

Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses (NUREG SR1556, Vol. 14)

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Abstract

As part of its redesign of the materials licensing process, NRC is consolidating and updating numerous guidance documents into a single comprehensive repository as described in NUREG-1539, "Methodology and Findings of the NRC's Materials Licensing Process Redesign," dated April 1996, and draft NUREG-1541, "Process and Design for Consolidating and Updating Materials Licensing Guidance," dated April 1996. NUREG-1556, Vol. 14, "Consolidated Guidance about Materials Licenses: Program-Specific Guidance about Well Logging, Tracer, and Field Flood Study Licenses," dated June 2000, is the fourteenth program-specific guidance document developed for the new process and is intended for use by applicants, licensees, and NRC staff, and will also be available to Agreement States. This document combines and updates the guidance found in Draft Regulatory Guide, "Guide for the Preparation of Applications for the Use of Radioactive Materials in Well Logging Operations," dated July 1987. This report takes a more risk-informed, performance-based approach to licensing of well logging, tracer, and field flood study operations, and it reduces the information (amount and level of detail) needed to support an application for these activities.

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Foreword

The United States Nuclear Regulatory Commission (NRC) is using Business Process Redesign (BPR) techniques to redesign its materials licensing process. This effort is described in NUREG-1539, "Methodology and Findings of the NRC's Materials Licensing Process

Redesign,” dated April 1996. A critical element of the new process is consolidating and updating numerous guidance documents into a NUREG series of reports. Below is a list of volumes currently included in the NUREG-1556 series:

Vol. No.	Volume Title	Status
1	Program-Specific Guidance About Portable Gauge Licenses	Final Report
2	Program-Specific Guidance About Industrial Radiography Licenses	Final Report
3	Applications for Sealed Source and Device Evaluation and Registration	Final Report
4	Program-Specific Guidance About Fixed Gauge Licenses	Final Report
5	Program-Specific Guidance About Self-Shielded Irradiator Licenses	Final Report
6	Program-Specific Guidance About 10 CFR Part 36 Irradiator Licenses	Final Report
7	Program-Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope	Final Report
8	Program-Specific Guidance About Exempt Distribution Licenses	Final Report
9	Program-Specific Guidance About Medical Use Licenses	Draft for Comment
10	Program-Specific Guidance About Master Materials Licenses	Draft for Comment
11	Program-Specific Guidance About Licenses of Broad Scope	Final Report
13	Program-Specific Guidance About Commercial Radiopharmacy Licenses	Final Report
14	Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses	Final Report

Vol. No.	Volume Title	Status
15	Guidance About Changes of Control and About Bankruptcy Involving Byproduct, Source, or Special Nuclear Materials Licenses	Draft for Comment
16	Program-Specific Guidance About Licenses Authorizing Distribution to General Licensees	Draft for Comment
17	Program-Specific Guidance About Licenses for Special Nuclear Material of Less Than Critical Mass	Draft for Comment
18	Program-Specific Guidance About Service Provider Licenses	Draft for Comment
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)	Draft for Comment
20	Guidance About Administrative Licensing Procedures	Draft for Comment

The current document, NUREG-1556, Vol. 14, "Consolidated Guidance about Materials Licenses: Program-Specific Guidance about Well Logging, Tracer, and Field Flood Study Licenses," dated June 2000, is the fourteenth program-specific guidance document developed for the new process. It is intended for use by applicants, licensees, NRC license reviewers, and other NRC personnel. It combines and updates the guidance for applicants and licensees previously found in a working draft of a "Guide for the Preparation of Applications for the Use of Radioactive Materials in Well Logging Operations," dated July 1987. In addition, this report also contains pertinent information found in NUREG Reports, Regulations, Guides, Policy and Guidance Directories, Information Notices, and other documents as listed in Appendix A.

This report takes a risk-informed, performance-based approach to licensing well logging, tracer,

and field flood study applications. It reduces the amount of information needed from an applicant seeking to possess and use radioactive materials in these applications.

A team composed of NRC staff from Headquarters, the Regional Offices, and Agreement State representatives from Louisiana and Texas drafted 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. A representative of NRC's Office of the General Counsel provided a legal perspective.

This document presents a step in the transition from the current paper-based process to the new electronic process. It is available on the Internet at the following address:

<<http://www.nrc.gov/NRC/NUREGS/SR1556/V14/index.html>>.

This document is not a substitute for NRC regulations, and compliance is not required. The approaches and methods described in this report are provided for information only. Methods and solutions different from those described in this report will be acceptable if they provide a basis for the staff to make the determination needed to issue or continue a license.

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Abbreviations

ALARA	as low as is reasonably achievable
ALI	Annual Limit on Intakes
ANSI	American National Standards Institute
bkg	background
BPR	business process redesign
Bq	becquerel
CDE	committed dose equivalent
CEDE	committed effective dose equivalent
CFR	Code of Federal Regulations
C/kg	coulombs/kilogram
cpm	counts per minute
DFP	Decommissioning Funding Plan
DIS	decay-in-storage
DOE	United States Department of Energy
DOT	United States Department of Transportation
dpm	disintegrations per minute
DTS	drill-to-stop
EA	environmental assessment
ECS	energy compensation source
EDE	effective dose equivalent
EPA	United States Environmental Protection Agency
F/A	financial assurance
FDA	United States Food and Drug Administration
FR	Federal Register
G-M	Geiger-Mueller
GBq	gigabecquerel
GPO	Government Printing Office
IN	Information Notice
LLW	low level waste
LSA	low specific activity

ALARA	as low as is reasonably achievable
LWD	logging while drilling
MBq	megabecquerel
MC	Manual Chapter
mGy	milligray
mR	milliroentgen
mrem	millirem
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
NORM	naturally-occurring radioactive material
NRC	United States Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
OCFO	Office of the Chief Financial Officer
OCR	optical character reader
OGC	Office of the General Counsel
OMB	Office of Management and Budget
OSP	Office of State Programs
OSL	optically stimulated luminescence
QA	quality assurance
R	roentgen
RES	Office of Nuclear Regulatory Research
RG	Regulatory Guide
RQ	reportable quantities
RSO	radiation safety officer
SDE	shallow dose equivalent
SI	International System of Units (abbreviated SI from the French Le Systeme Internationale d'Unites)
SSD	sealed source and device
std	standard

ALARA	as low as is reasonably achievable
Sv	sievert
T1/2	Half-life
TAR	technical assistance request
TEDE	total effective dose equivalent
TI	transportation index
TLD	thermoluminescent dosimeters
USASI	United States of America Standards Institute
USC	United States Code
USDA	United States Department of Agriculture

1 Purpose of Report

Byproduct material, as defined in 10 CFR 30.4, depleted uranium, as defined in 10 CFR 40.4, and special nuclear material, as defined in 10 CFR 70.4, 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 NRC criteria for evaluating the corresponding license application. It identifies the information needed to complete NRC Form 313 (Appendix B), Application for Material License, 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, 3150-014, 3150-35, 3150-0130, 3150-0017, 3150-0001, 3150-0130, 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 judge the adequacy of the applicant's response
- Discussion - provides additional information on the topic sufficient to meet the needs of most readers, and

- Response from Applicant - provides suggested response(s), 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.

NRC Form 313 does not have sufficient space for applicants to provide full responses to Items 5 through 11; as indicated on the form, the answers to those items are to be provided on separate sheets of paper and submitted with the completed NRC Form 313. For the convenience of applicants and for streamlined handling of applications for well logging, tracer, or field flood study licenses, use Appendix C to provide supporting information, attach it to NRC Form 313, and submit it to NRC.

Appendix D is a checklist that NRC staff use to review applications and that applicants can use to check for completeness. Appendix E is a sample well logging license, containing the conditions most often found on these licenses, although not all licenses will have all conditions. Appendices F through V contain additional information on various radiation safety topics.

Appendix F provides specific guidance for licensing field flood activities.

In this document, “dose” or “radiation absorbed dose” includes: dose equivalent; effective dose equivalent (EDE); committed dose equivalent (CDE); committed effective dose equivalent (CEDE); or total effective dose equivalent (TEDE). These terms are defined in 10 CFR Part 20. Rem, and its SI [Système International-(international units)] equivalent Sievert [1 rem = 0.01 Sievert (Sv)], is used to describe units of radiation exposure or dose.

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, or special nuclear materials used or possessed within their borders. Any applicant, other than a Federal Agency, who wishes to possess or use licensed material in one of these Agreement States needs to contact the responsible officials in that State for guidance on preparing an application; file these applications with State officials, not with the NRC.

In general, NRC's materials licensees who wish to conduct operations under reciprocity at temporary jobsites in an Agreement State should contact that State's radiation control program office for information about State regulations. To ensure compliance with Agreement State reciprocity requirements, a licensee should request authorization well in advance of scheduled use.

Under the provisions of 10 CFR 150.20, NRC can recognize and grant a general license to Agreement State licensees. This general license authorization allows Agreement State licensees to conduct licensed operations identified on the Agreement State license in Non-Agreement States; areas of exclusive Federal jurisdiction within Agreement States; and offshore waters provided:

- The Agreement State license does not limit authorized activity to a specific installation or location
- The Agreement State license contains no provisions to the contrary
- Activities, other than those in offshore waters, including storage of materials, are limited to a total of 180 days in any calendar year. Offshore activities, as specified in 10 CFR 150.20(b)(4), are authorized for an unlimited period of time
- NRC must be notified in accordance with the provision of 10 CFR 150.20(b)(1).

Licensees who are requesting generally licensed activities in offshore waters off of Louisiana, and are licensed by the State of Louisiana, can notify the State of Louisiana in lieu of notifying NRC. Notification to the State of Louisiana must be completed in accordance with the provisions of 10 CFR 150.20(c).

In the special situation of work at Federally-controlled sites in Agreement States, it is necessary to know the jurisdictional status of the land in order to determine whether NRC or the Agreement State has regulatory authority. As indicated above, NRC has regulatory authority only over land determined to be "exclusive Federal jurisdiction," while the Agreement State has jurisdiction over non-exclusive Federal jurisdiction land. Licensees are responsible for finding out, in advance, the jurisdictional status of the specific areas where they plan to conduct licensed operations. NRC recommends that licensees ask their local contact for the Federal Agency controlling the site (e.g., contract officer, base environmental health officer, district office staff) to help determine the jurisdictional status of the land and to provide the information in writing, so that licensees can comply with NRC or Agreement State regulatory requirements, as appropriate. Additional guidance on determining jurisdictional status is found in All Agreement

States Letter, SP-96-022, dated February 16, 1996, which is available from NRC upon request.

Table 2.1 provides a quick way to check on which Agency has regulatory authority.

Table 2.1 Who Regulates the Activity?

Applicant and Proposed Location of Work	Regulatory Agency
Federal Agency, regardless of location (except that Department of Energy [DOE] and, under most circumstances, its prime contractors are exempt from licensing [10 CFR 30.12])	NRC
Non-Federal entity in non-Agreement State, US territory, or possession	NRC
Non-Federal entity in Agreement State at non-Federally controlled site	Agreement State
Non-Federal entity in Agreement State at Federally-controlled site <i>not</i> subject to exclusive Federal jurisdiction	Agreement State
Non-Federal entity in Agreement State at Federally-controlled site subject to exclusive Federal jurisdiction	NRC

Figure 2.1 U.S. Map. Location of NRC Offices and Agreement States.

Reference: A current list of Agreement States (including names, addresses, and telephone numbers of responsible officials) may be obtained upon request from NRC’s Regional Offices. Or visit NRC’s Home Page <<http://www.nrc.gov>>, choose “Nuclear Materials,” then “Review of State Radiation Control Program Query Form,” and then “Directories.”

The All Agreement States Letter, SP-96-022, dated February 16, 1996, is available by contacting NRC’s Office of State Programs; call NRC’s toll free number (800) 368-5642, and then ask for extension 415-3340. Or visit NRC’s Home Page <<http://www.nrc.gov>>, choose “Nuclear Materials,” then choose “Review of State Radiation Control Program Query Form” and follow the directions for submitting a query for “SP-96-022.”

3 Management Responsibility

The NRC recognizes that effective radiation safety program management is vital to achieving safe and compliant operations. NRC believes that consistent compliance with its regulations provides reasonable assurance that licensed activities will be conducted safely. NRC also believes that effective management will result in increased safety and compliance.

Management refers to the processes for conducting and controlling radiation safety programs and to the individuals who are responsible for those processes and who have the authority to

provide necessary resources to achieve regulatory compliance.

To ensure adequate management involvement, a management representative must sign the submitted application acknowledging management's commitments and responsibility 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 NRC (10 CFR 30.9)
- Knowledge about the contents of the license and application
- Compliance with current NRC and Department of Transportation (DOT) regulations and the licensee's operating and emergency 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 that compliance with the regulations is maintained
- Selection and assignment of a qualified individual to serve as the Radiation Safety Officer (RSO) for licensed activities
- Prohibition against discrimination of employees engaged in protected activities (10 CFR 30.7)
- Commitment to provide information to employees regarding the employee protection, completeness and accuracy of information, and deliberate misconduct provisions in 10 CFR 30.7, 10 CFR 30.9 and 10 CFR 30.10
- Obtaining NRC's prior written consent before transferring control of the license
- Notifying the appropriate NRC Regional Administrator in writing, immediately following filing of petition for voluntary or involuntary bankruptcy.

For information on NRC inspection, investigation, enforcement, and other compliance programs, see the current version of "General Statement of Policy and Procedures for NRC Enforcement Actions," NUREG-1600, and Manual Chapter (MC) 87113, Appendix G, "Suggested Well Logging, Tracer, and Field Flood Study Audit Checklist." NUREG-1600 is available electronically at <<http://www.nrc.gov/OE>>. For hard copies of NUREG-1600 and MC 87113, see the Notice of Availability (on the inside front cover of this report).

4 Applicable Regulations

It is the applicant's or licensee's responsibility to have up-to-date copies of applicable regulations, read them, understand them, and comply with each applicable regulation.

The following Parts of 10 CFR Chapter I contain regulations applicable to well logging, tracer, and field flood study licenses:

- 10 CFR Part 2, "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders"
- 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 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."

Part 71 requires that licensees or applicants who transport licensed material outside the site of usage, as specified in the NRC license, or where transport is on public highways, or who deliver licensed material to a carrier for transport, shall comply with the applicable requirements of the DOT that are found in 49 CFR Parts 170 through 189, appropriate to the mode of transport. Copies of DOT regulations can be ordered from the Government Printing Office (GPO), whose address and telephone number are listed below.

- 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 Operating 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 NRC."

To request copies of the above documents, call GPO's order desk in Washington, DC at (202) 512-1800. Order the two-volume bound version of *Title 10, Code of Federal Regulations*,

Parts 0-50 and 51-199 from the GPO, Superintendent of Documents, Post Office Box 371954, Pittsburgh, Pennsylvania 15250-7954. You may also contact the GPO electronically at <<http://www.gpo.gov>>. Additionally, Title 10, Code of Federal Regulations, Parts 0-50 and

51-199, is available electronically from NRC's reference library at <<http://www.nrc.gov>>. Individuals may request single hard copies of the above documents from NRC's Regional Offices (see Figure 2.1 for addresses and telephone numbers). Note that NRC publishes amendments to its regulations in the *Federal Register*.

5 How to File

5.1 Paper Application

Applicants for a materials license should do the following:

- Be sure to 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
- For each separate sheet that is submitted with the application, other than Appendix B, identify and key it to the item number on the application or the topic to which it refers
- Submit all documents, including drawings, if practicable, on 8-1/2 x 11 inch paper. If the submission of larger documents is necessary, subdivide the document into 8-1/2 x 11 inch pages so that it can be reassembled by the NRC staff when required.
- Identify each drawing with drawing number, revision number, title, date, scale, and applicant's name. Clearly indicate if drawings have been reduced or enlarged.
- Avoid submitting proprietary information unless it is necessary
- Submit an original, signed application and one copy
- Retain one copy of the license application for future reference.

As required by 10 CFR 30.32(c), applications shall be signed by a duly authorized management representative; see section on "Certification."

Using the suggested wording of responses and committing to using the model procedures in NUREG-1556, Vol. 14 will expedite NRC's review.

All license applications will be available for review by the general public in NRC's Public Document Rooms. If it is necessary to submit proprietary information, follow the procedure in 10 CFR 2.790. Failure to follow this procedure could result in disclosure of the proprietary information to the public or substantial delays in processing the application. Employee personal information, i.e., home address, home telephone number, Social Security Number, date of birth, and radiation dose information, should not be submitted unless specifically requested by NRC.

- Do not submit personal information about employees
- Do not submit copies of NRC licenses.

As explained in the "Foreword," NRC's new licensing process will be faster and more efficient, in part, through acceptance and processing of electronic applications at some future date. NRC will continue to accept paper applications; however, these will be scanned and converted to an electronic format. To ensure a smooth transition, applicants are requested to follow these suggestions:

- Choose typeface designs that are sans serif, such as Arial, Helvetica, Futura, and Universe; the text of this document is in a serif font called Times New Roman
- Submit printed or typewritten, not handwritten, text on smooth, crisp paper that will feed

easily into the scanner

- Choose 12-point or larger font size
- Avoid stylized characters such as script, italic, etc.
- Be sure the print is clear and sharp
- Be sure there is high contrast between the ink and paper (black ink on white paper is best).

5.2 Electronic Application

As the electronic licensing process develops, it is anticipated that NRC may provide mechanisms for filing applications via diskettes, CD-ROM, and the Internet. Additional filing instructions will be provided as these new mechanisms become available. The existing paper process will be used until such time.

6 Where to File

Applicants wishing to possess or use licensed material in any State or U. S. Territory or possession subject to NRC jurisdiction must file an application with the NRC Regional Office for the locale in which the material will be possessed and/or used. Figure 2.1 shows NRC's four Regional Offices and their respective areas for licensing purposes and identifies Agreement States.

In general, applicants wishing to possess or use licensed material in Agreement States must file an application with the Agreement State, not NRC. However, if work will be conducted at Federally-controlled sites in Agreement States, applicants must first determine the jurisdictional status of the land in order to determine whether NRC or the Agreement State has regulatory authority. See the section on "Agreement States" for additional information.

7 License Fees

Each application for which a fee is specified must be accompanied by the appropriate fee. Refer to 10 CFR 170.31 to determine the amount of the fee. NRC will not issue the new license prior to fee receipt. An application for a new license or an amendment to an existing license requesting authorization to conduct field flood studies requires that an environmental assessment be performed. Fees for a licensing action that requires an environmental assessment are charged at an hourly rate. Full cost fee recovery is assessed by the professional staff time expended, as described in footnote e.3. to 10 CFR 170.31. Once technical review begins, no fees will be refunded; application fees will be charged regardless of 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. Consult 10 CFR 171.11 for additional 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 NRC's fees or completion of Item 12 of NRC Form 313 (Appendix B)

to the Office of the Chief Financial Officer (OCFO) at NRC Headquarters in Rockville, Maryland, (301) 415-7554. You may also call NRC's toll free number, (800) 368-5642, and then ask for extension 415-7554.

8 Contents of an Application

The following comments apply to the indicated items on NRC Form 313 (Appendix B).

8.1 Item 1: License Action Type

THIS IS AN APPLICATION FOR (Check appropriate item):

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

Check box A for a new license request.

Check box B for an amendment to an existing license, and provide license number.

Check box C for a renewal of an existing license, and provide license number.

8.2 Item 2: Applicant's Name and Mailing Address

Response from 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 or drawer number is an acceptable mailing address.

Notify NRC of changes in mailing address; these changes do not require a fee.

Note: NRC must be notified before control of the license is transferred or when bankruptcy proceedings have been initiated. See below for more details. NRC Information Notice (IN) 97-30, "Control of Licensed Material during Reorganizations, Employee-Management Disagreements, and Financial Crises," dated June 3, 1997, discusses the potential for the security and control of licensed material to be compromised during periods of organizational instability.

Timely Notification of Transfer of Control

Regulations: 10 CFR 30.34(b).

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

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

- Radioactive materials are possessed, used, or controlled only by persons who have valid NRC 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 the disposition of records and licensed materials
- Public health and safety are not compromised by the use of such materials.

Response from Applicant: None from an applicant for a new license; Appendix H, excerpted from IN 89-25 (Rev. 1), "Unauthorized Transfer of Ownership or Control of Licensed Activities," dated December 7, 1994, identifies the information to be provided about transferring control.

Notification of Bankruptcy Proceedings

Regulation: 10 CFR 30.34(h).

Criteria: Immediately (within 24 hours) following filing of 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: NRC must be cognizant when licensees are in bankruptcy proceedings in order to review the licensee's material accountability, to ensure that the licensee prevents access to licensed material by unauthorized personnel, and to allow NRC the opportunity to assess potential public health and safety concerns (e.g., contaminated facility). NRC, in turn, shares its findings with other involved entities (e.g., trustees), so that outstanding health and safety issues can be resolved before bankruptcy actions are completed.

Even though a licensee may have filed for bankruptcy, the licensee remains totally responsible for all regulatory requirements.

Response from Applicant: None at time of application for a new license. Licensees must notify NRC within 24 hours of filing a bankruptcy petition.

References: See the Notice of Availability (on the inside front cover of this report) to obtain copies of Policy and Guidance Directive PG 8-11, "NMSS Procedures for Reviewing Declarations of Bankruptcy" (dated August 8, 1996) and Inspection Procedure (IP) 87103, "Inspection of Material Licensees Involved in an Incident or Bankruptcy Filing." INs are available in the "Reference Library" on NRC's Home Page at <<http://www.nrc.gov>>. For hard

copies, also see the Notice of Availability (on the inside front cover of this report).

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., on Highway 10, 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, stored, or dispatched, and list the specific activities to be conducted at each location. Field stations are locations where licensed materials are stored or used and equipment is dispatched to temporary job sites. As illustrated in Fig. 8.1., a Post Office Box or Drawer address is not acceptable.

Figure 8.1 Location of Use. An acceptable location of use specifies street address, city, state, and ZIP code and does not include a Post Office box or drawer number.

Granting of an NRC license does not relieve a licensee from complying with other applicable Federal, State, or local regulations (e.g., local zoning requirements or a local ordinance requiring registration of a radiation-producing device).

8.4 Item 4: Person to Be Contacted about this Application

Identify the name and title of the individual who can answer questions about the application and include his or her telephone number. This is typically the proposed RSO or a principal user of radioactive materials, unless the applicant has named a different person as the contact. The NRC will contact this individual if there are questions about the application.

Notify NRC if the contact person or the contact person's telephone number changes so that NRC can contact the applicant or licensee in the future with questions, concerns, or information. This notice is for "information only" and does not require a license amendment or a fee.

As indicated on NRC Form 313 (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 using the model procedures in this report will expedite 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 and 10 CFR 39.13 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 NRC or an Agreement State.

Discussion: The applicant should list each requested radioisotope 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 amount requested. Table 8.1 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 (reactor-produced)	Yes	H-3, C-14, Na-22, S-35, Sc-46, Ca-45, *Fe-55, *Co-57, 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
Source material (Depleted Uranium)	Yes	Depleted Uranium
Special nuclear material	Yes	Pu-238:Be Sealed Source
Naturally occurring radioisotopes	No	Ra-226, Th-232, Th Natural
Accelerator-produced radioisotopes	No	Na-22, *Fe-55, *Co-57, Co-58

* Both accelerator and reactor produced

Possession limits should be specified in megabecquerels (MBq) [millicuries (mCi)] or gigabecquerels (GBq) [curies (Ci)] for each radioisotope. Applicants should include in the possession limits requested the total estimated inventory, including licensed material in storage and maintained as radioactive waste. The requested possession limits for any radioisotope should be commensurate with the applicant's needs and facilities for safe handling. Applicants, when establishing their possession limits 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 the Section on Financial Assurance and Decommissioning and in Appendix I.

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, due to 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. For iodine-131, the quantity requiring an emergency plan is 370 GBq [10 curies].

For non-federal licensees, requests to license naturally-occurring radioactive material (NORM) and accelerator-produced radioactive material should be made to the appropriate State regulatory Agency. NRC does not regulate NORM or accelerator-produced radioactive material.

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 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, without obtaining NRC's prior 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.
 - 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 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 NRC or an Agreement State.

A safety evaluation of sealed sources and devices is performed by 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. Information on SSD Registration Certificates may be obtained through the Registration Assistant by calling NRC's toll-free number, (800) 368-5642, extension 415-7231. Applicants must provide the manufacturer's name and model number for each requested sealed source and device (e.g., instrument calibrator) so that NRC can verify that each, when applicable, has been evaluated in an SSD Registration Certificate. See also NUREG-1556, Vol. 3.

- 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 FR 30.32(g), 10 CFR 39.41.

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 one of the following criteria:

- Sealed sources that were manufactured before July 14, 1989, may use either the design and performance criteria from the United States of America Standards Institute (USASI) N5 10-1968 or the criteria specified in 10 CFR 39.41. The use of the USASI N5 10-1968 standard is based on an NRC Notice of Generic Exemption issued on July 25, 1989 (54 FR 30883), which has been included in NRC's final rule issued on April 17, 2000 (65 FR 20337). A copy of the referenced generic exemption letter is included in Appendix J as reference.
- Sealed sources are required to satisfy the requirements of 10 CFR 39.41.

The primary difference between the two standards is that the vibration requirement in 10 CFR 39.41 is not included in the USASI standard. This vibration test was included to ensure consistency between the United States standard and international standards.

Discussion: 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 a Sealed Source and Device (SSD) Registration Certificate. Some examples of sealed sources used in well logging applications are shown in Figure 8.2.

Figure 8.2 Examples of Sealed Sources Used In Well Logging Operations.

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 NRC or an Agreement State, included in an SSD Registration Certificate, approved under the provisions granted by 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, etc. Conferring with the vendor or manufacturer before use helps ensure that the associated equipment selected is compatible with sealed sources requested in the application.

Response from Applicant:

- Identify each sealed source with an activity greater than 3.7 MBq (100 microcuries) by the manufacturer's name, model number, and radionuclide (element name and mass number).
- Identify each energy compensation source with an activity less than or equal to 3.7 MBq (100 microcuries) by the manufacturer's name, model number, and radionuclide (element name and mass number).
- Confirm that each sealed source is registered as an approved sealed source by NRC or an Agreement State and will be possessed and used in accordance with the conditions specified in the Registration Certificate.
- Confirm that sealed sources not satisfying 10 CFR 39.41 performance requirements are approved by USASI N5 10-1968 standard for well logging (See Appendix J).
- 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 NRC or by an Agreement State.
- Provide the license number of an NRC or Agreement State license that approves a well logging source that is not included in an SSD registration certificate.
- Identify any sealed sources and/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). An example of such a device is 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.

OR

- 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.

Note: Information on SSD registration certificates is available electronically at <http://www.nrc.gov>; select the "Library" section. The current version of NUREG-1556, Vol. 3, "Consolidated Guidance About Materials Licenses: Applications for Sealed Source and Device Evaluation and Registration" provides specific information about the SSD registration process. This document is also available electronically at the above internet location, or for a paper copy of NUREG-1556, Vol. 3, see the Notice of Availability (on the inside front cover of this report). For individual copies of SSD registration sheets, an applicant may contact the Registration Assistant by calling NRC's toll free number, (800) 368-5642, and then asking for extension 415-7217.

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 and 10 CFR 39.13 are satisfied.

Discussion: Each authorized radioisotope tracer is listed on the NRC license by its element name, chemical and/or physical form, total possession limit, and the maximum amount of each radioisotope (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:** Radioactive isotopes 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 radioactive isotopes injected into the well.
- **Field Flood Studies or Enhanced Oil and Gas Recovery Studies:** Tracer studies involving multiple wells where one or more radioactive isotopes 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 radioactive isotopes in the well.
- **Labeled Frac Sands:** Radioactive isotope(s) in liquid or solid forms that is(are) chemically bonded to glass and/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 radioactive isotope(s) remaining in the underground reservoir formation.

See the sample license in Appendix E. Table 8.2 identifies the types of byproduct material used in tracer and field flood study applications covered by this report.

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 radioisotope 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 maximum amount of each radioisotope tracer that you will use in each type of tracer study by its physical or chemical form. Identifying the forms as “any” is unacceptable.
- 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 30.72, Schedule C, to determine the quantities of radioactive material requiring an emergency plan for responding to a release.

8.5.3 Financial Assurance and Record Keeping for Decommissioning

Regulations: 10 CFR 30.34(b), 10 CFR 30.35.

Criteria: Financial assurance is not required by most well logging or tracer licensees; however, each licensee is obligated to maintain, in an identified location, decommissioning records related to facilities where licensed material is used, stored, or dispatched. Decommissioning records described above are not required at temporary jobsites. Pursuant to 10 CFR 30.35(g), 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: 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. 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 (53 FR 24018). These 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 (see Figure 8.3). Before a license is issued, applicants are required to submit F/A or a DFP when requesting authorization to possess any sealed or unsealed radioactive material with half life ($T_{1/2}$) greater than 120 days exceeding certain the limits. 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.

There are two parts to this rule: financial assurance that applies to some licensees and record keeping that applies to *all* licensees.

Figure 8.3 Methods of Certification of Financial Assurance for Decommissioning.

Table 8.3 provides a partial list of sealed and unsealed radioisotopes with $T_{1/2} > 120$ days with the corresponding limits in excess of which an F/A or a DFP is required. However, it is NRC's experience that most well logging, tracer, and field flood study licensees use only a few of these radioisotopes. The most frequently used radioisotopes requiring financial assurance in unsealed form are hydrogen-3, carbon-14, and silver-110 metastable, and for sealed sources, americium-241. Radioisotopes with $T_{1/2} > 120$ days are listed in Column 1. Column 2 lists the corresponding possession limits of radioisotopes requiring F/A. Column 3 lists the corresponding possession limits of unsealed radioisotopes requiring the submittal of a DFP. These limits apply when only one of these radioisotopes is possessed.

Applicants can use the data from Table 8.3 or the method given in Appendix I to determine if F/A is required and the amount that is required when more than one of these radioisotopes is requested.

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

Column 1: Radioisotope	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	N/A

*1 millicurie = 37 MBq

Regulatory Guide (RG) 3.66, “Standard Format and Content of Financial Assurance Mechanisms Required for Decommissioning Under 10 CFR Parts 30, 40, 70, and 72,” dated June 1990, contains approved wording for each mechanism authorized by the regulation to guarantee or secure funds, except for the Statement of Intent for Government licensees.

Record Keeping

The requirements for maintaining records important to decommissioning, including the type of information required, are stated in 10 CFR 30.35(g). All licensees are required to maintain these records in an identified location until the site is released for unrestricted use (see Figure 8.4). 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 NRC.

Figure 8.4 Types of Records That Must Be Maintained for Decommissioning.

<p>10 CFR 30.35(g), Requirements for Disposition of Records Important to Decommissioning</p> <ul style="list-style-type: none"> ● Before licensed activities are transferred or assigned according to 10 CFR 30.34(b), transfer to the new licensee. <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> ● Before the license is terminated, transfer records to the appropriate NRC Regional office.

Response from Applicants: No response is needed from most applicants. If F/A or a DFP is required, submit the required documents described in Regulatory Guide 3.66.

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.

References: See the Notice of Availability (on the inside front cover of this report) to obtain copies of RG 3.66 and Policy and Guidance Directive FC 90-2 (Rev. 1), "Standard Review Plan for Evaluating Compliance with Decommissioning Requirements," dated April 30, 1991.

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

Regulations: 10 CFR 30.33(a)(1), 10 CFR 39.13, 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.

Criteria: Radioisotopes 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 radioisotope 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, etc.). In addition, the licensee should describe the type of mineral or geophysical logging to be conducted, e.g., coal, salt domes, etc. 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 radioisotopes 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 NRC to determine the potential for exposure to occupationally exposed individuals and/or members of the public.

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

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

- Removing a sealed source from a source holder of a logging tool and maintenance on sealed sources or holders
- Using destructive techniques to remove a stuck sealed source from a source holder

- Opening, repairing, or modifying any sealed source
- Knowingly injecting licensed radioactive tracer material into a fresh water aquifer
- Using a sealed source in a well without a surface casing to protect fresh water aquifers.

Applicants may use the format given in Table 8.4 to provide the requested information.

Table 8.4 Sample Format for Providing Information About Requested Radioisotopes

Radioisotope	Chemical/Physical Form	Maximum Possession Limit	Proposed Use
Americium-241	Sealed neutron source (XYZ Inc., Model 10)	Not to exceed 5 curies per source	Oil, gas, and/or mineral logging.
Cesium-137	Sealed source (Okko Inc., Model 36)	Not to exceed 3 curies per source	Oil, gas, and/or mineral logging.
Hydrogen-3	Gas, titanium tritide neutron generator tube (Cols Inc., Model 3)	Not to exceed 3 curies per tube	Neutron activation logging in oil and gas wells in downhole accelerator
Iodine-131	Gas	100 millicuries total, not to exceed 20 millicuries per injection	Subsurface Tracer Operations
Iodine-131	Liquid	50 millicuries total, not to exceed 10 millicuries per injection	Subsurface Tracer Operations
Iridium-192	“Labeled” frac sand	200 millicuries total, not to exceed 15 millicuries per injection	Subsurface Tracer Operations
Cobalt-60	Metal wire	3 millicuries total, not to exceed 1 microcurie per individual unit	Pipe Joint Collar Markers, Subsidence Markers, Depth Determination
Silver-110m	Liquid	200 millicuries total, not to exceed 20 millicuries per injection	Field Flood Tracer Studies
Depleted Uranium	Sinker Bars	225 kilograms	Sinker Weights (Concentrated Mass)

If the material will be used in field flood studies where licensed material is intentionally released into the environment, an environmental assessment (EA) is required in accordance with

10 CFR 51.21. Revision 1, Supplement to Policy and Guidance Directive FC 84-20, "Impact of Revision of 10 CFR Part 51 on Materials License Actions," dated March 1994, provides criteria for determining when an EA is not needed.

Applicants should note that authorization granted by 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 the specific use or purpose of each sealed source and/or radioisotope 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: RSOs must have adequate training and experience.

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 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. 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 and/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 and/or temporary job sites.

Typical RSO duties are illustrated in Figure 8.5 and Appendix K. 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. Provide NRC with 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.

Figure 8.5 RSO Responsibilities - Typical duties and responsibilities of the RSO.

To be considered eligible for the RSO position, the applicant must submit for 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 Code of Federal Regulations (e.g., Parts 19, 20, 21, 30, 39, etc.). 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:

- 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

- The specific training and experience of the RSO

OR

- 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 and/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)

- Formal training in the establishment and maintenance of a radiation protection program

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.

Note: It is important to notify 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 39.13, 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, 10 CFR 30.33(a)(3), and 10 CFR 39.61. **Although persons engaged in field flood studies operations are not specifically addressed in 10 CFR Part 39, NRC staff has historically accepted classroom training for tracer studies to be an appropriate guide for individuals engaged in field flood studies.**

Discussion:

- A logging supervisor is a person who performs or personally supervises well logging operations, tracer/field flood study applications and is responsible for ensuring compliance with NRC regulations and the safe use of radioactive materials.
- A logging assistant is an individual, who under the *direct supervision and in the physical presence of the logging supervisor* uses well logging equipment (sealed sources containing byproduct material, related handling tools, unsealed sources of byproduct material, well logging devices, and radiation survey instruments) in performing well logging operations.

Didactic 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 L 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/or 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).

An internal inspection program (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 and logging assistant during an actual well logging operation at intervals not to exceed 12 months. If a logging supervisor or logging assistant has not participated in a well logging operation for more than 12 months since the last inspection, the

individual must be inspected the first time he or she engages in well logging operations.

Response from Applicant:

- 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. 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 M 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 inspecting the job performance of each well logging supervisor or logging assistant at intervals not to exceed 12 months, as described in 10 CFR 39.13.

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.

Licensed materials located in an unrestricted area and not in storage must be under the constant surveillance and immediate control of the licensee. Areas where material is used or stored, including below ground bunker storage areas, should (1) be 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.

Applicants may delay completing facilities and acquiring equipment until after the application review is completed. Delaying the acquisition 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, and the license is issued.

Response from Applicant:

- Submit a drawing or sketch of the proposed facility identifying areas where radioactive materials, including radioactive wastes, will be used or stored.
- 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.

10 CFR 20.2003 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.

8.10 Item 10: Radiation Safety Program

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:

- Development and implementation of an ALARA program
- Description of equipment and facilities adequate to protect personnel, the public and the environment
- Confirmation that licensed activities are conducted only by individuals qualified by training and experience
- Development and maintenance of written operating and emergency procedures
- Implementation of an audit program to inspect the job performance of well logging supervisors and assistants
- Description of organization structure and individuals responsible for ensuring day-to-day oversight of the radiation safety program
- Establishment and management of a radiation safety and decommissioning records system.

Discussion: Individual components of a radiation safety program are addressed in the topics found in this NUREG. Some topics 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.

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 F 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.

8.10.1 Well Owner/Operator Agreements

Regulations: 10 CFR 39.15(a), 10 CFR 39.15(d), 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 a sealed source 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 8.6:
 - Source must be immobilized and sealed in place with a cement plug
 - Provide a means to prevent inadvertent intrusion on the source, unless the source is not accessible to any subsequent drilling operations
 - Install a permanent identification plaque at the surface of the well, unless mounting of a plaque is not practical. Figure 8.7 provides a diagram of a permanent identification plaque, describing the information that should be included on the plaque.
 - Notify the appropriate NRC Regional Office by telephone of the circumstances that resulted in the inability to retrieve the source and obtain approval to implement abandonment procedures.
- Send a copy of the abandonment report within 30 days of the abandonment of the sealed source, to the appropriate NRC Regional Office and each appropriate State or Federal Agency that issued permits or otherwise approved of the drilling operation. The abandonment report must contain all the information outlined in 10 CFR 39.77(d). Refer to Appendix Q for additional guidance.

Figure 8.6 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 exigent 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 8.7 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 prior to well logging with a sealed source that meets the requirements specified in 10 CFR 39.15.”

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 reasonably achievable (ALARA) (10 CFR 20.1101)
- Records of audits and other reviews of program content and implementation are maintained for 3 years.

Discussion: Licensees are encouraged to implement as part of the radiation safety program a self-assessment and corrective action tracking program. Assessments necessary to ensure safe operations should result in a continuous process to self-identify violations, implement immediate corrective action when required, and track to completion and close-out of self-identified violations. NRC’s enforcement policy is designed to encourage and to give credit to licensees for self-identifying violations and for taking immediate corrective actions. NRC policy allows licensees with a good regulatory performance, as shown by a licensee’s inspection history, to be inspected less frequently than licensees where NRC staff identifies significant violation(s) during

an inspection. Although the annual ALARA audit required by 10 CFR 20.1101(b) is an important cornerstone of the radiation safety program, NRC encourages applicants/licensees to develop and implement an ongoing audit program and corresponding corrective action tracking program.

Appendix G contains a suggested annual audit program that is specific to well logging and tracer operations and is acceptable to NRC. All areas indicated in Appendix G may not be applicable to every licensee and may not need to be addressed during each audit.

Response from Applicant: The applicant is not required to, and should not, submit its radiation safety program audit (ALARA) to the NRC for review during the licensing phase. The applicant's program for reviewing the content and implementation of its radiation safety program will be examined during inspection.

References: The current version of NUREG-1600 is available electronically at <http://www.nrc.gov/OE>. INs are available in the "Reference Library" on NRC's Home Page at <http://www.nrc.gov>. For hard copies of NUREG-1600, IN 96-28, and MC 87113, Appendix A, "Well Logging Inspection Field Notes," see the Notice of Availability (on the inside front cover of this report).

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 0.1 milliroentgen (2.58×10^{-8} C/kg) per hour through at least 50 milliroentgen (1.29×10^{-5} C/Kg) per hour. 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 8.8 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.

NRC requires that calibrations be performed by the instrument manufacturer or a person specifically authorized by 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 N 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 N to NUREG-1556, Vol. 14, 'Program-Specific Guidance About Well Logging, Tracer and Field Flood Studies,' dated June 2000. 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 N to NUREG-1556, Vol. 14, 'Program-Specific Guidance About Well Logging, Tracer and Field Flood Studies,' dated June 2000. Additionally, we will implement the model survey meter calibration program published in Appendix N to NUREG-1556, Vol. 14, 'Program-Specific Guidance About Well Logging, Tracer and Field Flood Studies,' dated June 2000. We reserve the right to upgrade our survey instruments as necessary."

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. 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, 20.1906, 10 CFR 30.34(e), 10 CFR 30.35(g), 10 CFR 30.41, 10 CFR 30.51(g)(2), 10 CFR 39.37.

Criteria: Licensees with licensed material must do the following:

- Maintain records of receipt, transfer, and disposal of licensed materials
- Conduct physical inventories of licensed materials at least every 6 months to account for all sealed sources, tracer materials, and depleted uranium

- Maintain inventory records 3 years from the date of the inventory.

Discussion: 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 include locating, verifying the physical presence, and/or accounting for materials by the use of material receipt and transfer records.

Inventory records must 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 each sealed source
- Date the inventory occurred
- Name of individual performing the inventory.

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

Figure 8.9 Material Receipt and Accountability. *Licensees must maintain records of receipt and disposal and conduct physical inventories at intervals not to exceed 6 months.*

Response from Applicant: Provide the following:

A statement that: “Physical inventories will be conducted and documented at least every 6 months to account for all licensed material, including byproduct, tracer, and depleted uranium received and possessed under the license.”

8.10.5 Occupational Dosimetry

Regulations: 10 CFR 20.1201, 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, logging supervisors and logging assistants must wear either film badges or thermoluminescent dosimeters (TLDs) during the handling or use of licensed radioactive material. This requirement applies to personnel using dosimeters for whole body measurements. Although not included in 10 CFR 39.65, some Agreement States have authorized Optically Stimulated Luminescence (OSL) dosimetry devices approved by the National Voluntary Laboratory Accreditation Program (NVLAP). NRC is currently in the process of amending its regulations to authorize the use of OSL dosimetry devices. However, if a licensee wants to use OSL dosimetry until NRC’s regulations are changed, it is necessary for an applicant to specifically request authorization to use OSL dosimetry. Licensees must provide to employees, either a film or TLD that is processed by an accredited entity under the NVLAP operated by the National Institute of Standards and Technology (NIST).

Appendix O 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 8.10 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 a NVLAP-approved film badge, TLD, or OSL/personnel dosimeter (if specifically approved by NRC) that is sensitive to the type of radiation(s) to which the individual is exposed. If neutron sources are to be used, a commitment to provide neutron-sensitive dosimetry devices is required. Film badges must be replaced at intervals not to exceed 1 month, and TLDs or OSL must be replaced at intervals not to exceed 3 months.

For purposes of internal dosimetry, bioassays are required when individuals work with volatile radioactive material in the 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% 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 CEDE of 5 rems or a 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.” Copies may be obtained from NRC’s Regional Offices or at locations identified on the inside cover of the report in the Notice of Availability.

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

Response from Applicant:

Provide the following:

- A statement that the required film badge, TLD, or OSL dosimeter, processed and evaluated by a NVLAP-accredited entity and exchanged at the approved frequency, will be worn by well logging personnel.

To obtain a copy of the NIST Publication 810, “National Voluntary Laboratory Accreditation Program, 1997 Directory,” contact the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9225. (For information on the program, call NIST at 301-975-3679.) Also, NVLAP maintains a directory of accredited laboratories on the Internet (updated quarterly). The URL for NVLAP’s home page on the Internet is <<http://ts.nist.gov/nvlap>>.

AND/OR

- 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, its rationale should be stated.

OR

- In lieu of providing a bioassay program, applicants may provide a commitment that they will not allow any individual to 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. However, if an applicant plans to use an excess of the amounts described above or requests permission to repackage or process iodine-131 tracer materials at field stations, it is necessary to describe in detail the bioassay program. 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

- Contract with an outside group for bioassay services. Provide a commitment that each vendor is licensed or otherwise authorized by NRC or an Agreement State to provide required bioassay services.

8.10.6 Public Dose

Regulations: 10 CFR 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 material will be used, transported, stored, and disposed of in such a way that members of the public will not receive more than 1 mSv (100 mrem) in one year, and the dose in any unrestricted area will not exceed 0.02 mSv (2 mrem) in any one hour, from licensed operations
- Control and maintain constant surveillance of licensed material when in use and not in storage
- Secure stored licensed material 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 one 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, etc.) 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 to evaluate the effect on the public and use this information to determine operating and emergency procedures for using radioactive materials. See Appendix P 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 8.11 Calculating the Annual Dose to an Individual Member of the Public.

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 one year, and any unrestricted area does not exceed 0.02 mSv (2 mrem) in any one hour. See Appendix P 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. Operating and emergency procedures' elements must include the items outlined in 10 CFR 39.63. 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 fresh water 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
- 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) - (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
- 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
- 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
- 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)
- 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.

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 isotopes 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: If applicable to the materials and uses proposed, 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 to the NRC as part of the application package. Applicants should either submit their Operating and Emergency Procedures or an outline or summary as described in 10 CFR 39.13(c) in responding to subsequent sections.

8.10.8 Leak Tests

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

Criteria: 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: NRC licenses will require the performance of leak tests on sealed sources authorized for well logging at intervals approved by the NRC or an Agreement State and specified in the SSD Registration Sheet. The measurement of the leak test sample is a quantitative analysis requiring that instrumentation used to analyze the sample be capable of detecting 185 becquerels (0.005 microcuries) of radioactivity.

Manufacturers, consultants, and other organizations may be authorized by NRC or an Agreement

State either to perform the entire leak test sequence for other licensees or to provide leak test kits to licensees. In the latter case, the licensee is expected to take the leak test sample according to the gauge 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.

Response from Applicant:

Do either of the following:

- State: "Leak tests when required by the license will be performed at intervals approved by the NRC or an Agreement State and specified in the Sealed Source and Device Registration Sheet. Leak tests will be performed by an organization authorized by NRC or an Agreement State to provide leak testing services to other licensees or by the licensee using a leak test kit supplied by an organization authorized by NRC or an Agreement State to provide leak test kits to other licensees and according to the kit supplier's instructions."

OR

- State: "Leak testing procedures and analysis will be done by the applicant." Provide the information in supporting a request to perform leak testing. Appendix R may serve as guidance.

OR

- State: "Leak testing will follow the model procedures in Appendix R."

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 R criteria.

References: Draft Regulatory Guide FC 412-4, "Guide for the Preparation of Applications for the Use of Radioactive Materials in Leak-Testing Services," is available from NRC upon request.

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, and source handling tools 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 visually check source holders, logging tools, and source handling tools 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. At intervals not to exceed 6 months, licensees shall conduct a visual

inspection 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.

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.

If defects are found as a result of the inspection and maintenance programs, the equipment must be removed from service until repairs are made, and a record of the defect must be retained for 3 years after the defect is found.

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 Daily Maintenance

Regulations: 10 CFR 39.31, 10 CFR 39.43(a), 10 CFR 39.49.

Criteria: The licensee must have written procedures for visually inspecting and maintaining source holders, logging tools, and source handling tools 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: 10 CFR 39.43(a), requires that logging tools, source holders, and source handling tools be checked visually for defects prior to 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 and 39.49. Instructions in the operating procedures provided to personnel must clearly reflect the regulatory requirement—visual inspections are performed prior to use. Record after the inspection the date, inspector, equipment involved, any defects found, or repairs made. Equipment that fails the inspection and cannot be repaired 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, logging tools, and source handling tools.

Response from Applicant:

Provide the following:

- Submit a description of procedure(s) for conducting daily visual inspection.

OR

- State that “Visual daily inspections will be conducted and records maintained in accordance with Section 8.10.9.1 of NUREG 1556, Vol. 14, to ensure that well logging equipment is in good working condition and is labeled as required.”

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 containers, 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 specify, in part, that licensees adopt appropriate procedures to notify NRC of any equipment that is defective or could result in a substantial safety hazard, and additionally, that management be informed as soon as practicable, within 5 working days after the completion of the evaluation.

Discussion: Logging supervisors or assistants are expected to conduct visual inspections and provide routine maintenance activities on source holders, logging tools, injection tools, source handling tools, storage containers, transport containers, and uranium sinker bars to ensure that the labeling required by 10 CFR Part 39.31 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 your specific program and to the equipment possessed and used.

Reporting defects to the NRC, in accordance with 10 CFR 21.21, is a management responsibility. The specific mechanism or procedures for reporting to NRC need not be covered in instructions to personnel.

Response from Applicant:

Provide the following:

- Submit a description of procedure(s) for conducting semiannual inspections 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 labeling required by 10 CFR Part 39 is legible and that no physical damage is visible.

OR

- State that “Semiannual inspections and routine maintenance will be conducted and records maintained for source holders, logging tools, injection tools, source handling tools, storage containers, transport containers, and uranium sinker bars in accordance with Section 8.10.9.2

of NUREG-1556, Vol. 14, to ensure that well logging equipment is in good working condition with no physical damage evident and that the required labeling is present.”

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 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, e.g., any situation where tools are required to remove the stuck source.

Figure 8.12 Maintenance, Cleaning, and O-Ring Replacement.

Response from Applicant:

- Statement that “Prohibited activities described in Section 8.10.9.3 of NUREG-1556, Vol. 14 will not be conducted unless approved by the NRC.”

OR

- Submit detailed procedures for any prohibited activities, 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 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 71.13, 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 Department of Transportation (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. 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 S.

Figure 8.13 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 8.13 illustrates some DOT requirements often overlooked by well logging, tracer, and field flood study licensees. During an inspection, NRC uses the provisions of 10 CFR 71.5 and a Memorandum of Understanding with DOT to examine and enforce transportation requirements applicable to well logging, tracer and field flood study licensees. Appendix S lists major DOT regulations and provides a sample shipping paper.

Figure 8.14 Transport Container.

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

References: “A Review of Department of Transportation Regulations for Transportation of Radioactive Materials (1983 revision)” can be obtained by calling DOT’s Office of Hazardous Material Initiatives and Training at (202) 366-4425.

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: When designing facilities and developing procedures for their safe use, applicants should plan ahead and consider how to minimize radioactive contamination during operation, decontamination and decommissioning efforts, and radioactive waste generation. When

submitting new applications, applicants should consider the following:

- 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 found to be leaking in excess of 185 bequerels (.005 microcuries) of removal contamination must be immediately withdrawn from use and placed in a safe storage location until disposed of according to NRC requirements. Special authorization must be granted by NRC to applicants to decontaminate a facility contaminated by a leaking sealed source. Approval granted in a license by NRC or an Agreement State to provide these specialized services minimizes the spread of contamination and reduces radioactive waste associated with decontamination efforts.

Figure 8.15 Personnel Surveys.

Response from Applicant:

- The applicant does not need to provide a response to this item under the following conditions and NRC will consider that the above criteria have been met if the applicant's responses meet the criteria in the following sections: "Facilities and Equipment," "Radiation Safety Program - Tracer Studies," "Radiation Safety Program - Operating and Emergency Procedures," and "Radiation Safety Program - Waste Management."

AND

- Decontamination of the facility and/or the sealed source requires special authorization from the NRC or an Agreement State.

OR

- The licensee should submit its procedures to perform major decontamination activities if it intends to perform the activity rather than contracting the work to a licensed entity.

8.10.12 Sealed Sources

8.10.12.1 Drill-to-Stop Large Sealed Sources

Regulations: 10 CFR 39.13, 10 CFR 39.63.

Criteria: Licensee must develop and follow instructions to be used by logging personnel when using licensed sealed radioactive sources in drill-to-stop 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 8.16 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 acceptable procedures include:

- Obtaining specific knowledge of the borehole conditions from the drilling team or company
- First running a caliper log to show the hole is open or to find problem areas
- First running a tool without a radioactive source to show it can be freely removed
- Placing a temporary casing in sections of the hole giving problems.

Instructions in drill-to-stop well logging activities should include procedures for using appropriate remote handling tools for handling sealed sources. If only certain handling tools are to be used with particular sealed sources, instructions should clearly address which handling tool is required for each specific sealed source.

Response from Applicant:

- Submit operating and emergency procedures for conducting DTS well logging operations

OR

- Submit an outline or summary that addresses important radiation safety aspects of its Operating and Emergency Procedures when conducting DTS well logging operations.

8.10.12.2 Measurement While Drilling, Logging While Drilling

Regulations: 10 CFR 39.13, 10 CFR 39.63.

Criteria: Licensees 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. If only certain handling tools are to be used with particular sealed sources, instructions should clearly address which handling tool is required for each specific sealed source.

Response from Applicant:

- Submit operating and emergency procedures for conducting MWD and LWD well logging activities

OR

- Submit an outline or summary that addresses important radiation safety aspects of Operating and Emergency Procedures when conducting MWD and LWD well logging activities.

8.10.12.3 Energy Compensation Sources

Regulations: 10 CFR 39.13, 10 CFR 39.35, 10 CFR 39.37, 10 CFR 39.39, 10 CFR 39.41, 10 CFR 39.51, 10 CFR 39.63.

Criteria: Energy compensation sources (ECSs) used in well logging operations are low-activity special form singly or doubly encapsulated sources 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, in most instances, from leak testing requirements, per 10 CFR 39.35(e). ECSs requiring leak testing must be tested at intervals not to exceed 3 years.
- Exempt from abandonment requirements when only ECSs less than or equal to 3.7 MBq (100 microcuries) remain in the abandoned tool.
- Exempt from the performance requirements of sealed sources used in well logging operations.
- 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.

- Exempt from all requirements in 10 CFR Part 39, with the exceptions of physical inventory and 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.
- If a surface casing is not used to protect fresh water aquifers, see 10 CFR 39.53 for applicable requirements.

Figure 8.17 Singly Encapsulated ECS Sealed Source.

Response from Applicant:

- Submit Operating and Emergency Procedures for using and handling ECSs

OR

- Submit an outline or summary that addresses important radiation safety aspects of operating and emergency procedures when using or handling ECSs. The summary must include:
 - 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
 - A record system for maintaining records of use for ECSs.

OR

- Submit alternative procedures for NRC's review.

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

Regulations: 10 CFR 39.63.

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

Discussion: Use of radioactive materials in fresh water aquifers is a prohibited activity. Authorizing to use sealed sources or neutron generators in fresh water aquifers requires that OE procedures include the following information:

- Obtaining specific knowledge of the borehole conditions from the drilling team or company
- First running a caliper log to show the hole is open or to find problem areas
- First running a tool without a radioactive source to show it can be freely removed
- Placing a temporary casing in sections of the hole giving problems.

Response from Applicant: No response is required from the licensee unless it requests authorization for the prohibited activity.

8.10.13 Tracer Studies

8.10.13.1 Tracer Studies in Single Well Applications

Regulations: 10 CFR 39.45, 10 CFR 39.63.

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 concerns:

- 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: No response is required to this section, provided that the elements listed above are contained in other sections.

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 51.60, 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 F in developing step-by-step instructions for tracer personnel in performing field flood tracer studies for multiple wells.

Field flood study activities where licensed material is intentionally released into the environment require an environmental assessment (EA) in accordance with the provisions of 10 CFR 51.21.

NRC has determined that a full environmental assessment is not required, provided the amount of material requested for each isotope is within the generic bounding criteria established in Table 2.1 of NUREG/CR-3467, "Environmental Assessment of the Use of Radionuclides as Tracers in the Enhanced Recovery of Oil and Gas," dated November 1983. For copies of NUREG/CR-3467, see the Notice of Availability on the inside front cover of this report.

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 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.

Response from Applicant:

- Statement that “Field flood studies using tracer materials will not be conducted unless authorized specifically by license conditions.”

OR

- Licensees requesting authorization to conduct field flood studies in the enhanced recovery of oil and gas wells, should provide the information in Appendix F.

8.10.13.3 Tracer Studies in Fresh Water Aquifers

Regulations: 10 CFR 39.45, 10 CFR 51.22, 10 CFR 51.30, 10 CFR 51.60, 10 CFR 51.66.

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

Discussion: In 10 CFR Part 51.22, NRC specifies the criteria for categorical exclusions. When one or more of the criteria for a categorical exclusion are satisfied, the applicant or licensee is relieved from the requirements for preparing an environmental impact statement. This then

relieves the NRC from the requirement of preparing an environmental assessment prior to the issuance, amendment, or renewal of licenses authorizing the use of radioactive tracers in well logging procedures authorized under 10 CFR Part 39. However, the intentional release of licensed radioactive material directly to the environment as a result of a research or other study is not categorically excluded. The Commission specifies in 10 CFR 51.21 and 51.22(b) that in special circumstances and on its own initiative or on the request of any interested individual or party, an environmental assessment on an action normally covered by a categorical exclusion could be required.

NRC, in accordance with 10 CFR 39.45(b), prohibits the intentional injection of licensed tracer material into a fresh water aquifer unless the individual is specifically authorized by the Commission to perform this activity. NRC staff position concerning the intentional injection of licensed tracer material authorized under 10 CFR Part 39 into a fresh water aquifer requires the preparation of an environmental report by the licensee or applicant. Well logging applicants and applicants requesting field flood studies should refer to 10 CFR Part 51.45 and prepare an environmental report. Authorizing an applicant to conduct tracer studies in accordance with 10 CFR 39 in fresh water aquifers would require NRC's assessment of an environmental report and a "finding of no significant impact" by the NRC staff.

Authorizing field flood studies that require the applicant to intentional inject licensed tracer material into a fresh water aquifer would require that an environmental report be prepared by the applicant and an environmental assessment be made 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. Individuals planning activities of this nature should contact NRC well in advance of scheduled use.

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

Response from Applicant:

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

OR

- Applicants requesting authorization to inject licensed radioactive material into a fresh water aquifer must provide their reasons for performing the study and procedures to protect their occupationally exposed workers and the public. For tracer and field flood studies, licensees must also provide an environmental report containing the information outlined in 10 CFR 51.45. Applications require that NRC conduct an assessment and prepare an environmental impact statement. Authorization to inject licensed radioactive material into a fresh water aquifer requires that applicants provide procedures to safeguard the public, licensee personnel, and the environment.

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 at intervals not to exceed 6 months, 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, Schedule B. 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 at intervals not to exceed 6 months, 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 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, as described in Section 8.10.14 of NUREG-1556, Vol.14.”

OR

- Submit procedures for using radioactive markers that are in excess of the quantities in Section 8.10.14 of NUREG-1556, Vol.14.

8.10.15 Neutron Accelerators Using Licensed Material

Regulations: 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, it is subject to individual State, not NRC, regulatory authority. Nonfederal applicants using neutron generators should contact the appropriate State for additional information.

Note: Machine-produced radiation dose is additive to the dose from NRC-regulated materials when assessing total occupational dose occurring during a specified time interval.

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
- Exempt from leak test requirements
- Exempt from the performance requirements of sealed sources used in well logging operations
- Not exempt if a tritium neutron generator for target source is greater than 100 GBq (30 curies) or is used in a well without a surface casing to protect fresh water aquifers.

Section Guidance: Applicants using a neutron generator (particle accelerator) should include handling procedures that address contamination. Operating and Emergency procedures should instruct individuals in the handling of contamination resulting from the routine use, initial installation, replacement, or accidental damage of the targets or glass tubes. Refer to 10 CFR 39.55 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, Vol. 14.”

8.10.16 Depleted Uranium Sinker Bars

Regulations: 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 are both generally licensed and specifically licensed. Most well logging licensees acquire depleted uranium sinker bars under the provisions of 10 CFR 40.25 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 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 NRC; however, when acquired under the provisions of a general license, individuals must file Form NRC 244, "Registration Certificate — Use of Depleted Uranium Under General License." 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
- 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, as specified in 10 CFR 39.43(b)
- Remove bars from use if found defective, until repaired or disposed
- Record information specified in 10 CFR 39.43(b).

Response from Applicant:

- 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."

OR

- State that: "Depleted uranium sinker bars will not be obtained under the provision of a general license per 10 CFR 40.51 (general license)."

AND

- State that: "Uranium sinker bars will be possessed and inspected as specified in Section 8.10.16 of NUREG-1556, Vol. 14."

AND

- Specify the number of kilograms of materials requested.

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 and/or transferred to an authorized recipient. Authorized recipients are the original manufacturer, distributor, a commercial firm licensed by NRC or an Agreement State to accept radioactive waste from other persons, or in the case of sealed sources, transferred to another specific licensee authorized to possess the licensed material (i.e., a transferee's license specifically authorizes the same radionuclide, chemical or physical form, and in most instances, the same use). Records of transfer and waste disposal must be maintained.

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. 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.

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, etc.).

Unsealed radioactive waste must be stored in strong, tight containers (e.g., thick plastic bags, boxes, barrels, etc.) 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, 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
- Obtaining prior approval of NRC of any alternate method
- Release in effluents to unrestricted areas, other than into sanitary sewerage
- Incineration.

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

- Transfer to an authorized recipient
- Release into sanitary sewerage
- Extended interim storage
- Obtaining prior approval of NRC of any alternate method
- Release in effluents to unrestricted areas, other than into sanitary sewerage

- Incineration.

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

- Transfer to an authorized recipient
- DIS
- Extended interim storage.

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

- Transfer to an authorized recipient.

Licensees may choose any one or more of these methods to dispose of their radioactive waste. 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 decay-in-storage being the most frequently used. Applicants requesting authorization to dispose of radioactive tracer waste by incineration should first refer to Policy and Guidance Directive PG 8-10, "Disposal of Incinerator Ash as Ordinary Waste," dated January 1997, 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. NRC transmitted these guidelines to licensees in IN-94-23, "Guidance to Hazardous, Radioactive, and Mixed Waste Minimization Program," dated March 1994.

Disposal By Decay-in-Storage (DIS)

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 radioisotope 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 physical half-life. Waste containing radioisotopes with physical 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 radioisotope in the container. Waste management procedures should include: (a) methods of segregating waste by physical half-lives of 120 days or less, greater than 120 days; methods of surveying waste prior to disposal to confirm that waste above background levels is not inadvertently released; and 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 radioisotope had transpired, date of disposal, and results of 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 T.

Release Into Sanitary Sewerage

10 CFR 20.2003 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 radioisotope is released, the sum of the ratios of the average monthly discharge of a radioisotope to the corresponding limit in 10 CFR Part 20, Appendix B Table 3 cannot exceed 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 radioisotopes combined.

Licensees are responsible to demonstrate 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 radioisotopes 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 20.203 (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 T.

Note: 10 CFR Part 20 prohibits 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 radioisotopes 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 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 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.

Extended Interim Storage

Prior to requesting extended interim storage of radioactive waste materials, and this only as a last resort, licensees should exhaust all possible alternatives for disposal of radioactive waste. The protection of occupationally exposed workers or the public is enhanced by disposing of radioactive waste, rather than storing it. In addition, licensees may find it more economical to dispose of radioactive waste than to store it on-site. As available burial ground capacity decreases, cost of disposal of radioactive waste most likely will continue to increase. Other than DIS, LLW should be stored only when disposal capacity is unavailable and for no longer than is necessary. NRC IN 90-09, "Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Materials Licensees," dated February 1990 and NRC IN 93-50, "Extended Storage of Sealed Sources," dated July 1993, provides guidance to licensees for requesting an amendment to authorize extended interim storage of both sealed and unsealed LLW.

Response from Applicant:

A statement that:

1. "We will use the model waste procedures published in Appendix T to NUREG-1556, Vol. 14, 'Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses', dated April 2000."

OR

We will use the (specify either (1) Decay-In-Storage, or (2) Disposal of Liquids Into Sanitary Sewerage) model waste procedures that are published in Appendix T to NUREG-1556, Vol. 14, 'Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses,' dated April 2000."

OR

2. "Provided are our procedures for waste collection, storage and disposal by any of the authorized methods described in this section." Applicants should contact the appropriate Regional Office of the NRC for guidance to obtain approval of any method(s) of waste disposal other than those discussed in this section.

OR

- | | |
|----|--|
| 3. | If access to a radioactive waste burial site is unavailable, the applicant should request authorization for extended interim storage of waste. Applicant should refer to NRC IN 90-09, "Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Materials Licensees," dated February 1990 or NRC IN 93-50, "Extended Storage of Sealed Sources," dated July 1993, for guidance and submit the required information with the application. |
|----|--|

Note: Applicants do not need to provide information to NRC if they plan to dispose of LLW via transfer to an authorized recipient. Alternative responses will be reviewed using the criteria listed above.

References: See the Notice of Availability on the inside front cover of this report to obtain copies of:

- | | |
|----|--|
| 1. | Policy and Guidance Directive PG 8-10, "Disposal of Incinerator Ash as Ordinary Waste," dated January 1997 |
| 2. | Policy and Guidance Directive PG 94-05, "Updated Guidance on Decay-In-Storage," dated October 1994 |
| 3. | Information Notice 94-23, "Guidance to Hazardous, Radioactive, and Mixed Waste Minimization Program," dated May 1994 |
| 4. | Information Notice 94-07, "Solubility Criteria for Liquid Effluent Releases to Sanitary Sewerage Under the Revised 10 CFR 20," dated January 1994 |
| 5. | Information Notice 84-94, "Reconcentration of Radionuclides Involving Discharges into Sanitary Sewerage Systems Permitted Under 10 CFR 20.203 (now 10 CFR 20.2003)," dated December 1984 |
| 6. | Information Notice 90-09, "Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Materials Licensees," dated February 1990 |
| 7. | Information Notice 93-50, "Extended Storage of Sealed Sources," dated July 1993. |

Information Notices are available at <<http://www.nrc.gov>>.

8.12 Item 12: Fees

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

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

Note: Applicants who wish to perform field flood tracer studies should review 10 CFR Part 51 (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 and appropriate staff time expended, as described

in footnote e.3. to 10 CFR 170.31.

8.13 Item 13: Certification

Individuals acting in a private capacity are required to date and sign NRC Form 313. Otherwise, representatives of the corporation or legal entity filing the application should date and sign

NRC Form 313. Representatives signing an application must be authorized to make binding commitments and to sign official documents on behalf of the applicant. As discussed previously in “Management Responsibility,” signing the application acknowledges management’s commitment and responsibilities for the radiation protection program. NRC will return all unsigned applications for proper signature.

Note:

- 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 part of the licensing 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. 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, 10 CFR 30.36(a)).

Applications for license amendment, in addition to the following, must provide the appropriate fee. For renewal and amendment requests, applicants must do the following:

Be sure to use the most recent guidance in preparing an amendment or renewal request

- Submit in duplicate, either an NRC Form 313 or a letter requesting amendment or renewal
- Provide the license 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, NRC’s guidance, the licensee’s organization, or the radiation protection program. Alternatively, describe clearly the exact nature of the changes, additions, and deletions.

Using the suggested wording of responses and committing to using the model procedures in this report will expedite NRC’s review.
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10 Applications for Exemptions

Various sections of NRC's regulations address requests for exemptions (e.g., 10 CFR 19.31, 10 CFR 20.2301, 10 CFR 30.11(a), 10 CFR 39.91). These regulations state that NRC may grant an exemption, acting on its own initiative or on an application from an interested person. Key considerations are whether the exemption is authorized by law, will endanger life or property or the common defense and security, and is otherwise in the public interest.

Until NRC has granted an exemption in writing, NRC expects strict compliance with all applicable regulations.

Exemptions are not intended for large classes of licenses, and they are generally limited to a unique situation. Exemption requests must be accompanied by descriptions of the following:

- Regulations to which the exemption is requested and why the exemption is needed
- Proposed compensatory safety measures intended to provide a level of health and safety equivalent to the regulation for which the exemption is being requested.

11 Termination of Activities

Regulations: 10 CFR 20.1401; 10 CFR 20.1402; 10 CFR 20.1403; 10 CFR 20.1404; 10 CFR 20.1405; 10 CFR 20.1406. 10 CFR 30.34(b); 10 CFR 30.35(g); 10 CFR 30.36(d); 10 CFR 30.36(g); 10 CFR 30.36(h); 10 CFR 30.36(j); 10 CFR 30.51(f); and 10 CFR 39.91

Criteria: Pursuant to the regulations described above, the licensee must do the following:

- Notify NRC, in writing, within 60 days of:
 - the expiration of its license
 - a decision to permanently cease licensed activities at the *entire site* (regardless of contamination levels)
 - a decision to permanently cease licensed activities in *any separate building or outdoor area*, if they contain residual radioactivity making them unsuitable for release according to NRC requirements
 - no principal activities having been conducted at the *entire site* under the license for a period of 24 months
 - no principal activities having not been conducted for a period of 24 months in *any separate building or outdoor area*, if they contain residual radioactivity making them unsuitable for release according to NRC requirements.
- Submit 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, 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.

Discussion: As discussed above in “Criteria,” before a licensee can decide whether it must notify 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.

The permanent cessation of principal activities in an individual room or laboratory may require the licensee to notify NRC if no other licensed activities are being performed in the building.

Draft Regulatory Guide DG-4006, “Demonstrating Radiological Criteria For License Termination,” issued July 8, 1998 and NUREG/BR-0241, “NMSS Handbook for Decommissioning Fuel Cycle and Materials Licenses,” dated March 1997, contain the current regulatory guidance concerning decommissioning of facilities and termination of licenses. Appendix B of the Handbook contains a comprehensive list of NRC’s decommissioning regulations and guidance. NUREG-1575, “Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM),” dated December 1997, should be reviewed by licensees who have large facilities to decommission. An acceptable screening computer code for calculating screening values to demonstrate compliance with the unrestricted dose limits is D and D, Version 1; this was issued on August 20, 1998. Supplemental information on the implementation of the final rule on radiological criteria for license termination was published in the Federal Register (Volume 63, Number 222, Page 64132-64134) on November 18, 1998. This includes the following acceptable license termination screening values of common radionuclides for building surface contamination.

Table 11.1 Acceptable License Termination Screening Values of Common Radionuclides for Building Surface Contamination

Radionuclide	Symbol	Acceptable Screening Levels*
hydrogen-3 (tritium)	H-3	1.2 x 10 ⁸
carbon-14	C-14	3.7 x 10 ⁶
sodium-22	Na-22	9.5 x 10 ³
sulfur -35	S-35	1.3 x 10 ⁷
iron-55	Fe-55	4.5 x 10 ⁶
cobalt-60	Co-60	7.1 x 10 ³
nickel-63	Ni-63	1.8 x 10 ⁶
strontium-90	Sr-90	8.7 x 10 ⁶
cesium-137	Cs-137	2.8 x 10 ⁴
iridium-192	Ir-192	7.4 x 10 ⁴

Radionuclide	Symbol	Acceptable Screening Levels*
<p>* Screening levels are based on the assumption that the fraction of removable surface contamination is equal to 0.1. For cases when the fraction of removable contamination is undetermined or higher than 0.1, users may assume, for screening purposes, that 100% of surface contamination is removable; and therefore the screening levels should be decreased by a factor of 10. Alternatively, users having site-specific data on the fraction of removable contamination (e.g., within 10% to 100% range) may calculate site-specific screening levels using D and D Version 1, based on site-specific resuspension factor. For Unrestricted Release (dpm/100 cm²) Units are disintegrations per minute per 100 square centimeters (dpm/100 cm²). 1 dpm is equivalent to 0.0167 becquerel (Bq). The screening values represent surface concentrations of individual radionuclides that would be deemed in compliance with the 0.25 mSv/yr (25 mrem/yr) unrestricted release dose limit in 10 CFR 20.1402. For radionuclides in a mixture, the “sum of fractions” rule applies; see 10 CFR Part 20, Appendix B, Note 4. Refer to NRC Draft Guidance DG-4006 for further information on application of the values in this table.</p>		

Response from Applicant: The applicant is not required to submit a response to the NRC during the initial application. However, when the license expires or at the time the licensee ceases operations, then any necessary decommissioning activities must be undertaken, NRC Form 314 or equivalent information must be submitted, and other actions must be taken as summarized in the Criteria.

Reference: Copies of NRC Form 314, “Certificate of Disposition of Materials,” are available upon request from NRC’s Regional Offices. (See Figure 2.1 for addresses and telephone numbers).

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), Policy and Guidance Directives (P&GDs), Information Notices (INs), and Technical Assistance Requests (TARs) listed below. Other NRC documents such as Manual Chapters (MCs), Inspection Procedures (IPs), and Memoranda of Understanding (MOU) were also 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 NUREG Reports, Regulatory Guides, and Policy and Guidance Directives

Document Identification	Title	Date
Working Papers		

Document Identification	Title	Date
* Working Paper	Guide for the Preparation of Applications for the Use of Radioactive Materials as Inverell Tracers in Field Flooding for the Enhanced Recovery of Oil and Natural Gas, First Draft	9/16/83
Draft Regulatory Guide		
Draft Regulatory Guide FC 413-4	Guide for the Preparation of Applications for Licenses for the Use of Radioactive Materials in Calibrating Radiation Survey and Monitoring Instruments	6/85
Draft Regulatory Guide FC 412-4	Guide for the Preparation of Applications for the Use of Radioactive Materials in Leak-Testing Services	6/85
*Draft Regulatory Guide	Guide for the Preparation of Applications for the Use of Radioactive Materials in Well Logging Operations	7/87
Regulatory Guide		
Regulatory Guide (RG) 10.8, Rev.2	Guide for the Preparation of Applications for Medical Use Programs	8/87
Regulatory Guide (RG) 3.66	Standard Format and Content of Financial Assurance Mechanisms Required for Decommissioning Under 10 CFR Parts 30, 40, 70, and 72	6/90
Regulatory Guide (RG) 4.20	Constraints on Release of Airborne Radioactive Materials to the Environment for Licensees Other Than Power Reactors	6/90
Regulatory Guide (RG) 8.7, Rev.1	Instructions for Recording and Reporting Occupational Radiation Exposure Data	6/92

Document Identification	Title	Date
Regulatory Guide (RG) 8.25	Air Sampling in the Workplace	6/92
Regulatory Guide (RG) 8.34	Monitoring Criteria and Methods to Calculate Occupational Radiation Doses	7/92
Regulatory Guide (RG) 8.9	Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program	7/93
Regulatory Guide (RG) 8.37	ALARA Levels for Effluents from Materials Facilities	7/93
Regulatory Guide (RG) 8.32	Criteria for Establishing a Tritium Bioassay Program	7/98
NUREG		
NUREG-1541	Process and Design for Consolidating and Updating Materials Licensing Guidance	4/96
NUREG-1539	Methodology and Findings of the NRC's Materials Licensing Process Redesign	4/96
NUREG-1507	Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions	6/98
Letters		
*Generic Exemption to 10 CFR 39.41(a)(3)	All NRC Well Logging Licensee	8/10/89
SP-96-022	All Agreement States Letter	2/16/96
NCRP or ICRP Documents		
National Council on Radiation Protection and Measurements (NCRP) Report No. 49	Structural Shielding Design and Evaluation for Medical Use of X Rays and Gamma Rays of Energies Up to 10 MeV	

Document Identification	Title	Date
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 (1983 revision)	
	The Health Physics & Radiological Health Handbook, Revised Edition, Edited by Bernard Shleien	1992
Technical Assistance Requests		
*Memorandum	Richard Cunningham, Subject: Proposed Abandonment of Well-Logging Source in an Artesian Well	02/05/91
*Memorandum	Bill Beach, Subject: Burial of Frac Sands as a Method of Waste Disposal	07/01/91
*Memorandum	John Glenn, Subject: Interpretation of 10 CFR 39.47 - Radioactive Markers	10/29/91
*Memorandum	John Glenn, Subject: Use of “Exempt” Sources as Well Markers	03/11/92
*Memorandum	Richard Cunningham, Subject: Well Logging Source Lost Downhole	05/22/92

Document Identification	Title	Date
*Memorandum	John Glenn, Subject: Authorization to Use Cesium-137 or Cobalt-60 Sealed Sources in Specially Designed Bullets or Core Gun Driver Assemblies for Use as Radioactive Markers in Wells	05/17/93
*Memorandum	John Glenn, Subject: Exemption from Semiannual Timer Period for Equipment Inspection and Maintenance Specified in 10 CFR 39.43(b) When Equipment is in Storage	02/24/94
*Memorandum	John Glenn, Subject: Temporary Exemption From 10 CFR 39.41	03/17/94
*Memorandum	Carl Paperiello, Subject: Use of Tritiated Hexadecane as a Liquid for the Purpose of Tagging a Hydrocarbon-Based Gel to be Used in Tagging Mud Used in Oil Well Drilling Applications	04/13/94
*Memorandum	Carl J. Paperiello, Subject: Exemption to 10 CFR 39.47 Markers, 39.35(c) Leak Testing, 39.15(a)(3) Agreements, and 39.77(c)(1) Notification of Lost Source	09/21/94
*Memorandum	John Glenn, Subject: Exemption to 10 CFR 39.47 Markers, 39.35(c) Leak Testing, 39.15(a)(3) Agreements, and 39.77(c)(1) Notification of Lost Source	09/21/94
*Memorandum	Larry Camper, Subject: Use of Handling Tools When Using Tracer Materials	06/12/95

Document Identification	Title	Date
*Memorandum	Larry Camper, Subject: Request an Amendment to License to Add a Well as a Storage Site for a PDK Logging Tool	06/14/95
*Memorandum	Larry Camper, Subject: Alternative Training for Well Logging Supervisor	06/26/95
Information Notices		
IN 90-09	Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Material Licensees	2/90
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	2/94
IN 94-23	Guidance to Hazardous, Radioactive, and Mixed Waste Minimization Program	3/94
IN 96-28	Suggested Guidance Relating to Development and Implementation of Corrective Action	5/96
IN 97-30	Control of Licensed Material During Reorganizations, Employee-Management Disagreements and Financial Crises	6/97

Document Identification	Title	Date
Policy Guidance and Directives		
Policy and Guidance Directive FC 90-2 (Rev. 1)	Standard Review Plan for Evaluating Compliance with Decommissioning Requirements	4/30/91
Revision 1, Supplement to Policy and Guidance Directive FC 84-20	Impact of Revision of 10 CFR Part 51 on Materials License Actions	3/94
Policy and Guidance Directive PG 8-11	NMSS Procedures for Reviewing Declarations of Bankruptcy	8/8/96
Inspection Procedures		
Inspection Procedure (IP) 87103	Inspection of Material Licensees Involved in an Incident or Bankruptcy Filing	2/97
Inspection Procedure (IP) 87113	Appendix A - "Well Logging Inspection Field Notes"	1998

Appendix B: United States Nuclear Regulatory Commission Form 313

Form 313 - Sample Application Material License	
Page	Title
1 of 1	Application for Material License, 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.	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		
Radioisotope	Manufacturer/Model No.	Quantity
		Not to exceed the maximum activity per source as specified in the Sealed Source and Device Registration Sheet.
		Not to exceed the maximum activity per source as specified in the Sealed Source and Device Registration Sheet.
		Not to exceed the maximum activity per source as specified in the Sealed Source and Device Registration Sheet.

Neutron Generators		
Radioisotope	Manufacturer/Model No.	Quantity

Electronic Compensation Sources		
Radioisotope	Manufacturer/Model No.	Quantity
		Not to exceed the maximum activity per source as specified in the Sealed Source and Device Registration Sheet.
		Not to exceed the maximum activity per source as specified in the Sealed Source and Device Registration Sheet.

Tracer Materials					
Radioisotope	Chemical or Physical Form			Millicuries Per Injection	Total Quantity Requested
	<input type="checkbox"/> Gas	<input type="checkbox"/> Liquid	<input type="checkbox"/> Labeled Frac Sands		

	<input type="checkbox"/> Gas	<input type="checkbox"/> Liquid	<input type="checkbox"/> Labeled Frac Sands		
	<input type="checkbox"/> Gas	<input type="checkbox"/> Liquid	<input type="checkbox"/> Labeled Frac Sands		

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

Sealed Sources Not Used in Well Logging Operations		
Radioisotope	Manufacturer/Model No.	Quantity
		Not to exceed the maximum activity per source as specified in the Sealed Source and Device Registration Sheet.
		Not to exceed the maximum activity per source as specified in the Sealed Source and Device Registration Sheet.
Commitment:		Yes
Confirm that each sealed source used in above ground devices is registered as an approved sealed source or device by NRC or an Agreement State and will be possessed and used in accordance with the conditions specified in the registration certificate.		<input type="checkbox"/>
		N/A
		<input type="checkbox"/>

Item No.	Title and Criteria	Yes	N/A	Description Attached
	RADIOACTIVE MATERIAL Financial Assurance and Record Keeping for Decommissioning			

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Pursuant to 10 CFR 30.35(g), we shall maintain drawings and records important to decommissioning and transfer 			

Item No.	Title and Criteria	Yes	N/A	Description Attached
		[]	[]	
	• If financial assurance is required, submit evidence.	[]	[]	[]

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.	[]	[]	

Item No.	Title and Criteria	Yes	N/A	Description Attached
	• Mineral Well Logging.	[]	[]	
	• Geophysical Well Logging.	[]	[]	
	• Tracer Studies in Single Wells	[]	[]	

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> • Field Flood or Enhanced Recovery Studies in Multiple Wells. <p>OR</p>	[]	[]	

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Specify the purposes for which the sources and device(s) will be used other than those included in the manufacturer's recommendation 			

Item No.	Title and Criteria	Yes	N/A	Description Attached
				[]
	<ul style="list-style-type: none"> • We plan to perform in <i>fresh water</i> aquifers: 			
	- Tracer Studies	[]	[]	
	- Well logging using sealed sources	[]	[]	

Item No.	Title and Criteria	Yes	N/A	Description Attached
	- 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			

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> The name of the proposed RSO and other individuals who will be responsible for the radiation protection program. Name: _____ _____ _____	[]		

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> • Demonstrate that the RS O has sufficient independence and direct communication with responsible management officials by pro 			

Item No.	Title and Criteria	Yes	N/A	Description Attached
				[]
	<ul style="list-style-type: none"> The specific training and experience of the RS O OR			[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Alternative information demonstrating that the proposed RSO is qualified by training and experience, e.g., listed by name 		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
8	TRAINING FOR LOGGING SUPERVISORS AND LOGGING ASSISTANTS			

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Submit an outline of the training to be given to prospective logging supervisors and logging assistants. 			[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> • Submit your procedures for experienced logging supervisors who have worked for another licensee. 			[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Provide a copy of a typical examination and the correct answers to the examination questions. State the passing grade %. 			[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Specify the qualifications of your instructors. 			[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> If training will be conducted by someone outside the applicant's organization, identify the course by title and provide the name 	[]	[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Describe the field (practical) examination that will be given to prospective logging supervisors and logging assistants. 			[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Describe the annual refresher training program, including topics to be covered and how the training will be conducted. 			[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Submit a description of your program for inspecting the job performance of each well logging supervisor or logging assi 			[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
9	FACILITIES AND EQUIPMENT			

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Submit a drawing or sketch of the proposed facility, identifying areas where radioactive materials, including radioactive wastes, 		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Drawings should show, where applicable, adjacent buildings, boundary lines, security fences, and lockable storage areas. 		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> • Illustrate area (s) where explosive, flammable, or other hazardous materials may be stored. 		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Drawings should also show the relationship and distance between restricted areas and adjacent unrestricted areas. 		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Drawings should specify shielding materials (concrete, lead, etc.) and means for securing radioactive materials from unauthor 		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Submit a drawing or sketch of the proposed tracer material storage facilities, including rooms, buildings, below ground bunker 		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Describe protective clothing (such as rubber gloves, coveralls, respirators, and face shields), auxiliary shielding, absorbent material 		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Describe proposed laundry facilities, if applicable, used for contaminated protective clothing. Specify how the contaminated 		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Describe proposed decontamination facilities for trucks, tracer injection tools, or other equipment contaminated by tracer 		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
9	FACILITIES AND EQUIPMENT <i>(Cont'd)</i> • Describe, if applicable, equipment for "repackaging" gaseous, volatile,		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
10	RADIATION SAFETY PROGRAM			

Item No.	Title and Criteria	Yes	N/A	Description Attached
	The applicant is required to establish and submit its radiation protection program. The format use for providing information should be			[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	Radiation Safety Program Audit: The applicant is <i>not</i> required to, and should not, submit its audit program to the NR C for review		Need Not Be Submitted With Application	

Item No.	Title and Criteria	Yes	N/A	Description Attached
	Well Owner Operator/ Agreement			[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	Instruments • A description of the instrumentation (as described above) that will be used to perform required surveys. OR			[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> We will use instruments that meet the radiation monitoring instrument specifications published in Appendix N to NUREG-1556, 			

Item No.	Title and Criteria	Yes	N/A	Description Attached
		[]		

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> We will implement the model survey meter calibration program published in Appendix N to NUREG-G-1556, Vol. 14, 'Progr 			

Item No.	Title and Criteria	Yes	N/A	Description Attached
		[]	[]	

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> A description of alternative equipment and/or procedures for ensuring that appropriate radiation monitoring equipment will be used during 		[]	[]

Item No.	Title and Criteria	Yes	N/A	Description Attached
	Material Receipt and Accountability			

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Physical inventories will be conducted and documented at intervals not to exceed six months, to account for all byproduct 	[]		

Item No.	Title and Criteria	Yes	N/A	Description Attached
	Occupational Dosimetry			

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Film badge, TLD, or OS L dosimeter will be processed and evaluated by a NVLAP-accredited entity, exchanged at the approval 			

Item No.	Title and Criteria	Yes	N/A	Description Attached
		[]	[]	

Item No.	Title and Criteria	Yes	N/A	Description Attached
	<ul style="list-style-type: none"> Individual logging supervisors and logging assistants using more than 50 millicuries of iodine-131 at any one time or in any 	[]	[]	