U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1556
Volume 14, Rev. 1

Consolidated Guidance about Materials Licenses

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

Draft Report for Comment

Office of Federal and State Materials and
Environmental Management Programs

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Draft Report for Comment

Manuscript Completed: May 2014
Date Published: May 2014

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Office of Federal and State Materials and
Environmental Management Programs

COMMENTS ON DRAFT REPORT

Any interested party may submit comments on this report for consideration by the NRC staff. Comments may be accompanied by additional relevant information or supporting data. Please specify the report number NUREG-1556, Volume 14, Revision 1, in your comments, and send them by the end of the comment period specified in the *Federal Register* notice announcing the availability of this report.

Addresses: You may submit comments by any one of the following methods. Please include Docket ID **NRC-2014-0119** in the subject line of your comments. Comments submitted in writing or in electronic form will be posted on the NRC website and on the Federal rulemaking website http://www.regulations.gov.

Federal Rulemaking Website: Go to http://www.regulations.gov and search for documents filed under Docket ID **NRC-2014-0119**. Address questions about NRC dockets to Carol Gallagher at 301-287-3422 or by e-mail at Carol.Gallagher@nrc.gov.

Mail comments to: Cindy Bladey, Chief, Rules, Announcements, and Directives Branch (RADB), Division of Administrative Services, Office of Administration, Mail Stop: TWB-05-B01M, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

For any questions about the material in this report, please contact: Tomas Herrera, Team Leader at 301-415-7138 or by e-mail at Tomas.Herrera@nrc.gov.

Please be aware that any comments that you submit to the NRC will be considered a public record and entered into the Agencywide Documents Access and Management System (ADAMS). Do not provide information you would not want to be publicly available.

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

This NUREG contains information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collection requirements were approved by the Office of Management and Budget, approval number 3150-0120.

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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
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

Volume No.	*Volume Title*
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	Program-Specific Guidance about Administrative Licensing Procedures
21	Program-Specific Guidance about Possession Licenses for Production of Radioactive Materials Using an Accelerator
22	Reserved

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.

NUREG1556, Volume 14, Revision 1, is not a substitute for NRC 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 continue a license.

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ACKNOWLEDGMENTS

The working group thanks the individuals listed below for assisting in the review and update of the report. All participants provided valuable insights, observations, and recommendations.

The working group would like to thank the staff in the regional offices of the NRC and all of the States who provided comments and technical information that assisted in the development of this report.

The working group also thanks Lisa Dimmick, John O'Donnell, Monica Orendi, Tara Weidner, and Duane White for developing the formatting and language used in many parts of the report.

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ABBREVIATIONS

ADAMS	Agencywide Documents Access and Management System
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
EA	environmental assessment
ECS	energy compensation source
EPA	U.S. Environmental Protection Agency
F/A	financial assurance
FR	*Federal Register*
FSME	Office of Federal and State Materials and Environmental Management Programs
G-M	Geiger-Mueller
GBq	gigabecquerel
GPO	Government Printing Office
IN	information notice
LLW	low level waste
LSA	low specific activity
LWD	logging while drilling
MBq	megabecquerel
MC	manual chapter
mCi	millicurie
mR	milliroentgen
mrem	millirem
µSv	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
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
rad	radiation absorbed dose
rem	radiation dose equivalent (man)
RG	regulatory guide
RIS	regulatory information summary
RQ	reportable quantities
RSO	radiation safety officer
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
TI	transportation index
TLD	thermoluminescent dosimeters
USASI	United States of America Standards Institute

1. PURPOSE OF REPORT

Byproduct material, as defined in Title 10 of the *Code of Federal Regulations* (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 survey instruments and well logging tools.
- Sealed sources and tracer materials are used in the research and development of new techniques and equipment.

This report 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) criteria for evaluating the corresponding license application. Chapter 8 of this report, "Contents of an Application," identifies the information needed to complete NRC Form 313, "Application for Materials License," (see Appendix B) 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 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.

The format within this document 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.

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 C, "Suggested Format for Providing Information Requested in Items 5 through 11 of NRC Form 313," may be used to provide supporting information. Appendices D through V contain additional information on various radiation safety topics.

Appendix E provides specific guidance for licensing field flood activities

In this document, 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." Rem and its International System of Units (SI) equivalent, sievert (Sv) (1 rem = 0.01 Sv), are used to describe units of radiation exposure or dose. This is done because 10 CFR Part 20 sets dose limits in terms of rem, rather than rad or roentgen. 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 and neutron particles.

2. AGREEMENT STATES

Certain States, called Agreement States (see Figure 2.1), have entered into agreements with the 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.

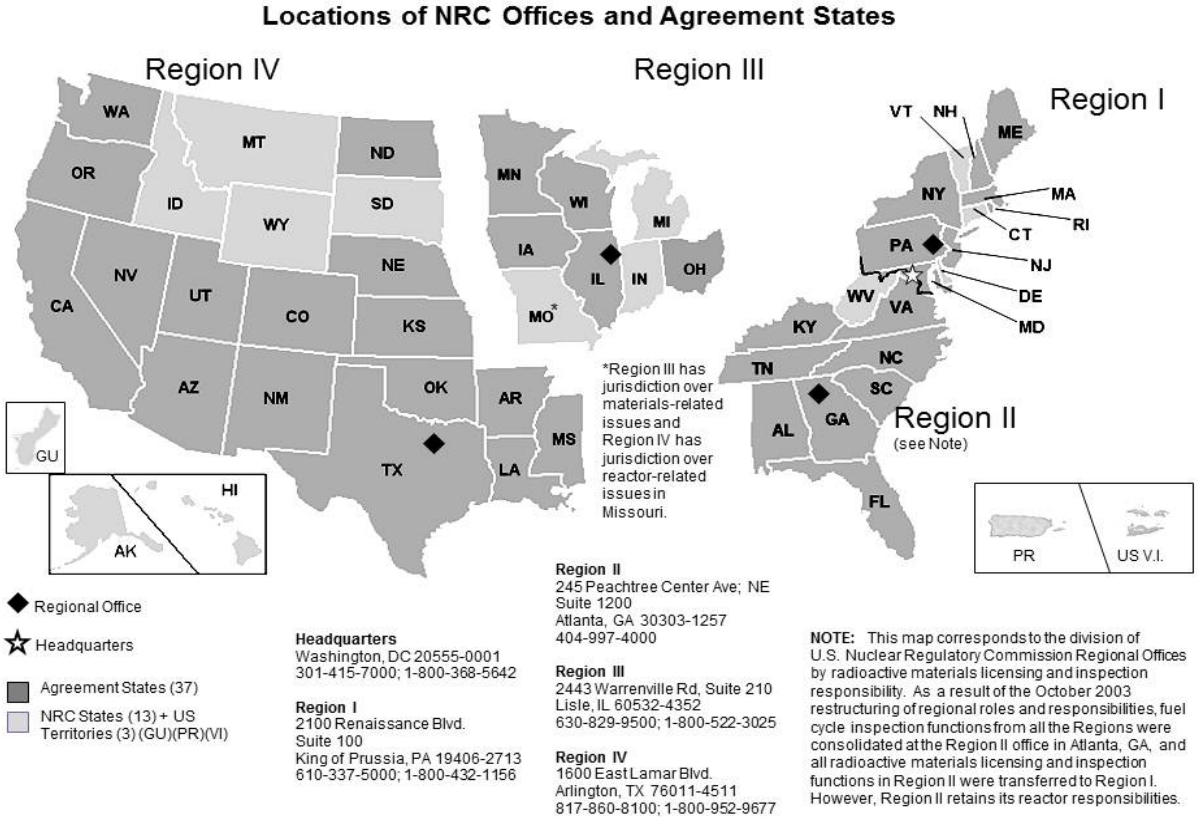

Figure 2.1 U.S. map: Locations of NRC Offices and Agreement States

In the special situation of work at Federally controlled sites in Agreement States, it is necessary to ascertain the jurisdictional status of the land to determine whether the NRC or the Agreement State has regulatory authority. These areas can also include tribal lands of federally recognized Indian tribes.[1]

[1] 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.

The NRC has regulatory authority over land determined to be "exclusive Federal jurisdiction," while the Agreement State has 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. The NRC recommends that applicants contact their local office of the Federal agency controlling the site (e.g., contract officer, base environmental health officer, district office staff) for assistance in determining the jurisdictional status of the land and to provide the information in writing to ensure compliance with NRC or Agreement State regulatory requirements, as appropriate. Additional guidance on determining jurisdictional status is found in the Office of Federal and State Materials and Environmental Management Program's (FSME) procedures in the State Agreement (SA) series, SA-500, "Jurisdiction Determination," which is available at http://nrc-stp.ornl.gov/. Once on the Web site, use the link for "FSME Procedures" in the left hand column under "Resources & Tools." The link will take you to another Web page where you can search for FSME Procedures.

Table 2.1 provides a quick way to evaluate whether the NRC or an Agreement State has regulatory authority.

Table 2.1 Who Regulates the Activity?

Applicant and Proposed Location of Work	Regulatory Agency
Federal agency regardless of location (except the U.S. Department of Energy and, under most circumstances, its prime contractors are exempt from licensing, in accordance with 10 CFR 30.12, "Persons using byproduct material under certain Department of Energy and Nuclear Regulatory Commission contracts")	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[2]
Federally recognized Indian Tribe or tribal member outside of Indian Tribal land in Agreement State.	Agreement State

[2] 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 are a few 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.

Applicant and Proposed Location of Work	Regulatory Agency
Non-Federal entity in Agreement State	Agreement State[3]
Non-Federal entity in Agreement State at Federally controlled site **not** subject to exclusive Federal jurisdiction	Agreement State[3]
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 preoperational phases of a reactor.	NRC
Non-Federal entity in Agreement State using radioactive materials **not** directly connected with Part 50 or 52 reactor operations or needed during the construction and preoperational phases of a reactor.	Agreement State[3]

Reference**:** A current list of Agreement States (including names, addresses, and telephone numbers of responsible officials) is available at the Office of Federal and State Materials and Environmental Management Programs' public Web site, http://nrc-stp.ornl.gov. As an alternative, a request for the list can be made to an NRC regional office.

[3] Section 274m. of the AEA gives the NRC regulatory authority over radioactive materials covered under the Section 274b. Agreement 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 at a site. (This is an uncommon situation which NRC usually evaluates on a case-by-case basis.) Companies that wish to possess or use licensed material at these sites should contact the licensee to determine the jurisdictional status for specific AEA radioactive materials they intend to possess or use at the site.

3. MANAGEMENT RESPONSIBILITY

The NRC recognizes that effective radiation safety program management 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 10 CFR 30.32(c), each application shall be signed by the applicant or licensee or a person duly authorized to act for and on the 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 the 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 licensee's commitments and responsibilities for the following:

- Radiation safety, security, and control of radioactive materials and compliance with regulations;
- Completeness and accuracy of the radiation safety records and all information provided to the NRC (10 CFR 30.9, "Completeness and accuracy of information");
- Knowledge about the contents of the license and application;
- Compliance with current NRC and U.S. Department of Transportation (DOT) regulations and the licensee's operating, emergency, and security procedures;
- 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;
- 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 (10 CFR 30.7, "Employee protection")

- Commitment to provide information to employees about the employee protection and deliberate misconduct provisions in 10 CFR 30.7 and 10 CFR 30.10, "Deliberate misconduct," respectively;

- 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 report);

- 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)), as discussed further in Section 8.2.1, "Notification of Bankruptcy Proceedings," of this report.

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 at http://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 the 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, the 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 S for the NRC's safety culture policy statement. More information on NRC activities relating to safety culture can be found at: http://www.nrc.gov/about-nrc/safety-culture.html.

Table 3.1 Traits of a Positive Safety Culture

Leadership Safety Values and Actions	**Problem Identification and Resolution**	**Personal Accountability**
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
Work Processes	**Continuous Learning**	**Environment for Raising Concerns**
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
Effective Safety Communications	**Respectful Work Environment**	**Questioning Attitude**
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 parts can be found under the "Basic References" link at the NRC's online library at http://www.nrc.gov/reading-rm.html; if 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 Printing Office order desk toll-free at 866–512–8600, in Washington, DC, at 202–512–1800 or online at http://bookstore.gpo.gov.

In addition, 10 CFR Parts 1 through 199 can be found on the NRC’s Web site at http://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 http://www.nrc.gov. The NRC and all other Federal agencies publish amendments to their regulations in the *Federal Register*.

5. HOW TO FILE

5.1 Paper Application

Applicants for a materials license should do the following:

- Use the most recent guidance in preparing an application.
- Complete NRC Form 313 (Appendix B) Items 1 through 4, 12, and 13 on the form itself.
- Complete NRC Form 313 Items 5 through 11 on supplementary pages or use Appendix C.
- Provide sufficient detail for the NRC to determine that equipment, facilities, training, experience, and the 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 C submitted with the application, identify and cross-reference submitted information to the item number on the application or the topic to which it refers.
- Submit all documents, typed, on 8½ x 11-inch paper.
- Avoid submitting proprietary information and personally identifiable information.
- If submitted, proprietary information and other sensitive information (e.g., personal privacy and security related) should be clearly identified according to 10 CFR 2.390, "Public inspections, exemptions, requests for withholding" (see Chapter 6, "Identifying and Protecting Sensitive Information").
- Submit an original, signed application.
- Retain one copy of the license application for future reference.

Applications must be signed by the applicant, licensee, or a person duly authorized as required by 10 CFR 30.32(c) (see Section 8.13, "Certification").

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 Transfer to Electronic Format

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 printed or typewritten—not handwritten—text on smooth, crisp paper that will feed easily into the scanner.
- Choose typeface designs that are sans serif, such as Arial, Helvetica, or Futura (the text of this document is in the Arial font).
- Use 12-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).

The NRC will provide additional instructions as the agency implements new mechanisms for electronic license application filing.

6. IDENTIFYING AND PROTECTING SENSITIVE INFORMATION

All licensing applications, except for portions containing sensitive information, will be made available for review in the NRC's Public Document Room and electronically at the NRC Library. For more information on the NRC Library, visit http://www.nrc.gov.

The licensee should identify, mark, and protect sensitive information against unauthorized disclosure to the public. Licensing applications that contain sensitive information should be marked as indicated below in accordance with 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.

- 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, which can be found on the NRC's Generic Communications webpage under "Regulatory Issue Summaries": http://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 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, "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 22, 2005, which can be found on the NRC's Generic Communications webpage under "Regulatory Issue Summaries": http://www.nrc.gov/reading-rm/doc-collections/gen-comm/. Additional information on procedures and any updates is available at http://www.nrc.gov/reading-rm/sensitive-info.html.

7. APPLICATION AND LICENSE FEES

Each application for which a fee is specified must be accompanied by the appropriate fee. Refer to 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 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 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."

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, MD, (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.

8. CONTENTS OF AN APPLICATION

The following information applies to the indicated items on NRC Form 313 (Appendix B).

All items in the application should be completed in enough detail for the NRC to determine that if the proposed equipment, facilities, training and experience, and radiation safety program satisfy regulatory requirements and are adequate to protect public health and safety and minimize danger to life and property. Consideration must 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.

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, "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.

10 CFR 20.1801, "Security of stored material," states that licensees shall secure from unauthorized removal or access licensed materials that are stored in controlled or unrestricted areas.

10 CFR 20.1802, "Control of material not in storage," states that licensees shall control and maintain constant surveillance of licensed material that is in a controlled or unrestricted area and that is not in storage.

Refer to Appendix R of this report for guidance regarding the definition of construction and the consideration of activities that can be performed by materials license applicants and potential applicants, and licensees before the NRC has concluded its environmental review of the proposed licensing action. The majority of materials licensing actions will meet the criteria in 10 CFR 51.22(c)(14)(xi) for a categorical exclusion. This means that the licensing action will not require an environmental assessment or environmental impact statement in accordance with 10 CFR 51.22(b), since the NRC has already determined that this type of licensing action does not have a significant impact on the environment. It is the applicant's responsibility to review the guidance in Appendix R to determine whether the categorical exclusion applies to the licensing action.

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.
[ ] A. New License	Not Applicable
[ ] B. Amendment	XX-XXXXX-XX
[ ] C. Renewal	XX-XXXXX-XX

Check Box A for a new license request. Note that a pre-licensing visit may be required before issuance of the license. Also, note that an initial security inspection may be conducted in accordance with NRC Inspection Manual Chapter 2800, "Materials 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 "Amendments and Renewals to a License" in Chapter 9 of this report.

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 before control of the license is transferred (see Section 9.1, "Timely Notification of Transfer of Control") or 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)

Criteria: Immediately following the filing of a voluntary or involuntary petition for bankruptcy for 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 responsible for all regulatory 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 may request that the United States Department of Justice (DOJ) 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 follow 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, 8 kilometers (5 miles) 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. In addition, applicants are encouraged to provide global positioning system coordinates, as appropriate.

A license amendment is required before receiving, using, and storing licensed material at an address or location not included with the application or 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), specify "temporary job sites anywhere in the United States where the NRC maintains jurisdiction."

If an applicant submits documents that give the exact location of use and storage 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 later 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 leak test records, sketches, and written descriptions of specific locations where licensed material was used or stored and any information relevant to damaged devices or leaking radioactive sources.

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. Also include business cell phone numbers and e-mail addresses. This individual, usually the 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 in order to provide information 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 B), Items 5 through 11 should be submitted on separate sheets of paper. Applicants may use Appendix C for this purpose and should note that using the suggested wording of responses and committing to use the model procedures in this report will facilitate the NRC's review.

8.5 Item 5: Radioactive Material

Regulations: 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.

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 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 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 report.

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 Materials

Type of Material	Covered by this Report	Examples
Byproduct material	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) [millicuries (mCi)] or gigabecquerels (GBq) [curies (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, Revision 1, "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 0.05 Sv [5 rems] to the thyroid, an emergency plan for responding to a release shall be included with the application (10 CFR 30.32(i)). For example: 370 GBq (10 curies) of iodine-131 is a quantity requiring an emergency plan.

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. 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, before obtaining the NRC's permission in a license amendment. To ensure that applicants use sources and devices according to the registration certificates, they may want to get a copy of the certificate and review it or discuss it with the manufacturer.

Response from Applicant:

- For sealed materials:
  - Identify each radionuclide (element name and mass number) that will be used in each sealed source within the NRC's jurisdiction.
  - Identify, for each source model, the maximum activity per source and total possession.
  - 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.

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) so that the NRC can verify that each, when applicable, has been evaluated in an SSD registration certificate.

After the NRC license is issued, the licensee needs to create an account in the National Source Tracking System (NSTS) to track, from cradle to grave, sealed sources with activities exceeding the activities listed in Appendix E of 10 CFR Part 20, "Nationally Tracked Source Thresholds." The receipt, transfer, and disposal transactions of NSTS sources must be reported in accordance with 10 CFR 20.2207, "Reports of Transactions Involving Nationally Tracked Sources."

- For unsealed tracer materials, including both volatile and nonvolatile materials (e.g., iodine-131, iodine-125, hydrogen-3):
  - 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.

8.5.1 Sealed Sources and Devices

Regulation: 10 CFR 30.32(g), 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) 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."

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. Applicants may elect to obtain copies of applicable SSD registration certificates for future reference.

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 microcuries), 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.

Response from Applicant:

- Complete the table in Appendix C 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.

OR

- On a separate page, include the following information to support the request for each sealed source:

- 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.

- 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.

- 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 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.

- Confirm that each sealed source is registered as an approved sealed source by the NRC or an Agreement State and will be possessed and used in accordance with the conditions specified in the registration certificate.

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 report:

- **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.

Table 8.2 Types of Radioactive Materials Used in Field Flood Studies and Single Well Tracer Operations

Field Flood Or Enhanced Oil And Gas Recovery Study Applications Tracers Used In Multiple Wells	
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
Well Logging Tracer Applications Tracers Used In A Single Well	
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

Response from Applicant:

- For unsealed nonvolatile and volatile (e.g., iodine-125, iodine-131, hydrogen-3, bromine-82) tracer materials:
  - Provide the element name and mass number.
  - 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 you will use 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.

  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 70.25

Criteria: Well logging licensees authorized to possess sealed sources and/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).

Each licensee is obligated 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. Decommissioning records described above are not required at temporary jobsites. Under 10 CFR 30.35(g) and/or 10 CFR 70.25(d) when terminating the license, licensees must transfer records important to decommissioning to either of the following:

- the new licensee before licensed activities are transferred or assigned according to 10 CFR 30.34(b)

- the appropriate NRC regional office before the license is terminated

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 (F/A) 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 may include the following:

- security bond
- trust agreement
- statement of intent
- certificate of deposit
- parent company guaranty

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 and/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 F/A are described in 10 CFR 30.35 and/or 10 CFR 70.25(d).

There are two parts to this rule: 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, Revision 1, "Consolidated Decommissioning Guidance: Financial Assurance, Recordkeeping, and Timeliness." The applicant 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 a half-life greater than 120 days with the corresponding limits in excess of which an F/A 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 F/A. 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 F/A is required and the amount that is required when more than one of these radionuclides is requested.

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.

Table 8.3 Commonly Used Licensed Materials Requiring Financial Assurance/Decommissioning Funding Plan

Column 1: Radionuclide	Column 2: Limit for F/A (millicuries*)	Column 3: Limit for DFP (millicuries*)
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

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/or 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 8.14). In the event that the licensed activities are transferred to another person or entity, these records shall 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. When the license is terminated, these records shall be transferred to the NRC.

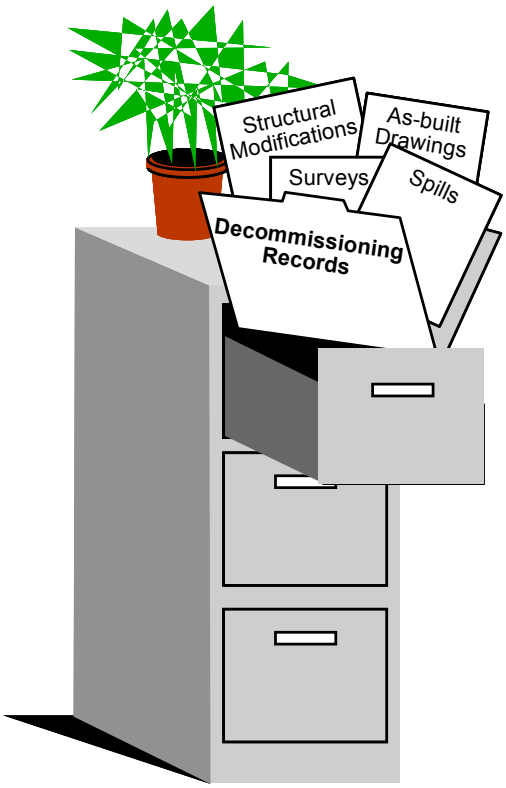

Figure 8.1 Types of records that must be maintained for decommissioning.

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

- transferred to the new licensee before licensed activities are transferred or assigned according to 10 CFR 30.34(b)

OR

- transferred to the appropriate NRC Regional office before the license is terminated

Response from Applicants:

- Under 10 CFR 30.35(g) and/or 10 CFR 70.25(g), we shall maintain drawings and records important to decommissioning and transfer these records to a new licensee before licensed activities are transferred, or assign the records to the appropriate NRC regional office before the license is terminated.

AND

- If F/A or a DFP is required, submit the required documents described in NUREG-1757, Volume 3.

Note: 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 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, or other unusual occurrences involving the spread of contamination in or around the licensee's facilities or field stations. Permanent decommissioning records described above are not required for temporary job site locations.

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.

Criteria: Radionuclides and sealed sources requested in the application must be used for purposes authorized by the Atomic Energy Act of 1954, as amended. The licensee 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 should be used only for the purposes for which they were designed, in accordance with the manufacturer's written recommendations and instructions, as specified in an approved SSD registration certificate, and as authorized on an NRC or Agreement State license. The licensee shall 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 freshwater 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 C to provide the requested information.

Table 8.4 Sample Format for Providing Information about Requested Radionuclides

Radionuclide	Chemical/Physical Form	Maximum Possession Limit	Proposed Use
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 (Okko 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 (Cols 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. [1]	Subsurface tracer operations
Iodine-131	Liquid	Include the maximum activity per injection and the total activity to be possessed. [1]	Subsurface tracer operations
Iridium-192	“Labeled” frac sand	Include the maximum activity per injection and the total activity to be possessed. [1]	Subsurface tracer operations
Cobalt-60	Metal wire	Include the maximum activity per individual unit and the total activity to be possessed.	Pipe joint collar markers, subsidence markers,dDepth determination

Radionuclide	Chemical/Physical Form	Maximum Possession Limit	Proposed Use
Silver-110m	Liquid	Include the maximum activity per injection and the total activity to be possessed.*	Field flood tracer studies
Depleted Uranium	Sinker Bars	225 kilograms	Sinker weights (concentrated mass)

*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.

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: List in Appendix C the specific use or purpose of each sealed source and radionuclide requested in the application.

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

8.7.1 Radiation Safety Officer (RSO)

Regulations: 10 CFR 30.33(a)(3)

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 G of this document

Discussion: The person responsible for the radiation protection program is identified on the license as the RSO. The NRC believes the RSO is the key to overseeing and ensuring safe operation of the licensee's well logging, tracer, or field flood study program. The RSO must have adequate training to understand the hazards associated with radioactive material and be familiar with all applicable regulatory requirements. The RSO needs independent authority to stop operations that he or she considers unsafe. He or she must have sufficient time and commitment from management to fulfill certain duties and responsibilities to ensure that radioactive materials are used in a safe manner, approved radiation safety procedures are being implemented, and the required records of licensed activities are maintained.

The RSO may delegate certain day-to-day tasks of the radiation protection program to other responsible individuals without delegating his or her responsibilities of the radiation safety program. 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. The RSO is typically listed as the point of contact for NRC/Licensee communications in Item 4 of the NRC Form 313 (see Section 8.4).

Typical RSO duties are illustrated in Figure 8.2. 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. Also, show in the organizational chart the position of the individual who signs the application in Item 13 of the NRC Form 313. Note: This individual should be an officer of the company that can make legal and financial commitments for the company.

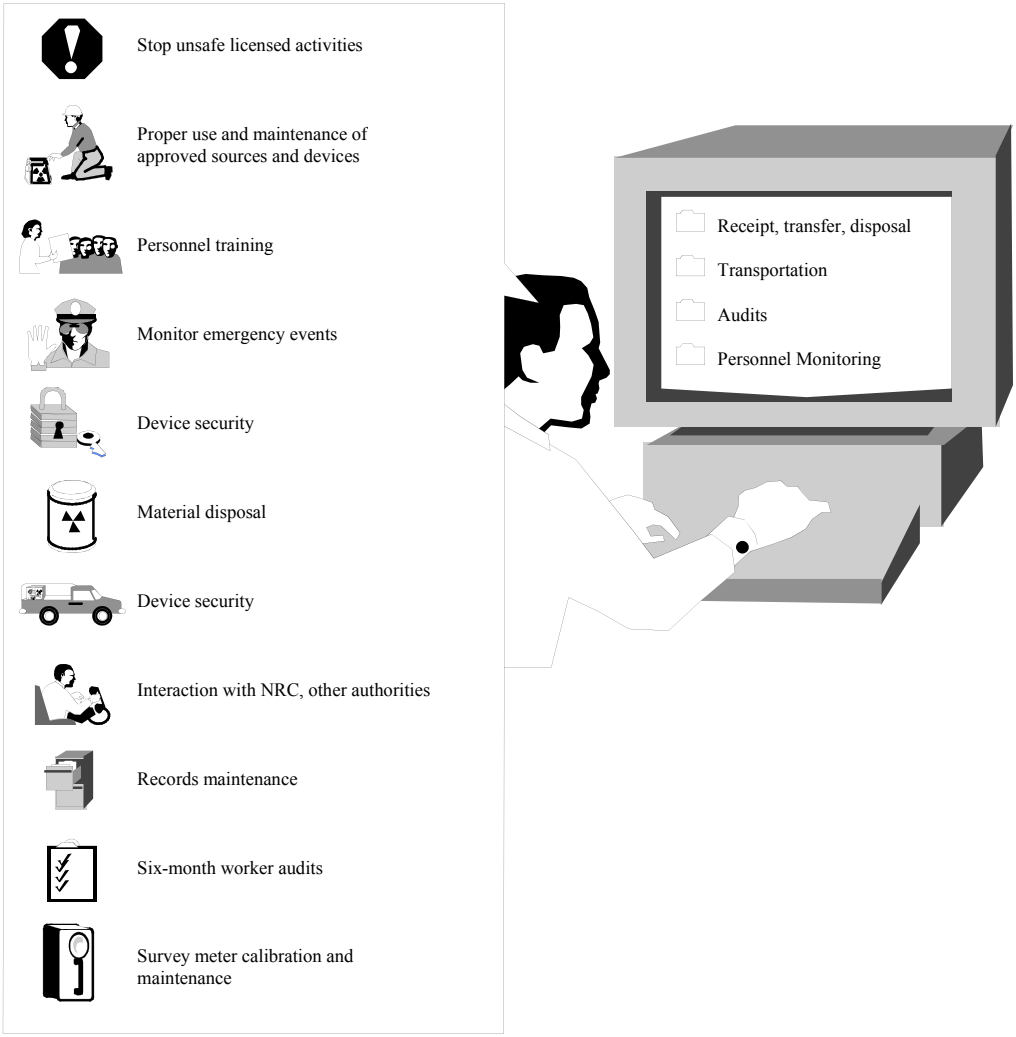

Figure 8.2 RSO responsibilities—Typical duties and responsibilities of the RSO

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 actual experience as a logging supervisor. The RSO is expected to coordinate the safe use of licensed materials and to ensure compliance with the applicable requirements of the 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.

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 EITHER

- Provide documentation demonstrating that the proposed RSO is qualified by training and experience (i.e., certificate of completion of a well logging RSO or authorized user's course)

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 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)

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.

Note: It is important to notify the NRC and obtain a license amendment prior to making changes in the designation of the RSO responsible for the radiation safety program.

8.8 Item 8: Training for Logging Supervisors and Logging Assistants

Regulations: 10 CFR 19.11, 10 CFR 19.12, 10 CFR 19.13, 10 CFR 30.7, 10 CFR 30.9, 10 CFR 30.10, 10 CFR 30.33, 10 CFR 39.2, 10 CFR 39.13, 10 CFR 39.61.

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.

Discussion:

- Logging supervisor means 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 means 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 surveys required by § 39.67.

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 G 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.

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.

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 your instructors in 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. The NRC suggests using the checklist in Appendix H as a source of potential areas to review during the field examination.

- Describe the annual refresher training program, including topics to be covered and how the training will be conducted.

- Submit a description of your program for annual safety reviews of the job performance of each well logging supervisor as described in 10 CFR 39.13(d).

8.9 Item 9: Facilities and Equipment

Regulations: 10 CFR 20.1406, 10 CFR 20.1101(b), 10 CFR 20.1703, 10 CFR 30.33(a)(2), 10 CFR 30.35(g), 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.

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.

According to 10 CFR 20.1801, "Security of stored material," and 10 CFR 20.1802, "Control of material not in storage," licensed materials located in an unrestricted area and not in storage must be under the constant surveillance and control of the licensee. Areas where material is used or stored, including below ground bunker storage areas, should be (1) accessible only by authorized persons; and (2) secured or locked when an authorized person is not physically present. Use or storage areas cannot be considered restricted areas for purposes of radiation safety if accessible by unauthorized persons.

In addition to the 10 CFR 20.1801 and 1802 requirements above, areas where radioactive material greater than category 1 and 2 quantities is possessed requires implementation of

10 CFR Part 37, “Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material.” Appendix A to 10 CFR Part 37, “Category 1 and Category 2 Radioactive Materials,” provides a table of category 1 and 2 quantities of radioactive materials of concern. Part 37 requires that where category 1 or 2 quantities of radioactive materials are used or stored, the licensee should: (1) ensure the radioactive materials are accessible only by individuals who have been deemed trustworthy and reliable, and who have been granted unescorted access; (2) have a security program to monitor and, without delay, detect, assess, and respond to any actual or attempted unauthorized access to radioactive material; (3coordinate, to the extent practicable, with the LLEA for responding to threats; (4) for portable and mobile devices, have two independent physical controls that form tangible barriers to secure the material from unauthorized removal when the device is not under direct control and constant surveillance by the licensee; and (5) provide for physical protection and tracking of radioactive materials in transit.

Applicants may delay completing facilities and acquiring equipment until after the application review is completed. Delaying the completion of facilities or the acquisition of equipment will allow for changes, if any, needed as a result of the application review. This delay will also ensure the adequacy of proposed facilities and equipment before the applicant makes a significant financial commitment. In all cases, the applicant cannot possess or use licensed material until after the facilities are approved, equipment is procured, a pre-licensing site visit has occurred by the NRC, and the license is issued.

Diagrams, drawings or sketches that provide exact locations of materials or depict specific locations of safety or security equipment should be marked as “Security-Related Information - Withhold Under 10 CFR 2.390.”

10 CFR 20.2003, “Disposal by release into sanitary sewerage,” authorizes the disposal of readily soluble radioactive materials via the sanitary sewage. Sanitary sewage does not include sewage treatment facilities, septic tanks, and leach fields owned or operated by a licensee. If you have any of these systems, please describe the controls used to prevent disposal in the prohibited systems.

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. Diagrams, drawings, or sketches should include indication of the scale, or include dimensions on each drawing or sketch and be marked: “Security-Related Information – Withhold Under 10 CFR 2.390” as appropriate.

- 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 (concrete, lead, etc.) 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 (concrete, lead, etc.) and means for securing tracer materials from unauthorized removal.

- Describe protective clothing (such as rubber gloves, coveralls, respirators, and face shields), auxiliary shielding, absorbent materials, injection equipment, secondary containers for waste water storage for decontamination purposes, plastic bags for storing contaminated items, etc., that 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.

- Submit a diagram, drawing or sketch of the proposed facility identifying areas where radioactive materials, including radioactive wastes, will be used or stored. Mark diagram, drawing, or sketch: "Security-Related Information – Withhold Under 10 CFR 2.390" as appropriate.

    - Show in drawings, 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.

    - Show in the drawings the relationship and distance between restricted areas and adjacent unrestricted areas.

    - Specify in the drawings shielding materials (concrete, lead, etc.) and means for securing radioactive materials from unauthorized removal.

    - Draw to an indicated scale, or include dimensions on each drawing or sketch.

- 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 (concrete, lead, etc.) and means for securing tracer materials from unauthorized removal.

- Describe protective clothing (such as rubber gloves, coveralls, respirators, and face shields), auxiliary shielding, absorbent materials, injection equipment, secondary containers for waste water storage for decontamination purposes, plastic bags for storing contaminated items, etc., that will be available at well sites when using tracer materials.

- Describe proposed laundry facilities, if applicable, used for contaminated protective clothing, and 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. For license applications with multiple use locations, please state the physical location(s) where NRC regulatory required records will be stored and available for review during NRC inspections.

- If applicable, the applicant will have in place a security program in accordance with 10 CFR Part 37 prior to possessing category 1 or category 2 quantities of radioactive materials.

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

8.10 Item 10: Radiation Safety Program

Regulations: 10 CFR 20.1101, 10 CFR 30.33, 10 CFR 39.13

Criteria: A radiation safety program must be established 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

- conduct of licensed activities by individuals qualified by training and experience
- written operating and emergency procedures
- program for the annual inspection of the job performance of well logging personnel
- description of organization structure and individuals responsible for ensuring implementation of 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.

Note: Appendix E 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 shall 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: Well logging operations conducted using sealed sources are performed only after a written agreement is executed with the employing well owner or operator. 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.
- 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.
- 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:
  - 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 8.4 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 such as global positioning system
    (6) the sealed source's radionuclide and activity (in standard and International System of Units (SI) units)
    (7) the depth the source was abandoned and depth to the top of the plug
    (8) an appropriate warning, such as "DO NOT RE-ENTER THIS WELL"
    (9) a statement of the Federal or State authorities to contact if additional well entrance is required

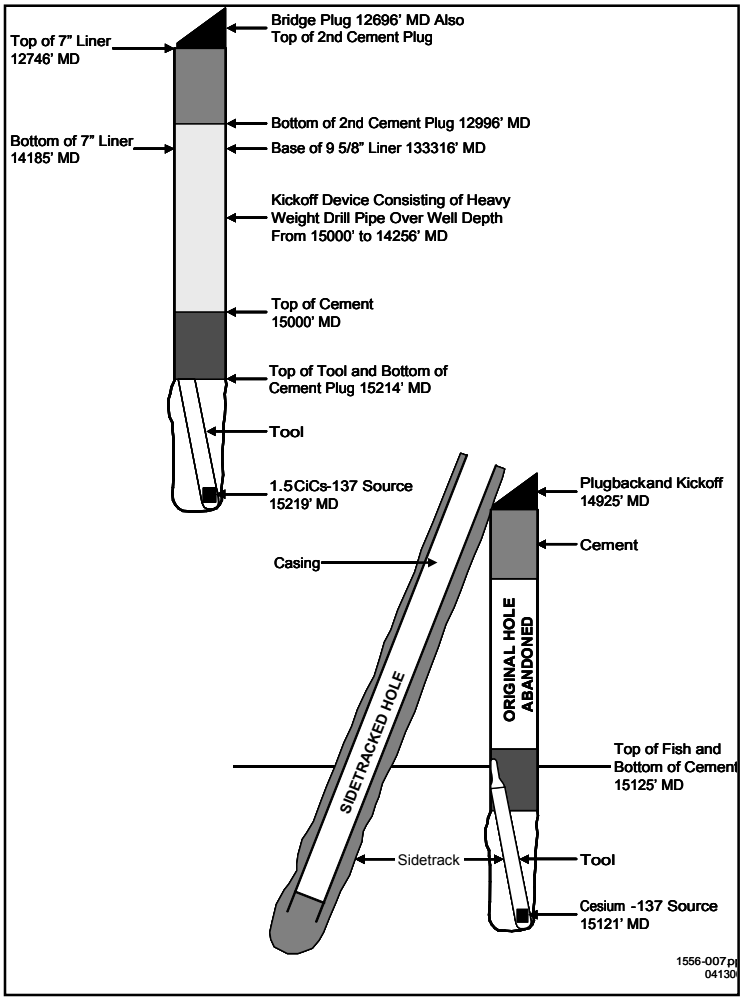

Figure 8.3 Features of a Typical Source Abandonment

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, without prior NRC approval, is authorized 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).

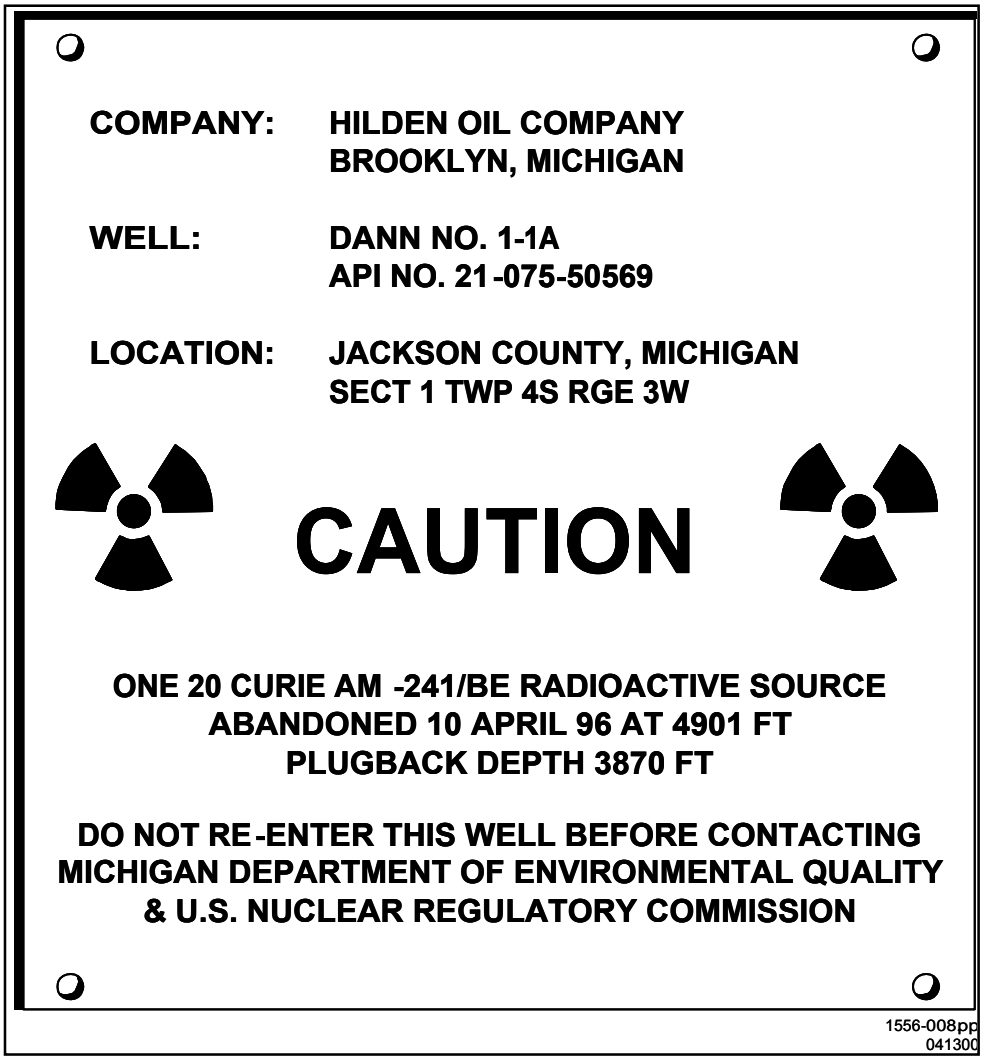

Figure 8.4 Permanent Identification Plaque

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 must still be met.

- If the requirement for a written agreement does not apply to you, then you should include a statement in your application that you will only log holes where the well owner or operator is part of your corporate structure or otherwise similarly affiliated, and you 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: (1) with a sealed source; (2) with a neutron generator exceeding 30 curies; or (3) with a neutron generator in a well without a surface casing."

8.10.2 Radiation Safety Program Audit

Regulations: 10 CFR 20.1101, 10 CFR 20.2102.

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

- compliance with NRC and DOT regulations (as applicable), and the terms and conditions of the license

- occupational doses and doses to members of the public are as low as is reasonably achievable (ALARA) (10 CFR 20.1101, "Radiation protection programs")

- records of audits and other reviews of program content and implementation are maintained for 3 years

Discussion: Appendix F contains a suggested annual audit program that is specific to well logging and tracer operations and is acceptable to the NRC. Since all areas indicated in Appendix F 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.

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 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 identified, problems are corrected comprehensively and in a timely manner. Information Notice (IN) 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," 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 if appropriate corrective actions were implemented in a timely manner to address 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. For information on the NRC's use of discretion in issuing a notice of violation, refer to the most recent version of NRC's enforcement documents at http://www.nrc.gov/reading-rm/doc-collections/enforcement/. The NRC's Enforcement Policy may be found online at http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html and the Enforcement Manual may be found online at http://www.nrc.gov/about-nrc/regulatory/enforcement/guidance.html.

Licensees must maintain records of audits and other reviews of program content and implementation for 3 years from the date of the record. The NRC has found audit records that contain the following information acceptable:

- date of audit.
- name of person or persons who conducted the audit
- names of persons contacted by the auditor or auditors
- areas audited

- audit findings and corrective actions
- follow-up

Response from Applicant: No response required. The licensee's program for auditing its radiation safety program will be reviewed during inspections.

References: The current version of the NRC's Enforcement Policy is included on the NRC's Web site at http://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: http://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

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, 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, instruments must be capable of measuring beta and gamma radiation at intensities ranging from 1 microsievert (μSv) (0.1 millirem (mrem)) per hour through at least 500 μSv (50 mrem) per hour. 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 shall possess operable and calibrated radiation detection/measurement instruments to perform the following, as necessary:

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

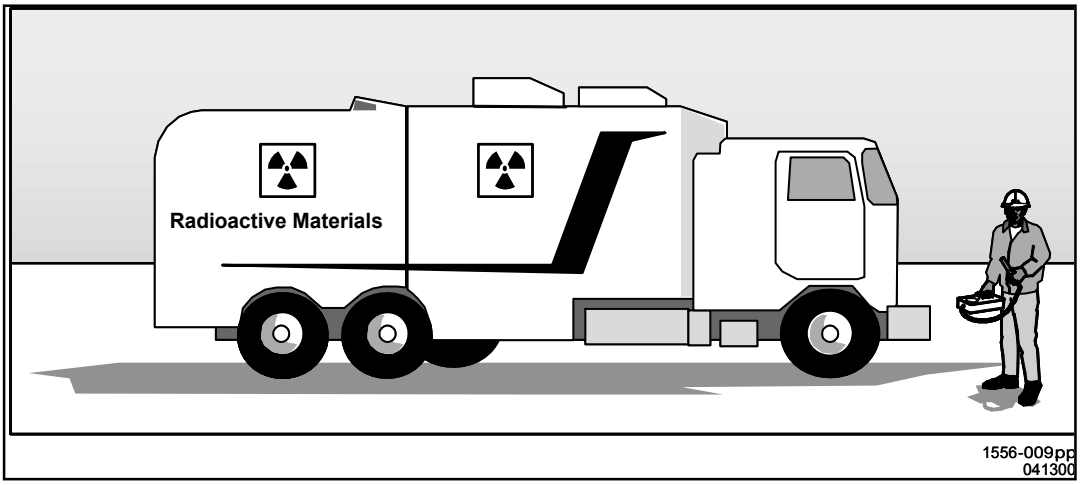

Figure 8.5 Types of surveys. *There are many different types of surveys performed by well logging, tracer, and field flood studies licensees.*

The choice of instrument should be appropriate for the type of radiation to be measured, and for the type of measurement to be taken (count rate, dose rate, etc.).
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. The NRC requires that calibrations be performed by the instrument manufacturer or a person specifically authorized by the NRC or an Agreement State, unless the applicant specifically requests this authorization. Applicants seeking authorization to perform survey instrument calibrations shall submit procedures for review. Appendix I provides information about instrument specifications and model calibration procedures.

Response from Applicant: Provide one of the following:

- A description of the instrumentation (as described above) that will be used to perform required surveys and a statement that: "We will use instruments that meet the radiation monitoring instrument specifications published in Appendix I 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 survey instruments as necessary."

OR

- A description of the instrumentation (as described above) that will be used to perform required surveys and a statement that: "We will use instruments that meet the radiation monitoring instrument specifications published in Appendix I 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 survey meter calibration program published in Appendix I 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 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 survey equipment will be performed. Further, the statement "We reserve the right to upgrade our survey instruments as necessary" should be added to the response.

***Note*:** Alternative responses will be reviewed using the criteria listed above.

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 39.37.

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 three 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 an annual inventory reconciliation, if applicable.
- Conduct physical inventories of licensed materials semiannually to account for all sealed sources, tracer materials, and depleted uranium.
- Retain inventory records for 3 years from the date of the inventory.

Discussion: As illustrated in Figure 8.6, licensed materials must be tracked from the time of receipt to disposal in order to ensure accountability, identify when licensed material is lost, stolen, or misplaced, and to ensure that possession limits listed on the license are not exceeded. Physical inventories, which should be conducted semiannually, 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).

Inventory records must be retained for 3 years and contain the following types of information:

- quantity and kind of licensed material including sealed sources, tracer material on hand (including waste), and depleted uranium in sinker bars
- location of licensed material
- date the inventory occurred
- name of individual performing the inventory

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

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 of 10 CFR Part 20, "Standards for Protection Against Radiation") must complete and submit to the National Source Tracking System (NSTS) a National Source Tracking Transaction Report by the close of the next business day after the transaction has occurred. 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 http://www.nrc.gov/security/byproduct/ismp/nsts.html.

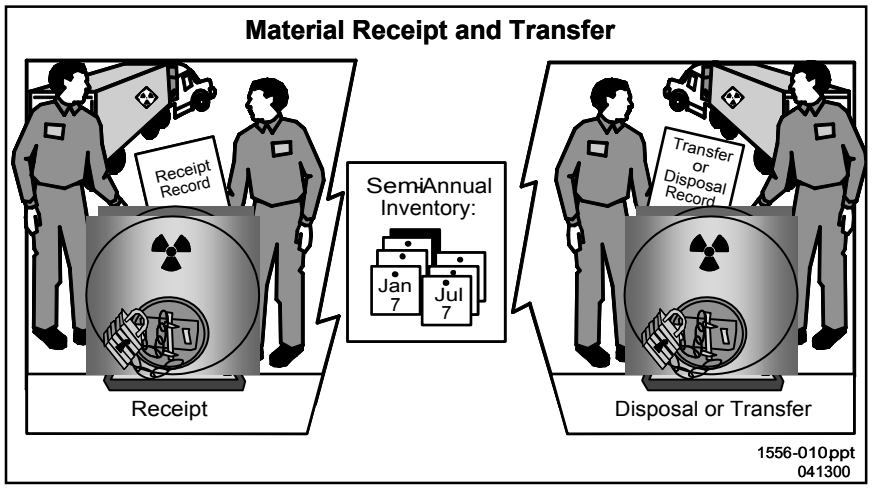

Figure 8.6 Material receipt and accountability. Licensees must retain records of receipt, transfer, and disposal in accordance with the retention period described in 10 CFR 30.51, "Records." Licensees must conduct semi-annual physical inventories and must retain inventory records for 3 years from the date of the inventory in accordance with 10 CFR 39.37, "Physical inventory."

Response from Applicant: Provide the following statements:

- "Physical inventories will be conducted and documented semiannually to account for all licensed material, including byproduct, tracer, and depleted uranium received and possessed under the license."

AND

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

AND

- If applicable, "We will comply with the National Source Tracking System (NSTS) reporting requirement as described in 10 CFR 22.2207."

8.10.5 Occupational Dosimetry

Regulations: 10 CFR 20.1201, 10 CFR 20.1202, 10 CFR 20.1203, 10 CFR 20.1207, 10 CFR 20.1208, 10 CFR 20.1501, 10 CFR 20.1502, 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 J 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.

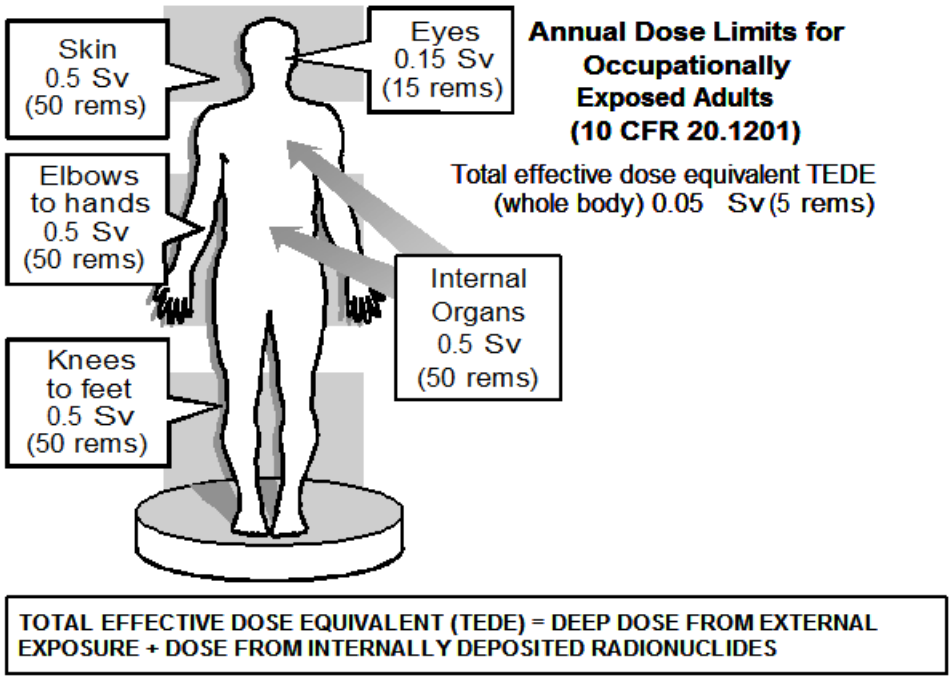

Figure 8.7 Annual dose limits for occupationally exposed adults

Discussion: 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 an NVLAP-approved personnel dosimeter that is sensitive to the type of radiation(s) 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 must be replaced at least monthly, and other personnel dosimeters (thermoluminescent dosimeters (TLDs) or optically stimulated luminescence dosimeters (OSLs)) must be replaced at least quarterly . A list of NVLAP approved dosimetry processors can be found at http://www.nist.gov/nvlap.

For purposes of internal dosimetry, the licensee may be required to provide bioassay services when individuals work with unsealed radioactive material. Bioassays 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 millicuries at any one time, or using a total of 50 millicuries 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, "Applications of Bioassay for iodine-125 and iodine-131." When handling tritium (H-3) exceeding 3.7 Gbq (0.1 curie) or gaseous H-3 exceeding 3700 Gbq (100 curies), 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 http://www.nrc.gov/reading-rm/doc-collections/reg-guides/occupational-health/rg.

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.

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 bioassay program when using unsealed radioactive tracer materials. If an applicant elects to provide a bioassay program that is less conservative than recommended in Regulatory Guide 8.20, 8.32, or other appropriate Regulatory Guide, its rationale should be stated. Bioassay programs should include what the applicant considers an acceptable interval or schedule for conducting bioassays, identify action levels or guidelines, and describe specific actions to be taken when action levels are exceeded. Because of the complex nature of bioassay and corresponding data analysis, it is acceptable for applicants to make reference to the procedures in NRC guidance documents.

OR

- In lieu of providing 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 providing a bioassay program, provide a commitment that the applicant will not allow any individual to use more than: (1) 50 millicuries of iodine-131 at any one time or in any 5-day period at field stations or at temporary job sites; (2) or more than 3.7 Gbq (0.1 curie) of H-3 or more than 3700 Gbq (100curies) of gaseous H-3.

8.10.6 Public Dose

Regulations: 10 CFR 20.1003, 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 millisievert (mSv) (100 mrem) in 1 year, and the dose in any unrestricted area will not exceed 0.02 mSv (2 mrem) in any 1 hour, from licensed operations.

- 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: 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 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 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 K for an example demonstrating that individual members of the public will not receive doses exceeding the allowable public limits.

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.

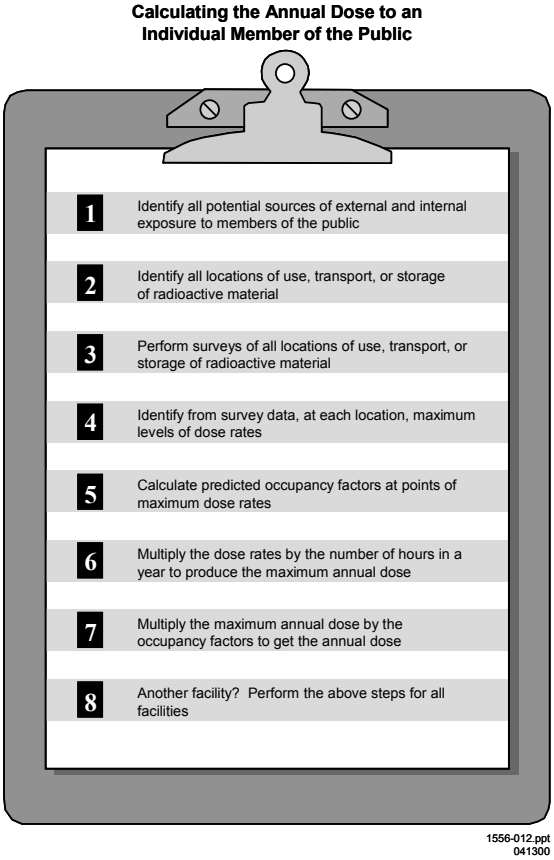

Figure 8.8 Steps used to calculate public dose.

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 1 year, and any unrestricted area does not exceed 0.02 mSv (2 mrem) in any 1 hour. See Appendix K 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 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.

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.

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:

- instructions for handling and using licensed materials, including sealed sources in wells, without surface casing for protecting freshwater aquifers
- instructions for maintaining security during storage and transportation
- 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, except 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) 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
- 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, 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 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 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 L 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 P 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.

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 non-routine operations, for example, inspection and maintenance of well logging and tracer equipment or conducting calibration of survey instruments, should be included as separate appendices in the application.

Operating and emergency procedures need not specify a particular make and model of survey instrument. Procedures should provide sufficient guidance and instruction for each specific type of well logging or associated equipment. For example, you 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.

Response from Applicant:

We will develop, implement, and maintain operating and emergency procedures that address the important radiation safety aspects, as described in 10 CFR 39.63.

8.10.8 Leak Tests

Regulations: 10 CFR 30.53, 10 CFR 39.13(f), 10 CFR 39.35.

Criteria: The NRC requires testing of sealed sources containing greater than 3.7 MBq (100 microcuries) of beta/gamma or 0.37 MBq (10 microcuries) of alpha radioactive material in order to determine whether there is any radioactive leakage from sealed sources. Requirements for leak tests are based on the type of radiation (beta/gamma/alpha) escaping from the inner capsule. Records of test results must be maintained.

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 and return it to the kit supplier for evaluation and reporting results. Licensees may also be authorized 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 microcurie (μCi)) of radioactivity.

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:

State either of the following:

- "Leak tests sample collection and analysis will be performed by an organization authorized by NRC or an Agreement State to provide leak testing services to other licensees; or by using a leak test sample collection kit supplied by an organization licensed by NRC or an Agreement State to provide leak test kits and/or sample analysis services to other licensees and according to the instructions provided in the leak test sample collection kit."

OR

- "Leak test sample collection and analysis will be done by the applicant." Provide the information in Appendix M supporting a request to perform leak test sample collection and sample analysis and either state that you will follow the model procedures in the appendix or submit a description of 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 M criteria.

8.10.9 Maintenance

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

Criteria: The licensee shall 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.

Discussion: Each licensee shall 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 prior to returning the equipment for use. Licensees shall 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 container, 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.

Non-routine 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 CF R 39.43(a), 10 CFR 39.49.

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. 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:

- State 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 before each use.

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.

Criteria: 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 shall 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 Part 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. As noted in 10 CFR Part 39, instructions for conducting these activities must be included as part of the operating and emergency procedures. 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 shall 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:

- State 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: 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 8.12 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

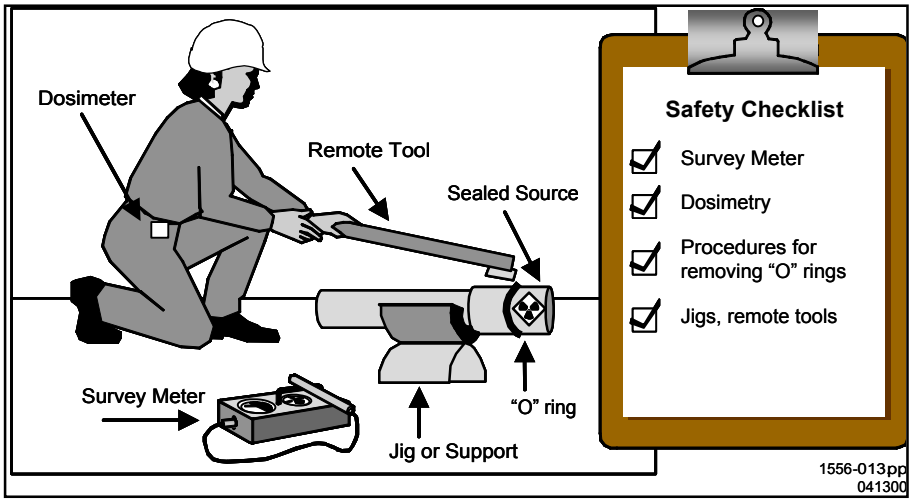

Figure 8.9 Maintenance, cleaning, and O-ring replacement.

Response from Applicant:

- Statethat "Activities described in 10 CFR 39.43(c) and (d) shall 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.

8.10.10 Transportation

Regulations: 10 CFR 20.1101, 10 CFR 30.41, 10 CFR 30.51, 10 CFR 39.31, 10 CFR 71.5, 10 CFR 71.12, 10 CFR 71.14, 10 CFR 71.37, 10 CFR 71.38, 10 CFR 71.47, Subpart H of 10 CFR Part 71, 49 CFR Parts 171-178.

Criteria: Applicants must develop, implement, and maintain safety programs for transport of radioactive material to ensure compliance with NRC and DOT regulations.

Discussion: 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 N.

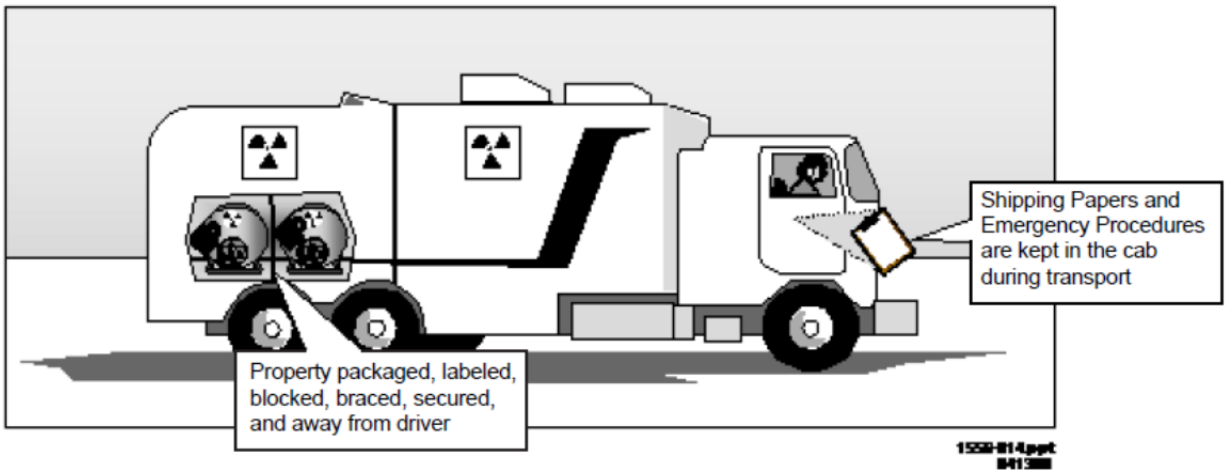

Figure 8.10 Transportation. Licensees often transport their equipment and radioactive materials, including sealed sources and tracer materials, to and from job sites and must ensure compliance with DOT regulations.

Discussion: Figure 8.10 illustrates some DOT requirements often overlooked by well logging, tracer, and field flood study licensees. During an inspection, the 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 N lists major DOT regulations and provides sample shipping documents, placards, and labels.

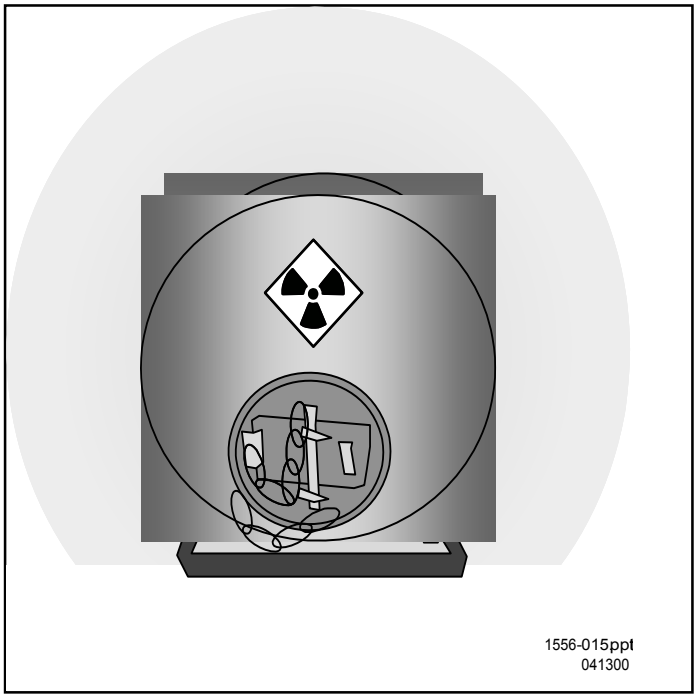

Figure 8.11 Transport container

Response from Applicant: No response is needed from applicants during the licensing phase. Transportation issues are reviewed during inspections.

References: The most recent version of "A Review of Department of Transportation Regulations for Transportation of Radioactive Materials" can be obtained at http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/RAM_Regulations_Review_12-2008.pdf .

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 need to 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 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

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. Sealed sources found to be leaking in excess of 185 becquerels (0.005 microcuries) of removable contamination must be withdrawn from use and decontaminated, repaired, or disposed of according to NRC requirements. 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. 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.

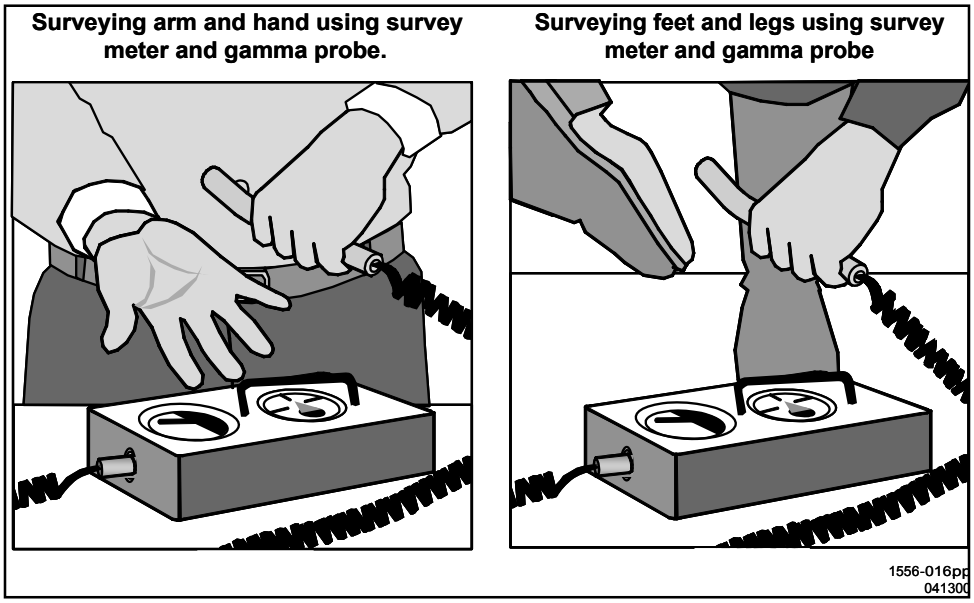

Figure 8.12 Personnel surveys

Response from Applicant:

- The applicant does not need to provide a response to this item if the applicant has met the criteria in the following sections: 8.5.1,"Radioactive Material—Sealed Sources and Devices;" 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—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, drill-to-stop (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.

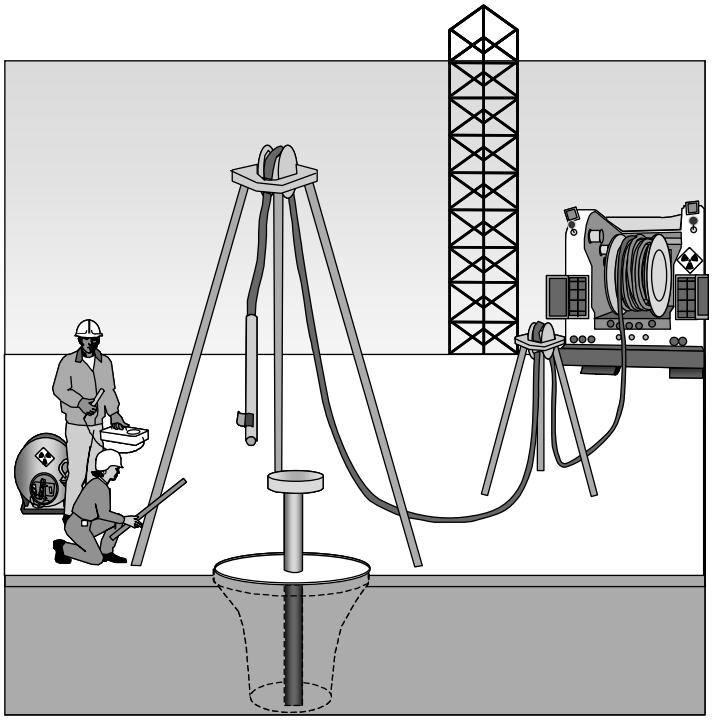

Figure 8.13 ***Drill to stop well logging operations***

Discussion: Operating and Emergency procedures that cover the use of sealed sources in DTS well logging operations must be developed and implemented.

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 giving problems

Drill-to-stop 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 step-by-step 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.

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 step-by-step 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 39.13, 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 microcuries) 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 not considered well logging sealed sources and are not required to satisfy the requirement for well logging sealed sources. As a result, ECSs are:

- exempt from leak testing requirements if the ECS contains less than or equal to 3.7 MBq (100 microcuries) each; however, sealed sources greater than 3.7 MBq (100 microcuries) 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.

- 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 microcuries) remain in the abandoned tool in a well with surface casing for protecting freshwater 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 microcuries). 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 during source recovery operations when only ECSs less than or equal to 3.7 MBq (100 microcuries) remain in a well logging tool that is lodged in a well with a surface casing; however, in wells without a surface casing to protect freshwater 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. 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.

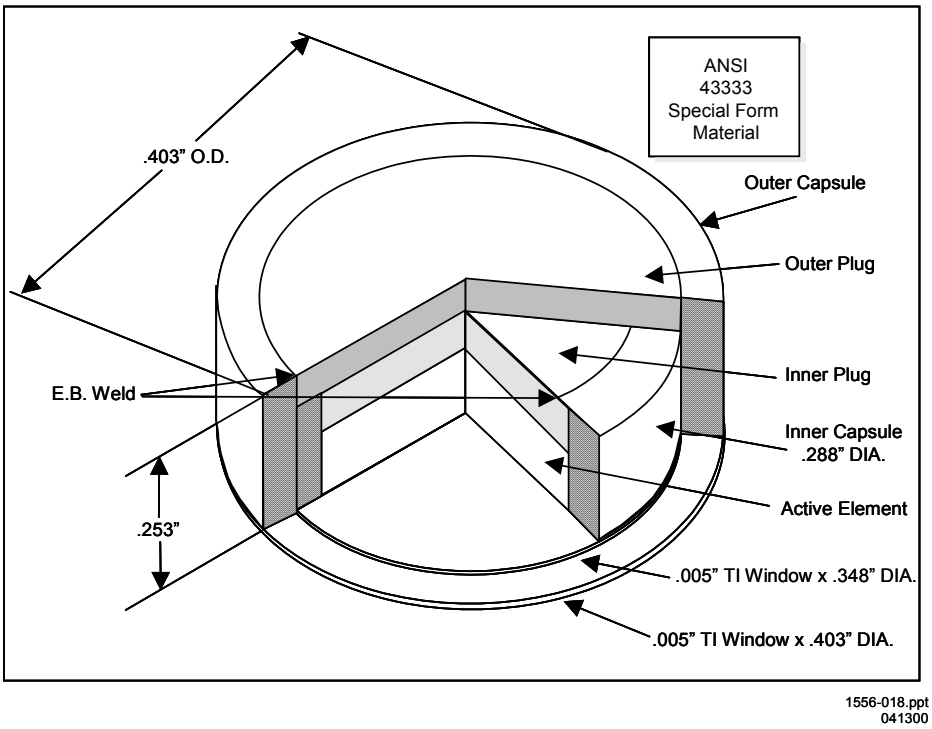

Figure 8.14 Singly encapsulated ECS sealed source

Response from Applicant:

- Submit Step-By-Step Operating and Emergency Procedures for using and handling ECSs. Include, among other aspects, 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 record system for maintaining inventory records required by 10 CFR 39.37, "Physical Inventory," and a record system for maintaining records of use for ECSs.

8.10.12.4 Use of Sealed Sources and/or Neutron Generators in Freshwater Aquifers

Regulations: 10 CFR 39.55, 10 CFR 39.63

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

Discussion: Use of radioactive materials in freshwater aquifers is a prohibited activity unless specifically authorized by the NRC. Authorization to use sealed sources or neutron generators in freshwater 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 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 giving problems

Response from Applicant:

State that: "We will not use sealed sources and/or neutron generators for conducting well logging operations in freshwater aquifers."

OR

Submit step-by-step operating and emergency procedures for conducting well logging activities using sealed sources and/or neutron generators in freshwater 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.

8.10.13 Subsurface Tracer Studies

Regulations: 10 CFR 39.45, 10 CFR 51.22(c)(14)(xi)

Discussion: The use of subsurface tracers in well logging activities may include in the injection of licensed radioactive tracers in: single wells; field flood studies involving secondary and tertiary recovery applications; and fresh water aquifers. The injection of tracers may be an activity that requires a licensee to prepare an environmental report, in accordance with 10 CFR 51.50, in order for the NRC to perform an environmental assessment. Licensees wanting to inject licensed tracers into fresh water aquifers will need to be specifically authorized to do so by the NRC.

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 (injector tools, remote handling tools, transportation containers, etc.)
- 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

Response from Applicant:

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

OR

"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; 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 E 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, 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.

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
- pre-injection phase of the field flood project
- injection phase
- post-injection 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 (injector tools, remote handling tools, transportation containers, etc.)
- 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 E for additional information on developing a program for conducting field flood studies and enhanced recovery of oil and gas wells.

Response from Applicant:

- Statement that "Field flood studies using tracer materials will not be conducted."

OR

- Statement that "Field flood studies using tracer materials will be conducted and we have submitted step-by-step procedures and information required in Appendix E, "Field Flood Studies/Enhanced Recovery of Oil and Gas Wells."

8.10.13.3 Tracer Studies in Freshwater 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 freshwater aquifers. Licensees may not knowingly inject licensed material into a freshwater 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 freshwater aquifer unless the individual is specifically authorized by the Commission to perform this activity.

Authorizing field flood studies where the applicant intends to intentionally inject licensed tracer material into a freshwater aquifer requires that an environmental report be prepared by the applicant in accordance with 10 CFR 51.45, "Environmental report," and an environmental assessment be performed by the NRC. 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 in the *Federal Register*.

Response from Applicant:

- State that: "We will not knowingly inject tracer material into a freshwater aquifer."

OR

- "We request authorization to inject tracer material into a freshwater aquifer and have submitted our reasons for performing the study and procedures to safeguard the public, licensee personnel, and the environment, and have provided an environmental report containing the information outlined in 10 CFR 51.45."

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 wires, tape, nails, etc. 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." Radioactive markers must be physically inventoried semi-annually as specified in 10 CFR 39.37.

Discussion: 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. However, 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. 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 or registered by the NRC or an Agreement State in an SSD registration certificate.

Response from Applicant:

State that: "We will only use radioactive markers where each individual marker contains only quantities of licensed material not exceeding the 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.

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, 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 curies) of tritium.

Neutron generator tubes are not considered well logging sealed sources and are not required to satisfy the requirement for well logging sealed sources. As a result, neutron generator tubes containing less than 110 GBq (30 curies) of tritium are exempt from:

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

Neutron generator tubes: (1) containing greater than 1,110 GBq (30 curies) of tritium; or (2) that are used in a well without surface casing to protect freshwater 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. 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 the NRC review.

Applicants should refer to 10 CFR 39.55, “Tritium neutron generator target source,” for applicable requirements for using neutron generators.

Response from Applicant:

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

OR

- State that: "We will use neutron generators (accelerators) in accordance with the criteria in Section 8.10.15 of NUREG-1556, Volume 14, Revision 1, 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

- State that: "We will use neutron generators (accelerators) in accordance with the criteria in Section 8.10.15 of NUREG-1556, Volume 14, Revision 1, and will provide step-by-step operating and emergency procedures for NRC review. We will perform calibration of neutron generators and step-by-step procedures for conducting calibration of neutron generators that are submitted 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.

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 only to individuals 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:

- 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.

- If defects are found record date, equipment, inspection and maintenance performed, defects found, and actions take to correct the defect. Records must be retained for 3 years.

Response from Applicant:

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

OR

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

AND/OR

- State that: “Depleted uranium sinker bars will be obtained under a specific license, specify the number of kilograms of material requested.”

AND

- State that: “Uranium sinker bars will be possessed and inspected as specified in Section 8.10.16 in NUREG-1556, Volume 14, Revision 1.”

8.10.17 Security Program for Category 1 and Category 2 Materials

Regulations: 10 CFR 20.2207, 10 CFR Part 37

Criteria: Licensees must ensure the security and control of licensed material.

Note: The requirements in 10 CFR 20.2207 are only applicable to those licensees that manufacture, transfer, receive, disassemble, or dispose of Category 1 and Category 2 sources., as specified in Appendix E to 10 CFR Part 20 . The regulations in 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material," apply to licensees that possess an aggregate amount of category 1 or category 2 quantity of radioactive material., as specified in Appendix A to 10 CFR Part 37.

Discussion: 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 an NSTS report. The NSTS is a major security initiative of the NRC. The NSTS is a secure, accessible and easy-to-use computer system that tracks high-risk radioactive sources from the time they are manufactured or imported through the time of their disposal or export, or until they decay enough to no longer be of concern.

In accordance with 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material," licensees authorized to possess Category 1 or Category 2 quantities of radioactive material must establish, implement, and maintain a security program to ensure physical protection of the radioactive material. For additional guidance 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."

Table 1 of Appendix A, "Category 1 and Category 2 Radioactive Materials," to 10 CFR Part 37 lists Category 1 and 2 threshold quantities of radioactive material. The applicant should refer to this table to determine if its program exceeds the Category 1 or Category 2 authorization thresholds.

If licensees possess, ship, or receive quantities of material exceeding Category 1, then they must also comply with requirements specific to Category 1 quantities. Refer to 10 CFR Part 37 for these additional requirements.

Per 10 CFR Part 37, Subpart B, licensees must establish an access authorization program to ensure that individuals who have unescorted access to Category 1 and 2 quantities of radioactive material and reviewing officials are trustworthy and reliable.

Per 10 CFR Part 37, Subpart C, licensees must establish a physical protection program 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 in use or storage.

Per 10 CFR Part 37, Subpart D, licensees must provide for physical protection of Category 1 or Category 2 quantity of radioactive materials in transit. These requirements apply to a person delivering material to a carrier for transport, as well as cases in which the person transports material.

Note: Refer to 10 CFR Part 37 and associated guidance in NUREG-2155 for additional details on security guidance.

Response from Applicant:
No response is required from an applicant or licensee that would become newly subject to 10 CFR Part 37.

8.11 Item 11: Waste Management

Regulations: 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 30.41, 10 CFR 30.51.

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 transferees' 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.

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. Records of transfer and disposal must be maintained as required by 10 CFR 30.51, "Records."

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, 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 Part 20. Radioactive waste must be secured against unauthorized access or removal. Depending on the radioactive half-life of the material, the NRC requires 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.
- 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

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

- transfer to an authorized recipient.
- ensure there is a current leak test prior to transfer to an authorized recipient

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. Regulation 10 CFR 30.51 requires, in part, that licensees maintain all appropriate records of disposal of radioactive waste. The U.S. Environmental Protection Agency (EPA) 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.

Disposal by Decay-in-Storage (DIS)

The NRC has concluded that materials with half-lives of less than or equal to 120 days are appropriate for DIS. The minimum holding period for decay is ten half-lives of the longest-lived radionuclide in the waste with a half-life of 120 days or less. Such waste may be disposed of as ordinary trash if radiation surveys (performed in a low background area and without any interposed shielding) of the waste at the end of the holding period indicate that radiation levels

are indistinguishable from background. 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 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 for at least ten half-lives based on the longest-lived radionuclide in the container. Waste management procedures should include: (a) methods of segregating waste by half-lives of 120 days or less, greater than 120 days; (b) methods of surveying waste prior to disposal to confirm that waste above background levels is not inadvertently released; and (c) maintenance of records of disposal. Disposal records for DIS should include the date when the waste was put in storage for decay, date when ten half-lives of the longest-lived radionuclide had transpired, date of disposal, and results of the final survey taken prior to disposal to ordinary trash. Additionally, a model procedure for disposal of radioactive waste by DIS, which incorporates the above guidelines, is provided in Appendix O.

Release into Sanitary Sewerage

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 that the licensee releases into the sewer each month averaged over the 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 rations for all of the radionuclides in a mixture may not exceed "1" (i.e. unity)
- Total quantity of licensed 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 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. NRC alerted licensees to the potentially significant problem of reconcentration of radionuclides released to sanitary sewerage systems in IN 84-94, "Reconcentration of Radionuclides Involving Discharges into Sanitary Sewerage 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 O.

Note: Regulations in 10 CFR Part 20 prohibit the disposal of radioactive materials via a sewage treatment facility, septic system, or leach field owned or operated by the licensee.

Transfer to an Authorized Recipient Licensees may transfer radioactive waste to an authorized recipient for disposal. 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 in 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.

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) to workers and members of the public. The program should include adequate safety procedures to protect workers, members of the public, and the environment. 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. 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.

Because of the difficulties and costs associated with disposal of sealed sources, e.g., sealed sources containing americium-241, applicants should preplan disposal. Applicants may want to consider contractual arrangements with the source supplier as part of a purchase agreement.

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/or contaminated waste to a licensed entity authorized to receive the material."

AND

- "We will use the model waste procedures published in Appendix O to NUREG-1556, Volume 14, Revision 1, 'Program-Specific Guidance about Well Logging, Tracer, and Field Flood Study Licenses' for disposing of radioactive materials and/or contaminated waste."

OR

- "We have provided our procedures for waste collection, storage, and disposal by any of the authorized methods described in this section."

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

(1) Information Notice (IN) 94-23, "Guidance to Hazardous, Radioactive, and Mixed Waste Generators on the Elements of a Waste Minimization Program," dated May 1994

(2) IN 94-07, "Solubility Criteria for Liquid Effluent Releases to Sanitary Sewerage under the Revised 10 CFR 20," issued January 1994

(3) IN 84-94, "Reconcentration of Radionuclides Involving Discharges into Sanitary Sewerage Systems Permitted under 10 CFR 20.203 (now 10 CFR 20.2003)," issued December 1984

The next two items on NRC Form 313 should be completed on the form itself.

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, MD, 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.

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 must 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 make a willful false statement or representation on applications or correspondence (18 U.S.C. 1001).

- When the application references commitments, those items become binding and are part of the license conditions and regulatory requirements.

9. AMENDMENTS AND RENEWALS TO A LICENSE

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 (10 CFR 2.109(a), 10 CFR 30.36(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 an 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 if many outdated documents are referenced or there have been significant changes in regulatory requirements, the NRC's guidance, the licensee's organization, or the licensee's radiation protection program. Alternatively, describe clearly the exact nature of the changes, additions, and deletions.

9.1 Timely Notification of Transfer of Control

Regulation: 10 CFR 30.34(b)

Criteria: Licensees must provide full information and obtain the NRC's *prior, written consent* before transferring control of the license, or, as some licensees call it, "change of ownership" and/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 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.

Response from Applicant: No response is required from an applicant for a new license. However, current licensees should refer to NUREG-1556, Volume 15, for more information about transfer of ownership.

10. APPLICATIONS FOR EXEMPTIONS

Regulations: 10 CFR 19.31, 10 CFR 20.2301, 10 CFR 30.11, 10 CFR 39.91

Criteria: Licensees may request exemptions from 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.

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, "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. Exemption requests must be accompanied by descriptions of the following:

- Exemption requested and justification for the requested exemption.
- Proposed compensatory safety measures intended to provide a level of health and safety equivalent to the regulation for which the exemption is being requested.
- Alternative methods for complying with the regulation and an explanation of why compliance with the existing regulation is not feasible.

Until the NRC has granted an exemption in writing, licensees must comply with all applicable regulations.

11. TERMINATION OF ACTIVITIES

Regulations: 10 CFR 30.34(b), 10 CFR 30.35(g), 10 CFR 30.36(d), 10 CFR 30.36(j)(1), 10 CFR 30.51(f), 10 CFR 30.36(g), 10 CFR 30.36(h)

Criteria: The licensee must do the following:

- Notify the NRC, in writing, within 60 days of the occurrence of any of the following:
  - Expiration of its license.
  - A decision to permanently cease licensed activities at the entire site.
  - A decision to permanently cease licensed activities in any separate building or outdoor area that contains residual radioactivity such that the building or area is unsuitable for release in accordance with NRC requirements.
  - No principal activities having been conducted at the entire site under the license 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 area is unsuitable for release according to NRC requirements.
- Submit a decommissioning plan, if required by 10 CFR 30.36(g).
- Conduct decommissioning, as required by 10 CFR 30.36(h) and 10 CFR 30.36(j).
- Submit to the appropriate NRC regional office a completed NRC Form 314, "Certificate of Disposition of Materials" (or equivalent information), and a demonstration that the premises are suitable for release for unrestricted use (e.g., results of final survey).
- Before a license is terminated, send the records important to decommissioning to the appropriate NRC regional office. If licensed activities are transferred or assigned in accordance with 10 CFR 30.34(b), transfer records important to decommissioning to the new licensee in accordance with 10 CFR 30.35(g).

Discussion: To comply with the above criteria, before a licensee can decide whether it must notify the NRC, 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." For guidance on decommissioning records, see Section 8.5.3, "Financial Assurance and Recordkeeping for Decommissioning."

The permanent cessation of principal activities 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.

NUREG-1757, Volume 1, Revision 2, "Consolidated Decommissioning Guidance: Decommissioning Process for Materials Licensees" contains the current guidance concerning decommissioning of facilities and termination of licenses. This document takes a risk-informed, performance-based approach to the information needed to support an application for decommissioning a materials license and compliance with the radiological criteria for license termination in 10 CFR Part 20, Subpart E. NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," should be reviewed by licensees who have large facilities to decommission. An acceptable method for calculating screening values to demonstrate compliance with the unrestricted dose limits is the Decontamination and Decommissioning (DandD) screening code.

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 http://www.nrc.gov/reading-rm/doc-collections/forms

APPENDIX A

LIST OF DOCUMENTS CONSIDERED IN DEVELOPMENT OF THIS NUREG

APPENDIX A LIST OF DOCUMENTS CONSIDERED IN DEVELOPMENT OF THIS NUREG

This report incorporates and updates the guidance previously found in the NUREG reports, regulatory guides (RGs), information notices (INs), and technical assistance requests (TARs) listed below. Other U.S Nuclear Regulatory Commission (NRC) documents, such as manual chapters (MCs), inspection procedures (IPs), and memoranda of understanding (MOUs) also were consulted during the preparation of this report. When this report is issued in final form, the documents marked with an asterisk (*) will be considered superseded and should not be used.

Table A.1 List of Regulatory Guides, NUREG Reports, and Policy and Guidance Directives

Document Identification	Title	Date
Regulatory Guide		
RG 4.20, Rev. 1	Constraints on Release of Airborne Radioactive Materials to the Environment for Licensees Other Than Power Reactors	4/12
RG 8.7, Rev. 2	Instructions for Recording and Reporting Occupational Radiation Exposure Data	11/05
RG 8.25, Rev. 1	Air Sampling in the Workplace	6/92
RG 8.34	Monitoring Criteria and Methods to Calculate Occupational Radiation Doses	7/92
RG 8.9, Rev. 1	Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program	7/93
RG 8.37	ALARA Levels for Effluents from Materials Facilities	7/93
RG 8.32	Criteria for Establishing a Tritium Bioassay Program	7/98
NUREG		
NUREG-1556, Volume 3, Rev. 1	Applications for Sealed Source and Device Evaluation and Registration	4/04
NUREG-1556, Volume 15	Guidance About Changes of Control and About Bankruptcy Involving Byproduct, Source, or Special Nuclear Materials Licenses	11/00
NUREG-1748	Environmental Review Guidance for Licensing Actions Associated with NMSS Programs	8/03
NUREG-1575, Rev. 1	Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)	8/00

Document Identification	Title	Date
NUREG-1757, Volume 1, Rev. 2	Consolidated Decommissioning Guidance: Decommissioning Process for Materials Licensees	9/06
NUREG-1757, Volume 3, Rev. 1	Consolidated Decommissioning Guidance: Financial Assurance, Recordkeeping, and Timeliness	2/12
NCRP or ICRP Documents		
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
ANSI Documents		
ANSI N13.1	Sampling Airborne Radioactive Materials in Nuclear Facilities	1991
ANSI N323A-1997	Radiation Protection Instrumentation Test and Calibration	1997
ANSI/HPS N43.6-1997	Sealed Radioactive Sources—Classifications	1997
Other Documents		
	A Review of Department of Transportation Regulations for Transportation of Radioactive Materials	
	The Health Physics & Radiological Health Handbook, Revised Edition, Edited by Bernard Shleien	1992
Information Notices		
IN 90-09	Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Material Licensees	2/5/90
IN 93-50	Extended Storage of Sealed Sources	7/8/93
IN 89-25 (Rev. 1)	Unauthorized Transfer of Ownership or Control of Licensed Activities	12/7/94
IN 94-07	Solubility Criteria for Liquid Effluent Releases to Sanitary Sewerage Under the Revised 10 CFR 20	1/28/94

Document Identification	Title	Date
IN 94-23	Guidance to Hazardous, Radioactive, and Mixed Waste Generators on the Elements of a Waste Minimization Program	3/25/94
IN 96-28	Suggested Guidance Relating to Development and Implementation of Corrective Action	5/1/96
IN 97-30	Control of Licensed Material During Reorganizations, Employee-Management Disagreements and Financial Crises	6/3/97
IN 04-03	Radiation Exposures to Members of the Public in Excess of Regulatory Limits Caused by Failures to Perform Appropriate Radiation Surveys During Well-logging Operations	2/24/04
IN 07-33	Exposures to Members of the Public Caused by Inadequate Controls Over Well Logging Sources	9/29/07
Inspection Procedures		
IP 87103	Inspection of Material Licensees Involved in an Incident or Bankruptcy Filing	2/97
IP 87123	Well Logging Programs	11/25/03

APPENDIX B

U.S. NUCLEAR REGULATORY COMMISSION FORM 313

APPENDIX B U.S. NUCLEAR REGULATORY COMMISSION FORM 313
Please use the most current version of this form, which may be found at:
http://www.nrc.gov/reading-rm/doc-collections/forms/

NRC FORM 313 (03-2014) 10 CFR 30, 32, 33, 34 35, 36, 37, 39, and 40

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR MATERIALS LICENSE

APPROVED BY OMB: NO. 3150-0120 **EXPIRES: 05/31/2015**

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 FOIA, Privacy, and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet 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.

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW. *AMENDMENTS/RENEWALS THAT INCREASE THE SCOPE OF THE EXISTING LICENSE TO A NEW OR HIGHER FEE CATEGORY WILL REQUIRE A FEE.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

OFFICE OF FEDERAL & STATE MATERIALS AND
ENVIRONMENTAL MANAGEMENT PROGRAMS
DIVISION OF MATERIALS SAFETY AND STATE AGREEMENTS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

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,

SEND APPLICATIONS TO:

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

IF YOU ARE LOCATED IN:

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

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,

SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
1600 E. LAMAR BOULEVARD
ARLINGTON, TX 76011-4511

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.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*
   - ☐ A. NEW LICENSE
   - ☐ B. AMENDMENT TO LICENSE NUMBER _____
   - ☐ C. RENEWAL OF LICENSE NUMBER _____

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include ZIP code)*

3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

BUSINESS TELEPHONE NUMBER | BUSINESS CELLULAR TELEPHONE NUMBER

BUSINESS EMAIL 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. maiximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSE FEES (Fees required only for new applications, with few exceptions*) *(See 10 CFR 170 and Section 170.31)* FEE CATEGORY _____ AMOUNT ENCLOSED $ _____

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 CONTANED 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 C RIMINAL 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

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED $	CHECK NUMBER	COMMENTS
APPROVED BY				DATE	

NRC FORM 313 (03-2014)

APPENDIX C

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

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

Item No.	Title and Criteria	Use Table Below	Description Attached
5 & 6	**RADIOACTIVE MATERIAL**		
	Sealed Sources and Devices		
	• Identify each radionuclide that will be used in sealed sources.	[ ]	[ ]
	• Identify each radionuclide that will be used in energy compensation sources.	[ ]	[ ]
	• Identify each radionuclide that will be used as tracer materials in single wells.	[ ]	[ ]
	• Identify each radionuclide that will be used as tracer materials in field flood studies in multiple wells.	[ ]	[ ]
	• Identify any depleted uranium that is used as shielding material or sinker bars.	[ ]	[ ]

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**			**Millicuries Per Injection**	**Total Quantity Requested**
	[ ] Gas	[ ] Liquid	[ ] Labeled Frac Sands		
	[ ] Gas	[ ] Liquid	[ ] Labeled Frac Sands		
	[ ] Gas	[ ] Liquid	[ ] Labeled Frac Sands		

Note: Indicate the rate of volatility or dispersion for each unsealed tracer material.

Depleted Uranium		
Radionuclide	**Manufacturer/ Model No.**	**Kilograms Requested**
Depleted Uranium (DU)		

Sealed Sources Not Used in Well Logging Operations		
Radionuclide	**Manufacturer/ Model No.**	**Maximum activity per source and total activity requested (mCi or Ci)**

Commitment:	**Yes**	**N/A**
Confirm that each sealed source, device, and source/device combination used is registered as an approved sealed source and/or device by the NRC or an Agreement State.	[ ]	[ ]
Confirm that each sealed source, device, and source/device combination will be possessed and used in accordance with the conditions specified in the registration certificate, and will not to exceed the maximum activity per source and/or device as specified in the Sealed Source and Device Registration Sheet.	[ ]	[ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	RADIOACTIVE MATERIAL **Financial Assurance and Record Keeping for Decommissioning** • Pursuant to 10 CFR 30.35(g), we will maintain drawings and records important to decommissioning and transfer these records to a new licensee before licensed activities are transferred, or assign the records to the appropriate NRC Regional Office before the license is terminated. AND • If financial assurance is required, we will submit evidence following NUREG-1757, Volume 3.	[ ]	[ ]	[ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
6	**PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED** • 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 • State "We plan to perform the following activities in ***freshwater*** aquifers": – Tracer studies – Well logging using sealed sources – Well logging using neutron generator	[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]	[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]	[ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
7	**INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE** **Radiation Safety Officer (RSO)**			
	• The name of the proposed RSO and other individuals who will be responsible for the radiation protection program. Name:_____	[ ]		
	• 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.			[ ]
	AND EITHER			
	• Documentation demonstrating that the proposed RSO is qualified by training and experience (i.e., certificate of completion of a well logging RSO or authorized user's course).		[ ]	[ ]
	OR			
	• 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.		[ ]	[ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
8	**TRAINING FOR LOGGING SUPERVISORS AND LOGGING ASSISTANTS**			
	• Submit an outline of the training to be given to prospective logging supervisors and logging assistants.			[ ]
	• Submit your procedures for experienced logging supervisors who have worked for another licensee.			[ ]
	• Provide a copy of a typical examination and the correct answers to the examination questions. State the passing grade percent.			[ ]
	• Specify the qualifications of your instructors.			[ ]
	• If training will be conducted by someone outside the applicant's organization, identify the course by title and provide the name and address of the company providing the training.			[ ]
	• 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 your program for annual inspections of the job performance of each well logging supervisor, as described in 10 CFR 39.13(d).			[ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
9	**FACILITIES AND EQUIPMENT**			
	• Submit a diagram, drawing or sketch of the proposed facility, identifying areas where radioactive materials, including radioactive wastes, will be used or stored. Diagrams, drawings, or sketches should include indication of the scale, or include dimensions on each drawing or sketch and be marked: "Security-Related Information–Withhold under 10 CFR 2.390" as appropriate.			[ ]
	• 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 (concrete, lead, etc.) 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 (concrete, lead, etc.) and means for securing tracer materials from unauthorized removal.		[ ]	[ ]
	• Describe protective clothing (such as rubber gloves, coveralls, respirators, and face shields), auxiliary shielding, absorbent materials, injection equipment, secondary containers for waste water storage for decontamination purposes, plastic bags for storing contaminated items, etc., that 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.			[ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
9	**FACILITIES AND EQUIPMENT** ***(Cont'd)***			
	• 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, the following equipment should be considered 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.		[ ]	[ ]
	• If applicable, we will have in place a security program in accordance with 10 CFR Part 37 prior to possessing category 1 or category 2 quantities of radioactive materials.	[ ]	[ ]	[ ]
	• State the physical location where NRC regulatory required records will be stored and available for review during NRC inspections.			[ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
10	**RADIATION SAFETY PROGRAM** 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. The radiation safety program should include each of the following items: • 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 • program for the annual inspection of the job performance of well logging personnel • description of organization structure and individuals responsible for ensuring implementation of radiation safety program • records management • 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 the use of tracer materials Appendix E includes a description of procedures for using tracer materials in field flood study operations.			[ ]
	Radiation Safety Program Audit: 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 program will be reviewed during inspections.	Need Not Be Submitted With Application		

Item No.	Title and Criteria	Yes	N/A	Description Attached
	Well Owner or Operator Agreement We will obtain a written agreement that meets the requirements specified in 10 CFR 39.15, "Agreement with well owner or operator," prior to well logging: (1) with a sealed source; (2) with a neutron generator exceeding 30 curies; or (3) with a neutron generator in a well without a surface casing.	[ ]	[ ]	[ ]
	Instruments • We will use instruments that meet the radiation monitoring instrument specifications published in Appendix I of NUREG-1556, Volume 14, Revision 1, "Program-Specific Guidance about Well Logging, Tracer and Field Flood Studies." A description of the instrumentation that will be used to perform required surveys is attached. We reserve the right to upgrade our survey instruments as necessary. Our instruments will be calibrated by an authorized service provider. OR • We will use instruments that meet the radiation monitoring instrument specifications published in Appendix I of NUREG-1556, Volume 14, Revision 1, "Program-Specific Guidance about Well Logging, Tracer and Field Flood Studies." A description of the instrumentation that will be used to perform required surveys is attached. We reserve the right to upgrade our survey instruments as necessary. • Additionally, we will perform instrument calibrations implementing the model survey meter calibration program published in Appendix I of NUREG-1556, Volume 14, Revision 1, "Program-Specific Guidance about Well Logging, Tracer and Field Flood Studies." OR • A description of alternative equipment and/or procedures for ensuring that appropriate radiation monitoring equipment will be used during licensed activities and that proper calibration and calibration frequency of survey equipment will be performed. We reserve the right to upgrade our survey instruments as necessary. ***Note*:** Alternative responses will be reviewed using the criteria listed above.	[ ] [ ] [ ]	[ ] [ ] [ ] [ ]	[ ] [ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
10	**RADIATION SAFETY PROGRAM *(Cont'd)***			
	Material Receipt and Accountability			
	• Physical inventories will be conducted and documented at intervals not to exceed 6 months, to account for all byproduct materials (sealed sources and tracer materials) and devices containing depleted uranium received and possessed under the license.	[ ]		
	AND			
	• 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."	[ ]	[ ]	
	Occupational Dosimetry			
	• Personnel dosimeters (e.g., film badge, TLD, or OSL) will be processed and evaluated by a NVLAP-accredited entity, exchanged at the approved frequency, and worn by well logging supervisors and logging assistants.	[ ]	[ ]	[ ]
	AND/OR			
	• Individual logging supervisors and logging assistants using more than 50 millicuries of iodine-131 at any one time or in any 5-day period will be provided a bioassay.	[ ]	[ ]	
	• Bioassay plan attached.	[ ]	[ ]	
	• Individual logging supervisors and logging assistants will not use more than 50 millicuries of iodine-131 at any one time or in any 5-day period at field stations or at temporary job sites.	[ ]	[ ]	[ ]
	• We will contract with a vendor for bioassay services and each vendor is licensed or otherwise authorized by the NRC or an Agreement State to provide required bioassay services.	[ ]	[ ]	
	OR			
	We will not allow any individual to use more than: (1) 50 millicuries of iodine-131 at any one time or in any 5-day period at field stations or at temporary job sites; (2) or more than 3.7 Gbq (0.1 curie) of tritium (H-3) or more than 3700 Gbq (100 curies) of gaseous H-3	[ ]	[ ]	[ ]
	Public Dose The applicant is not required to, and should not, submit a response to the public dose section during the licensing phase. This matter will be evaluated during an inspection.	Need Not Be Submitted With Application		

Item No.	Title and Criteria	Yes	N/A	Description Attached
10	**RADIATION SAFETY PROGRAM *(Cont'd)***			
	Operating and Emergency Procedures			
	• We will develop, implement, and maintain operating and emergency procedures that address the important radiation safety aspects as described in 10 CFR 39.63, "Operating and Emergency Procedures."	[ ]		[ ]
	Leak Tests			
	• 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; or by using a leak test sample collection kit supplied by an organization licensed by the NRC or an Agreement State to provide leak test kits or sample analysis services to other licensees and according to the instructions provided in the leak test sample collection kit.	[ ]		
	OR	[ ]		[ ]
	• Leak test sample collection and analysis will be done by the applicant. Provide the information in Appendix M supporting a request to perform leak test sample collection and sample analysis and either state that you will follow the model procedures in the appendix or submit a description of alternative procedures	[ ]	[ ]	[ ]
	Maintenance Before Use			
	• 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 before each use.	[ ]	[ ]	

Item No.	Title and Criteria	Yes	N/A	Description Attached
10	**RADIATION SAFETY PROGRAM *(Cont'd)***			
	Semiannual Visual Inspection and Maintenance • 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.	[ ]	[ ]	[ ]
	Maintenance Requiring Special Authorization • Activities described in 10 CFR 39.43(c) and (d) shall not be conducted unless written detailed 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.	[ ]	[ ] [ ]	[ ]
	Transportation No response is needed from applicants during the licensing phase. Transportation issues are reviewed during inspections.	No Response is Necessary for this Section		

Item No.	Title and Criteria	Yes	N/A	Description Attached
10	**RADIATION SAFETY PROGRAM *(Cont'd)*** **Minimization of Contamination** The applicant does not need to provide a response to this item if the applicant has met the criteria in the following sections: "Radioactive Material–Sealed Sources and Devices, and Unsealed (Tracer) Radioactive Material," "Facilities and Equipment," "Radiation Safety Program–Leak Tests", "Radiation Safety Program–Tracer Studies," "Radiation Safety Program–Operating and Emergency Procedures," and "Waste Management."	No Response is Necessary for this Section		
	AND • We will not conduct decontamination of a facility contaminated by a leaking sealed source or contaminated by unsealed material with a half-life greater than 120 days. This type of decontamination activity will be conducted by an NRC or Agreement State licensee that is specifically authorized to conduct such activity. OR • We have submitted procedures for the conduct of decontamination of a facility contaminated by a leaking sealed source or contaminated by unsealed material with a half-life greater than 120 days.	[ ] [ ]		[ ]
	Use of Sealed Sources in Drill-to-Stop Well Logging Operations • Submit step-by step operating and emergency procedures for conducting drill-to-stop (DTS) well logging operations. Procedures must address radiation safety aspects when conducting DTS well logging operations.	[ ]	[ ]	[ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
10	**RADIATION SAFETY PROGRAM *(Cont'd)***			
	Use of Sealed Sources in Measurement While Drilling or Logging While Drilling Well Logging Operations			
	• Submit step-by-step operating and emergency procedures for conducting measurement while drilling (MWD) and logging while drilling (LWD) well logging activities. Procedures must address radiation safety aspects when conducting MWD and LWD well logging operations.	[ ]	[ ]	[ ]
	Energy Compensation Sources			
	• Submit Step-by-Step Operating and Emergency Procedures for using and handling energy compensation sources (ECSs). Include, among other aspects, 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 record system for maintaining inventory records required by 10 CFR 39.37, "Physical Inventory," and a record system for maintaining records of use for ECSs.	[ ]	[ ]	[ ]
	Use of Sealed Sources and/or Neutron Generators in Freshwater Aquifers			
	• State that: "We will not use sealed sources and/or neutron generators for conducting well logging operations in freshwater aquifers."	[ ]		
	OR			
	• Submit step-by-step operating and emergency procedures for conducting well logging activities using sealed sources and/or neutron generators in freshwater aquifers that meet the criteria in Section 8.10.12.4 of NUREG-1556, Volume 14, Revision 1; 10 CFR 39.55; and 10 CFR 39.63.	[ ]		[ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	Tracer Studies in Single Well Applications			.
	• We will not perform tracer studies in single well applications. OR			[ ]
	• 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; 10 CFR 39.45; and 10 CFR 39.63.			[ ]
10	**RADIATION SAFETY PROGRAM *(Cont'd)***			
	Field Flood and Secondary Recovery Applications (Tracer Studies in Multiple Wells)	[ ]		
	• Field flood studies using tracer materials will not be conducted. OR	[ ]		
	• Field flood studies using tracer materials will be conducted and we have submitted step-by-step procedures and information required in Appendix E, "Field Flood Studies/Enhanced Recovery of Oil and Gas Wells."	[ ]	[ ]	[ ]
	Tracer Studies in Freshwater Aquifers			
	• We will not knowingly inject tracer material into a freshwater aquifer. OR	[ ]		
	• We request authorization to inject tracer material into a freshwater aquifer and have submitted our reasons for performing the study and procedures to safeguard the public, licensee personnel, and the environment, and have provided an environmental report containing the information outlined in 10 CFR 51.45, "Environmental Report."	[ ]	[ ]	[ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
10	**RADIATION SAFETY PROGRAM *(Cont'd)***			
	Radioactive Collar and Subsidence or Depth Control Markers			
	• 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."	[ ]	[ ]	
	Neutron Accelerators Using Licensed Material			
	• We will not use neutron generators (accelerators) in our well logging operations.	[ ]		
	OR			
	• We will use neutron generators (accelerators) in accordance with the criteria in Section 8.10.15 of NUREG-1556, Volume 14, Revision 1, 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			
	• We will use neutron generators (accelerators) in accordance with the criteria in Section 8.10.15 of NUREG-1556, Volume 14, Revision 1, and will provide step-by-step operating and emergency procedures for NRC review. We will perform calibration of neutron generators and step-by-step procedures for conducting calibration of neutron generators that are submitted for NRC review.	[ ]		[ ]

Item No.	Title and Criteria	Yes	N/A	Description Attached
10	**RADIATION SAFETY PROGRAM *(Cont'd)***			
	Depleted Uranium Sinker Bars			
	• We will not use depleted uranium sinker bars in our well logging operations.	[ ]	[ ]	
	OR			
	• 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			
	• Depleted uranium sinker bars will be obtained under a specific license. Specify the number of kilograms of material being requested.	[ ]	[ ]	
	AND			
	• Uranium sinker bars will be possessed and inspected as specified in Section 8.10.16 of NUREG-1556, Volume 14, Revision 1.	[ ]	[ ]	
	Security Program for Category 1 and Category 2 Materials In accordance with 10 CFR Part 37, licensees that possess an aggregated Category 1 or Category 2 quantity of radioactive material must establish, implement, and maintain an access authorization program and a security program to ensure physical protection of the radioactive material.	Need not be submitted with application		

Item No.	Title and Criteria	Yes	N/A	Description Attached
10	**RADIATION SAFETY PROGRAM *(Cont'd)***			
	Waste Management			
	• 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/or contaminated waste to a licensed entity authorized to receive the material.	[ ]	[ ]	[ ]
	AND			
	• We will use the model waste procedures published in Appendix O to NUREG-1556, Volume 14, Revision 1, "Program-Specific Guidance about Well Logging, Tracer, and Field Flood Study Licenses," for disposing of radioactive materials and/or contaminated waste.	[ ]	[ ]	[ ]
	OR			
	• We have provided our procedures for waste collection, storage and disposal by any of the authorized methods described in this section.	[ ]	[ ]	[ ]

APPENDIX D

CHECKLIST FOR LICENSE APPLICATION

APPENDIX D CHECKLIST FOR LICENSE APPLICATION

WELL LOGGING APPLICATION

REVIEW CHECKLIST

Date: _____

CONTENTS OF APPLICATION

ITEM 8.1 TYPE OF APPLICANT/LICENSEE

Type of Action	License No.
[ ] A. New License	Not Applicable
[ ] B. Amendment	
[ ] 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.

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

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

***MATERIAL USE LEGEND**			
O=Oil Well Logging	**G=Gas Well Logging**	**M=Mineral Well Logging**	**T=Tracer Studies in single wells**

*MATERIAL USE LEGEND			
FF=Field Flood or Enhanced Recovery Operations	**N=Neutron Generators**	**C=Calibration Sources in above ground applications**	

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:

[ ] Name	[ ] Experience	[ ] Training	[ ] Independent Authority to stop unsafe operations
[ ] Organizational Chart (Day-to-Day Radiation Safety Positions) provided			
[ ] Alternative Training and Experience, if applicable			
[ ] See Appendix for the minimum RSO duties and responsibilities			

ITEM 8.8 TRAINING FOR WELL LOGGING SUPERVISORS AND WELL LOGGING ASSISTANTS
LOGGING ASSISTANT TRAINING [§39.61(b)] and (d)
[ ] In-house Training:
[ ] Received copies of Parts 19, 20, & OE Procedures
[ ] Classroom instruction in Parts 19 & 20 (2-4 hours)
[ ] Instruction in the use of licensed materials, remote handling tools, survey equipment, etc. (1-2 hours)
[ ] 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 [§39.61(a) and (d)]

[ ] §39.61(e) Topics, by vendor

Vendor(s) Name: _____

[ ] Instructor's Name: ___

[ ] Instructor's Qualifications:

[ ] Classroom Training Conducted by Licensee (~24 hours):

[ ] §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 hours):

[ ] 10 CFR 19, 20, & 39

[ ] OE Procedures (§39.63)

[ ] License

[ ] ~8 hours 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 hours)

[ ] 1 month (160 hours) 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) [§39.61(c) and (d)]

[ ] Description of topics covered

[ ] Instructor name

ANNUAL JOB PERFORMANCE AUDIT OF WELL LOGGING SUPERVISORS [§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

[ ] Drawn to specified scale

[ ] 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 “pre-calibrated amounts” or “ready-to-use” forms

[ ] Usage of OTHER than “pre-calibrated 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: [§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. Operating and emergency procedures should address decontamination of the laundry area and equipment.
[ ] Description of decontamination facilities for trucks, tracer injection tools, or other equipment contaminated by tracer materials. Operating and emergency procedures should address decontamination of these types of equipment and facilities.

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 pre-arranged 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 8.10.1 AGREEMENT WITH WELL OWNER/OPERATOR [§39.15]

[ ] Elements of the Agreement:
[ ] 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 as per **§**39(a)(5)(iii)
[ ] Agreement refers to §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 curies)
[ ] Abandonment of ECSs with activity ***greater than*** 3.7 MBq (100 microcuries)

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 F reviewed

ITEM 8.10.3 RADIATION MONITORING INSTRUMENTS [§39.33(a)]
[ ] 0.1-50 mR/h
[ ] Type of instruments (GM, ion chamber, scintillation)
[ ] Type of radiation detected (α, β, γ, neutron)
[ ] Availability of survey instrument pursuant to 10 CFR 39.33(b)

<table>
<tr><td>Survey Instrument
• Manufacturer
• Model No.
• # Available
• Type
– GMI on-chamber
– Scintillation</td><td>Instrument Probes
• Model No.</td><td>Range
• CPM
• DPM
• mR/hr
• mr/hr</td><td>Radiation Detected
• α
• β
• γ
• neutron</td></tr>
<tr><td colspan="2">Counting Equipment For:
• Analysis of Contamination Swipes
• Analysis of Bioassay Samples</td><td>Calibration Standards</td><td>Minimum Detectable Activity</td></tr>
</table>

Special Equipment	# Available	Description
• **Air Samplers** • **Direct Reading Dosimeters** • **Condenser R meter**		

CALIBRATION OF RADIATION DETECTION INSTRUMENTS [§39.33(c)]

[ ] 6-month calibration frequency

[ ] In-house

[ ] By manufacturer

[ ] By outside firm

Name: _____

License No.: _____

[ ] Calibration procedures in Appendix I adopted

[ ] Alternative calibration procedures for radiation detection instruments provided for NRC review

ITEM 8.10.4 MATERIAL RECEIPT AND ACCOUNTABILITY/PHYSICAL INVENTORY [§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 PERSONNEL MONITORING [§39.65(a)]

[ ] TLD

[ ] Film

[ ] OSL-***Note:*** *Exemption should be requested*

[ ] Neutron capability

[ ] NVLAP-Approved

[ ] Exchange frequency

< > Monthly

< > Quarterly

BIOASSAYS [§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 K reviewed

ITEM 8.10.7 OPERATING AND EMERGENCY PROCEDURES [§39.63]

[ ] Instructions for handling and using licensed materials, including sealed sources in wells, without surface casing for protecting freshwater 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 P 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 [§39.35]

[ ] Vendor(s) Name: ___

Address: _____

Agreement State/NRC License No.: _____

[ ] Leak test kit
[ ] Leak testing conducted in-house using Appendix M procedures
[ ] Alternative leak testing procedures submitted for NRC review

ITEM 8.10.9 MAINTENANCE

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

SEMIANNUAL MAINTENANCE [§39.43(b)]

[ ] 6-month
( ) Defects (§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 [§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 [§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 [§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 N reviewed

ITEM 8.10.11 MINIMIZATION OF CONTAMINATION [§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 through survey
[ ] Levels of contamination
[ ] Decontamination operating and emergency procedures
[ ] Decontamination equipment
[ ] Prevention of contamination of personnel during decontamination
[ ] How to handle contaminated waste materials
[ ] Re-surveying 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 FRESHWATER AQUIFERS

[ ] Applicant will not use sealed sources and/or neutron generators for conducting well logging operations in freshwater 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 TRACER STUDIES
Tracer Studies in Single Well Applications [§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 (injector tools, remote handling tools, transportation containers, etc.)
[ ] 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

[ ] Pre-injection phase of the field flood project
[ ] Injection phase
[ ] Post-injection phase
[ ] Emergency procedures
[ ] Reporting and record keeping 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 (injector tools, remote handling tools, transportation containers, etc.)
[ ] 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 E provided

Tracer Studies in Single Well Applications in Freshwater Aquifers [§39.45]

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

ITEM 8.10.14 RADIOACTIVE COLLAR AND SUBSIDENCE OR DEPTH CONTROL MARKERS [§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 curies) of tritium are:
[ ] Exempt from leak testing requirements if they contain less than 3.7 MBq (100 microcuries)
[ ] 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 curies) cannot be used in wells without surface casing to protect freshwater 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 [§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 8.11 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

[ ] less than 120 day half-life (T½) material

[ ] Held for decay a minimum of 10 T½

[ ] Confirm that prior to disposal as in-house waste, you 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/hr)

< > 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

[ ] Sand-out, flowback, screenout, etc.

[ ] Disposal by release into sanitary sewerage (§20.2003)

[ ] Appendix O 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 E

FIELD FLOOD STUDIES/ENHANCED RECOVERY OF OIL AND GAS WELLS

APPENDIX E 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 non-tracer-bearing fluid or gas.

Planning Stage

Reservoir Information

Describe the reservoir information that you need 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 (1) the amount of radionuclide to be injected, and (2) the expected concentration of radionuclide in the fluids (gas, water, oil) at a recovery well site. Indicate your 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 you 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.

Pre-injection 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 (thermoluminescent dosimeters (TLDs), optically stimulated luminescence dosimeters (OSLs), film badges, finger badges, pocket dosimeters, etc.) and other radiation detection instruments in your 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.

Post-injection 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 post-injection samples and shipping the samples to your 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 your 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 you will follow 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, Record Keeping, 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 you will follow in case of accidents; and procedures for notifying the proper persons or organizations, such as your 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 F

SUGGESTED WELL LOGGING AND SUBSURFACE TRACER STUDIES AUDIT CHECKLIST

APPENDIX F 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. If the mailing address or places of use changed, was the license amended? [10 CFR 30.34]

2. 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]

3. 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)?

4. 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?

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 through at least 0.5 mSv (50 mrem) per hour? [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 71?

   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?

d. Are records of the receipt, transfer, and disposal of licensed materials maintained in accordance with 10 CFR 30.51?

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 semi-annual 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?

F. 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)]

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?

G. AREA RADIATION SURVEYS AND CONTAMINATION CONTROL

1. Compliance with dose limits for individual members of the public [10 CFR 20.1302]

    a. Have 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 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 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 freshwater 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 freshwater 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 survey measurements?

a. Describe the type, location, and results of measurements. Also note the 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)]

H. 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 workersworkersworkers' 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. Have all logging supervisors received training as required pursuant to 10 CFR 39.61(a)?

b. Have all logging assistants received training as required pursuant to 10 CFR 39.61(b)?

c. 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)?

d. Are records maintained, at least 3 years, for each logging supervisor and logging assistant training and annual safety review?

e. Are the subjects outlined in 10 CFR 39.61(e) included in the training program?

I. 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 or equal to 10 percent of the limit? [10 CFR 20.1502(a)]

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-approved? [10 CFR 20.1501(d)]

(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

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 notified annually of their exposures?

(7) Are records of exposures, surveys, monitoring, and evaluations maintained? [10 CFR 20.2102, 10 CFR 20.2103, 0 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. Has 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?

J. 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. Do radionuclides being stored all have half-lives less than 120 days?

c. Are radionuclides being segregated for storage according to half-life?

d. Before waste is disposed of:

(1) Is a survey performed at the container surface with an appropriate 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 each month averaged over the 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 curies (185 GBq) of hydrogen-3, 1 curie (37 GBq) of carbon-14, and 1 curie (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]

K. RECORD KEEPING FOR DECOMMISSIONING

1. Are records kept of information important for decommissioning? [10 CFR 30.35(g)]

2. Do records include all information outlined in 10 CFR 30.35(g)?

3. Are records of surveys required by 10 CFR 20.2103(a) maintained with records important for decommissioning as required by 10 CFR 20.1501(b)?

L. TRANSPORTATION [10 CFR 71.5(a)

1. Shipments are:

   - ☐ Delivered to common carriers
   - ☐ Transported in company's private vehicle
   - ☐ Both
   - ☐ 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 173.403, 49 CFR 173.441]

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]

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 incidents reported to the DOT National Response Center? [49 CFR 171.15, 49 CFR 171.16]

M. NOTIFICATION AND REPORTS

1. Was any licensed material lost or stolen? Were reports made? [10 CFR 20.2201, 10 CFR 30.50]

2. Did any reportable incidents occur? Were reports made? [10 CFR 20.2202, 10 CFR 30.50]

3. Did any overexposures or high radiation levels occur? Were they reported? [10 CFR 20.2203, 10 CFR 30.50]

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 A through D above) did occur, what was the root cause? Were appropriate notifications made and corrective actions taken?

6. Is the management/RSO aware of the telephone number for the NRC Emergency Operations Center? [301-816-5100]

N. 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]

O. 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?

P. 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. During the audit period, did any events occur requiring reporting under 10 CFR 39.77?

Q. BULLETINS AND INFORMATIONAL NOTICES

1. Are NRC Bulletins, NRC Informational Notices, Office of Nuclear Material Safety and Safeguards (NMSS) Newsletters received?

2. Are appropriate actions and training taken in response?

R. 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.

APPENDIX G

WELL LOGGING SUPERVISOR AND LOGGING ASSISTANT TRAINING REQUIREMENTS

APPENDIX G WELL LOGGING SUPERVISOR AND LOGGING ASSISTANT TRAINING REQUIREMENTS

Requirement		Training Criteria
10 CFR 39.61(a)		**Logging Supervisor**
A.	Receive Training in Title 10 of the *Code of Federal Regulations* (10 CFR) 39.61(e) Topics (Classroom Training-Approximately 24 hours in length)	Topics in 10 CFR 39.61(e) **Fundamentals of Radiation Safety** • characteristics of gamma radiation • units of radiation dose and quantity of radioactivity • hazards of exposure to radiation • levels of radiation from licensed material • methods of controlling radiation dose (time, distance, and shielding) • radiation safety practices, including prevention of contamination, and methods of decontamination **Radiation Detection Instruments** • use, operation, calibration and limitations • survey techniques • use of personnel monitoring equipment **Equipment to be Used** • operation of equipment, including source handling equipment and remote handling tools • storage, control, and disposal of licensed material • inspection and maintenance of equipment **Requirements of Pertinent Federal Regulations** **Case histories of accidents in well logging operations**

Requirement		Training Criteria
10 CFR 39.61(a)		Logging Supervisor
B.	On-the-Job Training-using sealed sources 160 hours for a mineral logging licensee, or a licensee using sealed sources with activities less than 500 millicuries **OR** 3 months or 520 hours for gas or oil well logging operations using sealed sources with activities greater than 500 millicuries	Under the supervision of a qualified logging supervisor
C.	On-the-Job Training-using tracer materials **Single Well Tracer Operations** 3 months or 520 hours or completion of 50 tracer operations **Field Flood Operations** 3 months or 520 hours or completion of 3 field flood tracer operations involving multiple wells	Under the supervision of a qualified logging supervisor
D.	Completion of a Written Examination	Complete a written examination submitted and approved by the NRC
E.	Must receive Copies of and Instruction in: (Classroom Training-Approximately 8 hours in length)	NRC Regulations • Applicable sections of 10 CFR Parts 19, 20, and 39 • The NRC License under which the logging supervisor will perform well logging • The Licensee's Operating & Emergency Procedures required by 10 CFR 39.63
F.	Pass Written Examination on 10 CFR 39.61(e) Topics outlined in Item A	• Complete a written examination submitted and approved by the NRC. • Passing Grade 80 percent

Requirement		Training Criteria
10 CFR 39.61(a)		**Logging Supervisor**
G.	Receive Equipment Training (Approximately 4 hours in length)	Training includes: • Well Logging Equipment • Sealed sources • Handling equipment • Survey meters • Daily inspection
H.	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
I.	Annual Refresher Training	Review the following: • Annual radiation safety program review • New procedures, equipment, or techniques • New regulations • Observations and deficiencies during audits of well logging supervisor and logging assistants and discussion of any significant incidents or accidents involving well logging • Employee questions
J.	Records	To be maintained in accordance with 10 CFR 39.61(d)

Requirement		Training Criteria
10 CFR 39.61(b)		**Logging Assistant**
A.	Must receive Copies of and Instruction in: (Classroom Training-Approximately 8 hours in length)	NRC Regulations • Applicable sections of 10 CFR Part 19 and Part 20 • The Licensee's Operating & Emergency Procedures required by 10 CFR 39.63

Requirement		Training Criteria
10 CFR 39.61(b)		**Logging Assistant**
B.	Pass Oral or Written Exam	• Complete a written examination submitted and approved by the NRC. • Passing Grade 80 percent
C.	Receive Equipment Training (Approximately 2-4 hours in length)	Training under the supervision of a qualified well logging supervisor appropriate for the logging assistant's intended job responsibilities: • well logging equipment • sealed sources • handling equipment • survey meters • daily inspection
D.	Annual Refresher Training	Review the following: • Any significant item identified in the annual review of the Radiation Safety Program • New procedures or equipment • New regulations • Observations and deficiencies during audits and discussion of any significant incidents or accidents involving well logging operations • Employee questions
E.	Records	To be maintained in accordance with 10 CFR 39.61(d)

APPENDIX H

ANNUAL INTERNAL JOB PERFORMANCE INSPECTION CHECKLIST FOR WELL LOGGING SUPERVISORS AND WELL LOGGING ASSISTANTS

APPENDIX H 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, or OSL badge, 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 survey meters? Availability of survey instrument calibration record?
		5. Individuals working with licensed material performing regulatory required radiation surveys?
		6. Most current survey records as required by paragraphs 10 CFR 39.67available? • Measurements of areas of storage and use • Measurements of positions occupied in transport vehicle • Measurement of vehicle exterior • Contamination check of well logging tool prior to transport • Measurements before and after subsurface tracer use
		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? Defective well logging equipment removed from service, sent to repair, 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 survey records available at field stations?

Yes	No	Questions
		11. Copy of the applicant's operating and emergency procedures, survey meter calibrations records, survey records, and copy of the radioactive materials license available at temporary jobsites?
		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 ALARA and 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.)
Remarks:		

APPENDIX I
RADIATION MONITORING INSTRUMENT SPECIFICATIONS AND MODEL SURVEY INSTRUMENT CALIBRATION PROGRAM

APPENDIX I RADIATION MONITORING INSTRUMENT SPECIFICATIONS AND MODEL SURVEY INSTRUMENT CALIBRATION PROGRAM

Radiation Monitoring Instrument Specifications

The specifications in Table I.1 will help applicants and licensees choose the proper radiation detection equipment for monitoring the radiological conditions at their facilities.

Table I.1 Typical Survey. *Instruments used to measure radiological conditions at licensed facilities.*[4]

Portable Instruments Used for Contamination and Ambient Radiation Surveys			
Detectors	Radiation	Energy Range	Efficiency
Exposure Rate Meters	Gamma, X-ray	μR-R	N/A
Count Rate Meters			
GM	Alpha	All energies (dependent on window thickness)	Moderate
	Beta	All energies (dependent on window thickness)	Moderate
	Gamma	All energies	< 1%
NaI Scintillator	Gamma	All energies (dependent on crystal thickness)	Moderate
Plastic Scintillator	Beta	Carbon-14 or higher (dependent on window thickness)	Moderate
Stationary Instruments Used to Measure Wipe, Bioassay, and Samples from Tracer/Field Flood Study Job sites			
Detectors	Radiation	Energy Range	Efficiency
Liquid Scintillation Counter*	Alpha	All energies	High
	Beta	All energies	High
	Gamma		Moderate

[4] Table adapted from The Health Physics & Radiological Health Handbook, Revised Edition, Edited by Bernard Shleien, 1992 (except for * items).

Stationary Instruments Used to Measure Wipe, Bioassay, and Samples from Tracer/Field Flood Study Job sites *(Cont'd)*			
Gamma Spectroscopy System using a (NaI)* detector	Gamma	All energies	High
Gas Proportional	Alpha	All energies	High
	Beta	All energies	Moderate
	Gamma	All energies	< 1%

Model Instrument Calibration Program

Training

Before allowing an individual to perform survey instrument calibrations, the radiation safety officer (RSO) will ensure that he or she has sufficient training and experience to perform independent survey instrument calibrations.

Classroom training may be in the form of lecture, videotape, or self-study and will cover the following subject areas:

- Principles and practices of radiation protection
- Radioactivity measurements, monitoring techniques, and using instruments
- Mathematics and calculations basic to using and measuring radioactivity
- Biological effects of radiation

Appropriate on-the-job training consists of the following:

- Observing authorized personnel performing survey instrument calibration

- Conducting 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 Rate or Exposure Rate Instruments

- To reduce doses received by individuals not calibrating instruments, calibrations will be conducted in an isolated area of the facility or at times when no one else is present.

- Individuals conducting calibrations will wear assigned dosimetry.

- Individuals conducting calibrations will use a calibrated and operable survey instrument to ensure that unexpected changes in exposure rates are identified and corrected.

Model Procedure for Calibrating Survey Instruments

A radioactive sealed source(s) used for calibrating survey instruments will:

- Approximate a point source.
- Have its apparent source activity or the exposure rate at a given distance traceable by documented measurements to a standard certified to be within ± 5% accuracy by National Institute of Standards and Technology (NIST).
- Approximate the same energy and type of radiation as the environment in which the calibrated device will be employed or develop energy curves to compensate for differing energies.
- For dose rate and exposure rate instruments, the source shall be strong enough to give an exposure rate of at least about 7.7×10^{-6} coulombs/kilogram/hour (30 mR/hr) at 100 cm [e.g., 3.1 gigabecquerels (85 mCi) of cesium-137 or 7.8×10^{2} megabecquerels (21 mCi) of cobalt-60].

The three kinds of scales frequently used on dose or dose rate survey meters are calibrated as follows[5]:

- Linear readout instruments with a single calibration control for all scales shall 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 shall be adjusted on each scale. After adjustment, the response of the instrument shall be checked at approximately 20 percent and 80 percent of full scale. The instrument's readings shall be within ± 15 percent of the conventionally true values for the lower point and ± 10 percent for the upper point.
- Logarithmic readout instruments, which commonly have a single readout scale spanning several decades, normally have two or more adjustments. The instrument shall be adjusted for each scale according to site specifications or the manufacturer's specifications. After adjustment, calibration shall be checked at a minimum of one point on each decade. Instrument readings shall have a maximum deviation from the conventionally true value of no more than 10 percent of the full decade value.
- Meters with a digital display device shall be calibrated the same as meters with a linear scale.
- Readings above 2.58×10^{-4} coulombs/kilogram/hour (1 R/hr) need not be calibrated, but such scales shall be checked for operation and response to radiation.
- The inverse square and radioactive decay laws shall be used to correct changes in exposure rate due to changes in distance or source decay.

[5] ANSI N323B-2003, "Radiation Protection Instrumentation Test and Calibration-Portable Survey Instrument for Near Background Operation."

Surface Contamination Measurement Instruments

- A survey meter's efficiency must be determined by using sealed sources with similar energies and types of radiation that the survey instrument will be used to measure or by developing energy curves to compensate for differing energies.

- If each scale has a calibration potentiometer, the reading shall be adjusted to read the conventionally true value at approximately 80 percent of full scale, and the reading at approximately 20 percent of full scale shall be observed. If only one calibration potentiometer is available, the reading shall be adjusted at mid-scale on one of the scales, and readings on the other scales shall be observed. Readings shall be within 20 percent of the conventionally true value.

Model Procedures for Calibrating, Liquid Scintillation Counters, Gamma Counters, Gas Flow Proportional Counters, and Multichannel Analyzers

A radioactive sealed source used for calibrating instruments will do the following:

- Approximate the geometry of the samples to be analyzed.

- Have its apparent source activity traceable by documented measurements to a standard certified to be within ± 5 percent accuracy by NIST.

- Approximate the same energy and type of radiation as the samples that the calibrated device will be used to measure.

Calibration

- Calibration of survey instruments used in well logging procedures for assessing dose or exposure rates must be conducted at least every 6 months or after instrument servicing.

- Calibration must produce readings within ± 20 percent of the actual values over the range of the instrument.

- Calibration of liquid scintillation counters will include quench correction.

Calibration Records

Calibration reports, for all survey instruments, shall indicate the procedure used and the data obtained. The calibration record shall include:

- the owner or user of the instrument

- a description of the 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

- for instruments with external detectors, the angle between the radiation flux field and the detector (i.e., parallel or perpendicular)

- for instruments with internal detectors, the angle between radiation flux field and a specified surface of the instrument

- for detectors with removable shielding, an indication 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 of the person who performed the calibration and the date it was performed

The following information shall be attached to the instrument as a calibration sticker or tag:

- for exposure rate meters, the source radionuclide used to calibrate the instrument (with correction factors) for each scale

- the efficiency of the 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

References:

1. "The Health Physics & Radiological Health Handbook, Revised Edition," edited by Bernard Shleien, dated 1992.

2. ANSI N323B-2003, "Radiation Protection Instrumentation Test and Calibration-Portable Survey Instrument for Near Background Operation." Copies may be obtained from the American National Standards Institute at the following address: www.ansi.org.

APPENDIX J

GUIDANCE FOR DEMONSTRATING THAT UNMONITORED INDIVIDUALS ARE NOT LIKELY TO EXCEED 10 PERCENT OF THE ALLOWABLE LIMITS

APPENDIX J GUIDANCE FOR DEMONSTRATING THAT UNMONITORED INDIVIDUALS ARE NOT LIKELY TO EXCEED 10 PERCENT OF THE ALLOWABLE LIMITS

Dosimetry is required for individual adults who are likely to receive in 1 year an occupational dose from sources external to the body in excess of 10 percent of the applicable regulatory limits in 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 either a film badge or a thermoluminescent dosimeter (TLD) when handling licensed tracer materials or sealed sources. In instances where pocket ion chamber dosimeters are used instead of film badges or TLDs 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 non-logging personnel, a licensee needs to have available an evaluation demonstrating that these nonmonitored workers are not likely to exceed 10 percent of the applicable annual limits—5 mSv (500 millirems) per year.

The applicable TEDE (whole body) limit is 50 mSv (5 rems) per year, and 10% of that value is 5 mSv (500 millirems) per year.

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 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/hr (1.5 mrem/hr). Mechanics are not expected to spend any more than a total of 3 hours 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 hr/wk x 1.5 mrem/hr x 52 wk/yr = 234 mrem. Based on the above, if any mechanic works in the area less than 6.4 hours per week, no dosimetry is required.

Note: The measurement 6.4 hours is the total amount of hours it would take for an individual to meet the 5 mSv (500 millirems) per year limit.

APPENDIX K

GUIDANCE FOR DEMONSTRATING THAT INDIVIDUAL MEMBERS OF THE PUBLIC WILL NOT RECEIVE DOSES EXCEEDING THE ALLOWABLE LIMITS

APPENDIX K GUIDANCE FOR DEMONSTRATING THAT INDIVIDUAL MEMBERS OF THE PUBLIC WILL NOT RECEIVE DOSES EXCEEDING THE ALLOWABLE LIMITS

Licensees must ensure that:

- The radiation dose received by individual members of the public does not exceed 1 mSv (100 mrem) in one calendar year resulting from the licensee's possession or use of licensed materials.

Members of the public include persons who live, work, or may be near locations where licensed material is used or stored and employees whose assigned duties do not include the use of licensed materials and who work in the vicinity where it is used or stored.

- The radiation dose in unrestricted areas does not exceed 0.02 mSv (2 mrem) in any one hour.

Typical unrestricted areas may include offices, shops, laboratories, areas outside buildings, property, and nonradioactive equipment storage areas. The licensee does not normally control access to these areas for purposes of controlling exposure to radiation or radioactive materials; however, the licensee may control access to these areas for other reasons, such as security.

Licensees must demonstrate compliance with both of the above regulations. 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 TLD) are often used to show compliance.

A Bird's Eye View of Office

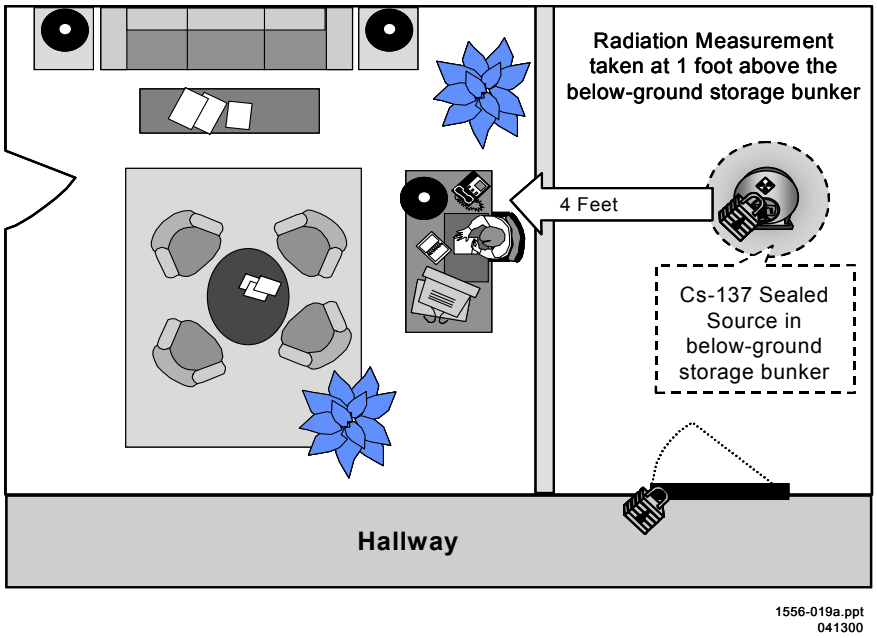

Figure K.1 Bird's-eye view of office

Calculation Method[6]

These measurements must be made with calibrated 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 hours (i.e., a "work year" of 40 hr/wk for 52 wk/yr) is equal to less than 0.5 microsievert (0.05 mrem) per hour.

This rate is well below the minimum sensitivity of most commonly available Geiger-Mueller (G-M) 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.

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[6] 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., LiF) may not have sufficient sensitivity for this purpose. Generally, the minimum reportable dose received is 0.1 mSv (10 mrem). Suppose a TLD monitors 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 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: (1) each cesium-137 logging source is a point source; (2) typical radiation levels are encountered when the source is in the unshielded position; and (3) 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.

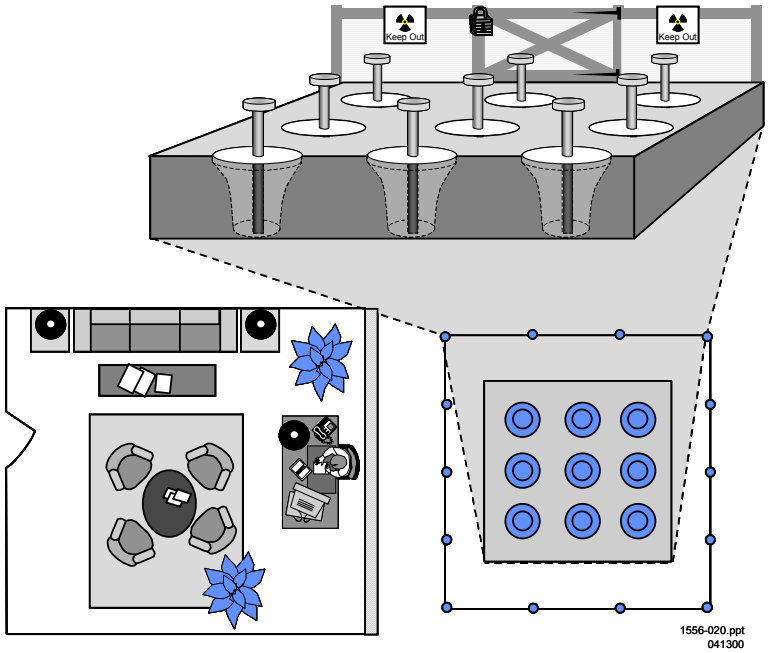

Figure K.2 Down-hole storage array

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 Elmo, 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. Elmo measures the distance from the shield to the center of the area in question and, using a calibrated survey instrument, measures the highest dose rate at one foot from the shield to be 2 mrem per hour.

Table K.1 summarizes the information Elmo has on the down-hole storage area.

Table K.1 Information Known about Dose at the Shield of the Cs-137 Source

Description of Known Information	Cesium-137 Logging Source
Dose rate encountered at 1 foot from the top of the shield, in mrem/hr.	2 mrem/hr.
Distance from the face of the shield to the nearest occupied work area, in ft.	4 ft

Example: Part 1

Elmo'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: (1) the cesium-137 is constantly located in down-hole storage area (i.e., 24 hours a day (hr/d)), and (2) the workers are constantly in the unrestricted work area (i.e., 24 hr/d). Elmo proceeds to calculate the dose the workers might receive hourly and yearly from the source, as shown in Table K.2 below.

Table K.2 Calculational Method, Part 1: Hourly and Annual Doses Received from a Logging Source Stored in Above Ground Transportation Container

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/hr by the square of the distance (ft) at which the measurement was made (e.g., 1 foot 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^2	$(4)^2$	16

Step No.	Description	Input Data	Results
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. **HOURLY DOSE RECEIVED FROM SOURCE**, in mrem in an hour	2/16	**0.125**
4	Multiply the result of Step 3 by 40 hr/work week x 52 weeks/year = **MAXIMUM ANNUAL DOSE RECEIVED FROM Cs-137 Source**, in mrem in a year	0.125 X 40 X 52	**260**

Note: The result in Step 3 demonstrates compliance with the 2 mrem in any one 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, Elmo is pleased to see that the total dose that an individual could receive in any one hour is only 0.125 mrem, less than the 2 mrem in any one 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

Elmo 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 hr/d). The annual dose received is then recalculated.

Table K.3 Calculational Method, Part 2: Annual Dose Received from a Logging Source Stored in Above Ground Transportation Container

Step No.	Description	Results
6	A. Average number of hours per day an individual spends in area of concern (e.g., a non-radiation worker spends 3.0 hr/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. (painting, grounds keeping, etc.)	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
7	Multiply the results of Step 7.A. by the results of Step 7.B. by the results of Step 7.C. = **AVERAGE NUMBER OF HOURS IN AREA OF CONCERN PER YEAR**	3 x 5 x 52 = **780**

Step No.	Description	Results
8	Multiply the results in Step 3 by the results of Step 8 = **ANNUAL DOSE RECEIVED FROM CESIUM-137 LOGGING SOURCE CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN**, in mrem in a year	0.125 x 780 = **97.5**

Elmo is pleased to note that the calculated annual dose received is significantly lower, and does not exceed the 100 mrem in a year limit.

Elmo 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 Elmo 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, MD 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, Elmo 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 L

NOTIFICATION OF PROPER PERSONS IN THE EVENT OF AN ACCIDENT

APPENDIX L 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 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 10 CFR 20.2202, "Records of Radiation Protection Programs," limits. 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.

Notifications

Event	Telephone Notification	Written Report	Regulatory Requirement
Theft or loss of material	immediate	30 days	10 CFR 20.2201(a)(1)(i)
Whole body dose greater than 0.25 Sv (25 rems)	immediate	30 days	10 CFR 20.2202(a)(1)(i)

Event	Telephone Notification	Written Report	Regulatory Requirement
Extremity dose greater than 2.5 Sv (250 rems)	immediate	30 days	10 CFR 20.2202(a)(1)(iii)
Whole body dose greater than 0.05 Sv (5 rems) in 24 hours	24 hours	30 days	10 CFR 20.2202(b)(1)(i)
Extremity dose greater than 0.5 Sv (50 rems) in 24 hours	24 hours	30 days	10 CFR 20.2202(b)(1)(iii)
Whole body dose greater than 0.05 Sv (5 rems)	none	30 days	10 CFR 20.2203(a)(2)(i)
Dose to individual member of public greater than 1 mSv (100 mrems)	none	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	2 days	30 days	10 CFR 21.21(d)(3)(i)
Event that prevents immediate protective actions necessary to avoid exposure to radioactive materials that could exceed regulatory limits	immediate	30 days	10 CFR 30.50(a)
Unplanned contamination event that requires restricted access for greater than 24 hours.	24 hours	30 days	10 CFR 30.50(b)(1)
Equipment is disabled or fails to function as designed when required to prevent radiation exposure in excess of regulatory limits	24 hours	30 days	10 CFR 30.50(b)(2)
Unplanned fire or explosion that affects the integrity of any licensed material or device, container, or equipment with licensed material	24 hours	30 days	10 CFR 30.50(b)(4)
Rupture of sealed source	immediate	30 days	10 CFR 39.77(a)
Sealed source becomes lodged in well bore and becomes classified as irretrievable, or licensee is requesting an extension to complete abandonment procedures	24 hours	30 days	10 CFR 39.77(c) 10 CFR 39.77(d)

Event	Telephone Notification	Written Report	Regulatory Requirement
Leak test of sealed source resulting in leakage greater than 185 Bq (0.005 microcuries)	none	5 days	10 CFR 39.35(d)
Failure of any component to perform its intended safety function	none	30 days	10 CFR 21.21

Note: Telephone notifications shall be made to the NRC Operations Center at **301-816-5100** except as noted.

APPENDIX M

MODEL LEAK TEST PROGRAM

APENDIX M MODEL LEAK TEST PROGRAM

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 test analysis.

Classroom training may be provided in the form of lecture, online, videotape, or self-study, and shall cover the following subject areas:

- principles and practices of radiation protection
- radioactivity measurements, monitoring techniques, and using instruments
- 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 tests and leak test 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(Tl) 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, the minimum detectable activity (MDA) shall be determined. 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% efficient)
t = 2 minutes

$$MDA = \frac{2.71 + 4.65\sqrt{(200 \text{ cpm} \times 2 \text{ minutes})}}{2 \times 0.1} = \frac{2.71 + 4.65\sqrt{(400)}}{0.2}$$

$$= \frac{2.71 + 4.65\ (20)}{0.2} = \frac{2.71 + 93}{0.2} = \frac{95.71}{0.2}$$

$$= \frac{478.55 \text{ disintegrations}}{\text{Minute}}$$

$$\text{becquerels (Bq)} = \frac{1 \text{ disintegration}}{\text{second}}$$

$$Bq = \frac{478.55 \text{ disintegration}}{\text{minutes}} \times \frac{\text{minute}}{60 \text{ seconds}} = 7.976 \text{ Bq}$$

Frequency for Conducting Leak Tests of Sealed Sources

Leak tests on well logging sealed sources will be conducted, in accordance with 10 CFR 39.35, at intervals not to exceed 6 months, or, for Energy Compensation Sources requiring leak tests, at intervals not to exceed 3 years.

Procedure for Performing Leak Testing and Analysis

- For each source to be tested, list identifying information such as the manufacturer's name, model number, serial number, radionuclide, and activity of the sealed source.
- 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.
- Using appropriate radiation safety principles (such as time, distance, and shielding) wipe the most accessible area (but not directly from the surface of the source) where contamination would accumulate if the sealed source were leaking (e.g., the leak test can be taken of the part that connects to the source or the inside of the transport container that has recently transported the source).
- Use a calibrated and operable survey instrument to check leak test samples for gross contamination before they are analyzed.
- Select an instrument for analysis that is sensitive enough to detect 185 Bq (0.005 microcuries) of the radionuclide.
- 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. Accuracy of standards shall 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 (NIST).

- Calculate efficiency.

  For example: $\frac{\text{[(cpm from std) - (cpm from bkg)]}}{\text{activity of std in Bq}}$ = efficiency in cpm/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 Bq (or µCi).

  For example: $\frac{\text{[(cpm from wipe sample) - (cpm from bkg)]}}{\text{efficiency in cpm/Bq}}$ = Bq on wipe sample

Sign and date the list of sources, data and calculations. Retain records for 3 years (under 10 CFR 20.2103(a)).

If the wipe test activity is 185 Bq (0.005 microcurie) or greater, notify the Radiation Safety Officer (RSO), so that the source can be withdrawn from use and disposed of properly. Also notify the NRC.

APPENDIX N

TRANSPORTATION—MAJOR DOT REGULATIONS; SAMPLE SHIPPING DOCUMENTS, PLACARDS AND LABELS

APPENDIX N TRANSPORTATION—MAJOR DOT REGULATIONS; SAMPLE SHIPPING DOCUMENTS, PLACARDS AND LABELS

***Note*:** The reference charts included at the end of this appendix are for reference only and are not a substitute for DOT and NRC transportation regulations.

The major areas in the DOT regulations that are most relevant for transportation of licensed material shipped as Type A quantities are as follows:

- Table of Hazardous Materials and Special Provisions—Subpart B, 49 CFR 172.101, App. A, list of hazardous substances and reportable quantities (RQ), Table 2: Radionuclides

- Shipping Papers—Subpart C, 49 CFR 172.200-204: General entries, description, additional description requirements, shipper's certification

- Marking—Subpart D, 49 CFR 172.300, 49 CFR 172.301, 49 CFR 172.303, 49 CFR 172.304, 49 CFR 172.310, 49 CFR 172.324: General marking requirements for non-bulk packaging, prohibited marking, marking requirements, radioactive material, hazardous substances in non-bulk packaging

- Labeling—Subpart E, 49 CFR 172.400, 49 CFR 172.401, 49 CFR 172.403, 49 CFR 172.406, 49 CFR 172.407, 49 CFR 172.436, 49 CFR 172.438, 49 CFR 172.440, 49 CFR 172.450: General labeling requirements, prohibited labeling, radioactive materials, placement of labels, specifications for radioactive labels and, specifications for "Empty" labels

- Placarding—Subpart F,49 CFR 172.500, 49 CFR 172.502, 49 CFR 172.504, 49 CFR 172.506, 49 CFR 172.516, 49 CFR 172.519, 49 CFR 172.556: Applicability, prohibited and permissible placarding, general placarding requirements, providing and affixing placards: highway, visibility and display of placards, specifications for "Radioactive" placards

- Emergency Response Information—Subpart G, 49 CFR 172.600, 49 CFR 172.602, 49 CFR 172.604, 49 CFR 172.606: Applicability and general requirements, emergency response information, emergency response telephone number and, carrier information contact

- Training—Subpart H, 49 CFR 172.702, 49 CFR 172.704: Applicability and responsibility for training and testing, training requirements

- Shippers—General Requirements for Shipments and Packaging—Subpart I, 49 CFR 173.403, 49 CFR 173.410, 49 CFR 173.412, 49 CFR 173.415, 49 CFR 173.431, 49 CFR 173.433, 49 CFR 173.435, 49 CFR 173.441, 49 CFR 173.443, 49 CFR 173.448, 49 CFR 173.475, 49 CFR 173.476: Definitions, general design requirements, additional design requirements for Type A packages, authorized Type A packages, activity limits for Type A packages, requirements for determining A_1 and A_2 values, table of A_1 and A_2 values for radionuclides, radiation level limitations, contamination control, general transportation

requirements, quality control requirements prior to each shipment, approval of special form radioactive materials

- Carriage by Public Highway - General Information and Regulations, 49 CFR 177.816, 49 CFR 177.817, 49 CFR 177.834(a), 49 CFR 177.842: Driver training, shipping paper, general requirements (secured against movement), Class 7 (radioactive) material.

The following are the major areas in DOT regulations most relevant for transporting licensed material that is shipped as Type B quantities in addition to the applicable requirements stated above:

A. Package Markings
49 CFR 172.310 - Radioactive material [Type B]

B. Shippers—General Requirements for Shipments and Packaging—49 CFR 173

Class 7 (Radioactive Materials) – Subpart I.

(1) 49 CFR 173.25 - Authorized packagings and overpacks
(2) 49 CFR 173.403 – Definitions
(3) 49 CFR 173.410 - General design requirements
(4) 49 CFR 173.413 - Requirements for Type B packages
(5) 49 CFR 173.416 - Authorized Type B packages

(6) 49 CFR 173.441 – Radiation level limitations and exclusive use provisions
(7) 49 CFR 173.443 – Contamination control
(8) 49 CFR 173.471 - Requirements for U.S. Nuclear Regulatory Commission approved packages

1. Minimum Required Packaging for Class 7 (Radioactive) Material[1] (49 CFR 173 and 10 CFR 71)[2]

These are basic reference charts; refer to current U.S. DOT & 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[3]		Excepted Quantities and Articles	Type A[4]	Type B
Activity Restrictions		≤ the limits specified in Table 4 of §173.425	≤ A_1 for special form ≤ A_2 for normal form	> A_1 for special form > A_2 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 package	Type B(U)F or Type B(M)F package

Minimum Packaging Required for LSA Material and SCO[5,6]

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[7,8]	Unpackaged[9] IP-1: solids, or liquids/exclusive use IP-2 : liquids/non-exclusive use Specification tank cars or cargo tank motor vehicles: liquids/exclusive use	- - IP-2: exclusive use IP-3: liquids or gases/non-exclusive use	- - IP-2: exclusive use IP-3: non-exclusive use	Unpackaged[9] IP-1 - -	- - IP-2 -
Alternative Provisions for Domestic only Transport[9]	Packaging shall meet the requirements of §§173.24, 24a, and 410 Transportation shall be an exclusive use shipment Activity per shipment must be less than an A_2 quantity				

[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) materials greater than A_1 or A_2.
[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 m from the unshielded material or objects (see §173.427(a)(1)).
[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. 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 LSA material and SCO, transport of combustible solids, all liquids and all gases classified as LSA-II and LSA-III material, and transport of all SCO-I and SCO-II is limited to a maximum activity of 100 A_2 in a conveyance (see §173.427(a)(2)).
[8] Unless excepted by §§173.427(c) or (d), the material or object(s) shall be appropriately packaged in a Type IP, DOT-7A Type A or Type B package.
[9] Certain LSA-I and SCO-I may be transported unpackaged under the conditions specified in §173.427(c).

2. Radiation Level, TI and CSI Limits for Transportation by Road, Rail and Air[1] (49 CFR 172 - 177, and 10 CFR 71)

Type of Transport	Non-exclusive use	Exclusive use		
Mode of Transport	Road, Rail, Vessel and Air	Road and Rail	Vessel	Air (cargo only)
Radiation Level Limits[2]				
Package Surface[1]	2 mSv/h (200 mrem/h)	2 mSv/h (200 mrem/h): other than closed vehicles 10 mSv/h (1000 mrem/h): closed vehicles	None specified	2 mSv/h (200 mrem/h)[3]
Conveyance[4]	N/A	2 mSv/h (200 mrem/h): outer surfaces (sides, top and underside) of vehicle[5]	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[5]	N/A	N/A
Occupied position	N/A	0.02 mSv/h (2 mrem/h): at any normally occupied area[6]	Requirement of §176.708 applies	N/A
Transport Index (TI) Limits[2]				
Package[1,7]	3: passenger aircraft 10: road, rail, vessels and cargo aircraft	No limit		10
Conveyance[4]	50: road, rail and passenger aircraft 50 to No limit: vessels[8] 200: cargo aircraft	No limit		200
Overpack	N/A: for road, rail 50 to 200: vessels[8] 3: passenger aircraft; 10: cargo aircraft	N/A	No limit[8]	N/A
Criticality Safety Index (CSI) Limit for fissile material[2]				
Package[1,7]	50	100	100	100
Conveyance[4]	50: road, rail and air 50: for holds, compartments or defined deck areas of vessels[8] 200 to No limit: for a total vessel[8]	100	200 to No limit: for a total vessel[8]	100
Overpack	50: road, rail, vessels[8] and air	N/A		

[1] The limits in this table do not apply to excepted packages.
[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, also the sum of the CSIs.
[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.
[5] The outer surfaces (sides, top and underside) of vehicles are defined 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. Also, see CSI limits established by §71.59.
[8] For details on TI and CSI limits for transport by vessel, see §176.708.

Based on U.S. DOT and NRC regulations in effect as of December 1, 2011.

Contacts: DOT – Rick.Boyle@dot.gov; NRC – John.Cook@nrc.gov

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 & 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 external surfaces of packages offered for transport must be kept as low as reasonable achievable, and shall not exceed the values shown in the following table:

Contaminant	Maximum permissible limits (§173.443(a), Table 9)		
	Bq/cm^2	µCi/cm^2	dpm/cm^2
Beta, gamma and low toxicity alpha emitters	4	10^{-4}	220
All other alpha emitting radionuclides	0.4	10^{-5}	22

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^2 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.

Provisions for Control of Contamination on Radioactive Material Packages Prior to Shipment

Prior to shipment, the non-fixed contamination on each package of radioactive material:

- must be kept as low as reasonable achievable; and
- may not exceed the limits set forth 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).
- Each transport vehicle used for transporting the radioactive material packages must be surveyed with appropriate radiation detection instruments after each use. If contamination values exceed acceptable levels, the transport vehicle may not be returned to service until 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 specified in §173.443(a), Table 9 (as shown above).

Provisions for Non-fixed (Removable) Contamination in Closed Rail and Road Vehicles that are used Solely for the Transportation of Radioactive Material

- The contamination levels must not exceed 10 times the levels prescribed in §173.443(a), Table 9 (as shown above).
- Each vehicle shall be stenciled 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.
- 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 offeror 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_2 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 443.

Based on U.S. DOT and NRC regulations in effect as of December 1, 2011.

Contacts: DOT – Rick.Boyle@dot.gov; NRC – John.Cook@nrc.gov

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 & NRC regulations for complete requirements.
NOTE: IAEA, IATA/ICAO, and IMO may require additional hazard communication information.

Shipping Paper Entries

Always Required	Sometimes Required	Optional Entries
Basic description (in sequence): • **UN Identification number** • **Proper Shipping Name** • **Hazard Class (7)** • **Total activity contained in each package in SI units** (e.g. Bq, TBq, etc.), or in both SI and customary units (e.g. Ci, mCi, etc.) with customary units in parentheses following the SI units • **Number and type of packages** Additional description: • **Name of each radionuclide**[1] • **Description of physical and chemical form** (unless special form) • **Category of label** used • **Transport index (TI)** of each package bearing a Yellow-II or Yellow-III label Additional entry requirements: • 24 hour **emergency telephone number** • **Shipper's Certification** shall be provided by each person offering radioactive material for transportation[2] • Proper page numbering (e.g. Page 1 of 4)	Materials-based Requirements: • The criticality safety index (CSI) or "Fissile Excepted" for fissile material • The words "Highway route controlled quantity" or the term "HRCQ" entered in the basic description for highway route controlled quantities • The letters "RQ" entered on the shipping paper either before or after the basic description for each hazardous substance (see §171.8) • Enter applicable subsidiary hazard class(es) in parentheses immediately following the primary hazard class when a subsidiary hazard label is required • A hazardous waste manifest and the word "Waste" preceding the proper shipping name is required for radioactive material that is hazardous waste Package-based Requirements: • The applicable DOE or NRC package approval identification marking for certified Type AF and Type B packages • The International Atomic Energy Agency (IAEA) Certificate of Competent Authority identification marking for export shipment or shipment in a foreign made package Shipment- and Administrative-based Requirements: • Specify "exclusive use shipment" as required • Specify instructions for maintaining exclusive use controls for shipments of LSA material or SCO under exclusive use • Specify the notation "DOT–SP" followed by the special permit number[3] for a special permit shipment	• The weight in grams or kilograms of radionuclides may be inserted instead of activity units for fissile radionuclides, except for Pu-239 and Pu-241 • The weight in grams of Pu-239 and Pu-241 may be inserted in addition to the activity units • The words "RESIDUE: Last Contained * * *" may be included in association with the basic description of the hazardous material last contained in the packaging • Other information is permitted provided it does not confuse or detract from the proper shipping name or other required information

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 §§172.600-606 shall be readily available on the transport vehicle.
- Shipments of limited quantities of radioactive material in excepted packages, under UN2908, 2909, 2910 and 2911, are excepted from shipping paper requirements if (a) the package does not contain fissile material unless excepted by §173.453, and (b) the limited quantity of radioactive material is not a hazardous substance or hazardous waste.
- 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.

[1] 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.

[2] The shipper's certification shall satisfy the requirements of either §§172.204(a)(1) or 204(a)(2); or if transported by air of §172.204(c); but is not required if the shipper is a private carrier and the shipment is not reshipped or transferred from one carrier to another.

[3] Shipments made under an exemption or special permit issued prior to October 1, 2007 may bear the notation "DOT–E" followed by the number assigned.

Based on U.S. DOT and NRC regulations in effect as of December 1, 2011.

Contacts: DOT – Rick.Boyle@dot.gov; NRC – John.Cook@nrc.gov

5. Hazard Communication for Class 7 (Radioactive) Materials: Marking of Packagings: (49 CFR 172, Subpart D; and 49 CFR 178.3 and 178.350)

These are basic reference charts; refer to current U.S. DOT & 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[1]

Markings for Non-bulk Packagings:

- Proper shipping name
- Identification number (preceded by "UN" or "NA," as appropriate)
- Name and address of consignor or consignee, unless the package is:
  - highway only and no motor carrier transfers; or
  - 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

Markings for Bulk Packages:

- Identification number on orange rectangular panel:
  - on each side and each end, if the packaging has a capacity of 3,785 L (1,000 gallons) or more, or
  - on two opposing sides, if the packaging has a capacity of less than 3,785 L (1,000 gallons), or
  - on each side and end of motor vehicle carrying cylinders permanently installed on a tube trailer

Additional Markings Sometimes Required

Package-based marking requirements:

- Gross mass, including the unit of measurement (which may be abbreviated) for each package with gross mass greater than 50 kg (110 lb)
- Package type as appropriate, i.e., "TYPE IP–1," "TYPE IP–2," "TYPE IP–3," "TYPE A," "TYPE B(U)" or "TYPE B(M)"[1]
- Marked with international vehicle registration code of country of origin for IP–1, IP–2, IP–3 or Type A package design [2]
- Radiation (trefoil) symbol[3] on outside of outermost receptacle of each Type B(U) or Type B(M) packaging design

- For NRC or DOE packaging, model number, serial number, gross weight, and package identification number for each certified package (Type AF, Type B(U), Type B(M), Type B(U)F, and Type B(M)F)
- 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.

Materials-based requirements:

- For non-bulk IP-1 package containing a liquid, use underlined double arrow symbol indicating upright orientation[4], where the symbol is placed on two opposite sides of the packaging

- If a hazardous substance in non-bulk package, mark outside of each package with the letters "RQ" in association with the proper shipping name

Administrative-based requirements:

- 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 U.S. Competent Authority Certificate
- Mark "DOT–SP" followed by the special permit number assigned for each package authorized by special permit
- Competent authority identification marking and revalidation for foreign made Type B(U), Type B(M), Type C, Type CF, Type H(U), Type H(M), or fissile material package for which a Competent Authority Certificate is required

Optional Markings

- Both the name and address of consignor and consignee is recommended.
- Other markings on packages such as advertising are permitted, but must be located away from required markings and labeling.

Special Considerations for Marking Requirements

- All markings are to be (a) on the outside of each packaging, (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.

[1] Some exceptions exist as specified in §§172.301(a) and 302(a); and in §§173.421(a), 422(a).

[2] The international vehicle registration code for packages designed by a U.S. company or agency is the symbol "USA."

[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 that conform to the 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.

Based on U.S. DOT and NRC regulations in effect as of December 1, 2011.

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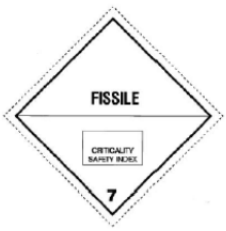
6. Hazard Communications for Class 7 (Radioactive) Materials:
Labeling of Packages (49 CFR 172.400-450)

These are basic reference charts; refer to current U.S. DOT & NRC regulations for complete requirements.
NOTE: IAEA, IATA/ICAO, and IMO may require additional hazard communication information.

Requirements for Labels [1]

- Label each package except for (a) excepted packages containing a limited quantity of radioactive material; and (b) Low Specific Activity (LSA) material and Surface Contaminated Objects (SCO), packaged or unpackaged, when transported domestically and when material or object contains less than an A_2 quantity.
- Labeling is 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) un-obscured by markings or other attachments, and (f) representative of hazardous material content.
- Display duplicate labels on at least two opposite sides or two ends (other than the bottom) of all non-bulk packages of radioactive material except as noted above for excepted packages, and packaged or unpackaged LSA material and SCO.

Radioactive Category Labels [3]			Other Labels [2]	
				
White-I	**Yellow-II**	**Yellow-III**	**Fissile**	**Empty**
Radiation Surface Level (RSL):			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 shipments of empty Class 7 (radioactive) packages satisfying §173.428; and any previously-used labels cannot be visible
mSv/h: **RSL** ≤ 0.005	0.005 < **RSL** ≤ 0.5	0.5 < **RSL** ≤ 2[4]		
mrem/h: **RSL** ≤ 0.5	0.5 < **RSL** ≤ 50	50 < **RSL** ≤ 200[4]		
Transport Index (TI):[4]				
TI = 0[4]	0[4] < **TI** ≤ 1	1 < **TI** ≤ 10[4, 5]		

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 §172.433(g); and, for LSA-I material, the term "LSA-I"; (b) 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.
- Each fissile label must contain the relevant Criticality Safety Index (CSI).

[1] Additional labeling may be required if the radioactive material also meets the definition of one or more other hazard classes. See §§172.402 and 403 for details on label requirements. See §§172.403, 421 and 427 for details when labels are not required, and see §172.407 for details on label design, size, color, form identification, exceptions, etc.

[2] An additional "Cargo Aircraft Only" label is required for each package containing a hazardous material which is authorized for cargo aircraft only.

[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 radiation level 1 m from package surface; see definition for TI in §173.403 for details. If the measured TI is not greater than 0.05, the value may be considered to be zero.

[5] RSLs less than or equal to 10 mSv/h (1000 mrem/h), and TIs more than 10 are allowed for shipments under exclusive-us; see §§172.403(a) – 403(c). In addition; any package containing a Highway Route Controlled Quantity (HRCQ) must bear a YELLOW-III label.

Based on U.S. DOT and NRC regulations in effect as of December 1, 2011.

Contacts: DOT – Rick.Boyle@dot.gov; NRC – John.Cook@nrc.gov

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 & NRC regulations for complete requirements.
NOTE: IAEA, IATA/ICAO, and IMO may require additional hazard communication information.

Conditions when Display of Radioactive Placards is Required [§§172.504, 507(a), 508 and 512(b)(2)]

- On bulk packages, road transport vehicles, rail cars, and freight containers, and on aircraft unit load devices having a capacity of 640 cubic feet or more[1], on each side and each end when they contain either a package with a Radioactive Yellow-III label, or low specific activity (LSA) material or surface contaminated objects (SCO) being transported under exclusive use.
- On a square background on any motor vehicle used to transport a package containing Highway Route Controlled Quantity (HRCQ) Class 7 (radioactive) materials[2].

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[3];
  - 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 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 authorized words or identification number 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 background of contrasting color, or dotted or solid line outer border which contrasts with the background color.

Radioactive Placards

PLACARD (FOR OTHER THAN HRCQ)	PLACARD FOR 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 for detailed requirements]	Square background must consist of a white square surrounded by black border. The placard inside the square is identical to that for other than HRCQ. [see.§172.527 for detailed requirements]

Special Considerations/Exceptions for Placarding

- Placards must conform to the specifications set forth in §172.519.
- A corrosive placard is required for more than 454 kg (1001 pounds) or more gross weight of fissile or low specific activity uranium hexafluoride.

[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 definition of Highway Route Controlled Quantity (HRCQ). A package containing an HRCQ must be labeled with RADIOACTIVE Yellow-III labels; see §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).

Based on U.S. DOT and NRC regulations in effect as of December 1, 2011.

Contacts: DOT – Rick.Boyle@dot.gov; NRC – John.Cook@nrc.gov

8. Requirements/Guidance for Registration, Emergency Response and Action for Class 7 (Radioactive) Materials: (49 CFR 107, Subpart G, 49 CFR 171.15 and 49 CFR 172, Subparts G and H)

These are basic reference charts; refer to current U.S. DOT & 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 ≥ 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 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 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

- Except for a road vehicle used solely for transporting Class 7 (radioactive) material, if radioactive material has been released in a road, rail, or air transport conveyance, the conveyance must be taken out of and remain out of service until the radiation dose rate at every accessible surface is less than 0.005 mSv/h (0.5 mrem/h) and the non-fixed radioactive surface contamination levels are below the values the limits in §173.443(a), Table 9 [see Chart 3].
- 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 [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 offeror (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) and 750(e), and §177.843(b)]

Provisions for Immediate Notification for Reportable Incidents Involving Radioactive Materials (§§171.15 and 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 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 specific or generic 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 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 Emergency Response Guidebook 2008 (ERG2008) is available at the following URL: http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/erg2008_eng.pdf

Based on U.S. DOT and NRC regulations in effect as of December 1, 2011.

Contacts: DOT – Rick.Boyle@dot.gov; NRC – John.Cook@nrc.gov

9. Requirements for Training and Security for Class 7 (Radioactive) Materials: (49 CFR 172, Subparts H and I, and 49 CFR 173)

These are basic reference charts; refer to current U.S. DOT & NRC regulations for complete requirements.

Provisions for Training (49 CFR 172, Subpart H)

- For any person who is employed by an employer or is self-employed, and who directly affects radioactive 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).

Provisions for Security (49 CFR 172, Subpart I and 49 CFR 173)

- 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));
  (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)); 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 en route 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).

Based on U.S. DOT and NRC regulations in effect as of December 1, 2011.

Contacts: DOT – Rick.Boyle@dot.gov; NRC – John.Cook@nrc.gov

Sample 2

HAZARDOUS MATERIAL SHIPPING CERTIFICATION

FOR COMPANY VEHICLE TRANSPORTING IRIDIUM 192 SEALED SOURCES

SHIPPER*	**CONSIGNEE***
EZ Logging, Inc. 1234 Main Street Anywhere, USA 20000	Mo-Rad, Inc. 1234 Main Street Anywhere, USA 20000

DATE*		**S.I. UNITS (CURIES)**	**TRANSPORT* INDEX** (mSv/hr @ 1meter) (Mr/hR @ 3.3 ft)	**CERTIFYING* SIGNATURE**
35915	EZ Logging Pipe Services 4321 Broad Street Somewhere, USA			

DESCRIPTION OF PIECES AND CONTENTS

RQ RADIOACTIVE MATERIAL - SPECIAL FORM N.O.S. - UN 2974 - CLASS 7
YELLOW LABEL II - TRANSPORT INDEX NOT TO EXCEED 1.0
YELLOW LABEL II - TRANSPORT INDEX NOT TO EXCEED 10.0

LIQUID/GAS/SOLID (RQ RADIOACTIVE MATERIAL - N.O.S.7) □ UN 2982	SPECIAL FORM □ UN 2974	RADIOACTIVE MATERIAL EXCEPTED PACKAGE - LIMITED QUANTITY □ UN 2910

This is to certify that the above named materials are properly classified, described, packaged, marked, labeled and are in proper condition for transportation according to the applicable regulations of the DEPARTMENT OF TRANSPORTATION. (See certifying signature above)

* Substitute appropriate information for your device and shipment.

APPENDIX O

MODEL WASTE MANAGEMENT PROCEDURES

APPENDIX O MODEL WASTE MANAGEMENT PROCEDURES

Model Waste Disposal Program

General Guidelines

A. All radioactivity labels must be defaced or removed from containers and packages prior to disposal. If nonradioactive waste is compacted, all radioactivity labels that are visible in the compacted mass must be defaced or removed.

B. Remind workers that non-radioactive waste should not be mixed with radioactive waste.

C. Procedures and associated activities should be reviewed periodically 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 operating and emergency procedures.

D. Evaluate the entire impact 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.

E. 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.

Model Procedure for Disposal by Decay-in-Storage (DIS)

A. Only short-lived waste (physical half-life of less than or equal to 120 days) shall be disposed of by DIS.

B. Short-lived waste shall be segregated from long-lived waste (half-life greater than 120 days) at the source.

C. Waste shall be stored in suitable containers, labeled in accordance with 10 CFR 20.1904, “Labeling containers,” and the containers shall be adequately shielded.

D. Liquid and solid wastes must be stored separately.

E. When the waste container is full, it shall be sealed. The sealed container shall be identified with a label affixed or attached to it.

F. In addition to the labeling requirements in 10 CFR 20.1904, the container shall be identified with the date the container was sealed, the longest-lived radionuclide in the container, date when ten half-lives of the longest-lived radionuclide will have transpired, and the initials of the individual who sealed the container. The container may be transferred to the DIS area.

G. The contents of the container shall be allowed to decay for at least 10 half-lives of the longest-lived radionuclide in the container. The decay interval beginning at the time the radioactive waste container is sealed and placed in storage for DIS shall be used for calculations and projected removal times.

H. Prior to disposal as ordinary trash, each container shall be monitored as follows:

1. Check the radiation detection survey meter for proper operation.

2. Survey the contents of each container in a low background area.

3. Remove any shielding from around the container.

4. Monitor all surfaces of the container.

5. 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.

6. If the surveys indicate residual radioactivity, return the container to DIS area and contact the RSO for further instructions.

I. If the surveys indicate no residual radioactivity, record the date when the container was sealed, the disposal date, type of waste (used or unused material, gloves, etc.), survey instrument used, and the initials of the individual performing surveys and disposing of the waste.

Model Procedure for Disposal of Liquids into Sanitary Sewerage

A. Confirm that the liquid radioactive waste containing radioactive material being discharged is soluble or readily dispersible in water.

B. Calculate the amount of each radionuclide that can be discharged by using the information from prior, similar discharges and the information in 10 CFR 20, “Standards for Protection against Radiation,” Appendix B.

C. Make sure that the amount of each radionuclide does not exceed the monthly and annual discharge limits specified in 10 CFR 20.2003, “Disposal by Release into Sanitary Sewerage,” and 10 CFR 20, Appendix B.

D. Record the date, radionuclide(s), estimated activity of each radionuclide, location where the material is discharged, and the initials of the individual discharging the radioactive waste.

E. Liquid radioactive waste must be discharged only via designated locations.

F. Discharge radioactive liquid waste slowly with water running from the faucet to dilute it.

G. Survey the designated disposal locations and surrounding work surfaces to confirm that no residual material or contamination remains.

H. Prior to leaving the area, decontaminate all areas or surfaces, if found to be contaminated.

I. Maintain disposal records that identify each radionuclide and its quantity and the concentration that is released into the sanitary sewer system.

APPENDIX P

ACTIONS TO BE TAKEN IF A SEALED SOURCE IS RUPTURED OR IF LICENSED MATERIALS HAVE CAUSED CONTAMINATION

APPENDIX P 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.

Your procedures 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) — 301-816-5100. Collect calls are accepted.

APPENDIX Q

MODEL DELEGATION OF AUTHORITY

APPENDIX Q 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 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 R

INTERIM STAFF GUIDANCE ON CONSTRUCTION

APPENDIX R INTERIM STAFF GUIDANCE ON CONSTRUCTION

INTERIM STAFF GUIDANCE TO NUREG-1556 AND NUREG-1520: COMMENCEMENT OF CONSTRUCTION AT EXISTING AND PROPOSED SOURCE, BYPRODUCT, AND SPECIAL NUCLEAR MATERIAL FACILITIES AND IRRADIATORS WITH SIGNIFICANT ENVIRONMENTAL IMPACTS

PURPOSE AND SCOPE

This Interim Staff Guidance (ISG) provides guidance to U.S. Nuclear Regulatory Commission (NRC) staff on the new definition of construction and the consideration of activities that can be performed by materials license applicants and potential applicants (hereinafter collectively referred to as "applicants"), and licensees before the NRC staff has concluded its environmental review of the proposed licensing action.

This ISG applies to the review of licensing actions related to the receipt and possession of licensable source, byproduct, and special nuclear material (SNM) for the conduct of any activity which the NRC determines will significantly affect the quality of the environment. This ISG is intended to provide guidance to NRC staff but may also be instructive to all holders of operating licenses for source, byproduct, and SNM facilities and irradiators, and all persons that have submitted applications to construct source, byproduct, and SNM facilities or irradiators, or have submitted letters of intent to submit such applications under Title 10 of the *Code of Federal Regulatio*ns (10 CFR) Parts 30, 36, 40, and 70.

This ISG applies to all Part 30, 36, 40 and 70 materials facilities other than uranium recovery facilities. Site preparation activities at uranium recovery facilities are addressed in Regulatory Issue Summary 2009-12, Uranium Recovery Policy Regarding Site Preparation Activities at Proposed, Unlicensed Uranium Recovery Facilities, September 23, 2009, ML092090353.

If a licensing action initiated pursuant to 10 CFR Parts 30, 40, or 70 meets any of the criteria in 10 CFR 51.20 or 51.21, then commencement of construction of a facility before the NRC staff has completed its environmental review process is grounds for denial of the license application, in accordance with 10 CFR 30.33(a)(5), 40.32(e), and 70.23(a)(7). However, if the licensing action meets the criteria in 10 CFR 51.22(c) for a categorical exclusion, and the NRC has not determined that an environmental assessment or an environmental impact statement is required in accordance with 10 CFR 51.22(b), then commencement of construction before the NRC staff concludes the environmental process should not be the sole basis for denial of the license application, as the NRC has already determined that this category of actions does not have a significant impact on the environment. In accordance with 10 CFR 36.15, commencement of construction of an irradiator will only be grounds for denial if the licensee or applicant has not submitted both an application and the requisite licensing fee.

BACKGROUND

The NRC amended its regulations in September 2011, by revising certain provisions applicable to the licensing and approval processes for byproduct, source and SNMs licenses, and irradiators in the final rule, "Licenses, Certifications, and Approvals for Materials Licensees" (76 FR 56951; September 15, 2011) (Material Licenses Construction Rule). The revisions contained in the Material Licenses Construction Rule revised the definitions of "construction" and "commencement of construction" with respect to materials licensing actions conducted

under the NRC's regulations. The NRC adopted these changes to further improve the effectiveness and efficiency of the licensing and approval processes for future materials license applications, as well as to eliminate certain inconsistencies that existed within the NRC's regulations with respect to the use and definition of the terms “construction” or “commencement of construction” for certain materials licensees for purposes of its environmental reviews.

The new definitions of “commencement of construction” in 10 CFR 30.4, 36.2, 40.4, and 70.4 are identical.

Commencement of construction means taking any action defined as “construction” or any other activity at the site of a facility subject to the regulations in this part that has a reasonable nexus to:

1. Radiological health and safety; or
2. Common defense and security.

In 10 CFR 150.31, *commencement of construction* means taking any action defined as “construction” or any other activity at the site of a facility subject to the regulations in this part that has a reasonable nexus to radiological health and safety. The regulations in 10 CFR 150.31 address the requirement for Agreement State regulation of byproduct material. Although Agreement State licensees may find this ISG informative, they should also communicate with the pertinent Agreement State agency for that agency’s applicable requirements and guidance.

The new definitions of “construction” in 10 CFR 30.4, 36.2, and 70.4 are also identical.

Construction means the installation of foundations, or in-place assembly, erection, fabrication, or testing for any structure, system, or component of a facility or activity subject to the regulations in this part that are related to radiological safety or security. The term “construction” does not include:

(1) Changes for temporary use of the land for public recreational purposes;
(2) Site exploration, including necessary borings to determine foundation conditions or other preconstruction monitoring to establish background information related to the suitability of the site, the environmental impacts of construction or operation, or the protection of environmental values;
(3) Preparation of the site for construction of the facility, including clearing of the site, grading, installation of drainage, erosion and other environmental mitigation measures, and construction of temporary roads and borrow areas;
(4) Erection of fences and other access control measures that are not related to the safe use of, or security of, radiological materials subject to this part;
(5) Excavation;
(6) Erection of support buildings (e.g., construction equipment storage sheds, warehouse and shop facilities, utilities, concrete mixing plants, docking and unloading facilities, and office buildings) for use in connection with the construction of the facility;
(7) Building of service facilities (e.g., paved roads, parking lots, railroad spurs, exterior utility and lighting systems, potable water systems, sanitary sewerage treatment facilities, and transmission lines);
(8) Procurement or fabrication of components or portions of the proposed facility occurring at other than the final, in-place location at the facility; or
(9) Taking any other action that has no reasonable nexus to:
    (i) Radiological health and safety, or
    (ii) Common defense and security.

"Construction," as defined in 10 CFR 40.4, also includes the installation of wells associated with radiological operations (e.g., production, injection, or monitoring well networks associated with in-situ recovery or other facilities).

The Atomic Energy Act of 1954, as amended, expressly limits the NRC's regulatory authority to matters concerning the radiological public health and safety or common defense and security and non-radiological hazards to the extent such hazards result from the actual processing of by-product material. The NRC has determined that this authority does not extend to site preparation activities that do not have a nexus to radiological health and safety or common defense and security.

This guidance provides criteria for NRC staff to use in evaluating whether a particular construction activity has a nexus to radiological health and safety, and thus falls under the jurisdiction of the NRC for licensing purposes. An activity or action has a reasonable nexus to radiological health and safety or the common defense and security if that activity or action has a rational, direct link to ensuring that a materials facility is operating, or will operate, in accordance with the NRC's regulations and in a manner that protects the public health and safety or the common defense and security from radiological hazards. The revised definition of construction in 10 CFR 30.4, 36.2, 40.4, 70.4, and 150.31 list activities that are not considered "construction." This guidance provides examples of activities that fall under each of the excepted activities that do not constitute construction. This guidance addresses some important considerations for materials licensees and applicants that were emphasized in the response to comments on the proposed Material Licenses Construction Rule. For example, site preparation activities that are not considered "construction," while not under NRC jurisdiction may be subject to the regulatory authority of another Federal, State, or local agency which may require National Environmental Policy Act or state environmental review. NRC's responsibilities under the National Historic Preservation Act of 1966, as amended (NHPA), must also be satisfied before a license is issued. Specifically, as noted in the SOC to the final Material Licenses Construction Rule, under certain circumstances the NRC may be required to deny a license application if the NRC determines that the applicant intentionally significantly adversely affected, or allowed to be affected, a historic property with intent to avoid the requirements of §106 of the NHPA.

DISCUSSION OF EXAMPLES

In addition to the background discussion provided above, the following examples clarify the delineation of site preparation activities and construction activities. It is important to recognize that the NRC may have regulatory authority over activities that can occur before construction begins, such as procurement of basic components as defined in 10 CFR Part 21, the process of dedicating commercial grade items or basic components, or procurement of items relied on

for safety (IROFS) as defined in 10 CFR Part 70. It should also be noted that, while site preparation activities may not require prior NRC approval, various local, State, or other Federal permits may be required.

<u>BYPRODUCT MATERIAL (10 CFR PART 30)</u>

Prior to the conclusion of the environmental review process, applicants for byproduct material licenses or license amendments should not perform construction activities that have a nexus to radiological health and safety or the common defense and security. An activity or action has a

reasonable nexus to radiological health and safety or the common defense and security if that activity or action has a rational, direct link to ensuring that a licensed materials facility is operating, or will operate, in accordance with the NRC's regulations and in a manner that

protects the public health and safety or the common defense and security from radiological hazards.

Installation of foundations or in-place assembly, erection, fabrication, or testing for any structure, system, or component of a facility or activity subject to 10 CFR Part 30 that are related to radiological health and safety or common defense and security should not be performed prior to the conclusion of the environmental review of a license application or amendment. Byproduct material license applicants subject to 10 CFR Part 30 may perform those site preparation activities identified in revised 10 CFR 30.4 before the NRC has completed its environmental review of the license application.

Excavation and other site preparation activities that do not have a reasonable nexus to radiological public health and safety or common defense and security, whether permanent or temporary, are not "construction" activities. For example, piles driven to support the erection of a bridge for a temporary or permanent access road to a new facility would not be considered as construction and may be performed prior to the NRC staff concluding its environmental review of a proposed action.

The installation of a temporary feature within an excavation for a building in which materials license activities will be conducted and that will be removed during construction is a site preparation activity. Such features include retaining walls, dewatering systems, ramps, and other structures that will have no physical presence following construction.

Construction includes installation of the foundation, including soil compaction; the installation of permanent drainage systems and geofabric; the placement of backfill, concrete (e.g., mudmats), or other materials that will not be removed before placement of the foundation of a structure; the placement and compaction of a subbase; the installation of reinforcing bars to be incorporated into the foundation of the structure; the erection of concrete forms for the foundations that will remain in place permanently (even if nonstructural); and the placement of concrete or other material constituting the foundation of any safety-related feature.

The term "permanent" in this context includes anything that will exist in its final, in-place facility location after commencement of operations with licensed material. Construction also includes the "onsite, in-place" fabrication, erection, integration, or testing activities for any in-scope

safety-related equipment. The terms "onsite, in place, fabrication, erection, integration, or testing" describe the process of constructing a facility in its final, onsite plant location, where components or modules are integrated into the final, in-plant location. The fabrication, assembly, and testing of components and modules in a shop building, warehouse, or laydown area, even if located onsite, is not construction. However, the installation or integration of the safety-related equipment into its final plant location is construction.

Construction also includes driving piles for safety-related equipment. Hence, an applicant must obtain a license before driving piles for safety-related equipment. However, driving piles that do not ensure the structural stability or integrity of a safety-related structure (e.g., piles driven to support the erection of a bridge for a temporary or permanent access road) is not construction;

therefore, those piles may be driven prior to the NRC staff concluding its environmental review of a proposed action.

IRRADIATORS (10 CFR PART 36)

An applicant for a new irradiator license under 10 CFR Part 36 may perform the non-construction activities identified in revised 10 CFR 36.2 at any time. However, installation of foundations or in-place assembly, erection, fabrication, or testing for any structure, system, or component of a facility or activity subject to 10 CFR Part 36 that have a reasonable nexus to radiological safety or security should not be performed prior to the submission of an application for a license and the fee required by 10 CFR 170.31. An activity or action has a reasonable nexus to radiological health and safety or the common defense and security if that activity or action has a rational, direct link to ensuring that a licensed materials facility is operating, or will operate, in accordance with the NRC's regulations and in a manner that protects the public health and safety or the common defense and security from radiological hazards. Activities that have a reasonable nexus to radiological health and safety or common defense and security include, but are not limited to, construction of systems subject to 10 CFR Part 36, Subpart C, and the following:

- Earthwork
- Pool excavation
- Footings and foundation for pool
- Irradiator foundations and walls
- Backfill pool
- Install pool liner
- Mechanical rough-in
- Electrical rough-in
- Shoring for roof
- Form and place roof
- Slab on grade

Subpart C of 10 CFR Part 36 currently lists the systems that have a nexus to radiological health and safety and defines the related engineering and safety concerns associated with each system:

- Access Control: Adequacy of access control systems using interlocks and radiation monitors to prevent inadvertent entry to areas where radiation sources are unshielded; to provide emergency exits; and to ensure compliance with all the requirements of 10 CFR 36.23. For computer-controlled access-control systems, licensing staff should consider expert evaluation of the software/system logic before operational testing.
- Site: Potential need for protection against flooding and earth slides.
- Base (soil, rock) for the Pool and Shielding Structures: Strength, settlement, liquefaction, ground water, soil compaction.
- Footers and Foundations for the Pool and Shielding Structures: Strength and reinforcement, alignment with pool and shielding structures.
- Pool and Shielding Structures: Strength and reinforcement, proper density of shielding materials, correct dimensions, minimization of voids in concrete or other shielding.
- Pool Liner: Contact with pool structure, penetrations in the liner, leak-tight welds.

- Pool Plumbing: Makeup water system; water cleanup system; effect of construction materials on pool-water chemistry; drainage system (potentially contaminated spilled water should flow into the pool); siphon breakers; radiation detection and alarm systems.
- Penetrations Through Shielding: Any significant effect on structural strength, shielding, or both.
- Source Rack Protection: If the product to be irradiated moves on a product conveyor system, the source rack and the mechanism that moves the rack must be protected by a barrier or guides to prevent products and product carriers from hitting or touching the rack or mechanism.
- Source-Rack Mechanical Positioning System: Strength and stiffness of the rack and positioning cables or chains, source shroud will not interfere with source positioning, adequacy of motive power, potential for jamming.
- Source-Rack Movement and Position-Sensing System: Structural attachments for electrical and mechanical transducers, adequacy of transducers for interacting with the source-rack control system.
- Source-Rack Electrical Control System: Adequacy of the design of logistical and operational electrical circuitry and electromechanical components, to ensure unambiguous response of the system, which includes programmable controllers or computers and their interaction with operations, interlocks, doors, signals, and alarms.
- Source-Leak Detection: Adequacy of systems for detecting and isolating leaking sources.
- Hard Wiring: Adequacy of wire gauge and insulation to safely carry design currents and to withstand radiation and ozone damage if exposed; locating and attaching wiring to prevent fretting, wear, and exposure to potential fire hazards; accessibility to wiring for inspection and repair.
- Uninterruptable Electrical Power Supply: Adequate and reliable power capability to operate all electrical systems that are important to safety (including backup power sources); compatibility of the power supply with the electrical system.
- Fire Protection System: Adequacy to detect fire and smoke and to be manually as well as automatically initiated; must ensure that raised sources are immediately lowered into the pool.
- Emergency Systems for Returning an Up-stuck Source Rack to the Pool: Capability of the electrical control system to sense and signal the occurrence of an up-stuck source-rack; adequacy of mechanical or electrical means for personnel to safely release and lower the rack; need for, and adequacy of, a system to cool the source-rack until it can be released and lowered.
- Ozone Ventilation System: Capability of the system to be properly initiated and to provide adequate volume flow rate of air to protect personnel and components.
- System for Transferring Sources from and to Transport Vehicles: Adequately sized openings in the shield-structure roof if sources are roof-loaded; structural adequacy of the roof-shield plug and its supports for its removal and replacement; structural and mechanical adequacy of systems for moving shipping containers into and out of the pool area.

URANIUM CONVERSION FACILITIES, ENRICHMENT FACILITIES, FUEL FABRICATION FACILITIES, AND URANIUM HEXAFLUORIDE (UF_6) DECONVERSION FACILITIES (10 CFR PART 40 and 10 CFR PART 70)

If any of the following actions are performed before the NRC staff has completed its environmental review process, then the NRC has grounds for denial of a license application, in accordance with 10 CFR 40.32(e), and 70.23(a)(7):

1. Procurement or construction of engineered items that are items relied on for safety (IROFS) required to meet the performance requirements of 10 CFR 70.61.
2. Construction of guard stations, fences, vehicle barriers, or other features that are, or will become, components of physical security systems required by regulations or orders.
3. Construction or installation of equipment whose purpose is the detection of radioactive material accidents or mitigation of the consequences of radioactive material accidents.
4. Installation of storage tanks that contain chemicals that could affect the safety of licensed material.
5. Construction of facilities or warehouses that will be used for operations involving licensed material.
6. Driving of piles; subsurface preparation; placement of backfill, concrete, or permanent retaining walls within an excavation; installation of foundations; or in-place assembly, erection, fabrication, or testing, which are for IROFS and on-site emergency facilities.
7. Erection of buildings, offices, construction trailers and warehouses that will become part of a Standard Practice Procedures Plan for Protection of Classified Information.

Construction includes the onsite, in-place fabrication, erection, integration, or testing activities for any safety related item. The terms “onsite, in place, fabrication, erection, integration, or testing” describe the process of constructing a fuel cycle facility in its final, onsite plant location, where components or modules are integrated into the final, in-plant location. Under the definition of “construction” applicants and existing licensees may be able to fabricate, assemble, and test components and modules in a shop building, warehouse, or laydown area, even if these facilities are located onsite. However, the installation or integration of that safety related equipment into its final plant location is a construction activity and should not be performed until after the NRC staff concludes its environmental review of the license application.

Excavation includes the removal of any soil, rock, gravel, or other material below the final ground elevation to the final parent material, and may be conducted prior to the conclusion of the NRC staff’s environmental review. However, placing permanent, nonstructural dewatering materials, mudmats, or engineered backfill in advance of placing the foundation and associated permanent retaining walls for buildings or structures that will contain licensed materials are construction activities and should not be performed prior to the conclusion of the NRC staff’s environmental review.

Construction includes driving piles for buildings or structures that will contain licensed materials. Hence the driving of piles for such buildings or structures should not be performed before the NRC staff concludes its environmental review. Driving piles that do not ensure the structural stability or integrity of buildings or structures within the scope of the definition of “construction” (e.g., piles driven to support the erection of a bridge for a temporary or permanent access road) is not “construction”; therefore, those piles may be driven prior to the conclusion of the NRC staff’s environmental review.

In addition to 10 CFR 40.4, 51.4, and 70.4 criteria that are used to determine the scope of activities that fall within the definition of construction, construction includes the necessary excavation for safety related items. A necessary excavation is the portion of an excavation that provides sufficient construction access to the structures that are within the definition of construction. Applicants should ensure, and NRC staff will confirm, that these construction activities are separate from, and do not result in, adverse interactions with construction-related safety related item including influence on the stability (static and dynamic) analyses.

Construction includes any change made to the parent material in which the excavation occurs (e.g., soil compaction, rock grouting); the driving of piles; the installation of foundations; the installation of permanent drainage systems and geofabric; the placement of backfill, concrete (e.g., mudmats) or other materials that will not be removed before placement of the foundation of a structure; the placement and compaction of a subbase; and the installation of reinforcing bars to be incorporated into the foundation of any safety related items that fall within the definition of construction. The foregoing items fall within the definition of construction because they have a rational, direct link to ensuring that a licensed materials facility is operating, or will operate, in accordance with the NRC's regulations and in a manner that protects the public health and safety from radiological hazards.

ACTIVITIES WHICH HAVE NO REASONABLE NEXUS TO RADIOLOGICAL SAFETY OR SECURITY

The NRC has determined that, in general, the following activities at source, byproduct, and SNM facilities and irradiators listed in 10 CFR 30.4, 36.2, 40.4, and 70.4, do not have a reasonable nexus to radiological health and safety and the common defense and security may be performed by a licensee or applicant at any time. Note that in some circumstances, based on the specific licensing proposal, any of these activities could be determined to have a reasonable nexus to radiological health and safety or common defense and security and, based on that determination, these activities would be construction:

(1) Changes for temporary use of the land for public recreational purposes;
(2) Site exploration, including necessary borings to determine foundation conditions or other preconstruction monitoring to establish background information related to the suitability of the site, the environmental impacts of construction or operation, or the protection of environmental values;
(3) Preparation of the site for construction of the facility, including clearing of the site, grading, installation of drainage, erosion and other environmental mitigation measures, and construction of temporary roads and borrow areas;
(4) Erection of fences and other access control measures that are not related to the safe use of, or security of, radiological materials subject to 10 CFR Parts 30, 36, 40, or 70;
(5) Excavation;
(6) Erection of support buildings (e.g., construction equipment storage sheds, warehouse and shop facilities, utilities, concrete mixing plants, docking and unloading facilities, and office buildings) for use in connection with the construction of the facility;
(7) Building of service facilities (e.g., paved roads, parking lots, railroad spurs, exterior utility and lighting systems, potable water systems, sanitary sewerage treatment facilities, and transmission lines);
(8) Procurement or fabrication of components or portions of the proposed facility occurring at other than the final, in-place location at the facility; or

(9) Taking any other action that has no reasonable nexus to:
    (i) Radiological health and safety, or
    (ii) Common defense and security.

While the above site preparation activities may not require prior NRC approval, other Federal, State, or Local permits may be required.

FINAL RESOLUTION

This interim staff guidance will be incorporated into the next revisions of NUREG-1556, and NUREG-1520.

APPLICABILITY

This ISG is applicable to all 10 CFR Parts 30, 36, 40, and 70 license applicants and existing licensees considering site preparation activities or construction activities at a facility that is subject to, or will be subject to, the licensing requirements of these parts.

REFERENCES

1) NUREG-1556, Volume 6, "Consolidated Guidance About Material Facilities: Program-Specific Guidance About 10 CFR Part 36 Irradiator Licenses," January 1999.
2) NUREG-1556, Volume 12, "Consolidated Guidance About Materials Licenses: Program Specific Guidance About Possession Licenses for Manufacturing and Distribution," December 2000.
3) NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," Revision 1, May 2010.
4) Regulatory Issue Summary 2009-12, Uranium Recovery Policy Regarding Site Preparation Activities at Proposed, Unlicensed Uranium Recovery Facilities, September 23, 2009, ML092090353.
5) NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with Materials Facilities," August 2003.
6) DC/COL-ISG-4, "Interim Staff Guidance on the Definition of Construction and on Limited Work Authorizations," February 9, 2009, ML082970729.
7) Inspection Manual Chapter 2815, "Construction and Preoperational Inspection of Panoramic Wet-Source-Storage Gamma Irradiators," March 27, 2001, ML010990225.
8) Docket No. 030-36974, Final Environmental Assessment Related to the Proposed Pa'ina Hawaii, LLC, Underwater Irradiator in Honolulu, Hawaii; August 10, 2007; ML071150121.
9) Docket No. 70-7015, Environmental Assessment for an Exemption to 10 CFR Parts 30, 40, and 70, Commencement of Construction Requirements, Areva Enrichment Services, Eagle Rock Enrichment Facility, Bonneville County, Idaho, February 28, 2010, ML093220528.
10) NUREG-1811, "Environmental Impact Statement for an Early Site Permit at the North Anna ESP Site," December 2006.
11) NUREG-1947, "Final Supplemental Environmental Impact Statement for Combined License (COLs) for Vogtle Electric Generating Plant Unit 3 and 4," March 2011.

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APPENDIX S

SAFETY CULTURE STATEMENT OF POLICY

APPENDIX S 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: http://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.

NRC FORM 335
(12-2010)
NRCMD 3.7

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER
(Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)
NUREG-1556, Volume 14, Revision 1
DRAFT

2. TITLE AND SUBTITLE
Consolidated Guidance about Materials Licenses: Program Specific Guidance about Well Logging, Tracer, and Field Flood Study Licenses (NUREG-1556, Volume 14, Revision 1) - Draft Report for Comment

3. DATE REPORT PUBLISHED

MONTH	YEAR
May	2014

4. FIN OR GRANT NUMBER

5. AUTHOR(S)
Kenneth Lambert, Steve Mack, Roberto J. Torres, Scott Wilson

6. TYPE OF REPORT
Technical

7. PERIOD COVERED (Inclusive Dates)
June 2000 to March 2014

8. PERFORMING ORGANIZATION - NAME AND ADDRESS (If NRC, provide Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)
Division of Materials Safety and State Agreements
Office of Federal and State Materials and Environmental Management Programs
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS (If NRC, type "Same as above", if contractor, provide NRC Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address.)
Same as above

10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)
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.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)
NUREG-1556
Volume 14
Well Logging
Well Loggers
Tracer
Field Flood Study

13. AVAILABILITY STATEMENT
unlimited

14. SECURITY CLASSIFICATION
(This Page)
unclassified
(This Report)
unclassified

15. NUMBER OF PAGES

16. PRICE

Federal Recycling Program

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

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