field stations and temporary job sites
- [ ] Use, inspection, and maintenance of equipment (e.g., injector tools, remote handling tools, transportation containers)
- [ ] Procedures to be used for picking up, receiving, and opening packages containing radioactive material
- [ ] Decontamination of the environment, equipment, and personnel
- [ ] Notifications of proper personnel in the event of an accident

#### **FIELD FLOOD AND SECONDARY RECOVERY APPLICATIONS**

- [ ] Field flood or Secondary Recovery Applications will not be conducted
- [ ] Agreement with well operator or owner, although not required by NRC regulations, is a good practice
- [ ] Field flood study project design
- [ ] Preinjection phase of the field flood project
- [ ] Injection phase
- [ ] Postinjection phase
- [ ] Emergency procedures
- [ ] Reporting and recordkeeping requirements
- [ ] Waste management
- [ ] Methods and occasions for conducting radiation surveys
- [ ] Methods and occasions for locking and securing tracer materials
- [ ] Personnel monitoring and the use of personnel monitoring equipment
- [ ] Transportation to temporary job sites and field stations, including the packaging and placing of tracer materials in vehicles, placarding of vehicles, and securing tracer materials during transportation
- [ ] Procedures for minimizing exposure to members of the public and occupationally exposed individuals in the event of an accident
- [ ] Maintenance of records at field stations and temporary job sites
- [ ] Use, inspection, and maintenance of equipment (e.g., injector tools, remote handling tools, transportation containers)
- [ ] Procedures to be used for picking up, receiving, and opening packages containing radioactive material
- [ ] Decontamination of the environment, equipment, and personnel
- [ ] Notifications of proper personnel in the event of an accident
- [ ] Information requested in Appendix D of NUREG–1556, Volume 14, Revision 1 provided

**TRACER STUDIES IN SINGLE WELL APPLICATIONS IN FRESH WATER  
AQUIFERS [10 CFR 39.45]**

- [ ] Tracer Studies in Single Well Application will not be conducted in Fresh water Aquifers
- [ ] Tracer Studies in Single Well Application will be conducted in Fresh water Aquifers, and an environmental report is provided for the NRC's review

**FRAC-TAGGING OPERATIONS**

- [ ] Frac-tagging operations will not be conducted
- [ ] Procedures for receiving, controlling, and handling fracking material during well injections
- [ ] Procedures for handling controlling, and disposing of unused fracking materials
- [ ] Procedures for containment and decontamination and disposal of spilled fracking materials

**ITEM 8.10.14 RADIOACTIVE COLLAR AND SUBSIDENCE OR DEPTH CONTROL  
MARKERS [10 CFR 39.47]**

- [ ] Operating and emergency procedures must include a commitment that radioactive markers can be used only where each individual marker contains quantities of licensed material not exceeding the quantities identified in 10 CFR 30.71, "Schedule B"
- [ ] Licensees are not restricted to using only one marker, and may use multiple markers in each pipe joint, provided each individual marker (wires, tape, nails, etc.) is *not greater than the quantities identified in 10 CFR 30.71*
- [ ] Provisions included in O&E procedures to ensure that radioactive markers be physically inventoried at intervals not to exceed 6 months, as specified in 10 CFR 39.37

**ITEM 8.10.15 NEUTRON ACCELERATORS USING LICENSED MATERIAL**

- [ ] Neutron generator tubes are not considered well logging sealed sources and are not required to satisfy the requirement for well logging sealed sources
- [ ] Neutron generator tubes containing less than 110 GBq [30 Ci] of tritium are:
  - ( ) Exempt from leak testing requirements if they contain less than 3.7 MBq [100 µCi]
  - ( ) Exempt from abandonment requirements
  - ( ) Exempt from the performance requirements of sealed sources used in well logging operations

- [ ] Neutron generators containing target sources greater than 100 GBq [30 Ci] cannot be used in wells without surface casing to protect fresh water aquifers, unless approved by the NRC
- [ ] O&E procedures address handling of contamination resulting from the routine use, initial installation, replacement, or accidental damage of the targets or glass tubes

**ITEM 8.10.16 DEPLETED URANIUM SINKER BARS [10 CFR 40.51]**

- [ ] Depleted uranium sinker bars will be obtained under the provisions of a general license per 10 CFR 40.51, "Transfer of source or byproduct material," and registration form NRC Form 244 will be filed, as required
- [ ] Depleted uranium sinker bars will not be obtained under the provision of general license 10 CFR 40.51
- [ ] Uranium sinker bars will be possessed and inspected as specified
- [ ] Number of kilograms of specifically licensed depleted uranium specified

**ITEM 8.10.17 SECURITY PROGRAM FOR CATEGORY 1 AND CATEGORY 2 RADIOACTIVE MATERIALS**

- [ ] Access authorization program per 10 CFR Part 37, Subpart B
- [ ] Security Program per 10 CFR Part 37, Subpart C
- [ ] Physical Protection During Transit per 10 CFR Part 37, Subpart D

**ITEM 8.11 WASTE MANAGEMENT [10 CFR Part 20, Subpart K]**

- [ ] Decay-in-storage disposal for radioactive materials with half-lives less than or equal to 120 days
  - ( ) When a container is transferred to the waste storage area, mark the container with an identification label that includes the date sealed, the isotope in the container, and the initials of the person sealing the container
- [ ] Confirm that prior to disposal as in-house waste, the licensee will monitor each container, as follows:
  - ( ) Check radiation detection survey meter for proper operation
  - ( ) Monitor container in a low-level area (less than 0.05 mrem/h)
  - ( ) Remove any shielding from container
  - ( ) Monitor all surfaces
  - ( ) Discard only those containers that cannot be distinguished from background
  - ( ) Container that can be distinguished from background must be returned to storage area for further decay or transferred to person licensed to receive such waste
- [ ] Return to manufacturer authorized recipient

- Extended Interim Storage of materials pending disposal or transfer to authorized recipient
- Licensed company
- Sandout, flowback, screenout, etc.
- Disposal by release into sanitary sewerage (10 CFR 20.2003)
- Appendix N of NUREG-1556, Volume 14, Revision 1 reviewed

**ITEM 8.12 FEES**

- Fee, if any required, attached

**ITEM 8.13 CERTIFICATION**

- Individual signing an application authorized to make binding commitments and to sign official documents on behalf of the legal entity or applicant

**APPENDIX D**

**FIELD FLOOD STUDIES/ENHANCED RECOVERY OF OIL AND GAS WELLS**





## Field Flood Studies/Enhanced Recovery of Oil and Gas Wells

A formal contractual agreement with the well operator or owner should specify control points where samples will be taken, establish criteria for setting minimum sample requirements, and confirm the willingness of the client company to abide by effluent restrictions and undertake remedial action, if required. Following are some examples:

Samples of recovered fluids or gas will be collected and measured according to the established sampling schedule.

- Appropriate remedial action will be taken if accidents or incidents occur that may result in the release of licensed materials to the environment. For example, if the concentration in the recovered fluid or gas approaches or exceeds the design limits, remedial action should be taken, such as reducing the injection pressure, temporarily shutting in the well, or diluting with nontracer-bearing fluid or gas.

### Planning Stage

#### Reservoir Information

Describe the reservoir information that the applicant/licensee needs in order to design a radionuclide tracer study for a field flood operation. Examples of reservoir information are shown below:

- reservoir volume
- reservoir thickness
- porosity
- injected volumes (liquids/gases)
- oil/water saturation ratios

#### Project Design

Outline the design of the tracer application requested. Examples of items to consider are the following:

- Choice of radionuclides and method used to determine (i) the amount of radionuclide to be injected, and (ii) the expected concentration of radionuclide in the fluids (gas, water, oil) at a recovery well site. Indicate the adherence to the as low as is reasonably achievable (ALARA) principle.
- How breakthrough time is predicted.
- How tracer concentrations in the recovered liquids and gases are estimated.
- How the sampling schedule at production wellheads is determined. Include a description of how the applicant/licensee would determine when sampling could be discontinued. As an example, monitoring of samples may be ended when the design life of the project is completed, unless the effluent concentration at the control point is above a specified fraction of the maximum permissible concentration (as listed for unrestricted areas in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20, "Standards for protection against radiation") and is increasing. In that case, the control point will be

monitored until the concentration is below the specified fraction of the annual average concentration specified in 10 CFR Part 20, Appendix B, Table 2.

### **Preinjection Stage**

**Transportation of licensed materials.** State that the applicant will comply with U.S. Nuclear Regulatory Commission (NRC) and U.S. Department of Transportation (DOT) regulations pertaining to the transportation of licensed material. Particular attention should be directed to monitoring requirements upon receipt of packages containing licensed materials.

**Integrity of wellhead assembly and wellbore.** Describe the test procedures used to ensure that the wellhead assembly, including injection equipment, will not leak under operating conditions. Describe the procedures used to ensure that the wellbore will not leak underground. For example, if the injection well operates properly for a 2-week period, integrity of the wellbore may be considered ensured.

### **Injection Stage**

Outline radiation safety practices during injection process.

Following are examples of practices:

- Remain upwind, if practical.
- Keep nonessential personnel at a distance.
- Use personnel monitoring devices [e.g., thermoluminescent dosimeters (TLDs), optically stimulated luminescence dosimeters (OSLs), film badges, finger badges, pocket dosimeters] and other radiation detection instruments in the monitoring and surveillance programs.
- Use special tools and devices to handle licensed material and to facilitate the injection process.
- Perform visual inspection, check pressure gauge, etc., to assure absence of leaks and proper delivery of injection liquid or gas.
- Continuously or intermittently monitor radiation levels outside the injection assembly to assure that the injection is proceeding according to the plan. Allow sufficient time before opening wellhead assembly.

### **Postinjection Stage**

Outline radiation safety practices that will be put into place after the injection phase is completed. Examples of practices include the following:

- Check exposure rate at wellhead assembly for residual activity.
- Take smear samples to detect removable contamination on wellhead assembly.
- Clean reusable tools and check for residual activity before securing for reuse.

- Collect contaminated materials or contaminated tools and package them into an appropriate waste container.
- Establish schedule for taking samples for bioassay when, for example, handling tritium (H-3) exceeding 3.7 GBq [0.1 Ci] or gaseous H-3 exceeding 3,700 GBq [100 Ci], or handling radioiodine exceeding 1.85 GBq [50 mCi] of iodine-131 or iodine-125. See Section 8.10.5, "Occupational Dosimetry" of NUREG-1556 Volume 14, Revision 1, for additional guidance on bioassay programs.
- Provide instructions to well operator's personnel for taking postinjection samples and shipping the samples to the applicant's/licensee's facilities for analysis. Include handling, packaging, and shipping procedures.
- Package waste materials for transportation, prepare appropriate labels and shipping papers, and check for radiation level and removable contamination outside the package.
- Measure concentrations of radionuclides in recovered liquids or gases, according to the established sampling schedule.
- Take corrective measures if the concentrations in the recovered liquids or gas approach or exceed design levels.
- Conduct area and personnel monitoring before leaving injection site.

### **Emergency Procedures**

Outline procedures that will be followed in the event of incidents or accidents that release radioactive materials to the environment. Following are examples of incidents and accidents:

- discovering contamination on the outside surface of the shipping package
- discovering that the radioactive material container is leaking
- dropping and breaking a radioactive material container, thereby spilling the material on the ground
- detecting leakage of radioactive materials from wellhead assembly
- measuring concentrations in liquids or gas from production wells exceeding limits specified in Table 2, Appendix B, 10 CFR Part 20.

### **Reporting, Recordkeeping, and Notification**

Outline the report that will be submitted to the NRC and the records maintained regarding the field flood injections. Following are examples of releases to include: records on the identification of wells, radionuclides, and quantities injected; concentrations of radionuclides in liquids or gases produced at production wells; and concentrations of radionuclides in products released from the field.

Also outline the procedures that will be followed in case of accidents; and procedures for notifying the proper persons or organizations, such as the company management

(radiation safety officer), well operator or owner, and Federal, State, or municipal governmental agencies involved with the control and oversight of affected wells.

### **Waste Management**

The applicant should outline the procedures for disposing of licensed material. Wastes from tracer operations such as unused materials, and contaminated wipes, gloves, tools, clothing, containers, etc., should be disposed of in accordance with 10 CFR Part 20. Recovered waste fluids that contain radioactive tracers should either be reinjected or treated as radioactive waste. A commonly used method of disposal is transfer to a commercial firm licensed by the NRC or an Agreement State to accept radioactive wastes. In dealing with these firms, prior contact is needed to determine the specific services they can provide. If commercial services will be used, this should be specified.

**APPENDIX E**  
**SUGGESTED WELL LOGGING AND SUBSURFACE TRACER STUDIES**  
**AUDIT CHECKLIST**



## Suggested Well Logging and Subsurface Tracer Studies Audit Checklist

All areas indicated in audit notes may not be applicable to every license and may not need to be addressed during each audit. For example, licensees do not need to address areas that do not apply to the licensee's activities, and activities that have not occurred since the last audit need not be reviewed at the next audit. Audits should be performance based, that is, focused on observing activities and identifying deficiencies rather than only reviewing records. For example, rather than just review records to ensure that daily checks of equipment are being performed, observe the daily checks to ensure staff are appropriately performing the activity.

Date of This Audit \_\_\_\_\_ Date of Last Audit \_\_\_\_\_

Next Audit Date \_\_\_\_\_

Auditor \_\_\_\_\_ Date \_\_\_\_\_  
(Signature)

Management Review \_\_\_\_\_ Date \_\_\_\_\_  
(Signature)

### A. AUDIT HISTORY

1. Last audit of this location conducted on (date).
2. Were previous audits conducted at intervals not to exceed 12 months?  
[10 CFR 20.1101]
3. Were records of previous audits maintained? [10 CFR 20.2102]
4. Were any deficiencies identified during last two audits or 2 years, whichever is longer?
5. Were corrective actions taken? (Look for repeated deficiencies)
6. Were corrective actions effective?

### B. ORGANIZATION AND SCOPE OF PROGRAM

1. Organizational structure (specify any changes)
  - a. Matches license requirements [license condition]
  - b. Multiple authorized locations of use and/or field sites authorized
  - c. List of location(s) inspected—attached or reference
  - d. Brief description of scope of activities, including types of equipment, types and quantities of use involving byproduct material, frequency of use, staff size, etc.
2. If the mailing address or places of use changed, was the license amended?  
[10 CFR 30.34]
3. If ownership changed or bankruptcy filed, was the U.S. Nuclear Regulatory Commission's (NRC's) prior consent obtained or was NRC notified?  
[10 CFR 30.34]

4. Authorized Users
  - a. Are well logging supervisors trained in accordance with 10 CFR 39.61(a)?
  - b. Are well logging assistants trained in accordance with 10 CFR 39.61(b)?
  - c. If there are new logging supervisors or logging assistants since the last audit, was the license amended (if required)?
5. Radiation Safety Officer
  - a. Is the RSO new since the last audit?
  - b. If the RSO was changed, was the license amended?
  - c. Is the RSO fulfilling his/her duties?
  - d. To whom does the RSO report?
  - e. Does the RSO have sufficient time to perform his/her radiation safety duties?
6. Commensurate security program implemented? [10 CFR Part 37]

**C. FACILITIES**

1. Are facilities as described in the NRC application?
2. If facilities have changed, has the NRC license been amended?
3. Are licensed materials secured from unauthorized removal or access?  
[10 CFR 20.1801]
4. Is control and constant surveillance maintained of licensed material not in storage?  
[10 CFR 20.1802]
5. Do storage locations comply with the appropriate security program measures?  
[10 CFR Part 37]

**D. EQUIPMENT AND INSTRUMENTATION**

1. Instruments
  - a. Are calibrated and operable radiation survey instruments capable of detecting beta and gamma radiation available at each storage location, field station, and temporary jobsite? [10 CFR 39.33]
  - b. Are radiation survey instruments capable of measuring 0.001 mSv [0.1 mrem] per hour (h) through at least 0.5 mSv [50 mrem]/h?  
[10 CFR 39.33(a)]
  - c. Are additional calibrated and operable radiation detection instruments available that are sensitive enough to detect the low radiation and contamination levels that could be encountered if a sealed source ruptured?  
[10 CFR 39.33(b)]
  - d. Are radiation survey instruments calibrated
    - (1) at intervals not to exceed 6 months and after instrument servicing?



- (2) for linear scale instruments, at two points located approximately 1/3 and 2/3 of full-scale on each scale; for logarithmic scale instruments, at midrange of each decade, and at two points of at least one decade; and for digital instruments, at appropriate points?
  - (3) so that an accuracy within plus or minus 20 percent of the calibration standard can be demonstrated on each scale?
- e. Are Radiation Detection Instrument calibration records retained for a period of 3 years after the date of calibration for inspection by the Commission?  
[10 CFR 39.33(d)]

2. Sources, Source Holders, Tools

- a. Are Sources, Source Holders, and Tools labeled in accordance with 10 CFR 39.31(a)?
- b. When licensed materials are transported, are the licensed materials packaged, labeled, marked, and accompanied by appropriate shipping papers in accordance with 10 CFR Part 71 and 49 CFR Parts 170-189?
- c. Are licensed materials stored and transported in accordance with the security precautions described in 10 CFR 39.31(b)?
- d. Do sealed sources used for well logging applications meet the design and performance criteria described in 10 CFR 39.41?
- e. Are uranium sinker bars (if used) marked in accordance with 10 CFR 39.49?
- f. Are source handling tools compatible with the type of sealed source being used?

**E. MATERIAL USE, CONTROL, AND TRANSFER**

1. Security and Control

- a. Are restricted areas, defined as in 10 CFR 20.1003, limited for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials?
- b. Are unrestricted areas, defined in 10 CFR 20.1003, re-evaluated when radioactive material storage areas are altered/changed or radioactivity was increased to verify that the relocation of the material has not affected the unrestricted area?
- c. Are licensed materials that are stored in controlled or unrestricted areas secured from unauthorized removal or access as required by 10 CFR 20.1801?
- d. Is licensed material that is in a controlled or unrestricted area and that is not in storage controlled and maintained under constant surveillance as required by 10 CFR 20.1802?
- e. Is a logging supervisor (defined in 10 CFR 39.2), physically present at a temporary jobsite whenever licensed materials are being handled or are not stored and locked in a vehicle or storage place, as required by 10 CFR 39.71(a)?

- f. As required by 10 CFR 39.71(b) during well logging, except when radiation sources are below ground or in shipping or storage containers, does the logging supervisor or other individual designated by the logging supervisor maintain direct surveillance of the operation to prevent unauthorized entry into a restricted area, as defined in 10 CFR 20.1003?
2. Receipt and Transfer of Licensed Material
    - a. During receipt and transfer of licensed materials, are dose limits for individual members of the public maintained in accordance with 10 CFR 20.1302?
    - b. Do the procedures for the receipt and opening of packages meet the requirements of 10 CFR 20.1906 and are these procedures followed?
    - c. Are licensed materials transferred in accordance with 10 CFR 30.41, 10 CFR 40.51 or 10 CFR 70.42?
    - d. Are records of the receipt, transfer, and disposal of licensed materials maintained in accordance with 10 CFR 30.51?
    - e. Are records of surveys maintained in accordance with 10 CFR 20.2103(a)?
    - f. Are transactions entered into the National Source Tracking System, including annual reconciliation, in accordance with 10 CFR 20.2207?
  3. Radionuclide, Chemical Form, Quantity, and Use
    - a. Is a semi-annual physical inventory conducted to account for all licensed material received and possessed in accordance with 10 CFR 39.37?
    - b. Are records of the semiannual physical inventories maintained in accordance with 10 CFR 39.37?
    - c. Are the quantities of licensed material used in radioactive markers limited to quantities not exceeding the quantities specified in 10 CFR 30.71?
    - d. Are radioactive markers inventoried in accordance with 10 CFR 39.37?
    - e. Are depleted uranium sinker bars used in accordance with 10 CFR 39.49?

## **F. INVENTORIES**

1. Are inventories conducted at 6-month intervals? [10 CFR 39.37]
2. Do the inventories contain all the information required by 10 CFR 39.37?
3. Are inventory records maintained for 3 years from the date of the inventory? [10 CFR 39.37]

## **G. INSPECTION AND MAINTENANCE**

1. Routine Inspection Program
  - a. Are visual checks of source holders, logging tools, and source handling tools, for defects made before each use to ensure that the equipment is in good working condition and that required labeling is present? [10 CFR 39.43(a)]
  - b. If defects were found, was the equipment removed from service until repaired, and a record made listing: the date of check, name of inspector, equipment involved, defects found, and repairs made? [10 CFR 39.43(a)]

- c. Are records of defects identified during routine inspection retained for 3 years after the defect is found? [10 CFR 39.43(a)]
- 2. Semiannual Inspection Program
  - a. Is there a program for semiannual visual inspection and routine maintenance of source holders, logging tools, injection tools, source handling tools, storage containers, transport containers, and uranium sinker bars to ensure that the required labeling is legible and that no physical damage is visible? [10 CFR 39.43(b)]
  - b. If defects are found, was the equipment removed from service until repaired, and a record made listing: date, equipment involved, inspection and maintenance operations performed, any defects found, and any actions taken to correct the defects? [10 CFR 39.43(b)]
  - c. Are records of defects identified during the semiannual inspection retained for 3 years after the defect is found? [10 CFR 39.43(b)]
- 3. Removal of Sources from Source Holders 10 CFR 39.43(c)
  - a. Have written procedures been developed pursuant to 10 CFR 39.63 and been approved either by the Commission pursuant to 10 CFR 39.13(c) or by an Agreement State for the removal of a sealed source from a source holder or logging tool, and maintenance on sealed sources or holders in which sealed sources are contained?
- 4. Stuck Sealed Sources 10 CFR 39.43(d)
  - a. Has specific approval by the Commission or an Agreement State been granted to perform any operation, such as drilling, cutting, or chiseling, on the source holder, if a sealed source is stuck in the source holder?  
**Note:** The opening, repair, or modification of any sealed source must be performed by persons specifically approved to do so by the Commission or an Agreement State. [10 CFR 39.43(e)] [license condition]
- 5. Notification of failure to comply or existence of a defect and its evaluation [10 CFR 21.21]
  - a. If defects were found during routine or semiannual inspections, were these defects evaluated in accordance with 10 CFR 21.21?
  - b. Were any defects reported under the requirements of 10 CFR 21.21?

## H. AREA RADIATION SURVEYS AND CONTAMINATION CONTROL

- 1. Compliance with dose limits for individual members of the public [10 CFR 20.1302]
  - a. Have radiation surveys or calculations been made to demonstrate compliance with the annual dose limit for individual members of the public?
  - b. Are records demonstrating compliance with the dose limit for individual members of the public maintained in accordance with 10 CFR 20.2107?

2. Radiation Surveys [10 CFR 39.67]
  - a. Were radiation surveys made in the storage areas for radioactive materials?
  - b. Are radiation surveys made of the position occupied by each individual in the vehicle and of the exterior of each vehicle used to transport the licensed materials, before transporting licensed materials?
  - c. Are radiation surveys made of the logging tool if the sealed source assembly is removed from the logging tool before departure from the temporary jobsite, to confirm that the logging tool is free of contamination by energizing the logging tool detector or by using a radiation survey meter?
  - d. Were any radiation surveys made during or after an operation where the encapsulation of the sealed source could have been damaged?
  - e. Were radiation surveys at temporary jobsite(s) made before and after each subsurface tracer study to confirm the absence of contamination?
  - f. Are the results of radiation surveys required by 10 CFR 39.67 recorded and include the date of the survey, the name of the individual making the survey, the identification of the survey, instrument used, and the location of the survey?
  - g. Are radiation survey records maintained for inspection by the Commission for 3 years after they are made?
3. Contamination Control [10 CFR 39.69]
  - a. Were there any events where there was evidence that a sealed source had ruptured or licensed materials had caused contamination?
  - b. Were the emergency procedures required by 10 CFR 39.63, initiated immediately?
  - c. Were there contamination events resulting from use of licensed material in well logging that required decontamination of work areas, equipment, and unrestricted areas?
  - d. During efforts to recover a sealed source lodged in a well, did the licensee continuously monitor, with an appropriate radiation detection instrument or a logging tool with a radiation detector, the circulating fluids from the well, if any, to check for contamination resulting from damage to the sealed source?
4. Leak Tests [10 CFR 39.35]
  - a. Is each sealed source [except an energy compensation source (ECS)] tested at intervals not to exceed 6 months?
  - b. Does the method of leak testing meet the requirements of 10 CFR 39.35(b)?
  - c. Are the records of leak test results in units of microcuries and retained for inspection by the Commission for 3 years after the leak test is performed?

**Note:** In the absence of a certificate from a transferor that a test has been made within the 6 months before the transfer, the sealed source may not be used until tested.

- d. Has each ECS that is not exempt from testing in accordance with 10 CFR 39.35(e) been tested at intervals not to exceed 3 years?

**Note:** In the absence of a certificate from a transferor that a test has been made within the 3 years before the transfer, the ECS may not be used until tested.

- e. During the audit period, did any sealed sources, or ECS, require removal from service and reporting as required by 10 CFR 39.35(d)?

5. Tracer Studies [10 CFR 39.45]

- a. Are personnel handling radioactive tracer material required to use protective gloves and other protective clothing and equipment?
- b. When using radioactive tracer material, are precautions taken to avoid ingestion or inhalation of radioactive tracer material and to avoid contamination of field stations and temporary jobsites?
- c. During the audit period, was specific authorization granted by the Commission to knowingly inject licensed material into fresh water aquifers?

6. Use of sealed sources in a well without a surface casing [10 CFR 39.51]

- a. During the audit period, were sealed sources used in a well without a surface casing for protecting fresh water aquifers?
- b. If sealed sources were used in a well without a surface casing, were procedures followed to reduce the probability of the source becoming lodged in the well?
- c. Were these procedures approved by the Commission pursuant to 10 CFR 39.13(c) or by an Agreement State?

7. Did the auditor make any independent radiation survey measurements?

- a. Describe the type, location, and results of measurements. Also note the radiation survey instrument used, serial number, and calibration date.
- b. Does any radiation level exceed regulatory limits? [10 CFR 20.1501(a), 10 CFR 20.1502(a)]

## I. TRAINING AND INSTRUCTION TO WORKERS

1. Instruction to Workers [10 CFR 19.12]

- a. Are all individuals likely to receive in a year an occupational dose in excess of 100 millirem [1 milliSievert]:
  - (1) Kept informed of the storage, transfer, or use of radiation and/or radioactive material?

- (2) Instructed in the health protection problems associated with exposure to radiation and/or radioactive material, in precautions or procedures to minimize exposure, and in the purposes and functions of protective devices employed?
  - (3) Instructed in, and required to observe, to the extent within the workers' control, the applicable provisions of Commission regulations and licenses for the protection of personnel from exposure to radiation and/or radioactive material?
  - (4) Instructed in the appropriate response to warnings made in the event of any unusual occurrence or malfunction that may involve exposure to radiation and/or radioactive material?
  - (5) Advised as to the radiation exposure reports that workers may request pursuant to 10 CFR 19.13?
2. Training [10 CFR 39.61]
- a. Training [10 CFR Part 20]
    - (1) Radiation safety program [10 CFR 20.1101]
      - Occupational exposure annual limits [10 CFR 20.1201, 10 CFR 20.1202]
      - Public annual dose limits [10 CFR 20.1301, 10 CFR 20.1302]
    - (2) NRC Forms 4 and 5
    - (3) 10 percent monitoring threshold [10 CFR 20.1502]
    - (4) Dose limits to embryo/fetus and declared pregnant worker [10 CFR 20.1208]
    - (5) Procedures for opening packages [10 CFR 20.1906]
    - (6) 10 CFR Parts 19, 20, 21, 30, 37, 39, 40, 70, and 71 reviewed, as applicable
  - b. Have all logging supervisors received training as required pursuant to 10 CFR 39.61(a)?
  - c. Have all logging assistants received training as required pursuant to 10 CFR 39.61(b)?
  - d. Were safety reviews for logging supervisors and logging assistants provided at least once during the calendar year as required pursuant to 10 CFR 39.61(c)?
  - e. Are records maintained, at least 3 years, for each logging supervisor and logging assistant training and annual safety review?
  - f. Are the subjects outlined in 10 CFR 39.61(e) included in the training program?

## J. RADIATION PROTECTION

### 1. Dosimetry

- a. Are ALARA considerations incorporated into the Radiation Protection Program? [10 CFR 20.1101(b)]
- b. Were prospective evaluations performed showing that unmonitored individuals receive less than the limits in 10 CFR 20.1502(a)? Did these evaluations consider doses to minors [10 CFR 20.1502(a)(2)] and declared pregnant women [10 CFR 20.1502(a)(3)]?
- c. Did unmonitored individuals' activities change during the year that could put them over 10 percent of the limit?
- d. If yes to "c." above, was a new evaluation performed?
- e. Is external dosimetry required (individuals likely to receive greater than 10 percent of the limit)? And is dosimetry provided to these individuals?
  - (1) Is the dosimetry supplier NVLAP-accredited? [10 CFR 20.1501(d), 10 CFR 39.65]
  - (2) Are the dosimeters exchanged at appropriate frequency?
  - (3) Are dosimetry reports reviewed by the RSO when they are received?
  - (4) Are the records on NRC Forms or equivalent? [10 CFR 20.2104(d), 10 CFR 20.2106(c)]
    - A. NRC-Form 4 "Cumulative Occupational Exposure History" completed?
    - B. NRC-Form 5 "Occupational Exposure Record for a Monitoring Period" completed?
  - (5) Declared pregnant worker/embryo/fetus [20.1502(a)]
    - A. If a worker declared her pregnancy, did licensee comply with [10 CFR 20.1208]?
    - B. Were records kept of embryo/fetus dose per [10 CFR 20.2106(e)]?
  - (6) Are workers whose exposures exceed 1 mSv [100 mrem] notified annually of their exposures?
  - (7) Are records of exposures, radiation surveys, monitoring, and evaluations maintained? [10 CFR 20.2102, 10 CFR 20.2103, 10 CFR 20.2106]

### 2. Programs

- a. Has a radiation protection program commensurate with the scope and extent of licensed activities and sufficient to ensure compliance with the provisions of 10 CFR Part 20 been developed, documented, and implemented as required by 10 CFR 20.1101(a)?

- b. Have, to the extent practical, procedures and engineering controls based upon sound radiation protection principles been used to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA)?
- c. Has the radiation protection program been reviewed at least annually, as required by 10 CFR 20.1101(c), for program content and implementation?
- d. Are licensed activities subject to the constraint on air emissions of radioactive material to the environment required by 10 CFR 20.1101(d)?
  - (1) Has a constraint on air emissions of radioactive material to the environment been established?
  - (2) If subject to the constraint on air emissions of radioactive material to the environment requirement:
    - A. Has the dose constraint been exceeded?
    - B. Was this exceedance reported as required by 10 CFR 20.2203 and were prompt appropriate corrective actions taken to ensure against recurrence?

**K. RADIOACTIVE WASTE MANAGEMENT**

- 1. Waste Storage Areas
  - a. Is storage area properly posted? [10 CFR 20.1902]
  - b. Are containers properly labeled? [10 CFR 20.1904]
  - c. Is the waste area secured against unauthorized removal of or access to licensed material? [10 CFR 20.1801]
- 2. Sealed Sources
  - a. Are sources transferred to authorized individuals? [10 CFR 20.2006, 10 CFR 20.2001, 10 CFR 30.41]
  - b. Name of organization: \_\_\_\_\_.
  - c. Are records of sealed sources transferred to authorized individuals maintained? [10 CFR 20.2108]
- 3. Decay-in-Storage [10 CFR 20.2001]
  - a. Are Decay-in-Storage procedures available and followed?
  - b. Are radionuclides being segregated for storage according to half-life?
  - c. Do radionuclides being stored all have half-lives less than 120 days?
  - d. Before waste is disposed of
    - (1) Is a radiation survey performed at the container surface with an appropriate radiation survey instrument set on its most sensitive scale, with no interposed shielding, to determine that its radioactivity cannot be distinguished from background?



- (2) Are all radiation labels removed or obliterated, as appropriate? [10 CFR 20.1904]
  - e. Are records of waste disposed of by the decay-in-storage method maintained? [10 CFR 20.2108]
- 4. Disposal by release into sanitary sewerage [10 CFR 20.2003]
  - a. Are procedures available and followed for disposal by release into sanitary sewerage?
  - b. Is licensed material readily soluble or readily dispersible in water? [10 CFR 20.2003(a)(1)]
  - c. Does the quantity of licensed material that the licensee releases into the sewer in one month, divided by the average monthly volume of water released into the sewer, not exceed the concentration specified in 10 CFR Part 20, Appendix B, Table 3?
  - d. If more than one radionuclide is released, does the sum of the ratios of the average monthly discharge of a radionuclide to the corresponding limit in 10 CFR Part 20, Appendix B, Table 3, not exceed unity?
  - e. Does the total quantity of licensed material and other radioactive material released into the sanitary sewerage system in a year not exceed 5 Ci [185 GBq] of hydrogen-3, 1 Ci [37 GBq] of carbon-14, and 1 Ci [37 GBq] of all other radioactive materials combined? [10 CFR 20.2003(a)(4)]
  - f. Are records of waste disposed of by release into sanitary sewerage maintained? [10 CFR 20.2108]
- 5. Transfer to Authorized Recipient
  - a. Is any waste being transferred to a person specifically authorized to receive it? [10 CFR 20.2001]
  - b. Is waste being transferred to a person specifically authorized to receive it, properly manifested? [10 CFR 20.2006]
  - c. Are records of waste disposed of by transfer to a person specifically authorized to receive it maintained? [10 CFR 20.2108]

**L. RECORDKEEPING FOR DECOMMISSIONING**

- 1. Are records kept of information important for decommissioning? [10 CFR 30.35(g), 10 CFR 70.25(g)]
- 2. Do records include all information outlined in 10 CFR 30.35(g) and 10 CFR 70.25(g)?
- 3. Are records of radiation surveys required by 10 CFR 20.2103(a) maintained with records important for decommissioning as required by 10 CFR 20.1501(b)?

**M. TRANSPORTATION [10 CFR 71.5(a) and 49 CFR 170-180]**

1. Shipments are:
  - a. Delivered to common carriers
  - b. Transported in company's private vehicle
  - c. Both
  - d. No shipments since last audit
2. Have personnel responsible for preparing a package containing licensed material, transporting a package containing licensed material, or delivering a package to a carrier for transport received HAZMAT training in accordance with 49 CFR 172.700-172.704?
3. Packages
  - a. Are authorized packages used for transporting licensed material? [49 CFR 173.415, 49 CFR 173.416]
  - b. Are performance test records on file:
    - (1) For Special Form sources? [49 CFR 173.476(a)]
    - (2) For DOT-7A packages? [49 CFR 173.415(a)]
4. Are Certificates of Compliance (COC's) for Type B packages on file? [10 CFR 71.17(c)(1)]
5. Does each package containing licensed material have two labels with Transportation Index (TI), Nuclide, Activity, and Hazard Class? [49 CFR 172.403, 49 CFR 172.441]
6. Are packages properly marked [Shipping name, UN number, Package Type, Reportable Quantity (RQ), Name and address of consignee]? [49 CFR 172.301, 49 CFR 172.310, 49 CFR 172.324, 49 CFR 172.101, 49 CFR 173.471]
7. Are packages containing licensed material closed and sealed during transport? [49 CFR 173.475(f), 49 CFR 173.412(a)]
8. Are shipping papers prepared and used? [49 CFR 172.200(a)]
9. Do shipping papers contain proper entries? [Shipping name; Hazard Class; Identification Number (UN Number); Total Quantity; Package Type; Nuclide; Reportable Quantity (RQ); Physical and Chemical Form; Activity (SI units required); category of label; TI; Shipper's Name, Certification, and Signature; Emergency Response Phone Number; Emergency Response Information; and Cargo Aircraft Only (if applicable)] [49 CFR 172.200, 49 CFR 172.201, 49 CFR 172.202, 49 CFR 172.203, 49 CFR 172.204, 49 CFR 172.604]
10. Are shipping papers within driver's reach and readily accessible during transport? [49 CFR 177.817(e)]
11. Are packages secured against movement? [49 CFR 177.834]
12. Are vehicles placarded, if required? [49 CFR 172.504]

13. Are proper overpacks in place, if used (shipping name, UN Number, labeled, statement indicating that inner package complies with specification package) [49 CFR 173.25]
14. Are components of a security plan in place? [49 CFR 172.802]
15. Are incidents reported to the DOT National Response Center? [49 CFR 171.15, 49 CFR 171.16]

**N. OPERATING AND EMERGENCY PROCEDURES**

1. Are procedures current? [10 CFR 39.63]
2. Do the procedures contain the information specified in 10 CFR 39.63?

**O. SECURITY PROGRAM FOR CATEGORY 1 AND CATEGORY 2 RADIOACTIVE MATERIALS [10 CFR Part 37]**

1. Has a commensurate security program been implemented?
2. Have trustworthiness and reliability determinations been made?
3. Is there access control to information and aggregated Category 1 or Category 2 quantities of radioactive material?
4. Have monitoring, detection, assessment, and response been operational all the time?
5. Has a valid test of the security system been performed to ensure operability?
6. Is there a plan for local law enforcement agency coordination?
7. Is there a method for tracking the transport of packages containing aggregated Category 1 or Category 2 quantities of radioactive material?
8. Are mobile devices secured?
9. Is sensitive information secured and only available to personnel who have been deemed trustworthy and reliable?
10. Were any security reports made (e.g., loss, theft, or sabotage of aggregated Category 1 or Category 2 quantities of radioactive material, the results of fingerprints are positive for the FBI Terrorist Screening Data)?
11. Were all records required by 10 CFR Part 37 maintained?

**P. AUDITOR'S INDEPENDENT MEASUREMENTS (IF MADE)**

Survey instrument	Serial No.	Last calibration
_____	_____	_____

1. Were the auditor's measurements compared to the licensee's?  
Describe the type, location, and results of measurements; attach a diagram/survey sheet.

**Q. NOTIFICATION AND REPORTS**

1. Was any licensed material lost or stolen? Were reports made? [10 CFR 20.2201]
2. Did any reportable incidents occur? Were reports made? [10 CFR 20.2202, 10 CFR 30.50, 10 CFR 40.60 10 CFR 70.50,]
3. Did any overexposures or high radiation levels occur? Were they reported? [10 CFR 20.2203, 10 CFR 30.50, 10 CFR 40.60, 10 CFR 70.50]
4. Were any contaminated packages or packages with surface radiation levels exceeding 200 mrem received? Were they reported to the NRC?
5. If any events (as described in items 1 through 4 above) did occur, what was the root cause? Were appropriate notifications made and corrective actions taken?
6. Were notifications and reports of radiation exposure data for individuals, monitored to show compliance with 10 CFR Part 20, made in accordance with 10 CFR 19.13?
7. Were reports of defects and noncompliances prepared and submitted to the NRC in accordance with 10 CFR 21.21?
8. Were annual reports of individual monitoring furnished to the NRC in accordance with 10 CFR 20.2206(b)?
9. Is the management/RSO aware of the telephone number for the NRC Emergency Operations Center? [301-816-5100]

**R. POSTING AND LABELING**

1. Is NRC-Form 3, "Notice to Workers" posted? [10 CFR 19.11]
2. Are NRC regulations and license documents posted or is a notice indicating where documents can be examined posted? [10 CFR 19.11, 10 CFR 21.6, Section 206 of Energy Reorganization Act of 1974]
3. Are other posting and labeling requirements met unless exempted by 10 CFR 20.1903 or 10 CFR 20.1905? [10 CFR 20.1902, 10 CFR 20.1904]

**S. FIELD STATIONS AND TEMPORARY JOB SITES**

1. Are documents and records required by 10 CFR 39.73 available at each field station?
2. Are documents and records required by 10 CFR 39.75 available at each temporary jobsite until the well logging operation is completed?

**T. ABANDONMENT OF SOURCES**

1. Is well logging with a sealed source performed only after obtaining a written agreement with the employing well owner or operator? [10 CFR 39.15]
2. Do written agreements with well owners or operators include the items contained in 10 CFR 39.15?
3. Is well logging with an unsealed material performed only after obtaining a written agreement with the employing well owner or operator?

4. Do written agreements with well owners or operators include the items contained in criteria of section 8.10.1 for unsealed material?
5. During the audit period, did any events occur requiring reporting under 10 CFR 39.77?

**U. NRC CORRESPONDENCE**

1. Have all NRC correspondence (e.g., NRC Regulatory Issue Summaries, NRC Bulletins, NRC Information Notices, and NMSS Newsletters) issued since the previous audit and applicable to well logging licensees been reviewed?
2. For the correspondence that is applicable to well logging licensees, has appropriate action been taken, (e.g., training, updating procedures, etc.), as necessary?

**V. INTERNAL AUDITS OR INSPECTIONS**

1. Internal audits are conducted?
  - Audits conducted by
  - Frequency
2. Content and implementation of the radiation protection program reviewed at least annually? [10 CFR 20.1101(c)]
3. Records are maintained in accordance with 10 CFR 20.2102 requirements?

**W. DEFICIENCIES IDENTIFIED IN AUDIT; CORRECTIVE ACTIONS**

1. Summarize problems/deficiencies identified during the audit.
2. If problems/deficiencies were identified in this audit, describe corrective actions planned or taken by the facility. Include date(s) when corrective actions are implemented.
3. Provide any other recommendations for improvement.

**X. LICENSE CONDITIONS OR ISSUES**

1. Review the license conditions, NRC or Agreement State violations, Orders, Confirmatory Action Letters, site-specific procedures and other safety or security issues, and describe any findings.
2. Were problems or deficiencies identified at licensee facilities other than at audit location?

**Y. PERFORMANCE-BASED REVIEW**

1. Conduct performance-based reviews of radiation workers performing licensed activities:
  - to assess the capability of the radiation workers to maintain exposures ALARA
  - to assess that radiation workers follow the operating procedures

- to assess the effectiveness of the operating procedures and compliance with the regulations, license conditions and the licensee commitments submitted in support of a license (and incorporated by “tie-down” conditions)
  - to ensure the safe and secure use of radioactive material
  - to verify that radiation workers are cognizant of the emergency procedures and, if necessary, would be able to implement them and maintain exposures ALARA
  - to ensure that emergency procedures have been developed for all likely scenarios
2. Take the necessary actions to address programmatic and performance deficiencies with radiation workers and facilitate immediate corrective measures.
- Note:** Performance-based reviews may include observation of licensed activities, review of records, and interviews with key personnel.

## **Z. EVALUATION OF OTHER FACTORS**

1. Are senior licensee management appropriately involved with the radiation safety program and RSO oversight?
2. Does the RSO have sufficient time to perform his/her radiation safety duties and is not too busy with other assignments?
3. Does the licensee have sufficient staff for the radiation safety and security programs?

**APPENDIX F**

**WELL LOGGING SUPERVISOR AND LOGGING ASSISTANT  
TRAINING REQUIREMENTS**





## Well Logging Supervisor and Logging Assistant Training Requirements

Requirement	Training Criteria
<b>10 CFR 39.61(a)</b>	<b>Logging Supervisor</b>
<p>A. Receive Training in Title 10 of the <i>Code of Federal Regulations</i> (10 CFR) 10.39.61(e) Topics</p> <p>(Classroom Training-Approximately 24 hours length)</p>	<p style="text-align: center;">Topics in 10 CFR 39.61(e)</p> <p><b>Fundamentals of Radiation Safety</b> characteristics of gamma radiation</p> <ul style="list-style-type: none"> <li>• units of radiation dose and quantity of radioactivity</li> <li>• hazards of exposure to radiation</li> <li>• levels of radiation from licensed material</li> <li>• methods of controlling radiation dose (time, distance, and shielding)</li> <li>• radiation safety practices, including prevention of contamination, and methods of decontamination</li> <li>• <b>Radiation Detection Instruments</b> use, operation, calibration, and limitations of radiation survey instruments               <ul style="list-style-type: none"> <li>• survey techniques</li> <li>• use of personnel monitoring equipment</li> </ul> </li> <li>• <b>Equipment to be Used</b> operation of equipment, including source handling equipment and remote handling tools               <ul style="list-style-type: none"> <li>• storage, control, and disposal of licensed material</li> <li>• inspection and maintenance of equipment</li> </ul> </li> <li>• <b>Requirements of Pertinent Federal Regulations</b> Case histories of accidents in well logging operations</li> </ul>

Requirement	Training Criteria
10 CFR 39.61(a)	Logging Supervisor
B. Must receive Copies of and Instruction in: (Classroom Training–Approximately 8 h in length)	NRC Regulations: <ul style="list-style-type: none"> <li>• Applicable sections of 10 CFR Parts 19, 20, and 39</li> <li>• The NRC License under which the logging supervisor will perform well logging</li> <li>• The Licensee’s Operating &amp; Emergency Procedures required by 10 CFR 39.63</li> </ul>
C. Receive Equipment Training (Approximately 4 h in length)	Training includes: <ul style="list-style-type: none"> <li>• Well Logging Equipment</li> <li>• Sealed sources</li> <li>• Handling equipment</li> <li>• Radiation survey meters</li> <li>• Daily inspection</li> </ul>
D. Completion of a Written Examination  Pass Written Examination on 10 CFR 39.61(e) Topics outlined in Item A	<ul style="list-style-type: none"> <li>• Complete a written examination approved by the NRC</li> <li>• Passing Grade 80 percent</li> </ul>
E. On-the-Job Training–using sealed sources  160 h for a mineral logging licensee, or a licensee using sealed sources with activities less than 500 mCi <b>OR</b> 3 months or 520 h for gas or oil well logging operations using sealed sources with activities greater than 500 mCi	Under the supervision of a qualified logging supervisor
F. On-the-Job Training–using tracer materials  <b>Single Well Tracer Operations</b> 3 months or 520 h or completion of 50 tracer operations <b>Field Flood Operations</b> 3 months or 520 h or completion of 3 field flood tracer operations involving multiple wells	Under the supervision of a qualified logging supervisor
G. Demonstrate Understanding in Use of Well Logging Equipment by Passing Practical Field Exam	Questions on topics determined by the licensee  Use the Well Logging Supervisor/Logging Assistant Inspection Checklist as a potential source of questions.

<b>Requirement</b>		<b>Training Criteria</b>	
<b>10 CFR 39.61(a)</b>		<b>Logging Supervisor</b>	
H.	Annual Refresher Training	Review the following: <ul style="list-style-type: none"> <li>• Annual radiation safety program review</li> <li>• Annual review of operating and emergency procedures</li> <li>• New procedures, equipment, or techniques</li> <li>• New regulations</li> <li>• Observations and deficiencies during audits of well logging supervisor and logging assistants and discussion of any significant incidents or accidents involving well logging</li> <li>• Employee questions</li> </ul>	
I.	Records	To be maintained in accordance with 10 CFR 39.61(d)	
<b>10 CFR 39.61(b)</b>		<b>Logging Assistant</b>	
A.	Must receive Copies of and Instruction in: (Classroom Training – Approximately 8 h in length)	NRC Regulations <ul style="list-style-type: none"> <li>• Applicable sections of 10 CFR Part 19 and Part 20</li> <li>• The Licensee’s Operating &amp; Emergency Procedures required by 10 CFR 39.63</li> </ul>	
B.	Pass Oral or Written Exam	<ul style="list-style-type: none"> <li>• Complete a written examination approved by the NRC.</li> <li>• Passing Grade 80 percent</li> </ul>	
C.	Receive Equipment Training  (Approximately 2 to 4 h in length)	<ul style="list-style-type: none"> <li>• Training under the supervision of a qualified well logging supervisor appropriate for the logging assistant’s intended job responsibilities:</li> <li>• Well logging equipment</li> <li>• Sealed sources</li> <li>• Handling equipment</li> <li>• Radiation survey meters</li> <li>• Daily inspection</li> </ul>	
D.	Annual Refresher Training	Review the following: <ul style="list-style-type: none"> <li>• Annual review of operating and emergency procedures</li> <li>• New procedures or equipment</li> <li>• New regulations</li> <li>• Observations and deficiencies during audits and discussion of any significant incidents or accidents involving well logging operations</li> <li>• Employee questions</li> </ul>	
E.	Records	To be maintained in accordance with 10 CFR 39.61(d)	



**APPENDIX G**

**ANNUAL INTERNAL JOB PERFORMANCE INSPECTION CHECKLIST FOR  
WELL LOGGING SUPERVISORS AND WELL LOGGING ASSISTANTS**



## Annual Internal Job Performance Inspection Checklist for Well Logging Supervisors and Well Logging Assistants

Well Logging Location _____		Date _____
Logging Supervisor _____		Time _____
Logging Assistant _____		
Inspector _____		
Yes	No	Questions
		1. Personnel dosimetry (TLD, OSL badge, or other) available and properly worn?
		2. Individuals working within the restricted area wearing personnel dosimeters?
		3. Restricted areas properly controlled to prevent unauthorized entry?
		4. Individuals working within the restricted area using calibrated and operable radiation survey meters? Availability of survey instrument calibration record?
		5. Individuals working with licensed material performing radiation surveys?
		6. Most current radiation survey records as required by 10 CFR 39.67 available? <ul style="list-style-type: none"> <li>• Measurements of areas of storage and use</li> <li>• Measurements of positions occupied in transport vehicle</li> <li>• Measurement of vehicle exterior</li> <li>• Contamination check of well logging tool prior to transport</li> <li>• Measurements before and after subsurface tracer use</li> </ul>
		7. Shipping papers for transportation of radioactive material available and properly filled out?
		8. Utilization log properly filled out with complete and accurate information?
		9. Visual check of well logging equipment to identify defects and to identify that required labels are present is being performed before each use? Is defective well logging equipment removed from service, sent to be repaired, and a record made in accordance with 10 CFR 39.43?
		10. Copy of 10 CFR Parts 19, 20, and 39 of NRC regulations, copy of the radioactive materials license, operating and emergency procedures, radiation survey instrument calibration, leak test records, physical inventory records, utilization records, inspection and maintenance records, training records and radiation survey records available at field stations?
		11. Copy of the licensee's operating and emergency procedures, radiation survey meter calibrations records, radiation survey records, and copy of the radioactive materials license available at temporary jobsites?

Yes	No	Questions
		12. Licensed material stored and secured properly to prevent unauthorized removal? Licensed material under constant surveillance when in use and not in storage?
		13. Storage area properly posted with "Caution or Danger Radioactive Material" signs?
		14. Are well logging supervisors and/or well logging assistants following the company's operating and emergency procedures?
		15. Are well logging supervisors and/or well logging assistants using specific handling tools that are compatible with the sealed sources in accordance with manufacturers/distributors instructions?
		16. Additional items of noncompliance noted during this audit? (If any, explain, in remarks.)
<b>Remarks:</b>		



## **APPENDIX H**

### **RADIATION MONITORING INSTRUMENT SPECIFICATIONS AND MODEL SURVEY INSTRUMENT CALIBRATION PROGRAM**



## Radiation Monitoring Instrument Specifications and Model Survey Instrument Calibration Program

### Radiation Monitoring Instrument Specifications

The specifications in Table H-1<sup>1</sup> will help applicants and licensees choose the proper radiation-detection equipment for monitoring the radiological conditions at their facilities or jobsites. Additional information about instruments and their uses also can be found in NUREG-1575, "Multi Agency Radiation Survey and Sited Investigation Manual (MARSSIM)," Chapter 6 and Appendix H.

<b>Table H-1. Typical Survey Instruments<sup>2</sup></b>			
<b>Portable Instruments Used for Contamination and Ambient Radiation Surveys</b>			
Detectors	Radiation	Energy Range	Efficiency
Exposure Rate Meters	Gamma, X-Ray	micro-Roentgen to Roentgen	N/A
Count Rate Meters			
Geiger Mueller (GM)	Alpha	All energies (dependent on window thickness)	Moderate
	Beta	All energies (dependent on window thickness)	Moderate
	Gamma	All energies	< 1 percent
Sodium Iodide (NaI) Scintillator	Gamma	All energies (dependent on crystal thickness)	Moderate
Plastic Scintillator	Beta	C-14 or higher (dependent on window thickness)	Moderate
He Proportional Detector*	Neutron	Thermal to 12 MeV	Moderate
Proton Recoil Scintillator*	Neutron	Thermal to 100 MeV	Moderate

<sup>1</sup>Table adapted from "The Health Physics and Radiological Health Handbook, Revised Edition," edited by Bernard Shleien, 1992 (except for \* items).

<sup>2</sup>Instruments used to measure radiological conditions at licensed facilities or jobsites.

**Table H-1. Typical Survey Instruments<sup>2</sup>**

<b>Stationary Instruments Used to Measure Wipe, Bioassay, and Samples from Tracer and Field Flood Study Job Sites</b>			
Detectors	Radiation	Energy Range	Efficiency
Liquid Scintillation Counter (LSC)*	Alpha	All energies	High
	Beta	All energies	High
	Gamma		Moderate
Gamma Counter (NaI)*	Gamma	All energies	High
Gas Proportional	Alpha	All energies	High
	Beta	All energies	Moderate
	Gamma	All energies	<1%

In addition to selecting an instrument that is appropriate for the radiation(s) of interest, it is important to know if the instrument is sufficiently sensitive to make measurements at the required level. This is particularly important for measurements such as leak-test samples and bioassay measurement, and for decommissioning of facilities or equipment. The “minimum detectable activity” (MDA) for the instrument should be a fraction (10 to 50 percent) of the criteria to be met.

Guidance for performing surveys for decommissioning, which require direct measurement surveys, scanning measurement surveys, and surveys for removable contamination, is found in NUREG-1757, “Consolidated Decommissioning Guidance.” Additional information related to determining the MDA and minimum detectable concentration for direct measurements and scanning measurements may be found in Chapter 6 and Appendix H of NUREG-1575.

### **Model Radiation Survey Instrument Calibration Program**

#### **Training**

Before independently calibrating radiation survey instruments, an individual should complete both classroom and on-the-job training as follows:

- Classroom training may be in the form of lecture, video, computer-based, or self-study and will cover the following subject areas:
  - principles and practices of radiation protection
  - radioactivity measurements, monitoring techniques, and the use of radiation detection instruments

- mathematics related to the use and measurement of radioactivity
- biological effects of radiation
- On-the-job training will consist of the following:
  - observing authorized personnel performing radiation survey instrument calibration
  - conducting radiation survey meter calibrations under the supervision and in the physical presence of an individual authorized to perform calibrations

### **Facilities and Equipment for Calibration of Dose and Dose Rate Measuring Instruments**

- Individuals conducting radiation survey instrument calibrations will wear assigned dosimetry.
- Individuals conducting calibrations will use a calibrated and operable radiation survey instrument to ensure that unexpected changes in exposure rates are identified and corrected.
- To reduce doses received by individuals not calibrating radiation survey instruments, calibrations will be conducted in an isolated area of the facility or at times when no one else is present.
- The calibration source should be well collimated, and the calibration area should be designed to minimize scatter of radiation, which could affect the calibration process.
- The calibration area should be appropriately controlled so that persons entering the area will be aware if a radiation source is in use.
- Evaluate posting of the calibration area with appropriate radiation warning signs, as required by Subpart J of 10 CFR Part 20.

### **Frequency of Calibration of Radiation Measurement Instruments and Equipment**

A licensee committed to a routine or emergency radiation survey program should perform an acceptable calibration of all radiation measurement instruments and equipment at the frequency specified in U.S. Nuclear Regulatory Commission (NRC) regulations, annually, or at the frequency recommended by the manufacturer, whichever period is shorter.

Special calibrations should be performed at any time there is reason to believe that the operating characteristics of a radiation measurement instrument have changed, by repair or alteration, or whenever system performance is observed to change significantly.

Routine maintenance of radiation measurement instruments should be performed as recommended by the manufacturer.

Primary or secondary standard instruments used to calibrate radiation measurement instruments should be inspected frequently for consistency of performance.

## Calibration Sources for Dose and Dose Rate Measuring Instruments

Radioactive sealed sources will be used for calibrating dose and dose rate measuring radiation survey instruments; these sources will have the following characteristics:

- The sources should approximate a point source.
- Calibration fields from gamma sources should be known with an accuracy when compared to secondary or primary national standards of 5 percent for dose rates greater than or equal to 1.0 microgray/hour ( $\mu\text{Gy/h}$ ) [0.1 millirad/hour (mrad/h)] and 10 percent for dose rates less than 1.0  $\mu\text{Gy/h}$  [0.1 mrad/h].
- The sources should contain a radionuclide that emits radiation of identical or similar type and energy as the environment in which the calibrated device will be used.
- The sources should be strong enough to give an exposure rate of at least 7.7 microcoulomb per kilogram per hour [30 milliroentgen per hour] at 100 centimeters {e.g., 3.1 gigabecquerels [(85 mCi (millicuries))] of cesium-137 or 780 megabecquerels [21 mCi] of cobalt-60}.

**Note:** Inverse square and radioactive decay laws should be used to correct changes in exposure rate due to changes in distance or source decay.

## Calibration of Dose or Dose Rate Measuring Instruments

There are three kinds of scales frequently used on dose and dose-rate survey meters. These are calibrated as follows:

- **Linear readout instruments** with a single calibration control for all scales should be adjusted at the point recommended by the manufacturer or at a point within the normal range of use. Instruments with calibration controls for each scale should be adjusted on each scale. After adjustment, check the response of the instrument at approximately 20 percent and 80 percent of full scale. Instrument readings should be within  $\pm x$  (noted below) of the conventionally true value for the following ranges:
  - Background to 10  $\mu\text{Gy/h}$  [1.0 mrad/h];  $\pm x = \pm 30\%$
  - 10  $\mu\text{Gy/h}$  [1.0 mrad/h] to 1.0 mGy/h [100 mrad/h];  $\pm x = \pm 20\%$
  - 1.0 mGy/h [100 mrad/h] to 10 Gray/h [1,000 Rad/h];  $\pm x = \pm 10\%$
- **Logarithmic readout instruments**, which commonly have a single readout scale spanning several decades, normally have two or more adjustments. Adjust the instrument for each scale according to site specifications or the manufacturer's specifications. After adjustment, check the calibration at a minimum of one point on each decade. Instrument readings should have a maximum deviation from the conventionally true value as described for linear readout instruments.

**Digital readout instruments** should be calibrated the same as linear readout instruments.

**Note:** Readings above  $2.58 \times 10^{-4}$  coulomb/kilogram/hour [1 roentgen/h] need not be calibrated, unless the licensee expects to make measurements at higher dose rates; regardless, such scales should be checked for operation and response to radiation.

**Note:** Instruments used to monitor higher energies are most easily calibrated in known radiation fields produced by sources of gamma rays of approximately the same energies as those to be measured.

### **Calibration of Surface Contamination Measurement Instruments**

Instruments used to detect surface contamination usually consist of a count-rate meter and a detector that is appropriate for the types of radiations being measured.

The efficiency of radiation survey meters must be determined by using radiation sources with similar energies and types of radiation that users of the radiation survey instrument intend to measure.

If each scale has a calibration potentiometer, the reading should be adjusted to respond to the calibration source at approximately 80 percent of full scale, and the response at approximately 20 percent of full scale should be observed. If only one calibration potentiometer is available, the response should be adjusted at mid-scale on one of the scales, and response on the other scales should be observed. The instrument efficiency factor (e.g., cpm/dpm) thus obtained should have a signal-to-noise ratio, including the compilation of source and instrument uncertainties, of  $\pm x$  for the following ranges:

- alpha measurement
  - 0.01 Bq/cm<sup>2</sup> to 2.0 Bq/cm<sup>2</sup> [60 to 12,000 dpm/100 cm<sup>2</sup>];  $\pm x = \pm 20\%$
  - 2.0 Bq/cm<sup>2</sup> to 200 Bq/cm<sup>2</sup> [12,000 to 1,200,000 dpm/100 cm<sup>2</sup>];  $\pm x = \pm 10\%$
- beta measurement
  - 0.05 Bq/cm<sup>2</sup> to 2.0 Bq/cm<sup>2</sup> [300 to 12,000 dpm/100 cm<sup>2</sup>];  $\pm x = \pm 20\%$
  - 2.0 Bq/cm<sup>2</sup> to 200 Bq/cm<sup>2</sup> [12,000 to 1,200,000 dpm/100 cm<sup>2</sup>];  $\pm x = \pm 10\%$

### **Calibration of Analytical Instruments Such as Liquid Scintillation Counters, Gamma Counters, Gas Flow Proportional Counters, and Multichannel Analyzers**

Analytical instruments used to determine radioactivity in a sample may be specialized equipment according to the type of samples to be analyzed and the types and quantities of radioactivity to be measured. Typically, the sample sizes and activities are very small, and can be difficult to measure. Sample collection and preparation may differ for the various analytical instruments, so manufacturer procedures and industry standard practices should be followed. Such analytical instruments should be calibrated in accordance with the manufacturer's instructions. Analytical instruments typically require routine maintenance and verification procedures to ensure that they are operating properly when used.

As with calibration of other radiation measurement instruments, calibration of analytical instruments use radioactive sealed sources. These should be suitable for the geometry of the samples to be analyzed. The calibration sources should have a known activity and be of similar type and energy as the radioactive materials to be analyzed. The analysis should be sensitive enough to detect the lowest levels of radioactivity desired. Correction of results for quenching, self-absorption, and other factors may be required, depending on the analytical instrument, the samples type, and other environmental conditions.

### **Calibration Records**

Calibration records for all radiation survey instruments should indicate the procedure used and the results of the calibration. The records should include the following:

- the owner or user of the radiation survey instrument
- a description of the radiation survey instrument, including the manufacturer's name, model number, serial number, and type of detector
- a description of the calibration source, including the exposure rate at a specified distance or activity on a specified date
- for each calibration point, the calculated exposure rate or count rate, the indicated exposure rate or count rate, the deduced correction factor (the calculated exposure rate or count rate divided by the indicated exposure rate or count rate), and the scale selected on the instrument
- the exposure reading indicated with the radiation survey instrument in the "battery check" mode (if available on the instrument)
- for radiation survey instruments with external detectors, the angle between the radiation flux field and the detector (i.e., parallel or perpendicular)
- for radiation survey instruments with internal detectors, the angle between radiation flux field and a specified surface of the instrument
- for radiation detectors with removable shielding, an indication as to whether the shielding was in place or removed during the calibration procedure
- the exposure rate or count rate from a check source, if used
- the name and signature of the individual who performed the calibration and the date on which the calibration was performed

The following information will be attached to the radiation survey instrument as a calibration sticker or tag:

- for dose and dose rate measuring instruments, the source radionuclide used to calibrate the radiation survey instrument (with correction factors) for each scale



- for surface contamination measurement instruments, the efficiency of the radiation survey instrument, for each radionuclide the instrument will be used to measure (if efficiency is not calculated before each use)
- for each scale or decade not calibrated, an indication that the scale or decade was checked only for function but not calibrated
- the date of calibration and the next calibration due date
- the apparent exposure rate or count rate from the check source, if used

Service providers who will perform calibrations as a commercial service will also include their company name and radioactive materials license number on the calibration certificate.

### **Air Sampler Calibration**

To assess accurately the air concentration of radioactive materials in a given location, the volume of air sampled and the quantity of contaminant in the sample must be determined. Accurate determination of the volume of air sampled requires standard, reproducible, and periodic calibration of the air metering devices that are used with air sampling instruments.

Licenses can find guidance on total air sample volume calibration methods acceptable to NRC staff in the publication titled "Air Sampling Instruments," which can be found in the 9th Edition, American Conference of Governmental Industrial Hygienists, 2001. This information is supplemented below.

### **Frequency of Calibration of Air Sampling Equipment**

- A licensee committed to a routine or emergency air sampling program should perform an acceptable calibration of all airflow or volume metering devices at least annually (Regulatory Guide 8.25, Rev. 1, "Air Sampling in the Workplace").
- Special calibrations should be performed at any time there is reason to believe that the operating characteristics of a metering device have been changed, by repair or alteration, or whenever system performance is observed to have changed significantly.
- Routine instrument maintenance should be performed as recommended by the manufacturer.
- Primary or secondary standard instruments used to calibrate air sampling instruments should be inspected frequently for consistency of performance.

### **Error Limit for Measurement of Air Sample Volume**

Most methods of calibrating airflow or air volume metering devices require direct comparison to a primary or secondary standard instrument to determine a calibration curve or a correction factor. An example of a primary standard is a spirometer that measures total air volume directly with high precision by liquid displacement. An example of a secondary standard is a wet-test meter that has been calibrated against a primary standard.

The following are significant errors associated with determining the total air volume sampled:

$E_C$ : The error in determining the calibration factor. (An acceptable estimate is the percentage error associated with the standard instrument used in the calibration.)<sup>3</sup>

$E_S$ : Intrinsic error in reading the meter scale. (An acceptable estimate is the percentage equivalent of one-half of the smallest scale division, compared to the scale reading.)

$E_t$ : The percentage error in measurement of sampling time that should be kept within 1 percent.

$E_V$ : The most probable value of the cumulative percentage error in the determination of the total air volume sampled.  $E_V$  can be calculated from the following equation, provided there are no additional significant sources of errors:

$$E_V = [E_S^2 + E_C^2 + E_t^2]^{1/2}$$

The most probable value of the cumulative error  $E_V$ , in the determination of total volume, should be less than 20 percent.

A sample calculation of the most probable value of the cumulative error in total volume measured is as follows: If accuracies of the scale reading, the calibration factor, and sample time are  $\pm 4$ , 2, and 1 percent, respectively, and there are no other significant sources of error, the cumulative error would be:

$$E_V = [4^2 + 2^2 + 1^2]^{1/2} = 4.58\% \text{ or approx. } 5\%$$

If there are significant differences in pressure and temperature between the calibration site and the sampling site, appropriate corrections should be made using the ideal gas laws provided below:

$$V_s = V_1 * (P_1/760) * (273/T_1)$$

where  $V_s$  = volume at standard pressure and temperature (760 mm Hg and 273° K)

$V_1$  = volume measured at conditions  $P_1$  and  $T_1$

$T_1$  = temperature of  $V_1$  in K

$P_1$  = pressure of  $V_1$  in mm Hg

### **Documentation of Calibration of Air Metering Devices**

The licensee should maintain records of all routine and special calibrations of airflow or volume metering devices, including the primary or secondary standard used, method employed, and estimates of accuracy of the calibrated metering devices. All instruments should be clearly

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<sup>3</sup>The calibration factor should be based on two kinds of determinations. First, correction factors should be determined at several flow rates distributed over the full-scale range. Each flow rate correction factor should be determined while adjusting flow rates upscale and again while adjusting flow rates downscale, and the two sets of data should be compared. Second, subsequent calibrations should compare the new correction factors to those determined during the previous calibration. If observed differences are significant compared to the overall volume error limit of 20 percent, licensees should include an additional error term in the calculation above.

labeled as to the date and results of the most recent calibration and should include the appropriate correction factors to be used.

**References:**

The Health Physics and Radiological Health Handbook, 4<sup>th</sup> Edition. Edited by Thomas E. Johnson and Brian K. Birky, dated 2012.

American National Standards Institute (ANSI) N323AB-2013, "American National Standard for Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments." Copies may be obtained from the American National Standards Institute (ANSI) at [www.ansi.org](http://www.ansi.org).

Regulatory Guide 8.25, Revision 1, "Air Sampling in the Workplace," June 1992 NUREG-1400, "Air Sampling in the Workplace," September 1993 (ADAMS Accession No. ML13051A671).

"Air Sampling Instruments," American Conference of Governmental Industrial Hygienists, 9<sup>th</sup> Edition, 2001.



## **APPENDIX I**

**GUIDANCE FOR DEMONSTRATING THAT UNMONITORED INDIVIDUALS  
ARE NOT LIKELY TO EXCEED 10 PERCENT OF THE ALLOWABLE LIMITS**



## Guidance for Demonstrating That Unmonitored Individuals Are Not Likely To Exceed 10 Percent of the Allowable Limits

Dosimetry is required for individual adults likely to receive, in a year from sources external to the body, an occupational dose in excess of 10 percent of the applicable regulatory limits in Title 10 of the *Code of Federal Regulations* (10 CFR) 20.1201, "Occupational dose limits for adults." However, logging supervisors or logging assistants are required by 10 CFR 39.65(a) to wear a personnel dosimeter that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program processor at all times during the handling of licensed radioactive materials such as licensed tracer materials or sealed sources. Personnel dosimeters may be a film badge, a thermoluminescent dosimeter (TLD), or an optically stimulated luminescence (OSL) dosimeter. In instances where pocket ion chamber dosimeters are used instead of film badges, TLDs, or OSL dosimeters to assess radiation dosage of personnel who are not logging supervisors or logging assistants, a check of the response of the dosimeters to radiation should be made every 12 months. Acceptable pocket dosimeters should read within plus or minus 20 percent of the true radiation dose. To demonstrate to the NRC that dosimetry is *not* required for nonlogging personnel, a licensee may need to perform a prospective evaluation in accordance with 10 CFR 20.1502 to demonstrate that the unmonitored adult workers are not likely to exceed 10 percent of the applicable limits.

**The applicable total effective dose equivalent (TEDE) (whole body) limit is 50 mSv [5 rems] per year, and 10% of that value is 5 mSv [500 millirems] per year for an adult radiation worker.**

Three common ways that individuals may exceed 10 percent of the applicable limits are mishandling tracer radionuclides, logging tools, or any devices containing sealed sources. However, most routine well logging or tracer activities result in minimal doses to well logging and tracer personnel. A licensee will need to conduct an evaluation of doses occupationally exposed adult workers could receive in performing tasks involving the handling of radioactive materials to assess the need for dosimetry.

**Example:** A careful radiation measurement using a survey meter of the location producing the highest dose rate at the rear of the logging truck where radioactive material is stored in its transport compartment and where mechanics routinely work, is found to be 0.015 mSv/h [1.5 mrem/h]. Mechanics are not expected to spend any more than a total of 3 h per week at the location near the storage containers where the sealed sources are housed at the rear of the truck. Based on this measured dose rate, the annual dose is expected to be less than 2.34 mSv [234 mrem]. Specifically,  $3 \text{ h/wk} \times 1.5 \text{ mrem/h} \times 52 \text{ wk/yr} = 234 \text{ mrem}$ . Based on the above, if any mechanic works in the area less than 6.4 h per week, no dosimetry is required.

**Note:** The measurement 6.4 h is the total amount of hours it would take for an individual to meet the 5 mSv [500 millirems] per year limit.

Table I-1 may be helpful in performing a prospective evaluation and provides an example of the documentation to show that unmonitored individuals will not exceed 10 percent of the allowable dose limits.

Licensees should review evaluations periodically and revise them, as needed. Licensees should check assumptions used in their evaluations to ensure that the assumptions are up-to-date and accurate, especially when there is an increase in the possession of radioactive material.

**Table I-1. Dosimetry Evaluation**

Dosimetry Evaluation for _____			
A.	Time needed to perform the entire work activity	_____ minutes	_____ hour (divide # of minutes by 60)
B.	Expected whole body dose rate that the individual will encounter, determined using measured or manufacturer-provided data	_____ millirem/hour	
C.	Time the <i>extremities</i> were exposed to the unshielded source (if applicable)	_____ minutes	_____ hour
D.	Expected extremity dose rate that the individual will encounter, determined using measured or manufacturer-provided data for the unshielded source at the typical distance from the hands to the unshielded source	_____ millirem/hour	
Estimated Whole Body Dose Equivalent* Formula: ( _____ hours in Row A) × ( _____ millirem/hour in Row B) = ( _____ estimated millirem) × ( _____ # times conducted each year) = _____ millirem			
Estimated Extremity Dose Equivalent† Formula: ( _____ hours in Row C) × ( _____ millirem/hour in Row D) = ( _____ estimated millirem) × ( _____ # of times conducted each year) = _____ millirem			
*An expected Whole Body Dose Equivalent <i>less than</i> 500 millirem requires no dosimetry. †An expected Extremity Dose Equivalent <i>less than</i> 5,000 millirem requires no dosimetry.			



## **APPENDIX J**

**GUIDANCE FOR DEMONSTRATING THAT INDIVIDUAL MEMBERS OF THE  
PUBLIC WILL NOT RECEIVE DOSES EXCEEDING THE ALLOWABLE LIMITS**



## Guidance for Demonstrating That Individual Members of the Public Will Not Receive Doses Exceeding the Allowable Limits

This appendix describes methods for determining radiation dose to members of the public.

Licensees must ensure that:

- The radiation dose received by individual members of the public does not exceed 1 millisievert (mSv) [100 millirem (mrem)] in 1 calendar year resulting from the licensee’s possession or use of licensed materials.
- The radiation dose in unrestricted areas does not exceed 0.02 mSv [2 mrem] in any one hour.
- Air emissions of radioactive materials to the environment, excluding radon-222 and its daughters, do not result in doses greater than 0.1 mSv [10 mrem] per year total effective dose equivalent (TEDE). As required by Title 10 of the *Code of Federal Regulations* (10 CFR) 20.1101(d), if the licensee exceeds the 0.1 mSv [10 mrem] per year air emission dose constraint, the licensee must report the exceedance as provided in 10 CFR 20.2203, and promptly take appropriate corrective action to ensure against recurrence.

Members of the public include persons who live, work, study, or may be near locations where licensed material is used or stored and employees whose assigned duties do not include the use of licensed material but who may work in the vicinity where such materials are used or stored.

<b>Doses to Members of the Public</b>	
<p><b>INCLUDES</b> doses from:</p> <ul style="list-style-type: none"> <li>• radiation or radioactive material released by a licensee</li> <li>• sources of radiation under the control of a licensee</li> <li>• air effluents from sources of licensed radioactive materials</li> <li>• licensed material in transportation or storage at the licensee’s facility</li> </ul>	<p><b>DOES NOT INCLUDE</b> doses from:</p> <ul style="list-style-type: none"> <li>• sanitary sewerage discharges from licensee action taken in accordance with 10 CFR 20.2003</li> <li>• natural background radiation</li> <li>• medical administration of radioactive material including patients released under 10 CFR 35.75</li> <li>• voluntary participation in medical research</li> </ul>

As defined in 10 CFR 20.1003, the term *unrestricted area* means “an area, access to which is neither limited nor controlled by the licensee.” For purposes of this definition in 20.1003, an “unrestricted area” is an area where access is neither limited nor controlled by the licensees for purposes of limiting exposures to radiation and radioactive materials. An “unrestricted area” for purposes of 20.1003 may be controlled for other purposes, such as for security purposes (see, e.g., 10 CFR 20.1801 and 20.1802), and still be considered an “unrestricted area” as long as it is not required to be controlled for limiting exposure to radiation and radioactive materials. Typical unrestricted areas may include offices, shops, areas outside buildings, property, and storage areas for nonradioactive materials, and other facilities and laboratories where licensed materials are not normally used or stored.

Licensees must demonstrate compliance with the requirements noted above while taking into account exposure contributions from gamma and neutrons.<sup>1</sup> For areas adjacent to facilities where licensed material is used or stored, calculations or a combination of calculations and measurements [e.g., using an environmental thermoluminescent dosimeters (TLD)] are often used to show compliance.

The licensee must show compliance with the annual dose limit for individual members of the public by:

- demonstrating by measurement or calculation that the TEDE to the individual likely to receive the highest dose, in an unrestricted area from licensed operations, does not exceed 1 mSv [100 mrem] in a year, or
- demonstrating that the annual average concentration of radioactive material released in gaseous and liquid effluents at the boundary of the unrestricted area does not exceed the values specified in Table 2, “Effluent Concentrations,” of Appendix B to 10 CFR Part 20. The licensee must also show that if an individual were continuously present in an unrestricted area, the dose from external sources would not exceed 0.02 mSv [2 mrem] in 1 hour and 0.5 mSv [0.05 rem] in a year, and
- demonstrating by measurement or calculation that the TEDE to an individual will not exceed 0.02 mSv [2 mrem] in any one hour at an established boundary for temporary jobsites

To perform a dose assessment, the licensee should identify all potential sources of external and internal radiation exposure to members of the public and all locations of use, transport, and storage of radioactive material at the facility. The licensee must then take radiation measurements or perform calculations to demonstrate compliance.

### **Measurements**

The licensee may use measurements to demonstrate that the average annual releases are within regulatory limits, as well as demonstrate that the TEDE to the individual likely to receive

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<sup>1</sup>Thermal Neutron Dose Contributions (Handbook of Health Physics and Radiological Health, Third Edition, 1998) 1 Curie Am/Be source = ~34.7 mR/h @ 30 cm (neutron); 1 Curie Am/Be source = ~ 0.17 mR/h @ 30 cm (gamma); 2.8 10<sup>6</sup> neutrons/second/curie

the highest dose at the boundary of the unrestricted area does not exceed 1 mSv [100 mrem] in a year. These measurements may include:

- dose rate surveys for radiation exposures from external radiation sources
- measurements of radionuclides in air and water effluents
- use of environmental dosimeters in unrestricted areas

The method used to measure dose will depend upon the nature of the radiation source. If the source of radiation is constant, it may be adequate to measure the dose rate and integrate it over time. If the source of radiation differs or changes over time, it may be necessary to perform continuous measurements.

Radioactivity releases may be determined by effluent monitoring or by effluent sampling and analysis. Airborne effluents may be discharged when volatile materials are used, such as during waste compactions, but the discharge itself is usually not continuous since volatile materials are often used periodically rather than continuously. Liquid effluents may be discharged continuously or may be stored and subsequently discharged on a batch basis. For each type of source and for each route of potential exposure, consider the location of measurement points, whether continuous or periodic monitoring is required, the frequency of sampling and measurement, and any additional information. For discharges of airborne radionuclides, for example, it may be necessary to obtain information on the efficiency of filters and the air flow rate of the discharge system, as well as meteorological data and the distance to the nearest individual member of the public.

### **Calculation Method**

Using a calculation method, the licensee must determine the highest dose an individual is likely to receive in an unrestricted area from licensed operations. The licensee must take into account the individual's exposure from external sources and the concentration of radionuclides in gaseous and liquid releases. In practice, the licensee may wish to make conservative assumptions to simplify the dose calculation.

The public dose limit applies to the individual who is likely to receive the highest dose from licensed operations. Therefore, the dose calculations must consider the location with the potential for the highest internal and external exposures. The occupancy factor for an area is defined as the average fraction of time the maximally exposed individual is present and exposed to a radiation source. If a source is used intermittently, the occupancy factor is a fraction of the hours in a week that a given person would occupy the area. If the result of the calculation using an occupancy factor of 1 demonstrates that the public dose limit is not exceeded, then there is no need for further evaluation.

If, however, the licensee would rather choose a more realistic assumption of the individual's occupancy at the points of highest internal and external exposures, then the licensee may use the occupancy factors in Table J-1 or may calculate a specific occupancy factor by determining the likely fraction of time that the individual is present. The occupancy factors in Table J-1 are general guidance values and may be used if more detailed information is not available.

<b>Occupancy Factor</b>	<b>Description</b>
1	Full occupancy areas such as administrative and clerical offices, receptionist areas, laboratories, pharmacies and other work areas fully occupied by an individual, attended waiting rooms, and occupied space in nearby buildings
1/2	Areas where individuals are present for a major part of the day
1/5	Corridors, employee lounges, staff rest rooms, and classrooms
1/20	Unattended waiting rooms, public rest rooms, unattended vending rooms, storage areas, janitor's closets, attics, outdoor areas with seating, and recreational areas
1/40	Outdoor areas with only transient pedestrian or vehicular traffic, unattended parking lots, vehicular drop off areas (unattended), stairways, and unattended elevators

### Records

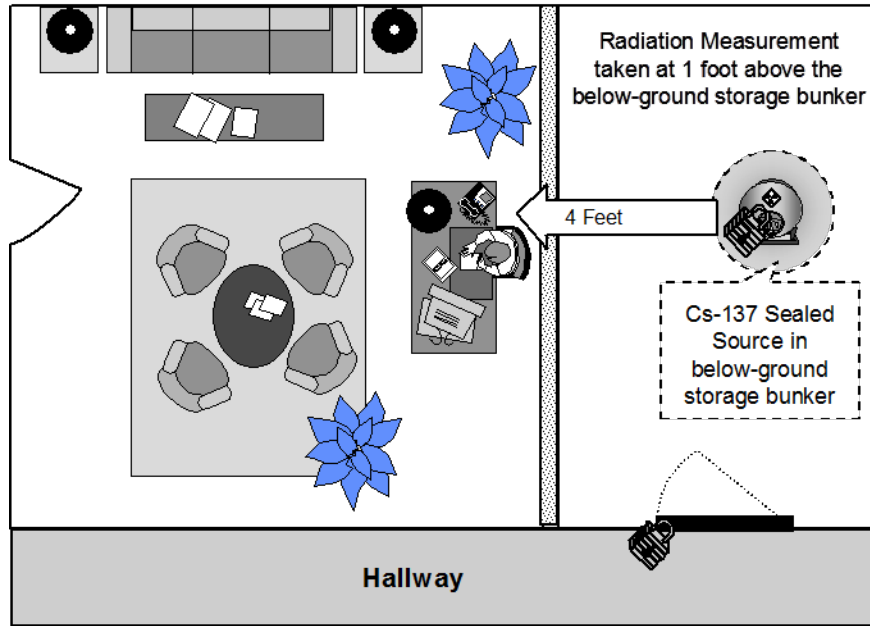
In accordance with 10 CFR 20.2107, the licensee must maintain records to demonstrate compliance with the dose limit for individual members of the public, until the Commission terminates the license. In general, survey and monitoring records of ambient radiation and effluent radioactivity should be adequate.

Records demonstrating the dose to an individual member of the public will identify the instruments used in the survey, the name of the surveyor, the date of the survey, the location of the survey(s), including a description or drawing of the areas surveyed, survey results, and if applicable, the occupancy factors used and justification for their use. In addition, records demonstrating the dose to an individual member of the public that involve effluent sampling analysis should include information on concentrations of specific radionuclides, minimum detectable activity of the system, and the estimated uncertainty of measurements.

The following is a simple example to demonstrate the above concepts for calculating direct measurement with sensitive instrumentation and combination of calculating and measurement.

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<sup>2</sup>Adapted from NCRP Report No. 147, "Structural Shielding Design for Medical X-Ray Imaging Facilities," issued November 19, 2004 and NCRP Report No. 151, "Structural Shielding Design and Evaluation for MegaVoltage X- and Gamma-Ray Radiotherapy Facilities," issued December 31, 2005



1556-019a.ppt  
041300

**Figure J-1. Bird's-Eye View of Office**

**Calculation Method<sup>3</sup>**

These measurements must be made with calibrated radiation survey meters sufficiently sensitive to measure background levels of radiation. However, licensees must exercise caution when making these measurements, and they must use currently calibrated radiation survey instruments. A maximum dose of 1 mSv [100 mrem] received by an individual over a period of 2080 h (i.e., a “work year” of 40 h/wk for 52 wk/yr) is equal to less than 0.5 microSievert [0.05 mrem]/h.

This rate is well below the minimum sensitivity of most commonly available Geiger-Mueller (GM) survey instruments.

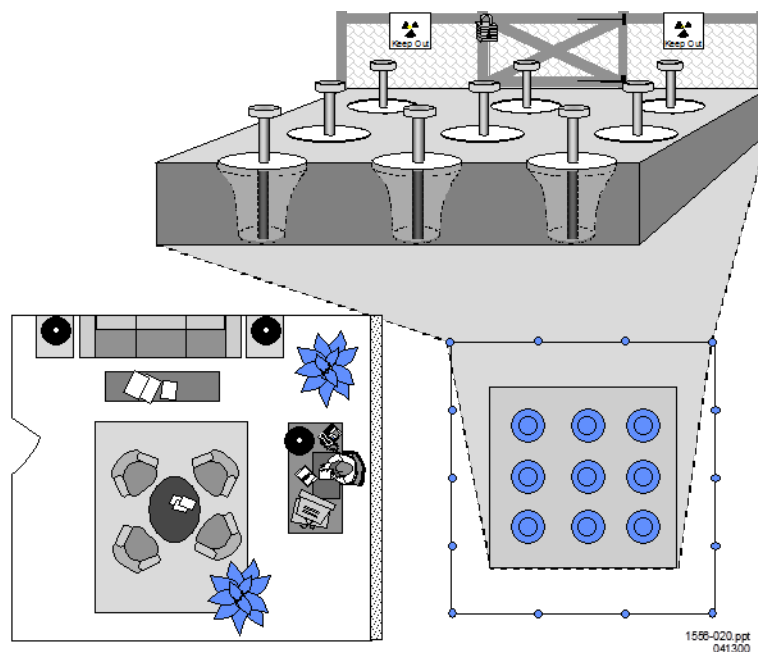
Instruments used to make measurements for calculations must be sufficiently sensitive. An instrument equipped with a scintillation-type detector [e.g., NaI(Tl)] or a micro-R meter used in making very low gamma radiation measurements should be adequate.

Licensees may also choose to use environmental TLDs in unrestricted areas next to the down-hole source storage area for monitoring. This direct measurement method would provide a definitive measurement of actual radiation levels in unrestricted areas without any restrictive assumptions. Records of these measurements can then be evaluated to ensure that rates in unrestricted areas do not exceed the 1 mSv/yr [100 mrem/yr] limit.

<sup>3</sup>For ease of use, the examples in this Appendix use conventional units. The conversions to SI units are as follows: 1 foot (ft) = 0.305 meter; 1 mrem = 0.01 mSv.

TLDs used for personnel monitoring (e.g., Lithium Fluoride) may not have sufficient sensitivity for this purpose. Generally, the minimum reportable dose received is 0.1 mSv [10 mrem]. Suppose a TLD monitor's dose received and is changed once a month. If the measurements are at the minimum reportable level, the annual dose received could have been about 1.2 mSv [120 mrem], a value in excess of the 1 mSv/yr [100 mrem/yr] limit. If licensees use TLDs to evaluate compliance with the public dose limits, they should consult with their TLD supplier and choose more sensitive TLDs, such as those containing  $\text{CaF}_2$  that are used for environmental monitoring.

The combined measurement-calculational method may be used to estimate the maximum dose to a member of the public. The combined measurement-calculational method takes a tiered approach, going through a two-part process, starting with a worst-case situation and moving toward more realistic situations. It makes the following simplifications: (i) each cesium-137 logging source is a point source; (ii) typical radiation levels are encountered when the source is in the unshielded position; and (iii) no credit is taken for any shielding found between the source storage area and the unrestricted areas. The method is only valid for the source activity at the time of measurement and must be repeated if the source strength or shielding is changed. Part 1 of the combined measurement-calculational method is simple but conservative. It assumes that an affected member of the public is present 24 hours a day and uses only the inverse square law to determine if the distance between the down-hole storage area and the affected member of the public is sufficient to show compliance with the public dose limits. Part 2 considers not only distance, but also the time that the affected member of the public is actually in the area under consideration. Using this approach, licensees make only those calculations that are needed to demonstrate compliance. The results of these calculations typically result in higher radiation levels than would exist at typical facilities, but they provide a method for estimating conservative doses that could be received.



**Figure J-2. Down-Hole Storage Array**



## Example

To better understand the combined measurement-calculational method, we will examine EZ Well Logging, Inc., a well logging licensee. Yesterday, the company's president noted that the top shield of the down-hole storage area is close to an area used by workers whose assigned duties do not include the use of licensed materials, and he asked the radiation safety officer (RSO), to determine if the company is complying with NRC's regulations.

The area in question is near the floor under the workers' desks, which constitutes the primary shield of the down-hole storage area. The RSO measures the distance from the shield to the center of the area in question and, using a calibrated radiation survey instrument, measures the highest dose rate at 1 foot from the shield to be 2 mrem/h.

Table J-2 summarizes the information the RSO has on the down-hole storage area.

Description of Known Information	Cesium-137 Logging Source
Dose rate encountered at 1 foot from the top of the shield, in mrem/h.	2 mrem/h
Distance from the face of the shield to the nearest occupied work area, in ft.	4 ft

### Example: Part 1

The RSO's first thought is that the distance between the down-hole storage area shield and the area in question may be sufficient to show compliance with the regulation in 10 CFR 20.1301, "Dose Limits for Individual Members of the Public." So, taking a worst-case approach, he assumes: (i) the cesium-137 is constantly located in the down-hole storage area [i.e., 24 h a day (h/d)], and (ii) the workers are constantly in the unrestricted work area (i.e., 24 h/d). The RSO proceeds to calculate the dose the workers might receive hourly and yearly from the source, as shown in Table J-3 below.

Step No.	Description	Input Data	Results
1.	Multiply the measured dose rate measured at 1.0 ft from the face of the shield floor in mrem/h by the square of the distance (ft) at which the measurement was made (e.g., 1 ft from the face of the shield)	$2 \times (1)^2$	2
2.	Square of the distance (ft) from the face of the shield to the nearest unrestricted area, in ft <sup>2</sup>	$(4)^2$	16

<b>Table J-3. Calculational Method, Part 1: Hourly and Annual Doses Received from a Logging Source Stored in Above Ground Transportation Container</b>			
<b>Step No.</b>	<b>Description</b>	<b>Input Data</b>	<b>Results</b>
3.	Divide the result of Step 1 by the result of Step 2 to calculate the dose received by an individual in the area near the shield. <b>HOURLY DOSE RECEIVED FROM SOURCE</b> , in mrem in 1 hour	2/16	0.125
4.	Multiply the result of Step 3 by 40 h/work week × 52 weeks/year = <b>MAXIMUM ANNUAL DOSE RECEIVED FROM Cs-137 Source</b> , in mrem in a year	0.125 × 40 × 52	260

**Note:** The result in Step 3 demonstrates compliance with the 2 mrem in any 1 hour limit. Re-evaluate if assumptions change. If the result in Step 4 exceeds 100 mrem/yr, proceed to Part 2 of the calculational method.

At this point, the RSO is pleased to see that the total dose that an individual could receive in any 1 hour is only 0.125 mrem, less than the 2 mrem in any 1 hour limit but notes that an individual could receive a dose of 260 mrem in a year, higher than the 100 mrem limit.

Example: Part 2

The RSO reviews the assumptions and recognizes that the workers are not in an area near the shield all of the time. A realistic estimate of the number of hours the workers spend in the area is made, keeping the other assumptions constant (i.e., the source is constantly in the down-hole storage area (i.e., 24 h/d). The annual dose received is then recalculated.

<b>Table J-4. Calculational Method, Part 2: Annual Dose Received from a Logging Source Stored in Above Ground Transportation Container</b>		
<b>Step No.</b>	<b>Description</b>	<b>Results</b>
5.	A. Average number of hours per day an individual spends in area of concern (e.g., a nonradiation worker spends 3.0 h/day at their desk in the area near the shield; the remainder of the day the worker is away from the area assigned to jobs unrelated to radiation (e.g., painting, grounds keeping)	3.0
	B. Average number of days per week in area	5
	C. Average number of weeks per year in area (e.g., full time workers)	52
6.	Multiply the results of Step 5.A. by the results of Step 5.B. by the results of Step 5.C. = <b>AVERAGE NUMBER OF HOURS IN AREA OF CONCERN PER YEAR</b>	$3 \times 5 \times 52 = 780$

Table J-4. Calculational Method, Part 2: Annual Dose Received from a Logging Source Stored in Above Ground Transportation Container		
Step No.	Step No.	
7.	Multiply the results in Step 3 by the results of Step 6 = <b>ANNUAL DOSE RECEIVED FROM CESIUM-137 LOGGING SOURCE CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN</b> , in mrem in a year.	$0.125 \times 780 = 97.5$

The RSO is pleased to note that the calculated annual dose received is lower and does not exceed the 100 mrem in a year limit.

The RSO is glad to see that the results in Step 8 show compliance with the 100 mrem in a year limit. Had the result in Step 8 been higher than 100 mrem in a year, then the RSO could have done one or more of the following:

- Consider whether the assumptions used to determine occupancy are accurate, revise the assumptions as needed, and recalculate using any new assumptions.
- Consider the assumption used to determine occupancy, including the average time the source is stored at the down-hole storage area.
- Calculate the effect of any shielding located between the storage area and the floor of the public area—such calculation is beyond the scope of this Appendix.
- Take corrective action (e.g., change work patterns to reduce the time spent in the area near the shield) and perform new calculations to demonstrate compliance.
- Designate the area inside the use area as a restricted area and the workers as occupationally exposed individuals. This would require controlling access to the area for purposes of radiation protection and training the workers as required by 10 CFR 19.12, “Instruction to Workers.”

National Council on Radiation Protection and Measurements (NCRP) Report No. 151, “Structural Shielding Design and Evaluation for Megavoltage X- and Gamma-Ray Radiotherapy Facilities (2005),” contains helpful information to determine doses to members of the public based on occupancy factors, work load, and shielding. It is available from NCRP, 7910 Woodmont Avenue, Suite 400, Bethesda, Maryland 20814-3095. NCRP’s telephone number is: 301-657-2652 or 1-800-229-2652. NCRP’s Web address is <http://www.ncrppublications.org>.

Note that in the example the RSO evaluated the unrestricted area outside only one wall of the down-hole storage area. Licensees also need to make similar evaluations for other unrestricted areas and to keep in mind the as low as is reasonably achievable (ALARA) principle, taking reasonable steps to keep radiation dose received below regulatory requirements. In addition, licensees need to be alert to changes in situations (e.g., adding sources to the storage area, changing the work habits of the workers, or otherwise changing the estimate of the portion of time spent in the area in question) and to perform additional evaluations, as needed.

**RECORDKEEPING:** Regulations in 10 CFR 20.2107 require licensees to maintain records demonstrating compliance with the dose limits for individual members of the public.

**APPENDIX K**

**NOTIFICATION OF PROPER PERSONS IN THE EVENT OF AN ACCIDENT**



# Notification of Proper Persons In The Event of an Accident

## Emergency Procedure

Notify the persons listed below of the situation, in the order shown.

Name*	Work Phone Number*	Home Phone Number*
Radiation Safety Officer (RSO)		
Senior Logging Supervisors		
Manufacturers/Distributors		
Consultant		
*Fill in with (and update, as needed) the names and telephone numbers of appropriate personnel [e.g., the Radiation Safety Officer (RSO) or other knowledgeable licensee staff, licensee's consultant, device manufacturer] to be contacted in case of emergency.		

Follow the directions provided by the person contacted above.

RSO and licensee management discuss emergency operating procedures and ensure no operations are conducted until the situation has been discussed with and approved by the RSO or other knowledgeable staff, consultants, or the device manufacturer. Management should have access to emergency equipment to keep doses as low as is reasonably achievable. Emergency equipment may include special radiation survey equipment required by 10 CFR 39.33(b).

Notify local authorities as well as the NRC, as required. (Even if notification is not required, ANY incident may be reported to the NRC by calling NRC's Emergency Operations Center at 301-816-5100, which is staffed 24 hours a day and accepts collect calls.) NRC notification is required when sources or devices containing licensed material are lost or stolen and when sealed or unsealed radioactive material or equipment is involved in incidents that may have caused or that threaten to cause an exposure in excess of the limits in 10 CFR 20.2202, "Notification of incidents,". Reports to the NRC must be made within the reporting time frames specified by the regulations. Notification and reporting requirements are found in 10 CFR 20.2201–2203, 10 CFR Part 21.21, 10 CFR 30.50, and 10 CFR 39.77.

In addition, under 10 CFR 37.41(a)(3), any licensee that has not previously implemented the Security Orders (i.e., orders issued by the NRC to require licensees to implement interim security measures) or been subject to the provisions of 10 CFR Part 37, Subpart C shall notify the NRC at least 90 days before aggregating radioactive material to a quantity that equals or exceeds the Category 2 threshold. Reporting of an unauthorized entry that results in an actual or attempted theft, sabotage, or diversion of a Category 1 or Category 2 quantity of radioactive material or any suspicious activity related to possible theft, sabotage, or diversion of a Category 1 or Category 2 quantity of radioactive material must be reported to the local law enforcement agency and NRC per 10 CFR 37.57.

**Note:** The following list of notification and reporting requirements is provided to inform licensees about typical notification and reporting requirements that apply to their licensed activities. Licensees should note that the list is incomplete in that not all potentially applicable requirements have been included. Also, notification and reporting requirements change; therefore, licensees should consult the regulations for definitive information about current requirements.

### Required Regulatory Notifications

Event	Telephone Notification	Written Report	Regulatory Requirement
Package received with removable radioactive surface contamination exceeding the limits of 10 CFR 71.87(i) or external radiation levels exceeding the limits of 10 CFR 71.47	Immediate (NRC and final delivery carrier must be notified)	None	10 CFR 20.1906(d)
Theft or loss of material	Immediate	Within 30 days	10 CFR 20.2201(a)(1)(i) & (b)(1)
Whole body dose greater than 0.25 Sv [25 rems] per event	Immediate	Within 30 days	10 CFR 20.2202(a)(1)(i) 10 CFR 20.2203(a)(1)
Extremity dose greater than 2.5 Gy [250 rad]	Immediate	Within 30 days	10 CFR 20.2202(a)(1)(iii) 10 CFR 20.2203(a)(1)
Whole body dose greater than 0.05 Sv [5 rems] in 24 hours	Within 24 hours	Within 30 days	10 CFR 20.2202(b)(1)(i) 10 CFR 20.2203(a)(1)
Extremity dose greater than 0.5 Sv [50 rems] in 24 hours	Within 24 hours	Within 30 days	10 CFR 20.2202(b)(1)(iii) 10 CFR 20.2203(a)(1)
Whole body dose greater than 0.05 Sv [5 rems] in a year	None	Within 30 days	10 CFR 20.2203(a)(2)(i)
Dose to individual member of public greater than 1 mSv [100 mrems] in a year	None	Within 30 days	10 CFR 20.2203(a)(2)(iv)
Defect in equipment that could create a substantial safety hazard subject to the requirements of 10 CFR Parts 30, 40, and 70	Within 2 days	Within 30 days	10 CFR 21.21(d)(3)(i) & (ii)
Event that prevents immediate protective actions necessary to avoid exposure to radioactive materials that could exceed regulatory limits	Immediate	Within 30 days	10 CFR 30.50(a)&(c)(2)



Event	Telephone Notification	Written Report	Regulatory Requirement
Unplanned contamination event that requires restricted access for more than 24 hours and involves a quantity of material greater than five times the lowest annual limit on intake for the material as specified in Appendix B of 10 CFR Part 20 and requires the area to be restricted for a reason other than to allow radionuclides with half-lives less than 24 hours to decay	Within 24 hours	Within 30 days	10 CFR 30.50(b)(1) & (c)(2)
Equipment is disabled or fails to function as designed when required to prevent radiation exposure in excess of regulatory limits	Within 24 hours	Within 30 days	10 CFR 30.50(b)(2) & (c)(2)
Unplanned fire or explosion that affects the integrity of any licensed material or device, container, or equipment with licensed material	Within 24 hours	Within 30 days	10 CFR 30.50(b)(4) & (c)(2)
Coordination with local law enforcement agency (LLEA) has failed, either because the LLEA has not responded or because the LLEA does not plan to participate	3 business days	Submittal of a written report concerning failures of coordination with LLEA as described in 10 CFR 37.45(b) is not required; however, licensees must document their efforts to coordinate with the LLEA and keep this documentation for 3 years	10 CFR 37.45(b) & (c)

Event	Telephone Notification	Written Report	Regulatory Requirement
Determination that an unauthorized entry resulted in an actual or attempted theft, sabotage, or diversion of Category 1 or Category 2 quantity of radioactive material	As soon as possible (but not at the expense of causing delay or interfering with the LLEA response), but no later than 4 hours after discovery	30 days	10 CFR 37.57(a) & (c)
Assessment of any suspicious activity related to possible theft, sabotage, or diversion of Category 1 or Category 2 quantities of radioactive material	As soon as possible, but no later than 4 hours after notifying the LLEA	None	10 CFR 37.57(b)
Determination that a shipment containing a Category 1 quantity of material is lost or missing in transport	Within 1 hour of the determination. Also notify LLEA within 1 hour of determination	30 days and periodic updates (if subsequent substantive information)	10 CFR 37.81(a),(g) & (h)
Determination that a shipment containing a Category 2 quantity of material is lost or missing in transport	Within 4 hours of the determination and again within 24 hours if the material has not yet been located and secured	30 days and periodic updates (if subsequent substantive information)	10 CFR 37.81(b),(g) & (h)
Discovery along the route of any actual or attempted theft or diversion, or suspicious activity, related to a Category 1 quantity of material in transport	As soon as possible upon discovery. Also notify LLEA as soon as possible upon discovery	30 days (except no report for suspicious activity) and periodic updates after report (if subsequent substantive information)	10 CFR 37.81(c),(g) & (h)

Event	Telephone Notification	Written Report	Regulatory Requirement
Discovery of any actual or attempted theft or diversion, or suspicious activity, related to a Category 2 quantity of material in transport	As soon as possible	30 days (except no report for suspicious activity) and periodic updates after report (if subsequent substantive information)	10 CFR 37.81(d),(g) & (h)
Upon recovery of any lost or missing Category 1 quantity of material	As soon as possible. Also notify the LLEA as soon as possible	To be included in the 30-day report of an event described in 10 CFR 37.81(g), if recovered during that time or in a subsequent update	10 CFR 37.81(e) & (h)
Upon recovery of any lost or missing Category 2 quantity of material	As soon as possible	To be included in the 30-day report of an event described in 10 CFR 37.81(g), if recovered during that time or in a subsequent update	10 CFR 37.81(f) & (h)
Rupture of sealed source	Immediate	Within 30 days	10 CFR 39.77(a)
Sealed source becomes lodged in well bore and becomes classified as irretrievable	As soon as possible	Within 30 days	10 CFR 39.77(c) & (d)
Leak test of sealed source resulting in leakage greater than 185 Bq [0.005 microcuries]	none	Within 5 days	10 CFR 39.35(d)

Event	Telephone Notification	Written Report	Regulatory Requirement
Defect in equipment that could create a substantial safety hazard	Within 2 days	Within 30 days	10 CFR 21.21(d)(3)(i) & (ii)

**Note:** Telephone notifications will be made to the NRC Operations Center at 301-816-5100 or by facsimile to 301-816-5151 except as noted. The Center is staffed 24 hours a day and accepts collect calls. NRC notification is required when licensed materials are lost or stolen or are involved in an incident that may have resulted in doses in excess of NRC limits.

**APPENDIX L**  
**MODEL LEAK TEST PROGRAM**



# Model Leak Test Program

## Requests to Perform Leak Testing and Sample Analysis

### Training

Before allowing an individual to perform leak testing, the licensee must ensure that he or she has sufficient classroom and on-the-job training to show competency in performing leak testing and sample analysis independently.

Classroom training may be in the form of lecture, online, video, hands-on, or self-study and should cover the following subject areas:

- principles and practices of radiation protection
- radioactivity measurements, monitoring techniques, and instrument use
- mathematics and calculations used for measuring radioactivity
- biological effects of radiation

Appropriate on-the-job-training consists of the following:

- observing authorized personnel collecting and analyzing leak-test samples
- collecting and analyzing leak-test samples under the supervision and in the physical presence of an individual authorized to perform leak testing and sample analysis

### Facilities and Equipment

- To ensure achieving the required sensitivity of measurements, analyze leak tests in a low-background area.
- Use a calibrated and operable survey instrument to check leak test samples for gross contamination before they are analyzed.
- Analyze the leak test sample using an instrument that is appropriate for the type of radiation to be measured [e.g., NaI (TI) well-counter system for gamma emitters, liquid scintillation for beta emitters, gas-flow proportional counters for alpha emitters].
- If the sensitivity of the counting system is unknown, determine the minimum detectable activity (MDA). The MDA may be determined using the following formula:

$$MDA = \frac{2.71 + 4.65 \sqrt{bkg \times t}}{t \times E}$$

where: MDA = minimum detectable activity in disintegrations per minute (dpm)  
bkg = background count rate in counts per minute (cpm)  
t = background counting time in minutes  
E = detector efficiency in counts per disintegration

For example:

where: bkg = 200 counts per minute (cpm)  
E = 0.1 counts per disintegration (10 percent efficient)  
t = 2 minutes

$$\begin{aligned} \text{MDA} &= \frac{2.71 + 4.65 \sqrt{200 \text{ cpm} \times 2 \text{ minutes}}}{2 \times 0.1} = \frac{2.71 + 4.65 \sqrt{400}}{0.2} \\ &= \frac{2.71 + 4.65(20)}{0.2} = \frac{2.71 + 93}{0.2} = \frac{95.71}{0.2} \\ &= \frac{478.55 \text{ disintegrations}}{\text{minute}} \\ \text{becquerels (Bq)} &= \frac{1 \text{ disintegration}}{\text{second}} \\ \text{MDA} &= \frac{478.55 \text{ disintegration}}{\text{minutes}} \times \frac{\text{minute}}{60 \text{ seconds}} = 7.976 \text{ Bq} \end{aligned}$$

**Note:** The MDA equation shown above assumes that counting times for the background measurement and for the sample will be equal. MDA equations for nonequal counting times, as well as derivations of equations and discussions of limitations, can be found in "Decommissioning Health Physics—A Handbook for MARSSIM Users," Eric W. Abelquist, published by Taylor & Francis Group, 2001.

### Frequency for Conducting Leak Tests of Sealed Sources

Leak tests will be conducted at the frequency specified in the respective Sealed Source and Device registration certificate. If a sealed source is not registered, leak tests should be conducted at 6-month intervals, unless a different interval is established during the licensing process. Leak testing of sealed sources may be required by license condition.

### Procedure for Performing Leak Testing and Analysis

- For each sealed source to be tested, list identifying information such as the sealed source serial number, manufacturer, model number, radionuclides, and activity of the sealed source.
- Use a radiation survey meter to monitor exposure.
- Prepare a separate wipe sample (e.g., cotton swab or filter paper) for each source.
- Number each wipe to correlate with identifying information for each source.
- Wipe the most accessible area where contamination would accumulate if the sealed source were leaking, but do not wipe the surface of a plated or foil source (see manufacturer's instructions).



- Select instrumentation that is sensitive enough to detect 185 becquerels (Bq) [0.005 microcuries (μCi)] of the radionuclide contained in the sealed source.
- Using the selected instrument, count and record background count rate.
- Check the instrument's counting efficiency using a standard source of the same radionuclide as the source being tested or one with similar energy characteristics. The calibration source should be in the same configuration as the sample. Accuracy of standards should be within plus or minus 5 percent of the stated value and traceable to primary radiation standards such as those maintained by the National Institute of Standards and Technology.
- Calculate the counting efficiency of the detector.

$$\text{Efficiency in cpm/Bq} = \frac{[(\text{cpm from std}) - (\text{cpm from bkg})]}{\text{activity of std in Bq}}$$

Where: cpm = counts per minute  
 std = standard  
 bkg = background  
 Bq = becquerel

- Count each wipe sample; determine net count rate.
- For each sample, calculate and record estimated activity in becquerels (or microcuries). The activity of the sample in becquerels may be calculated using the following formula:

$$\text{Activity of sample [Bq]} = \frac{[(\text{cpm from wipe sample}) - (\text{cpm from bkg})]}{\text{efficiency in cpm/Bq}}$$

- Sign and date the list of sources, data, and calculations. Retain records for 3 years [under Title 10 of the *Code of Federal Regulations* (10 CFR) 20.2103(a)].
- If the wipe test activity is 185 becquerels [0.005 μCi] or greater, notify the radiation safety officer (RSO), so that the source can be withdrawn from use and disposed of properly. Also, notify the U.S. Nuclear Regulatory Commission (NRC).

**Reference:** See NUREG–1556, Volume 18, “Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Service Provider Licenses,” if the applicant wants to provide leak testing and sample analysis as a commercial service provider.



**APPENDIX M**

**TRANSPORTATION—MAJOR DEPARTMENT OF TRANSPORTATION  
REGULATIONS; SAMPLE SHIPPING DOCUMENTS,  
PLACARDS, AND LABELS**



## Transportation—Major Department of Transportation Regulations; Sample Shipping Documents, Placards and Labels

**Note:** The following list of U.S. Department of Transportation (DOT) regulations is provided to inform licensees about typical requirements that apply to the transportation of licensed material including the preparation of shipments of licensed material. Licensees should note that the list is incomplete in that not all potentially applicable requirements have been included. Also, transportation requirements change; therefore, licensees should consult the regulations for definitive information about current requirements. Additional information on transportation requirements may be found at the DOT Web site: <https://www.dot.gov/>.

Title 10 of the *Code of Federal Regulations* (10 CFR) 71.5 requires compliance with DOT regulations in 49 CFR Parts 107, 171 through 180 and 390 through 397, appropriate to the mode of transport. The following are the major areas in DOT regulations most relevant for transporting radioactive materials as Type A or Type B quantities:

- Table of Hazardous Materials and Special Provisions—49 CFR 172, Subpart B
  - 49 CFR 172.101—Hazardous Materials Table [proper shipping name, hazard class, identification number]
  - 49 CFR 172.101—List of Hazardous Substances and Reportable Quantities, Table 2 to Appendix A—Radionuclides
- Shipping Papers—49 CFR 172, Subpart C
  - 49 CFR 172.201—Preparation and retention of shipping papers
  - 49 CFR 172.202—Description of hazardous material on shipping papers
  - 49 CFR 172.203—Additional description requirements
  - 49 CFR 172.204—Shipper's certification
- Marking—49 CFR 172, Subpart D
  - 49 CFR 172.300—Applicability
  - 49 CFR 172.301—General marking requirements for nonbulk packagings
  - 49 CFR 172.304—Marking requirements
  - 49 CFR 172.310—Class 7 (radioactive) materials
  - 49 CFR 172.324—Hazardous substances in nonbulk packagings [designation of "reportable quantities" with the letters "RQ"]
- Labeling—49 CFR 172, Subpart E
  - 49 CFR 172.400—General labeling requirements
  - 49 CFR 172.400a—Exceptions from labeling
  - 49 CFR 172.401—Prohibited labeling
  - 49 CFR 172.403—Class 7 (radioactive) material
  - 49 CFR 172.406—Placement of labels
  - 49 CFR 172.436—RADIOACTIVE WHITE-I label
  - 49 CFR 172.438—RADIOACTIVE YELLOW-II label
  - 49 CFR 172.440—RADIOACTIVE YELLOW-III label

- Placarding—49 CFR 172, Subpart F
  - 49 CFR 172.500—Applicability of placarding requirements
  - 49 CFR 172.504—General placarding requirements
  - 49 CFR 172.516—Visibility and display of placards
  - 49 CFR 172.556—RADIOACTIVE placard
- Emergency Response Information—49 CFR 172, Subpart G
  - 49 CFR 172.600—Applicability and general requirements
  - 49 CFR 172.602—Emergency response information
  - 49 CFR 172.604—Emergency response telephone number
- Training—49 CFR 172, Subpart H
  - 49 CFR 172.702—Applicability and responsibility for training and testing
  - 49 CFR 172.704—Training requirements
- Safety and Security Plans—49 CFR 172, Subpart I
  - 49 CFR 172.800—Purpose and applicability
  - 49 CFR 172.802—Components of a security plan
- Shippers—General Requirements for Shipments and Packagings—49 CFR Part 173

Class 7 (Radioactive Materials) – Subpart I

- 49 CFR 173.25—Authorized packagings and overpacks
- 49 CFR 173.403—Definitions
- 49 CFR 173.411—Industrial packages
- 49 CFR 173.412—Additional design requirements for Type A packages
- 49 CFR 173.413—Requirements for Type B packages
- 49 CFR 173.415—Authorized Type A packages
- 49 CFR 173.416—Authorized Type B packages
- 49 CFR 173.433—Requirements for determining basic radionuclide values, and for the listing of radionuclides on shipping papers and labels
- 49 CFR 173.435—Table of A1 and A2 values for radionuclides
- 49 CFR 173.441—Radiation level limitations and exclusive use provisions
- 49 CFR 173.471—Requirements for U.S. Nuclear Regulatory Commission approved packages

- 49 CFR 173.475—Quality control requirements prior to each shipment of Class 7 (radioactive) materials
- 49 CFR 173.476—Approval of special form Class 7 (radioactive) materials
- Carriage by Public Highway—49 CFR Part 177
  - 49 CFR 177.817—Shipping papers
  - 49 CFR 177.842—Class 7 (radioactive) material [includes requirement for blocking and bracing during transport]

**Note:** The following reference charts are for reference only and are not a substitute for DOT and U.S. Nuclear Regulatory Commission transportation regulations.

**1. Minimum Required Packaging for Class 7 (Radioactive) Material:<sup>[1]</sup>  
(49 CFR 173 and 10 CFR 71)<sup>[2]</sup>**

These are basic reference charts; refer to current U.S. DOT and NRC regulations for complete requirements.

Minimum Packaging Required for Radioactive Materials other than Low Specific Activity (LSA) Material and Surface Contaminated Objects (SCO) based on Activity of Package Contents					
Radioactive Material Quantity <sup>[3]</sup>		Limited Quantities and Articles	Type A <sup>[4]</sup> <sup>[9]</sup>	Type B	
Activity Restrictions		≤ the limits specified in <b>Table 4 of § 173.425</b>	≤ A <sub>1</sub> for special form ≤ A <sub>2</sub> for normal form	> A <sub>1</sub> for special form > A <sub>2</sub> for normal form	
Contents of Package	Non-fissile and Fissile Excepted	Excepted Package	Type A Package	Type B(U) or Type B(M) package	
	Fissile	N/A	Type AF <sup>[10]</sup> package	Type B(U)F or Type B(M)F package	
Minimum Packaging Required for LSA Material and SCO <sup>[5,6]</sup>					
Type(s) of LSA and/or SCO	LSA-I	LSA-II	LSA-III	SCO-I	SCO-II
Category of Package for Domestic or International Transport <sup>[7,8]</sup>	<b>Unpackaged<sup>[8]</sup></b> IP-1: solids or liquids/exclusive use IP-2: liquids/non-exclusive use <b>Specification tank cars or cargo tank motor vehicles: liquids/exclusive use</b>	- - IP-2: exclusive use <sup>[9]</sup> IP-3: liquids or gases/non-exclusive use <sup>[9]</sup>	- - IP-2: exclusive use IP-3: non-exclusive use	<b>Unpackaged<sup>[8]</sup></b> IP-1 - -	- - IP-2 -
Alternative Provisions for Domestic only Transport <sup>[8]</sup>	<p align="center"> <b>Packaging shall meet the requirements of §§ 173.24, 24a, and 173.410.</b>  <b>Transportation shall be an exclusive use shipment.</b>  <b>Activity per shipment must be less than an A<sub>2</sub> quantity (see § 173.427(b)(4)).</b> </p>				

- [1] Additional provisions may apply for radioactive materials that are pyrophoric, oxidizing, fissile excepted, or uranium hexafluoride.
- [2] Each NRC licensee shall comply with the applicable requirements of the DOT regulations in 49 CFR parts 107, 171 through 180, and 390 through 397 (see § 71.5).
- [3] Materials that contain radionuclides, where both the activity concentration and the total activity in the consignment exceed either the values specified in the table in § 173.436 or the values derived according to the instructions in § 173.433, must be regulated in transport as Class 7 (radioactive) material.
- [4] Except for LSA material and SCO, a Type A package may not contain a quantity of Class 7 (radioactive) material greater than A<sub>1</sub> or A<sub>2</sub> (see § 173.431(a)). See A<sub>1</sub> and A<sub>2</sub> definitions in § 173.403.
- [5] The external dose rate from LSA material or SCO in a single package may not exceed 10 mSv/h (1 rem/h) at 3 meters from the unshielded material or objects (see §§ 173.427(a)(1) and (d)).
- [6] LSA material and SCOs that are or contain fissile material in quantities that are not fissile excepted must be packaged in appropriate Type AF or Type BF packages, and not classified as LSA material or SCO. For alternate domestic transport provisions, see § 173.427(b)(4). For comprehensive guidance on packaging and transportation of LSA material and SCO, see NUREG-1608.
- [7] For the quantity of LSA material and SCO transported in a single conveyance, see the limits specified in § 173.427(a)(2).
- [8] LSA material or SCO shall be appropriately packaged in accordance with § 173.427(b) or (d). Certain LSA-I material and SCO-I may be transported unpackaged under the conditions in § 173.427(c).
- [9] See §§ 173.411(c) and 173.415(a) for requirements related to package record retention (2 years) and associated documentation of physical tests.
- [10] See §§ 71.22(a), 71.23(a) and 173.417(a) for regulations regarding the use of non-AF packages for fissile materials.



**2. Radiation Level, TI and CSI Limits for Transportation by Mode:<sup>[1]</sup> (49 CFR 173 - 177, and 10 CFR 71)<sup>[10]</sup>**

Type of Transport	Non-exclusive use	Exclusive use		
Mode of Transport	Road, Rail, Vessel and Air <sup>[9]</sup>	Road and Rail	Vessel	Air (cargo only)
<b>Radiation Level Limits<sup>[2]</sup></b>				
Package Surface	2 mSv/h (200 mrem/h)	2 mSv/h (200 mrem/h): other than closed vehicles 10 mSv/h (1000 mrem/h): closed vehicles	2 mSv/h <sup>[11]</sup> (200 mrem/h)	2 mSv/h (200 mrem/h) <sup>[3]</sup>
Conveyance <sup>[4]</sup>	N/A	2 mSv/h (200 mrem/h): outer surfaces (sides, top and underside) of vehicle <sup>[5]</sup>	N/A	N/A
		0.1 mSv/h (10 mrem/h): at any point two (2) m (6.6 ft) from sides of the vehicle <sup>[5]</sup>	N/A	N/A
Occupied position	N/A	0.02 mSv/h (2 mrem/h): in any normally occupied area <sup>[6]</sup>	Requirements of § 176.708 apply	N/A
<b>Transport Index (TI) Limits<sup>[2]</sup></b>				
Package <sup>[7]</sup>	3: passenger aircraft 10: road, rail, vessels and cargo aircraft	No limit		10
Conveyance <sup>[4]</sup>	50: road, rail and passenger aircraft 50 to No limit: vessels <sup>[8]</sup> 200: cargo aircraft	No limit		200
Overpack	N/A: for road, rail 50 to 200: vessel <sup>[8]</sup> 3: passenger aircraft; 10: cargo aircraft	N/A	No limit <sup>[8]</sup>	N/A
<b>Criticality Safety Index (CSI) Limit for fissile material<sup>[2]</sup></b>				
Package <sup>[7]</sup>	50	100	100	100
Conveyance <sup>[4]</sup>	50: road, rail and air 50: for holds, compartments or defined deck areas of vessels <sup>[8]</sup> 200 to No limit: for a total vessel <sup>[8]</sup>	100	200 to No limit: for a total vessel <sup>[8]</sup>	100
Overpack	50: road, rail, vessels <sup>[8]</sup> and air	N/A		

[1] Radiation level, TI, and CSI are defined in § 173.403.

[2] In addition to any applicable radiation level, TI and CSI limits, separation distance requirements apply to packages, conveyances, freight containers and overpacks; to occupied positions; and to materials stored in transit. Separation distances are based on the sum of the TIs and, for fissile materials, the sum of the CSIs. [see applicable 49 CFR references for: Rail - § 174.700; Air – §§ 175.700 through 175.703; Vessel - §§ 176.700 through 176.708; and Highway - § 177.842].

[3] Higher package surface radiation levels may be allowed through an approved special arrangement.

[4] Conveyance is, for transport by public highway or rail, any transport vehicle or large freight container; and for transport by air, any aircraft. See definitions in § 173.403.

[5] The outer surfaces (sides, top and underside) of vehicles are specified for road and rail vehicles in § 173.441.

[6] For rail, normally occupied areas include the transport vehicle and adjacent rail cars. The 0.02 mSv/h (2 mrem/h) limit does not apply to carriers operating under a State or federally regulated radiation protection program where personnel wear radiation dosimetry devices.

[7] Additional TI and CSI limits apply for individual packages when non-fissile radioactive material packages are mixed with fissile material packages (see § 173.459).

[8] For details on TI and CSI limits for transport by vessel, see § 176.708.

[9] Only excepted packages and packages intended for use in research, medical diagnosis, and treatment are permitted on passenger aircraft (see §§ 173.448(f) and 175.700).

[10] The limits in this table do not apply to excepted packages. See the following references for the radiation level limits for: limited quantities, § 173.421; instruments and articles, § 173.424; articles containing natural uranium or thorium, § 173.426; or empty packaging, § 173.428.

[11] 2 mSv/h (200 mrem/h) other than intermodal transport of closed transport vehicles or exclusive use vessel.

**3. Contamination Limits and Quality Control for Class 7 (Radioactive) Materials:  
(49 CFR 173.443 and 173.475, and 10 CFR 71)**

These are basic reference charts; refer to current U.S. DOT and NRC regulations for complete requirements.

**Maximum Permissible Limits for Non-fixed Radioactive Contamination on Packages When Offered for Transport**

The level of non-fixed (removable) radioactive contamination on the external surface of each package, conveyance, freight container, and overpack offered for transport must be kept as low as reasonably achievable, and shall not exceed the values shown in the following table:

Contaminant	Maximum permissible limits (§ 173.443(a), Table 9)		
	Bq/cm <sup>2</sup>	µCi/cm <sup>2</sup>	dpm/cm <sup>2</sup>
Beta and gamma emitters and low toxicity alpha emitters	4	10 <sup>-4</sup>	240
All other alpha emitting radionuclides	0.4	10 <sup>-5</sup>	24

The non-fixed contamination shall be determined by:

- (a) wiping, with an absorbent material using moderate pressure, sufficient areas on the package to obtain a representative sampling of the non-fixed contamination;
- (b) ensuring each wipe area is 300 cm<sup>2</sup> in size;
- (c) measuring the activity on each single wiping material and dividing that value by the surface area wiped and the efficiency of the wipe procedure, where an actual wipe efficiency may be used, or it may be assumed to be 0.10.

Alternatively, the contamination level may be determined using alternative methods of equal or greater efficiency.

A conveyance used for non-exclusive use shipments is not required to be surveyed unless there is reason to suspect that it exhibits contamination (see § 173.443(a)(2)).

**Provisions for Control of Contamination on Radioactive Material Packages Offered for Transport and at the Time of Receipt**

- When offered for transport, the non-fixed contamination on each package of radioactive material must be kept as low as reasonably achievable and may not exceed the limits set forth in § 173.443(a), Table 9 (as shown above).
- During transport, non-fixed contamination levels on packages transported as exclusive use by rail or highway may not exceed 10 times the limits in § 173.443(a), Table 9 (as shown above).

**Provisions for Non-fixed (Removable) Contamination on Excepted and Empty Radioactive Material Packages**

- The non-fixed radioactive surface contamination on the external surface of excepted and empty packages shall not exceed the limits specified in § 173.443(a), Table 9 (as shown above).
- The internal contamination of an empty package must not exceed 100 times the limits in § 173.443(a), Table 9 (as shown above).

**Provisions for Non-fixed (Removable) Contamination on Packages and in Rail and Road Vehicles used for Exclusive Use Shipments of Radioactive Material**

- The levels of non-fixed radioactive contamination on the packages (a) at the beginning of transport, may not exceed the levels prescribed in the above table, and (b) at any time during transport, may not exceed ten times the levels prescribed in § 173.443(a), Table 9 (as shown above) [see § 173.443(b)].
- Each conveyance, overpack, freight container, or tank used for transporting Class 7 (radioactive) material as an exclusive use shipment that utilizes the provisions of § 173.443(b) must be surveyed with appropriate radiation detection instruments after each exclusive use transport. If contamination values exceed acceptable levels, the transport vehicle may not be returned to exclusive use transport service, and then only for subsequent exclusive use shipment, unless the radiation dose rate at each accessible surface is demonstrated to be 0.005 mSv/h (0.5 mrem/h) or less, and that there is no significant non-fixed radioactive surface contamination as specified in § 173.443(a), Table 9 (as shown above) [see § 173.443(c)].

**Provisions for Non-fixed (Removable) Contamination in Closed Rail and Road Vehicles that are used Solely for the Transportation of Radioactive Material (§ 173.443(d))**

- The contamination levels must not exceed 10 times the levels prescribed in § 173.443(a), Table 9 (as shown above).
- Each vehicle is marked with the words "For Radioactive Materials Use Only" in letters at least 76 mm (3 in) high in a conspicuous place on both sides of the exterior of the vehicle.
- The vehicle must meet the placard requirements of Subpart F of Part 172.
- A survey of the interior surfaces of the empty closed vehicle must show that the radiation dose rate at any point does not exceed 0.1 mSv/h (10 mrem/h) at the surface or 0.02 mSv/h (2 mrem/h) at 1 m (3.3 feet) from the surfaces.
- Each vehicle shall be kept closed except for loading or unloading.

**Provisions for Quality Control Prior to Each Shipment of Radioactive Material (§ 173.475)**

- Before each shipment of any radioactive materials package, the offer or must ensure, by examination or appropriate tests, that:
  - (a) the packaging is proper for the contents to be shipped;
  - (b) the packaging is in unimpaired physical condition, except for superficial marks;
  - (c) each closure device of the packaging, including any required gasket, is properly installed, secured, and free of defects;
  - (d) for fissile material, each moderator and neutron absorber, if required, is present and in proper condition;
  - (e) each special instruction for filling, closing, and preparation of the packaging for shipment has been followed;
  - (f) each closure, valve, or other opening of the containment system is properly closed and sealed;
  - (g) each packaging containing liquid in excess of an A<sub>2</sub> quantity and intended for air shipment has been tested to show that it will not leak under an ambient atmospheric pressure of not more than 25 kPa, absolute (3.6 psia), where the test must be conducted on the entire containment system, or on any receptacle or vessel within the containment system, to determine compliance with this requirement;
  - (h) the internal pressure of the containment system will not exceed the design pressure during transportation; and
  - (i) the external radiation and contamination levels are within the allowable limits specified in §§ 173.441 and 173.443.

#### 4. Hazard Communications for Class 7 (Radioactive) Materials: Shipping Papers (49 CFR 172, Subpart C)

These are basic reference charts; refer to current U.S. DOT and NRC regulations for complete requirements.

NOTE: IAEA, IATA/ICAO, and IMO may require additional hazard communication information. <sup>[1]</sup>

#### Shipping Paper Entries

Always Required	Sometimes Required	Optional Entries
<p><u>Basic description (in sequence):</u></p> <ul style="list-style-type: none"> <li>• <b>UN Identification number</b></li> <li>• <b>Proper Shipping Name</b></li> <li>• <b>Hazard Class (7)</b></li> <li>• <b>Maximum activity contained in each package in SI units</b> (e.g., Bq, TBq), or in both SI and customary units (e.g., Ci, mCi) with customary units in parentheses following the SI units</li> <li>• <b>Number and type of packages</b></li> </ul> <p><u>Additional description:</u></p> <ul style="list-style-type: none"> <li>• <b>Name of each radionuclide</b><sup>[2]</sup></li> <li>• <b>Description of physical and chemical form</b> (unless special form)</li> <li>• <b>“Special form” when not in the proper shipping name</b></li> <li>• <b>Category of label</b> used</li> <li>• <b>Transport index (TI)</b> of each package bearing a Yellow-II or Yellow-III label</li> </ul> <p><u>Additional entry requirements:</u></p> <ul style="list-style-type: none"> <li>• 24 hour <b>emergency telephone number</b></li> <li>• <b>Shipper’s Certification</b> shall be provided by each person offering radioactive material for transportation<sup>[3]</sup></li> <li>• Proper page numbering (e.g., Page 1 of 4)</li> </ul>	<p><u>Materials-based Requirements:</u></p> <ul style="list-style-type: none"> <li>• The criticality safety index (CSI) or “Fissile Excepted” for fissile material</li> <li>• “Highway route controlled quantity” or “HRCQ” for highway route controlled quantities</li> <li>• The letters “RQ” entered either before or after the basic description for each hazardous substance [see § 171.8]</li> <li>• Enter applicable subsidiary hazard class(es) in parentheses immediately following the primary hazard class when a subsidiary hazard label is required</li> <li>• A hazardous waste manifest and the word “Waste” preceding the proper shipping name is required for radioactive material that is hazardous waste</li> </ul> <p><u>Package-based Requirements:</u></p> <ul style="list-style-type: none"> <li>• The applicable DOE or NRC package approval identification marking for each Type B(U), Type B(M), or fissile material package</li> <li>• The International Atomic Energy Agency (IAEA) Certificate of Competent Authority identification marking for export shipment or shipment in a foreign made package</li> </ul> <p><u>Shipment- and Administrative-based Requirements:</u></p> <ul style="list-style-type: none"> <li>• Specify “exclusive use shipment” as required</li> <li>• Specify instructions for maintaining exclusive use controls for shipments of LSA material or SCO under exclusive use</li> <li>• Specify the notation “DOT–SP” followed by the special permit number for a special permit shipment</li> </ul>	<ul style="list-style-type: none"> <li>• The weight in grams or kilograms may be inserted instead of activity units for fissile radionuclides, except for Pu-239 and Pu-241</li> <li>• The weight in grams of Pu-239 and Pu-241 may be inserted in addition to the activity units</li> <li>• Other information is permitted provided it does not confuse or detract from the proper shipping name or other required information</li> </ul>

#### Special Considerations/Exceptions for Shipping Papers

- For shipments of multiple cargo types, any HAZMAT entries must appear as the first entries on the shipping papers, or be entered in a color that readily contrasts with any description on the shipping papers or highlighted on the shipping papers in a contrasting color, or be designated by an “X” (or “RQ” if appropriate).
- Emergency response information consistent with §§ 172.600 – 172.606 shall be readily available on the transport vehicle.
- Shipments of excepted radioactive material in excepted packages, under UN2908, UN2909, UN2910, and UN2911, are excepted from shipping paper requirements if (a) the material is not a hazardous substance or hazardous waste and (b) the package does not contain fissile material or contain fissile material that is excepted by § 173.453.
- For road transport, the shipping papers shall be (a) readily available to authorities in the event of accident or inspection, (b) stored within the driver’s immediate reach while he is restrained by the lap belt, (c) readily visible to a person entering the driver’s compartment or in a holder which is mounted to the inside of the door on the driver’s side of the vehicle, and (d) either in a holder mounted to the inside of the door on the driver’s side of the vehicle or on the driver’s seat [see § 177.817(e)].

[1] International Atomic Energy Agency (IAEA); International Air Transportation Association (IATA); International Civil Aviation Organization (ICAO); International Maritime Organization (IMO).



[2] For mixtures of radionuclides, the radionuclides to be shown must be determined in accordance with § 173.433(g), which is commonly known as the 95% rule; abbreviations (symbols) are authorized.

[3] The Shipper’s certification shall satisfy the requirements of § 172.204.

**5. Hazard Communication for Class 7 (Radioactive) Materials: Marking of Packages:**  
**(49 CFR 172, Subpart D; and 49 CFR 173.471, 178.3 and 178.350)**

These are basic reference charts; refer to current U.S. DOT and NRC regulations for complete requirements.  
 NOTE: IAEA, IATA/ICAO, and IMO may require additional hazard communication information.

**Markings on Packages**

Markings Always Required Unless Excepted <sup>[1]</sup>	Additional Markings Sometimes Required	Optional Markings
<p><b>For Non-bulk Packages:</b></p> <ul style="list-style-type: none"> <li>Proper shipping name</li> <li>Identification number (preceded by “UN” or “NA,” as appropriate)</li> <li>Name and address of consignor or consignee, unless the package is:                             <ul style="list-style-type: none"> <li>highway only and no motor carrier transfers; or</li> <li>part of a rail carload or truckload lot or freight container load, and entire contents of railcar, truck, or freight container are shipped from one consignor to one consignee</li> </ul> </li> </ul> <p><b>For Bulk Packages:</b></p> <ul style="list-style-type: none"> <li>Identification number on orange panel or white square-on-point display [see §§ 172.332 or 172.336]:                             <ul style="list-style-type: none"> <li>on each side and each end, if the packaging has a capacity of 3,785 L (1,000 gallons) or more<sup>[2]</sup>, or</li> <li>on two opposing sides, if the packaging has a capacity of less than 3,785 L (1,000 gallons)<sup>[2]</sup></li> </ul> </li> </ul>	<p><b>Package-based marking requirements:</b></p> <ul style="list-style-type: none"> <li>Gross mass, including the unit of measurement (which may be abbreviated) for each package with gross mass greater than 50 kg (110 lb)</li> <li>Package type as appropriate, i.e., “TYPE IP-1,” “TYPE IP-2,” “TYPE IP-3,” “TYPE A,” “TYPE B(U)” or “TYPE B(M)”<sup>[1]</sup></li> <li>Marked with international vehicle registration code of country of origin for IP-1, IP-2, IP-3 or Type A package design (e.g., “USA”)</li> <li>Radiation (trefoil) symbol<sup>[3]</sup> on outside of outermost receptacle of each Type B(U) or Type B(M) </li> <li>Each NRC-approved package (e.g., Type AF, Type B(U), Type B(M), Type B(U)F, and Type B(M)F) must be marked with the identification marking indicated in the package approval</li> <li>For Specification 7A packaging, mark on the outside with “USA DOT 7A Type A”, and the name and address or symbol of the manufacturer satisfying §§ 178.3 and 178.350</li> </ul> <p><b>Materials-based requirements:</b></p> <ul style="list-style-type: none"> <li>For a non-bulk IP-1 package containing a liquid, use underlined double arrow symbol indicating upright orientation<sup>[4]</sup>, where the symbol is placed on two opposite sides of the packaging [see § 172.312] </li> <li>For a non-bulk package containing a hazardous substance, mark the outside of each package with the letters “RQ” in association with the proper shipping name</li> </ul> <p><b>Administrative-based requirements:</b></p> <ul style="list-style-type: none"> <li>For each Type B(U), Type B(M) or fissile material package destined for export shipment, mark “USA” in conjunction with specification marking, or certificate identification; and package identification indicated in the U.S. Competent Authority Certificate</li> <li>Mark “DOT-SP” followed by the special permit number assigned for each package authorized by special permit</li> <li>Competent authority identification marking and revalidation for foreign made Type B(U), Type B(M), Type H(U), Type H(M), or fissile material package for which a Competent Authority Certificate is required</li> </ul>	<ul style="list-style-type: none"> <li>Both the name and address of consignor and consignee is recommended.</li> <li>Other markings on packages such as advertising are permitted, but must be located away from required markings and labeling.</li> </ul> <p>For marking exceptions for LSA material and SCO, [see § 173.427(a)(6)(vi)] (e.g., RADIOACTIVE-LSA, RADIOACTIVE-SCO, or RQ, as appropriate).</p> <p>For an overpack, the marking “OVERPACK” in lettering 12 mm (0.5 inches) high. <b>This marking is not required if the package type contained in the overpack is visible from the outside</b> [see § 173.25].</p>

**Special Considerations for Marking Requirements**

- All markings are to be (a) on the outside of each package, (b) durable and legible, (c) in English, (d) printed on or affixed to the surface of a package or on a label, tag, or sign, (e) displayed on a background of sharply contrasting color, and (f) unobscured by labels or attachments.
- When an overpack is used, see §§ 173.25 and 173.448(g) for marking requirements.

[1] Some marking exceptions exist for excepted packages, as specified in §§ 173.421, 173.422, 173.424, 173.426 and 173.428.  
 [2] If the identification number marking on a bulk package is not visible, the transport vehicle or freight container must be marked on each side and each end [see § 172.331].  
 [3] The radiation symbol shall be resistant to the effects of fire and water, plainly marked by embossing, stamping or other means resistant to the effects of fire and water and conform to the size requirements of Appendix B to Part 172.  
 [4] The arrows must be either black or red on white or other suitable contrasting background and commensurate with the size of the package; depicting a rectangular border around the arrows is optional.

**6. Hazard Communications for Class 7 (Radioactive) Materials:  
Labeling of Packages (49 CFR 172.400-450)**




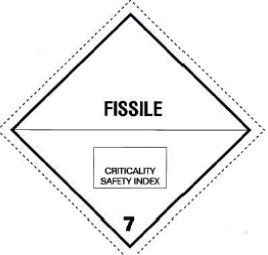
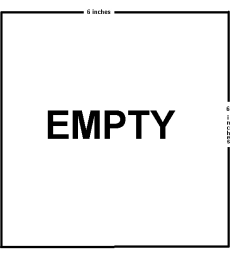
These are basic reference charts; refer to current U.S. DOT and NRC regulations for complete requirements.  
NOTE: IAEA, IATA/ICAO, and IMO may require additional hazard communication information.

**Requirements for Labels<sup>[1]</sup>**

- Label each package, except for (a) excepted packages of radioactive material; and (b) Low Specific Activity (LSA) material and Surface Contaminated Objects (SCO), packaged or unpackaged, when transported under exclusive use controls domestically and when the material or object contains less than an A<sub>2</sub> quantity.
- Labels are required to be (a) printed or affixed to a surface other than the bottom of the package, (b) placed near the proper shipping name marking, (c) printed or affixed to a background of contrasting color or have a dotted or solid line outer border, (d) clearly visible, (e) not obscured by markings or other attachments, (f) representative of the hazardous material content, and (g) in conformance with the label specifications of § 172.407.
- The appropriate radioactive label must be affixed to opposite sides or two ends (other than the bottom) of all non-bulk packages of radioactive material.

**Category of Radioactive Labels<sup>[3]</sup>**

**Other Radioactive Labels<sup>[2]</sup>**

					
<b>White-I</b>	<b>Yellow-II</b>	<b>Yellow-III</b>	<b>Fissile</b>	<b>Empty</b>	
<b>Maximum Radiation Surface Level (RSL)</b>			Fissile labels required for each package containing fissile material, other than fissile-excepted material; and labels must be affixed adjacent to radioactive category labels.	Empty labels required for empty Class 7 (radioactive) packages satisfying § 173.428; and any previously-used labels must not be visible.	
mSv/h	<b>RSL ≤ 0.005</b>	0.005 < RSL ≤ 0.5			0.5 < RSL ≤ 2 <sup>[5]</sup>
mrem/h	<b>RSL ≤ 0.5</b>	0.5 < RSL ≤ 50			50 < RSL ≤ 200 <sup>[5]</sup>
<b>Transport Index (TI):<sup>[4]</sup></b>					
<b>TI = 0</b>		0 < TI ≤ 1	1 < TI ≤ 10 <sup>[5]</sup>		

**Contents on Labels**

- Each radioactive category label must contain: (a) Except for LSA-I material, the names of the radionuclides in the package where, for mixtures of radionuclides, the names listed must be in accordance with the 95% rule specified in § 173.433(g); and, for LSA-I material, the term “LSA-I”; (b) maximum activity in appropriate SI units (e.g., Bq, TBq), or appropriate customary units (e.g., Ci, mCi) in parentheses following SI units; and (c) for Yellow-II or Yellow-III labels the Transport Index (TI). Abbreviations and symbols may be used. Except for Pu-239 and Pu-241, the weight in g or kg of fissile radionuclides may be inserted instead of activity units; for Pu-239 and Pu-241, the weight in g of fissile radionuclides may be inserted in addition to the activity units [see § 173.403 for fissile material definition].
- Each fissile label must contain the relevant Criticality Safety Index (CSI) [see § 172.403(e)].

[1] Additional labels may be required if the contents of a package contains material that also meets the definition of one or more other hazard class. See §§ 172.402 and 406(c) for details on additional labeling requirements. [See §§ 172.400a, 173.421 through 173.427 for details when labels are not required, and see § 172.407 for details on label durability, design, size, color, form identification, exceptions, and the trefoil symbol size].

[2] A “Cargo Aircraft Only” label is required for each package containing a hazardous material which is authorized for cargo aircraft only [see § 172.402(c)].

[3] The category of the label must be the higher of the two values specified for RSL and TI [see § 172.403(b)].

[4] The TI is determined from the radiation level 1 meter from the package surface [see TI definition in § 173.403]. If the measured TI is not greater than 0.05, the value may be considered to be zero. When an overpack is used, it must be labeled in accordance with § 172.403(h).

[5] Packages with a TI > 10 or an RSL > 2 mSv/h (200 mrem/h) must be transported under exclusive use provisions [see § 173.441(b)]. Any package containing a Highway Route Controlled Quantity (HRCQ) must be labelled as RADIOACTIVE YELLOW-III.

**7. Hazard Communications for Class 7 (Radioactive) Materials: Placarding (49 CFR 172, Subpart F)**

These are basic reference charts; refer to current U.S. DOT and NRC regulations for complete requirements.

NOTE: IAEA, IATA/ICAO, and IMO may require additional hazard communication information.

**Conditions when Display of Placards is Required [§§ 172.504, 172.507(a), 172.508, and 172.512]**

- Each bulk package, freight container, unit load device<sup>[1]</sup>, transport vehicle, or rail car containing any quantity of hazardous material must be placarded on each side and each end with the placards specified in § 172.504(e).
- Radioactive placards are required for: shipments that contain a package labeled as Radioactive Yellow-III; unpackaged LSA-I or SCO-I when transported under exclusive use provisions; shipments required by §§ 173.427, 173.441, and 173.457 to be operated under exclusive use; and closed vehicles marked “For Radioactive Materials Use Only” transported under § 173.443(d).
- The Radioactive placard is placed on a square background on any motor vehicle used to transport a package containing a Highway Route Controlled Quantity (HRCQ) Class 7 (radioactive) material<sup>[2]</sup>.

**Visibility and Display of Radioactive Placards [§ 172.516]**

- Placards are required to:
  - be clearly visible, on a motor vehicle and rail car, from the direction they face, except from the direction of another transport vehicle or rail car to which the motor vehicle or rail car is coupled<sup>[3]</sup>
  - be securely attached or affixed thereto or placed in a holder thereon
  - be located clear of appurtenances and devices such as ladders, pipes, doors, and tarpaulins
  - be located, so far as practical, so dirt or water is not directed to it from the transport vehicle wheels
  - be located at least 3 inches (76.0 mm) away from any marking (e.g. advertising) that could reduce its effectiveness
  - have “RADIOACTIVE” printed on it displayed horizontally, reading from left to right
  - be maintained by the carrier so format, legibility, color, and visibility of the placard will not be substantially reduced due to damage, deterioration, or obscurement by dirt or other matter
  - be affixed to a background of contrasting color, or have a dotted or solid line outer border which contrasts with the background color.

**Radioactive Placards**

**PLACARD (FOR OTHER THAN HRCQ)**



White triangular background color in the lower portion with yellow triangle in the upper portion; trefoil symbol, text, class number and inner and outer borders in black.  
[see § 172.556 and Appendix B of Part 172]

**PLACARD FOR HRCQ**



Square background must consist of a white square surrounded by one-inch black border. The placard inside the square is identical to that for other than HRCQ.  
[see § 172.527]

**General Specifications for Placards and Subsidiary Hazard Placarding**

- Placards must conform to the specifications in § 172.519.
- A CORROSIVE placard is also required for each transport vehicle that contains 454 kg (1001 pounds) or more gross weight of non-fissile, fissile-excepted, or fissile uranium hexafluoride [see § 172.505(b)].
- Placards are also required for subsidiary hazards of POISON INHALATION HAZARD, POISON GAS, or DANGEROUS WHEN WET [see § 172.505].

[1] See § 172.512 for exceptions and variations to the placarding requirements for freight containers and aircraft unit load devices.

[2] See § 173.403 for the definition of Highway Route Controlled Quantity (HRCQ). A package containing an HRCQ must be labeled with RADIOACTIVE Yellow-III labels [see §§ 172.403(c) and 172.507(a)].

[3] Required placarding of the front of a motor vehicle may be on the front of a truck-tractor instead of or in addition to the placarding on the front of the cargo body to which a truck-tractor is attached § 172.516(b).

## 8. Requirements/Guidance for Registration, Emergency Response and Action for Class 7 (Radioactive) Materials: (49 CFR 107, Subpart G; 49 CFR 171.15; 49 CFR 172, Subparts F and G)

These are basic reference charts; refer to current U.S. DOT and NRC regulations for complete requirements.

### Provisions for Persons Who Offer or Transport Class 7 (Radioactive) Materials (49 CFR 107, Subpart G)

- Any person, other than those excepted by § 107.606, who offers for transportation, or transports, in foreign, interstate or intrastate commerce any of the following Class 7 (radioactive) materials must satisfy registration and fee requirements of Part 107, Subpart G:
  - a highway route-controlled quantity of radioactive material;
  - a shipment in a bulk packaging with a capacity  $\geq$  13,248 L (3,500 gallons) for liquids or gases, or  $>$  13.24 cubic meters (468 cubic feet) for solids; or
  - any quantity of radioactive material that requires placarding, under provisions of Part 172, Subpart F.
- Any person required to register must submit a complete and accurate registration statement on DOT Form F 5800.2 by June 30th for each registration year, or in time to have on file a current Certificate of Registration in accordance with § 107.620.
- Each registrant or designee must maintain for a period of 3 years from the date of issuance a copy of the registration statement and Certificate of Registration issued by PHMSA and must furnish its Certificate of Registration (or a copy thereof) and related records to an authorized representative or special agent of DOT upon request.
- Each motor carrier subject to registration requirements of this subpart must carry a copy of its current Certificate of Registration or another document bearing the registration number on board each truck and truck tractor, and the Certificate of Registration or document must be made available, upon request, to enforcement personnel.
- The amount of fees to be paid and procedures to be followed are found at §§ 107.612 and 107.616.

### Provisions for Providing and Maintaining Emergency Response Information (49 CFR 172, Subpart G)

- When shipping papers for the transportation of radioactive materials are required [see Part 172, Subpart C], emergency response information shall
  - be provided and maintained during transportation and at facilities where materials are loaded for transportation, stored incidental to transportation, or otherwise handled during any phase of transportation;
  - be provided by persons who offer for transportation, accept for transportation, transfer or otherwise handle hazardous materials during transportation;
  - be immediately available for use at all times the hazardous material is present; and
  - include and make available the emergency response telephone number [see § 172.604] to any person, representing a Federal, State or local government agency, who responds to an incident involving the material or is conducting an investigation which involves the material.
- Emergency response information is information that can be used in mitigating an incident involving radioactive materials. It must contain at least the information specified in §§ 172.602 and 172.604; and includes an emergency response telephone number that is monitored at all times the material is in transportation by (a) knowledgeable person, or (b) a person who has immediate access to a knowledgeable person, or (c) an organization capable of accepting responsibility for providing the necessary detailed information concerning the material.
- Each carrier who transports or accepts for transportation radioactive material for which a shipping paper is required shall instruct, according to the requirements of § 172.606, the operator of a conveyance to contact the carrier in the event of an incident involving the material.

### Actions to be Taken in the Event of Spillage, Breakage, or Suspected Contamination by Radioactive Material

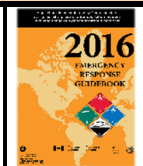
- If there is evidence of a leaking package or conveyance, access to the package or conveyance must be restricted, the area impacted and the extent of the contamination must be determined, and appropriate measures must be taken to minimize impact to persons and the environment [see § 173.443(e)].
- Except for a road vehicle used solely for transporting Class 7 (radioactive) material [see § 173.443(d)], each aircraft used routinely, and each motor vehicle used for transporting radioactive materials under exclusive use, must be (a) periodically checked for radioactive contamination, (b) taken out of service if contamination levels are above acceptable limits, and (c) remain out of service until the radiation dose rates at accessible surfaces are less than 0.005 mSv/h (0.5 mrem/h) and non-fixed radioactive surface contamination levels are below the limits in §§ 173.443(a), Table 9; and 173.443(c) for exclusive use vehicle provisions [see Chart 3].
- Following any breakage, spillage, release or suspected radioactive contamination incident, any rail or air carrier shall notify, as soon as possible, the offer or (i.e. the consignor); special provisions apply for buildings, areas, and equipment that might become contaminated during rail transport. Alternative provisions may apply for motor vehicles transporting radioactive materials under exclusive use [see §§ 174.750(a), 175.705(e), and 177.843(b)].

### Provisions for Immediate Notification for Reportable Incidents Involving Radioactive Materials (§§ 171.15 and 171.16)

- Each person in physical possession of radioactive material must provide notice in the event of a reportable incident (see § 171.15(b)) as soon as practical, but no later than 12 hours after the occurrence of the reportable incident, to the National Response Center (NRC) by telephone at 800-424-8802 (toll free) or 202-267-2675 (toll call) or online at <http://www.nrc.uscg.mil>.
- Each notice must include the information specified in § 171.15(a)(1) – (a)(7).
- A detailed incident report must also be submitted as required by § 171.16.

### Guidance on Responding to Emergencies (Emergency Response Guidebook)

- The DOT issues guidance to aid first responders in quickly identifying the hazards of the dangerous goods involved in an accident or incident, and for protecting themselves and the general public during the initial response to the accident or incident. For each proper shipping name or UN ID Number, the user is led to a specific guide that provides insight into potential hazards and steps to be taken for public safety and emergency response.
- The current edition of the Emergency Response Guidebook is available at <http://phmsa.dot.gov/hazmat/outreach-training/erg>.



**9. Requirements for Training and Safety and Security Plans for Class 7 (Radioactive) Materials:  
(49 CFR 172, Subparts H and I, 49 CFR 173, and 10 CFR 37)**

These are basic reference charts; refer to current U.S. DOT and NRC regulations for complete requirements.

**Training (49 CFR 172, Subpart H)**

- For any person who is employed by an employer or is self-employed, and who directly affects hazardous materials transportation safety, a systematic program shall be established to ensure that the person:
  - has familiarity with the general provisions of [Part 172, Subpart H](#);
  - is able to recognize and identify radioactive materials;
  - has knowledge of specific requirements of [Part 172](#) that are applicable to functions performed by the employee;
  - has knowledge of emergency response information, self-protection measures and accident prevention methods and procedures; and
  - does not perform any function related to the requirements of [Part 172](#) unless instructed in the requirements that apply to that function.
- The person shall be trained pursuant to the requirements of [§ 172.704\(a\)](#) and [\(b\)](#), may be trained by the employer or by other public or private sources, and shall be tested by appropriate means. The training must include the following:
  - (a) general awareness training providing familiarity with applicable regulatory requirements;
  - (b) function-specific training applicable to functions the employee performs;
  - (c) safety training concerning emergency response information, measures to protect the employee from hazards, and methods and procedures for avoiding accidents;
  - (d) security awareness training providing awareness of security risks and methods designed to enhance transportation security; and
  - (e) in-depth security training if a security plan is required for the shipment(s) involved.
- Initial and recurrent training shall comply with the requirements of [§ 172.704\(c\)](#).
- Records of training shall be created and retained in compliance with the requirements of [§ 172.704\(d\)](#).

**Security (49 CFR 172, Subpart I, 49 CFR 173, and 10 CFR 37)**

- A security plan for hazardous materials that conforms to the requirements of [Part 172, Subpart I](#) must be developed and adhered to by each person who offers for transportation in commerce or transports in commerce in a motor vehicle, rail car, or freight container any of the following radioactive materials:
  - (a) IAEA Code of Conduct Category 1 and 2 materials (see [§§ 172.800\(b\)\(15\)](#) and [10 CFR 37](#));
  - (b) a highway route controlled quantity (HRCQ) of radioactive material as defined in [§ 173.403](#) [see [§ 172.800\(b\)\(15\)](#)];
  - (c) known radionuclides in forms listed as radioactive material quantities of concern (RAM-QC) by the NRC [see [§§ 172.800\(b\)\(15\)](#) and [10 CFR 37](#)]; or
  - (d) a quantity of uranium hexafluoride requiring placarding under [§ 172.505\(b\)](#) [see [§ 172.800\(b\)\(14\)](#)].
- The security plan must include an assessment of possible transportation security risks and appropriate measures to address the assessed risks.
- Specific measures put into place by the plan may vary commensurate with the level of threat at a particular time.
- At a minimum, a security plan must address personnel security, unauthorized access, and enroute security.
- The security plan must be
  - (a) in writing;
  - (b) retained for as long as it remains in effect;
  - (c) available as copies or portions thereof to the employees who are responsible for implementing it, consistent with personnel security clearance or background investigation restrictions and a demonstrated need to know;
  - (d) revised and updated as necessary to reflect changing circumstances; and
  - (e) maintained (all copies) as of the date of the most recent revision, when it is updated or revised.
- Security plans that conform to regulations, standards, protocols, or guidelines issued by other Federal agencies, international organizations, or industry organizations may be used to satisfy the requirements in [Part 172](#), provided such security plans address the requirements specified in [Part 172, Subpart I](#).
- Additional security planning requirements may apply for rail transport of a highway route controlled quantity of radioactive material [see [§§ 172.820](#) and [173.403](#)].



**APPENDIX N**  
**MODEL WASTE MANAGEMENT PROCEDURES**



## Model Waste Management Procedures

### General Guidelines

- All radioactivity labels must be defaced or removed from containers and packages prior to disposal into ordinary “nonradioactive” waste streams. If waste is compacted, all labels that are visible in the compacted mass must be defaced or removed.
- Remind workers that nonradioactive waste should not be mixed with radioactive waste.
- Occasionally monitor all procedures to ensure that radioactive waste is not created unnecessarily. Review all new procedures to ensure that waste is handled in a manner consistent with established procedures.
- In all cases, consider the entire effect of various available disposal routes. Consider occupational and public exposure to radiation, other hazards associated with the material and routes of disposal (e.g., toxicity, carcinogenicity, pathogenicity, flammability), and costs.
- The waste management program should include waste handling procedures. Also, procedures should be available for well logging personnel who may collect waste from areas of use to bring to the storage area for eventual disposal.
- A waste generator, collector, or processor who transports, or offers for transportation, low-level radioactive waste intended for ultimate disposal at a licensed low-level radioactive waste land disposal facility must prepare a Manifest in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20, Appendix G, “Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests.”

### Model Procedure for Disposal by Decay-in-Storage

Applicants should ensure that adequate space and facilities are available for the storage of waste for decay-in-storage (DIS). Licensees can minimize the need for storage space if the waste is segregated according to physical half-life.

- Only short-lived waste (physical half-life of less than or equal to 120 days) should be disposed of by DIS.
- Short-lived waste should be segregated from long-lived waste (half-life greater than 120 days) at the source.
- Waste should be stored in suitable, well-marked containers, and the containers should be adequately shielded.
- Liquid and solid wastes should be stored separately.
- When the waste container is full, it should be sealed. The sealed container should be identified with a label affixed or attached to it.

- The identification label should include the date when the container was sealed, the longest-lived radionuclide in the container, total activity, and the name of the individual who sealed the container. The container may be transferred to the DIS area. When large quantities are held for DIS, sufficient quantities may be present even after many half-lives and persons performing surveys should be aware of the potential for measurable radiation.
- The contents of the container should be allowed to decay for a period of time after which it is expected that the radiation levels would not be distinguishable from background. The period of time depends on both the half-life of the radionuclide(s) and the original amount present.
- Prior to disposal as ordinary trash, each container should be monitored with an appropriate radiation detection instrument, on the lowest setting, as follows:
  - Check the radiation detection survey meter for proper operation.
  - Survey the contents of each container in a low background area.
  - Remove any shielding from around the container.
  - Monitor all surfaces of the container.
  - Discard the contents as ordinary trash only if the surveys of the contents indicate no residual radioactivity (i.e., surface readings are indistinguishable from background).
  - If the surveys indicate residual radioactivity, return the container to the DIS area and contact the RSO for further instructions.
  - If the surveys indicate no residual radioactivity, record the date when the container was sealed, the disposal date, type of waste (e.g., used or unused material, gloves), survey instrument used, and the name of the individual performing surveys and disposing of the waste.

### **Model Procedure for Disposal of Liquids into Sanitary Sewerage**

- Confirm that the sewer system is a public system, not a private sanitary sewer, septic system, or leach field.
- Confirm that the liquid waste being discharged is soluble (or is material that is readily dispersible) in water.
- Calculate the amount of each radionuclide that can be discharged by using the information from prior, similar discharges and the information in 10 CFR Part 20, Appendix B.
- Make sure that the amount of each radionuclide does not exceed the monthly and annual discharge limits specified in 10 CFR 20.2003(a)(4) and 10 CFR Part 20, Appendix B, Table 3.

- If more than one radionuclide is released, the sum of the ratios of the average monthly discharge of a radionuclide to the corresponding limit in 10 CFR Part 20, Appendix B, Table 3 must not exceed unity.
- Confirm that the total quantity of licensed material released into the sanitary sewerage system in a year does not exceed 185 gigabecquerel (GBq) [5 Curies (Ci)] of H-3 (tritium), 37 GBq [1 Ci] of C-14, and 37 GBq [1 Ci] of all other radionuclides combined.
- Record the date, radionuclide(s), estimated activity of each radionuclide, location where the material is discharged, and the name of the individual discharging the waste.
- Liquid radioactive waste should be discharged only via designated locations.
- Discharge liquid waste slowly (to minimize splashing) with water running, to be sure that the material moves out of the sink and into the sewer system.
- Survey the sink and surrounding work surfaces to confirm that no residual material or contamination remained in the sink or on work surfaces.
- Prior to leaving the area, decontaminate all areas or surfaces, if found to be contaminated.
- Maintain records of releases of licensed material to the sanitary sewer system. These records should include, for each release, the date, radionuclide(s), estimated activity of each radionuclide, location where the material is discharged, and the initials of the individual discharging the waste. For the licensed facility as a whole, records should be maintained of the quantity and concentration of radionuclides that are released into the sewer system that demonstrate compliance with the regulatory limits for total quantity released and concentrations released by the licensed facility.

### **Model Procedure for Compaction**

The following information should be provided by licensees that propose to compact waste.

- Describe the compactor to demonstrate that it is adequately designed and manufactured to safely compact the type and quantity of waste generated during licensed operations. Provide manufacturer's specifications, annotated sketches or photographs, and other information about the compactor's design.
- Describe the type, quantities, and concentrations of waste to be compacted.
- Provide an analysis of the potential for airborne release of radioactive material during compaction activities.
- Provide the location of any compactors within the waste processing area(s), as well as a description of the ventilation and filtration systems used in conjunction with the compactors. Include a description of the procedures for monitoring filter blockage and exchange.
- Discuss the methods used to monitor worker breathing zones and exhaust systems.

- Discuss the types and frequencies of surveys that will be performed for contamination control in the compactor area.
- Discuss the instruction provided to compactor operators, including instructions for protective clothing, checks for proper functioning of equipment, method of handling uncompacted waste, and examining containers for defects.

## **APPENDIX O**

### **ACTIONS TO BE TAKEN IF A SEALED SOURCE IS RUPTURED OR IF LICENSED MATERIALS HAVE CAUSED CONTAMINATION**





## **Actions to be Taken if a Sealed Source is Ruptured or if Licensed Materials Have Caused Contamination**

Regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) 39.69(a) require immediate initiation of emergency procedures if there is evidence that a sealed source has ruptured or that licensed materials have caused contamination.

The procedures required under 10 CFR 39.63 should instruct logging personnel to:

- Stop well logging activities immediately after finding evidence that a sealed source has ruptured or that licensed materials have caused contamination.
- Notify immediately the Radiation Safety Officer (RSO) or other appropriate management personnel.
- Follow emergency procedures as directed by the RSO.
- Secure and restrict access to the area until responsible individuals arrive.
- Instruct individuals on site not to take any unnecessary actions that could spread contamination.
- Minimize inhalation or ingestion of licensed material by using protective clothing and respirators.
- Discuss procedures for preventing the spread of contamination and for minimizing inhalation or ingestion with any potentially exposed personnel.
- Obtain suitable radiation survey instruments as required by 10 CFR 39.33, "Radiation Detection Instruments."
- Notify the well owner or operator as soon as possible.
- Notify immediately the U.S. Nuclear Regulatory Commission operations center at the telephone number specified in 10 CFR 20.2202(d)(2) at 301-816-5100. Collect calls are accepted.



**APPENDIX P**  
**MODEL DELEGATION OF AUTHORITY**



## Model Delegation of Authority

Memo To: Radiation Safety Officer  
From: Chief Executive Officer  
Subject: Delegation of Authority

You, \_\_\_\_\_, have been appointed radiation safety officer and are responsible for ensuring the safe and secure use of radiation. You are responsible for managing the Radiation Protection Program, identifying radiation protection problems, initiating, recommending, or providing corrective actions, verifying implementation of corrective actions, stopping unsafe activities, and ensuring compliance with regulations. You are hereby delegated the authority necessary to meet those responsibilities, including prohibiting the use of byproduct material by employees who do not meet the necessary requirements and shutting down operations, when justified, to maintain radiation safety. You are required to notify management if staff does not cooperate and does not address radiation safety issues. In addition, you are free to raise issues with the U.S. Nuclear Regulatory Commission at any time. It is estimated that you will spend \_\_\_\_\_ hours per week conducting radiation protection activities.

\_\_\_\_\_  
Signature of Management Representative

\_\_\_\_\_  
Date

I accept the above responsibilities,

\_\_\_\_\_  
Signature of Radiation Safety Officer

\_\_\_\_\_  
Date

**cc: Affected department heads**



**APPENDIX Q**

**CHECKLIST FOR REQUESTS TO WITHHOLD PROPRIETARY  
INFORMATION FROM PUBLIC DISCLOSURE (UNDER 10 CFR 2.390)**





## Checklist for Requests to Withhold Proprietary Information from Public Disclosure (Under 10 CFR 2.390)

In order to request that the U.S. Nuclear Regulatory Commission (NRC) withhold information from public disclosure, the applicant or licensee must submit the information, including an affidavit, in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390, "Public inspections, exemptions, requests for withholding." The applicant should submit all of the following:

<input type="checkbox"/>	A proprietary copy of the information. Brackets should be placed around the material considered to be proprietary. This copy should be marked as proprietary.
<input type="checkbox"/>	A nonproprietary copy of the information. Applicants should white out or black out the proprietary portions (i.e., those in the brackets), leaving the nonproprietary portions intact. This copy should <b>not</b> be marked as proprietary.
<input type="checkbox"/>	An affidavit that:
<input type="checkbox"/>	Is signed under oath and affirmation (notarization may suffice).
<input type="checkbox"/>	Clearly identifies (such as by name or title and date) the document to be withheld.
<input type="checkbox"/>	Clearly identifies the position of the person executing the affidavit. This person must be an officer or upper-level management official who has been delegated the function of reviewing the information the organization is seeking to withhold and is authorized to apply for withholding on behalf of the organization.
<input type="checkbox"/>	States that the organization submitting the information is the owner of the information or is required, by agreement with the owner of the information, to treat the information as proprietary.
<input type="checkbox"/>	Provides a rational basis for holding the information in confidence.
<input type="checkbox"/>	Fully addresses the following issues:
<input type="checkbox"/>	Is the information submitted to, and received by, the NRC in confidence? Provide details.
<input type="checkbox"/>	To the best of the applicant's knowledge, is the information currently available in public sources?
<input type="checkbox"/>	Does the applicant customarily treat this information, or this type of information, as confidential? Explain why.
<input type="checkbox"/>	Would public disclosure of the information be likely to cause substantial harm to the competitive position of the applicant? If so, explain why in detail. The explanation should include the value of the information to your organization, the amount of effort or money expended in developing the information, and the ease or difficulty for others to acquire the information.



**APPENDIX R**  
**SAFETY CULTURE STATEMENT OF POLICY**



## Safety Culture Statement of Policy

The safety culture policy statement was published in the *Federal Register* (76 FR 34773) on June 14, 2011 and can be found at: <https://www.gpo.gov/fdsys/pkg/FR-2011-06-14/pdf/2011-14656.pdf>. It is also posted in the NRC's Agencywide Documents Access and Management System, Accession No. ML11146A047.

### Safety Culture Policy Statement

The purpose of this Statement of Policy is to set forth the Commission's expectation that individuals and organizations establish and maintain a positive safety culture commensurate with the safety and security significance of their activities and the nature and complexity of their organizations and functions. This includes all licensees, certificate holders, permit holders, authorization holders, holders of quality assurance program approvals, vendors and suppliers of safety-related components, and applicants for a license, certificate, permit, authorization, or quality assurance program approval, subject to U.S. Nuclear Regulatory Commission (NRC) authority. The Commission encourages the Agreement States, Agreement State licensees, and other organizations interested in nuclear safety to support the development and maintenance of a positive safety culture, as articulated in this Statement of Policy.

Nuclear Safety Culture is defined as "the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment." Individuals and organizations performing regulated activities bear the primary responsibility for safety and security. The performance of individuals and organizations can be monitored and trended and, therefore, may be used to determine compliance with requirements and commitments and may serve as an indicator of possible problem areas in an organization's safety culture. The NRC will not monitor or trend values. These will be the organization's responsibility as part of its safety culture program.

Organizations should ensure that personnel in the safety and security sectors have an appreciation for the importance of each, emphasizing the need for integration and balance to achieve both safety and security in their activities. Safety and security activities are closely intertwined. While many safety and security activities complement each other, there may be instances in which safety and security interests create competing goals. It is important that consideration of these activities be integrated so as not to diminish or adversely affect either; thus, mechanisms should be established to identify and resolve these differences. A safety culture that accomplishes this would include all nuclear safety and security issues associated with NRC-regulated activities.

Experience has shown that certain personal and organizational traits are present in a positive safety culture. A trait, in this case, is a pattern of thinking, feeling, and behaving that emphasizes safety, particularly in goal conflict situations, e.g., production, schedule, and the cost of the effort versus safety. It should be noted that although the term "security" is not expressly included in the following traits, safety and security are the primary pillars of the NRC's regulatory mission. Consequently, consideration of both safety and security issues, commensurate with their significance, is an underlying principle of this Statement of Policy.

The following are traits of a positive safety culture:

- (1) *Leadership Safety Values and Actions*—Leaders demonstrate a commitment to safety in their decisions and behaviors;

- (2) *Problem Identification and Resolution*—Issues potentially impacting safety are promptly identified, fully evaluated, and promptly addressed and corrected commensurate with their significance;
- (3) *Personal Accountability*—All individuals take personal responsibility for safety;
- (4) *Work Processes*—The process of planning and controlling work activities is implemented so that safety is maintained;
- (5) *Continuous Learning*—Opportunities to learn about ways to ensure safety are sought out and implemented;
- (6) *Environment for Raising Concerns*—A safety-conscious work environment is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination;
- (7) *Effective Safety Communication*—Communications maintain a focus on safety;
- (8) *Respectful Work Environment*—Trust and respect permeate the organization; and
- (9) *Questioning Attitude*—Individuals avoid complacency and continuously challenge existing conditions and activities in order to identify discrepancies that might result in error or inappropriate action.

There may be traits not included in this Statement of Policy that are also important in a positive safety culture. It should be noted that these traits were not developed to be used for inspection purposes.

It is the Commission's expectation that all individuals and organizations, performing or overseeing regulated activities involving nuclear materials, should take the necessary steps to promote a positive safety culture by fostering these traits as they apply to their organizational environments. The Commission recognizes the diversity of these organizations and acknowledges that some organizations have already spent significant time and resources in the development of a positive safety culture. The Commission will take this into consideration as the regulated community addresses the Statement of Policy.







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This technical report contains information intended to provide program-specific guidance and assist applicants and licensees in preparing applications for materials licenses for well logging, tracer, and field flood studies. In particular, it describes the types of information needed to complete U.S. Nuclear Regulatory Commission (NRC) Form 313, "Application for Materials License." This document describes both the methods acceptable to the NRC license reviewers in implementing the regulations and the techniques used by the reviewers in evaluating the application to determine if the proposed activities are acceptable for licensing purposes.

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