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Volume 2, Rev. 1

Consolidated Guidance About Materials Licenses

Program-Specific Guidance About
Industrial Radiography Licenses

Final Report

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Consolidated Guidance About Materials Licenses

Program-Specific Guidance About Industrial Radiography Licenses

Final Report

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ABSTRACT

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

Paperwork Reduction Act Statement

This NUREG references information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget (OMB), approval numbers 3150-0014; 3150-0035; 3150-0017; 3150-0001; 3150-0007; 3150-0214; 3150-0008; and 3150-0120.

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FOREWORD

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

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

The current document, NUREG–1556, Volume 2, Revision 1, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Industrial Radiography Licenses," is intended for use by applicants, licensees, and NRC staff. This revision provides a general update to the previous information contained in NUREG–1556, Volume 2, issued August 1998. See Appendix A of this NUREG for a list of documents considered in the development of this NUREG–1556 report.

This report takes a risk-informed, performance-based approach to licensing the use of sealed sources in industrial radiography. A team composed of staff from NRC Headquarters, NRC regional offices, and Agreement States prepared this document, drawing on their collective experience in radiation safety in general and as specifically applied to industrial radiography. NUREG–1556, Volume 2, Revision 1, is not a substitute for NRC or Agreement State regulations. The approaches and methods described in this report are provided for information only. Methods and solutions different from those described in this report may be acceptable if they include a basis for the NRC staff to make the determinations needed to issue or renew a license.

The comments received during the public comment period for NUREG–1556, Volume 2, Revision 1, were summarized and addressed in a document that can be located on the NRC's Agencywide Documents and Management System (ADAMS) under ML15033A308. Access to ADAMS is available on the public Web site at: <http://www.nrc.gov/reading-rm/adams.html>. The comments received by NRC included general corrections, comments on training, and comments on safety culture.

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ABBREVIATIONS

ADAMS	Agencywide Documents Access Management System
AEA	Atomic Energy Act
ALARA	as low as is reasonably achievable
ANSI	American National Standards Institute
bkg	background
Bq	becquerel
CFR	<i>Code of Federal Regulations</i>
Ci	curie
cm	centimeter
Co	cobalt-60
COC	certificate of compliance
cpm	counts per minute
DOJ	U.S. Department of Justice
DOT	U.S. Department of Transportation
dpm	disintegrations per minute
DU	depleted uranium
ft	foot
GBq	Gigabecquerel
GPO	Government Printing Office
GPS	global positioning system
Gy	gray
h	hour
HVL	half-value layer
IN	information notice
Ir	iridium-192
μCi	microcurie
LLEA	local law enforcement agency
MDA	minimum detectable activity
m	meter
mR	milliroentgen
mrem	millirem
mrem/h	millirem per hour
mSv	millisievert
mSv/h	millisievert per hour
NIST	National Institute of Standards and Technology
NMSS	Office of Nuclear Material Safety and Safeguards
NRC	U.S. Nuclear Regulatory Commission
NSTS	National Source Tracking System
NSTTR	National Source Tracking Transaction Reports
NVLAP	National Voluntary Laboratory Accreditation Program
OMB	Office of Management and Budget
PII	Personally Identifiable Information
R	roentgen
RIS	regulatory issue summary
RQ	reportable quantities
RSO	radiation safety officer
SSD	sealed source and device
SSR	Suggested State Regulations
std	standard

Sv	sievert
TBq	Terabecquerel
TEDE	total effective dose equivalent
T	time
TI	Transport Index
TLD	thermoluminescent dosimeter
U.S.C.	United States Code

1 PURPOSE OF REPORT

This report provides guidance to an applicant applying for an industrial radiography (radiography) license and provides the U.S. Nuclear Regulatory Commission (NRC) with criteria for evaluating such applications. This document uses the terms “byproduct material,” “licensed material,” and “radioactive material” interchangeably. The term “radiography,” as used in this report, means an examination of the structure of materials by nondestructive methods using ionizing radiation to make radiographic images, as authorized under the Title 10 of the *Code of Federal Regulations* (10 CFR) Part 34, “Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations.” The radionuclides most commonly used for radiography are cobalt-60 and iridium-192; however, other radionuclides (e.g., californium-252, ytterbium-169, selenium-75) with unique radiological characteristics might also be used. This report does not address the research and development of radiography devices and associated equipment, or the commercial aspects of manufacturing, distribution, and service of such devices or equipment.

Chapter 8, “Contents of an Application,” of this guide identifies the information needed to complete NRC Form 313, “Application for Materials License,” (see Appendix B of this NUREG) for the use of sealed sources containing byproduct material in radiography devices. The Office of Management and Budget (OMB) has approved the information collection requirements in 10 CFR Part 30, “Rules of General Applicability to Domestic Licensing of Byproduct Material”; 10 CFR Part 34 and NRC Form 313 under OMB Clearance Nos. 3150-0017, 3150-0007; and 3150-0120, respectively.

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 about the topic.
- 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 and may not be found for each item on NRC Form 313. Appendix A of this NUREG includes specific NRC references used in the development of this guidance document.

NRC Form 313 does not have sufficient space for applicants to provide full responses to Items 5 through 11, as indicated on the form. Applicants should address those items on separate sheets of paper and submit them along with the completed NRC Form 313. For the convenience and streamlined handling of industrial radiography applications, NUREG-1556, Volume 2, Revision 1, Appendix C, “Suggested Format for Providing Information Requested in Items 5 through 11 of NRC Form 313,” may be used to provide supporting information.

In this document, “dose” or “radiation dose” means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent (TEDE), as defined in 10 CFR Part 20, “Standards for Protection Against Radiation.” To describe units of radiation exposure or dose, rem and its International

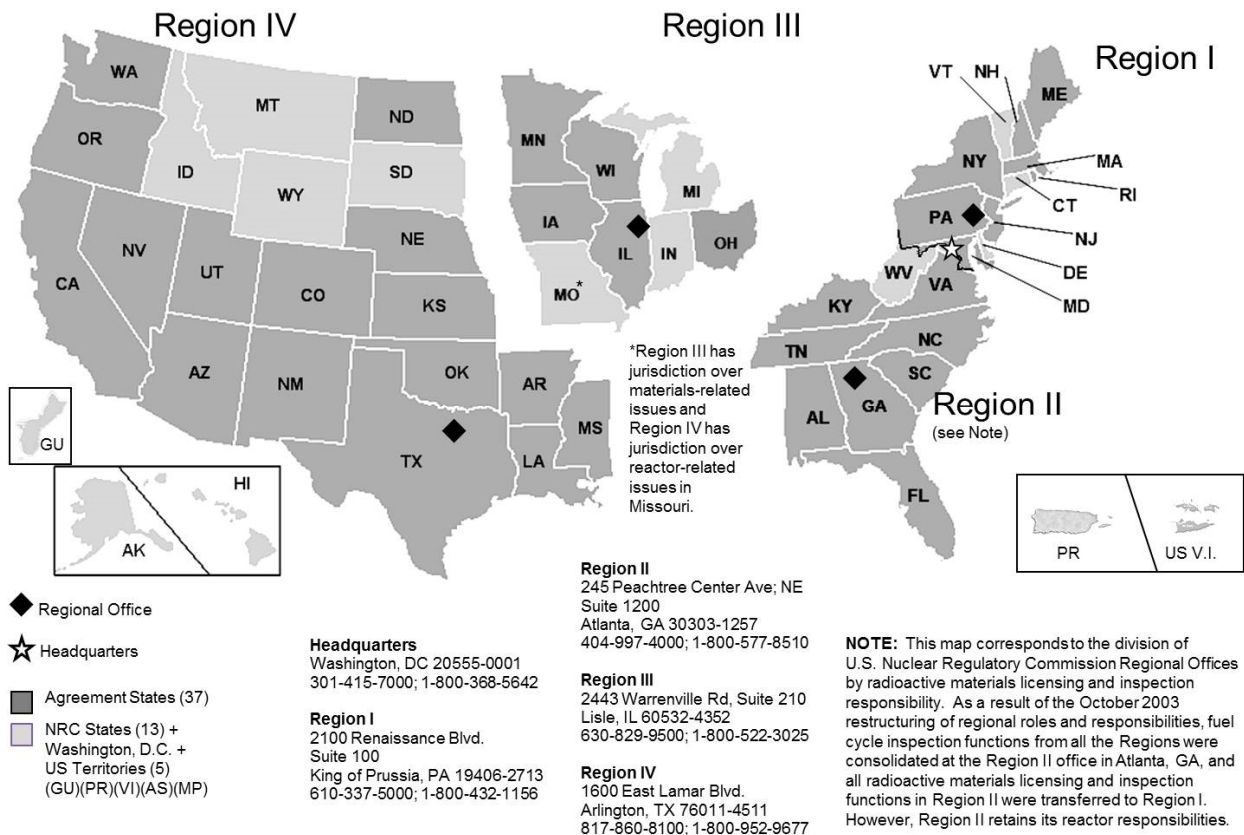
System of Units equivalent, sievert (Sv) [1 rem = 0.01 Sv], are used. This is done because 10 CFR Part 20 sets dose limits in terms of rem (Sv), rather than rad or roentgen. When the radioactive material emits beta and gamma rays, 1 roentgen is assumed to equal 1 rad, which is assumed to equal 1 rem. For alpha and neutron-emitting radioactive material, 1 rad is not equal to 1 rem. Determination of dose equivalent (rem) from absorbed dose (rad) from alpha particles and neutrons requires the use of an appropriate quality factor (Q) value. These Q values are used to convert absorbed dose (rad) to dose equivalent (rem). Tables 1004(b).1 and .2 in 10 CFR 20.1004, "Units of radiation dose," address the Q values for alpha particles and neutrons.

2 AGREEMENT STATES

2.1 Jurisdiction Determination

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

¹Locations of NRC Offices and Agreement States



¹Current regional office addresses can be verified at <http://www.nrc.gov/about-nrc/locations.html>

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

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

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

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

Table 2-1. Who Regulates the Activity?	
Applicant and Proposed Location of Work	Regulatory Agency
Federal agency, regardless of location (except that the U.S. Department of Energy and, under most circumstances, its prime contractors are exempt from licensing, in accordance with 10 CFR 30.12, “Persons using byproduct material under certain U.S. Department of Energy and U.S. Nuclear Regulatory Commission contracts”)	NRC
Non-Federal entity in non-Agreement State, District of Columbia, U.S. territory, or possession, or in offshore Federal waters	NRC
Federally recognized Indian Tribe or tribal member on Indian Tribal land	NRC
Non-Federal entity on federally recognized Indian Tribal land	NRC ³
Federally recognized Indian Tribe or tribal member outside of Indian Tribal land in Agreement State	Agreement State
Non-Federal entity in Agreement State	Agreement State ⁴

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

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

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

Applicant and Proposed Location of Work	Regulatory Agency
Non-Federal entity in Agreement State at federally controlled site not subject to exclusive Federal jurisdiction	Agreement State ⁴
Non-Federal entity in Agreement State at federally controlled site subject to exclusive Federal jurisdiction	NRC
Non-Federal entity in Agreement State conducting industrial radiography at a Part 50 or 52 reactor site, including construction, preoperational, and operational phases	Agreement State

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

2.2 Reciprocal Recognition of Specific Licenses

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

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

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

3 MANAGEMENT RESPONSIBILITY

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

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

3.1 Commitments and Responsibilities

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

- to ensure radiation safety, security, and control of radioactive materials and compliance with regulations;
- to ensure that radiation safety records and all information provided to the NRC are complete and accurate (10 CFR 30.9, “Completeness and accuracy of information”);
- to affirm the licensee’s knowledge about the contents of the license and application;
- to comply with NRC and Department of Transportation (DOT) regulations, the licensee’s operating, emergency, and security procedures, and NRC license commitments;
- to provide adequate resources (including space, equipment, personnel, time, and, if needed, contractors) to the radiation protection program to ensure that the public and workers are protected from radiation hazards and compliance with regulations is maintained;
- to report defects, noncompliances, or reportable events in accordance with regulations;
- to select and assign a qualified individual to serve as the radiation safety officer (RSO) for licensed activities and confirmation that the RSO has independent authority to stop unsafe operations and will be given sufficient time to fulfill radiation safety duties and responsibilities;
- to ensure that radiation workers have adequate training;
- to prevent discrimination of employees engaged in protected activities (10 CFR 30.7, “Employee protection”);

- to provide information to employees about the employee protection and deliberate misconduct provisions in 10 CFR 30.7, “Employee protection,” and 10 CFR 30.10, “Deliberate misconduct;”
- to obtain NRC’s prior written consent before transferring control of the license (see Section 9.1, “Timely Notification of Transfer of Control,” of this NUREG); and
- to notify the appropriate NRC Regional Administrator, in writing, immediately following the filing of petition for voluntary or involuntary bankruptcy [10 CFR 30.34(h)], as discussed further in Section 8.2.1, “Notification of Bankruptcy Proceedings,” of this NUREG.

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

3.2 Safety Culture

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

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

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

The NRC, as the regulatory agency with an independent oversight role, reviews the performance of individuals and organizations to determine compliance with requirements and commitments through its existing inspection and assessment processes. However, NRC’s safety culture policy statement and traits are not incorporated into the regulations. Safety

culture traits may be inherent to an organization’s existing radiation safety practices and programs. For instance, the annual refresher training required for radiographers and radiographer assistants may correspond with the safety culture trait specified in Table 3-1 as “Continuous Learning” (opportunities to learn about ways to ensure safety are sought out and implemented). However, licensees should be aware that this is just an example, and should consider reviewing their radiation safety programs in order to develop and implement a safety culture commensurate with the nature and complexity of their organizations and functions.

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

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

4 APPLICABLE REGULATIONS

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

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

- [10 CFR Part 2](#) "Agency Rules of Practice and Procedure"
- [10 CFR Part 19](#) "Notices, Instructions and Reports to Workers: Inspection and Investigations"
- [10 CFR Part 20](#) "Standards for Protection Against Radiation"
- [10 CFR Part 21](#) "Reporting of Defects and Noncompliance"
- [10 CFR Part 30](#) "Rules of General Applicability to Domestic Licensing of Byproduct Material"
- [10 CFR Part 32](#) "Specific Domestic Licenses to Manufacture or Transfer Certain Items Containing Byproduct Material"
- [10 CFR Part 34](#) "Licenses for Industrial Radiography and Radiation Safety for Industrial Radiographic Operations"
- [10 CFR Part 37](#) "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material"
- [10 CFR Part 40](#) "Domestic Licensing of Source Material"
- [10 CFR Part 71](#) "Packaging and Transportation of Radioactive Material"
- [10 CFR Part 110](#) "Export and Import of Nuclear Equipment and Material"
- [10 CFR Part 150](#) "Exemptions and Continued Regulatory Authority in Agreement States and in Offshore Waters under Section 274"
- [10 CFR Part 170](#) "Fees for Facilities, Materials, Import and Export Licenses, and Other Regulatory Services Under the Atomic Energy Act of 1954, as Amended"

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

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

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

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

5 HOW TO FILE

5.1 Application Preparation

Applicants for a materials license should do the following:

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

5.2 Where to File

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

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

5.3 Paper Applications

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

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

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

5.4 Electronic Applications

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

6 IDENTIFYING AND PROTECTING SENSITIVE INFORMATION

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

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

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

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

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

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

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

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

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

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

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

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

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

7 APPLICATION AND LICENSE FEES

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

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

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

8 CONTENTS OF AN APPLICATION

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

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

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

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

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

8.1 Item 1: License Action Type

Item 1 of NRC Form 313 states the following:

This is an application for (check appropriate item):

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

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

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

Check box C for a renewal of an existing license and provide the license number. See "License Amendments and Renewals" in Chapter 9 of this report.

8.2 Item 2: Name and Mailing Address of Applicant

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

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

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

8.2.1 Notification of Bankruptcy Proceedings

Regulation: 10 CFR 30.34(h)

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

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

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

Reference: See NUREG-1556, Volume 15, "Consolidated Guidance About Materials Licenses: Guidance About Changes of Control and about Bankruptcy Involving Byproduct, Source, or Special Nuclear Materials Licenses."

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

Specify the street address, city, and State or other descriptive address (e.g., on Highway 10, 5 miles east of the intersection of Highway 10 and State Route 234, Anytown, State) for each facility. The descriptive address should be sufficient to allow an NRC inspector to find the facility location. A post office box address is not acceptable (see Figure 8-1). In addition, applicants are encouraged to provide global positioning system (GPS) coordinates, as appropriate, for each permanent storage or use facility and field station located in a remote area. A field station is a location where licensed material may be stored or used and from which

the applicant will dispatch equipment to jobsites. If devices will not be stored at a dispatch site or field station, the applicant should indicate this. The applicant should also state whether a location will be used to perform radiographic operations or only for storage of sources and devices.

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

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

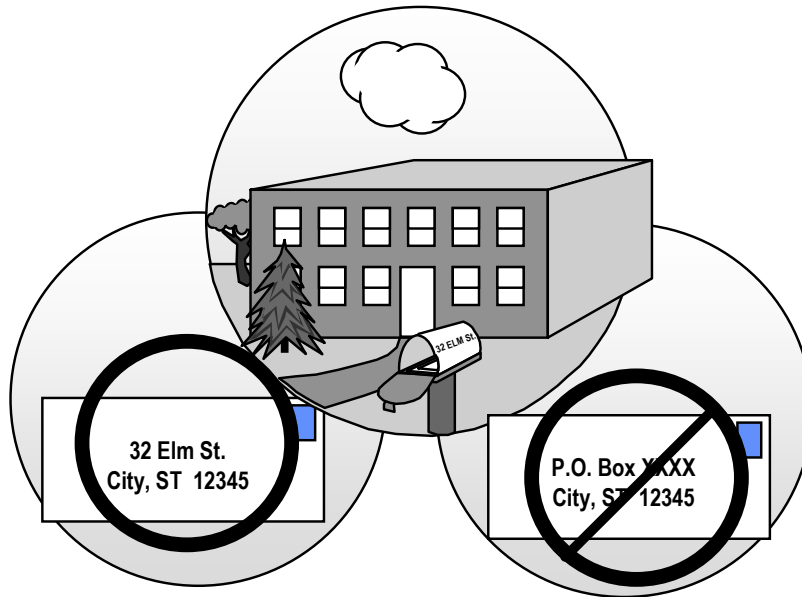
If an applicant submits documents that give the exact location of use and storage for any amount of radioactive material, the applicant should mark these documents as “Security Related Information—Withhold under 10 CFR 2.390.” See Chapter 6, “Identifying and Protecting Sensitive Information,” for more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

Response from Applicant:

- If a device will be used in a permanent radiographic installation, provide the specific address of each location. If applicable, describe the locations of use of the property outside of the installation where radiographic operations will be conducted.
- If radiography equipment will be stored or used at a field station, provide the specific address of each field station (and the GPS coordinates, if available). If applicable, describe the locations outside of the field station where radiographic operations will be conducted.
- If radiography operations will be conducted at temporary jobsites (i.e., locations where work is conducted for limited periods of time), the address may be stated as “temporary jobsites anywhere in the United States where NRC maintains jurisdiction.”

Note: Locations where licensed material may be stored or used and from which equipment is dispatched are considered field stations, which, as specified in 10 CFR 34.13(j), must be identified in the application. Residential locations where industrial radiographic equipment is stored prior to dispatch to temporary jobsites must be treated as a field station.

Note: If radiography operations are expected to exceed 180 days at a temporary jobsite, then provide written notification to the appropriate NRC regional office before exceeding the 180 days, in accordance with 10 CFR 34.101(c) (a license amendment or authorization by the NRC regional office is not required).



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

Figure 8-1. Location of Use or Possession

Note: As discussed in Section 8.5.2, “Financial Assurance and Recordkeeping for Decommissioning,” licensees must maintain permanent records that describe where licensed material was used or stored while the license was in effect. This is important for making future determinations about the release of these locations for unrestricted use (e.g., before the license is terminated). Acceptable records are sketches, written descriptions of the specific locations or room numbers where licensed material is used or stored, and any records of leaking radioactive sources or other unusual occurrences involving the possible spread of contamination in or around the licensee’s facilities.

8.4 Item 4: Person To Be Contacted about This Application

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

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

8.5 Item 5: Radioactive Material

8.5.1 Sealed Sources and Devices

Regulations: 10 CFR 30.3, 10 CFR 30.32(g), 10 CFR 30.33(a)(2), 10 CFR 32.210, 10 CFR 34.20, 10 CFR Part 37

Criteria: Applicants must provide the manufacturer's (or distributor's) name and model number for each requested source assembly (the sealed source and a connector that attaches the source to the control cable), exposure device, and source changer. Licensees will only be authorized for compatible radiographic exposure devices, source assemblies, or sealed sources containing byproduct material meeting NRC performance requirements and specifically approved or registered by the NRC or an Agreement State. In addition, identify any depleted uranium that is used as shielding material (radiographic exposure devices, source changers, and some collimators contain depleted uranium). Licensees must also protect Category 1 and Category 2 quantities of radioactive material from theft and diversion.

Discussion: The NRC or an Agreement State performs safety evaluations of radiography source assemblies, exposure devices, and source changers before distribution of these sources and devices to specific licensees. The safety evaluation is documented in a sealed source and device (SSD) registration certificate issued to the manufacturer (or distributor). Therefore, if the NRC or an Agreement State agency approves the source assemblies, exposure devices, or source changers for use, the applicant must note the manufacturer's (or distributor's) name and the model number of the compatible sources and devices in its license application to demonstrate that the requirements are met. Manufacturers and distributors of industrial radiography equipment may voluntarily include the items of associated equipment that were used in the industrial radiography system with their sealed sources and devices that are registered. To include associated equipment in the certificate of registration, the manufacturer's or distributor's application must include information that demonstrates the associated equipment meets the minimum criteria in 10 CFR 34.20, "Performance requirements for individual radiography equipment."

Consult with the proposed supplier to ensure that sources and devices conform to the sealed source and device designations registered with the NRC or an Agreement State. To ensure that the use of radiographic equipment is in accordance with registration certificates, licensees may want to review the certificate, discuss with the manufacturer, or obtain a copy of the certificate. Licensees may not make modifications to exposure devices, source changers, source assemblies, and associated equipment unless the design of any replacement component, including source holder, source assembly, controls, or guide tubes, would not compromise the design safety features of the system.

Consult with the manufacturer of the associated equipment (i.e., equipment that is used in conjunction with the exposure device that drives, guides, or comes in contact with the source) to be sure that the associated equipment is compatible with the sources and devices. If the manufacturer and supplier are no longer in service, a copy of the SSD registration certificate may be requested from the NRC or the issuing Agreement State.

Licensees must demonstrate that associated equipment meets the performance requirements in 10 CFR 34.20. Regulatory Issue Summary (RIS) 2005-10, "Performance-Based Approach for Associated Equipment in 10 CFR 34.20," dated June 10, 2005, alerts licensees to the difference between items of equipment that are considered to be associated equipment and items of

equipment that are not. For example, the portion of the connector that is attached to the end of the control cable is actually a component of the source assembly and is subject to the safety evaluation that must be completed by the NRC or an Agreement State before the source assembly may be specifically authorized for use by a licensee. RIS 2005-10 also contains a number of ways that licensees can demonstrate that their associated equipment meets the performance requirements stated in 10 CFR 34.20.

Radiography sealed sources are usually at or above Category 2 quantities, as defined in 10 CFR Part 37 (see Section 8.10.10, "Security Program for Category 1 and Category 2 Radioactive Material," for more information on the applicability of 10 CFR Part 37). Applicant and licensee information on manufacturers, model numbers, and possession limits is sensitive and should be marked accordingly (see Chapter 6, "Identifying and Protecting Sensitive Information"). Category 1 and Category 2 sources must be tracked in the National Source Tracking System (NSTS), in accordance with 10 CFR 20.2207. After the NRC license is issued, the licensee needs to create an account in the NSTS to track, from cradle to grave, sealed sources with activities exceeding the activities listed in Appendix E of 10 CFR Part 20, "Nationally Tracked Source Thresholds." The receipt, transfer, and disposal transactions of NSTS sources must be reported in accordance with 10 CFR 20.2207. More information on NSTS can be found in the NRC Web site at <http://www.nrc.gov/security/byproduct/ismp/nsts.html>.

Response from Applicant:

- Identify each radionuclide that will be used for performing radiography. Identify the manufacturer (or distributor) and model number of each sealed source, source assembly, exposure device, or source changer to be possessed. Identify any depleted uranium that is used as shielding material, and specify the total amount in kilograms.
- For each sealed-source model, identify the radionuclide, maximum activity per source, and total possession limit.
- Confirm that each sealed source, device, and source/device combination possessed is registered as an approved sealed source or device by the NRC or an Agreement State and will be possessed and used in accordance with the conditions specified in the registration certificate. Obtain from the manufacturer/distributor a copy of the SSD registration certificate and provide the sealed source and device registry number with the application.
- Confirm that associated equipment is compatible with the exposure devices, source changers, and sealed sources containing byproduct material.
- Confirm that all radiographic exposure devices, source assemblies, or sealed sources, and all associated equipment, which meet the requirements specified in 10 CFR 34.20, will be used in radiographic operations.
- Identify by radionuclide and manufacturer (or distributor) and model number of any other device and sealed source containing byproduct material that will not be used for performing radiography.

8.5.2 Financial Assurance and Recordkeeping for Decommissioning

Regulations: 10 CFR 30.34(b), 10 CFR 30.35, 10 CFR 30.51 (f), 10 CFR 34.13(k)

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

Licensees are required to maintain, in an identified location, decommissioning records related to structures and equipment where devices are used or stored, as well as records related to leaking sources. Pursuant to 10 CFR 30.35(g), licensees must transfer records important to decommissioning to new licensees before licensed activities are transferred or assigned, according to 10 CFR 30.34(b). Furthermore, pursuant to 10 CFR 30.51(f), prior to license termination, each licensee shall forward the records required by 10 CFR 30.35(g) to the appropriate NRC regional office.

Decommissioning records described above are not required for temporary jobsite locations.

Discussion: The requirements for financial assurance are specific to the types and quantities of byproduct material authorized on a license. Most industrial radiography applicants and licensees do not need to comply with the financial assurance requirements, because the thresholds for sealed sources containing byproduct material are 3.7×10^5 Gigabecquerels (GBq) [10,000 curies (Ci)] of cobalt-60 and 3.7×10^6 GBq [100,000 Ci] of cesium-137 or byproduct material with half-lives less than 120 days (e.g., iridium-192, ytterbium-169). Thus, a licensee would need to possess hundreds of sealed sources before the financial assurance requirements would apply. Applicants and licensees desiring to possess sources exceeding the threshold amounts must submit evidence of financial assurance. Licensees may follow the guidance provided in NUREG-1757, Volume 3, “Consolidated Decommissioning Guidance—Financial Assurance, Recordkeeping and Timeliness.”

The regulations in 10 CFR 30.35(g) also require that licensees maintain records important to decommissioning in identified locations other than at any temporary jobsite. All industrial radiography licensees need to maintain records of structures and equipment where devices are used or stored. As-built drawings showing modifications to structures and equipment fulfill this requirement. If drawings are not available, licensees may substitute appropriate records (e.g., a sketch of the room or building or a narrative description of the area) concerning the areas and locations. In addition, industrial radiography licensees who have experienced unusual occurrences (e.g., leaking sources or other incidents that involve spread of contamination, such as S-tube breakthrough) also need to maintain records about contamination that remains after cleanup or contamination that may have spread to inaccessible areas. Leak test results are part of the decommissioning records.

Response from Applicants:

- State the following: “Pursuant to 10 CFR 30.35(g), we shall maintain records important to decommissioning and transfer these records to an NRC or Agreement State licensee before licensed activities are transferred or assigned, in accordance with 10 CFR 30.34(b). Furthermore, pursuant to 10 CFR 30.51(f), prior to license termination, we shall forward the records required by 10 CFR 30.35(g) to the appropriate NRC regional office.”

AND

- If financial assurance is required, submit evidence of financial assurance following the guidance of NUREG–1757, Volume 3.

Reference: NUREG–1757, Volume 3, “Consolidated Decommissioning Guidance—Financial Assurance, Recordkeeping and Timeliness.”

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

Regulations: 10 CFR 30.33(a)(1), 10 CFR 34.13

Criteria: An application for a license will be approved if the proposed activity is authorized by the Atomic Energy Act of 1954, as amended, and sealed sources and devices will be used only for the purposes for which they were designed and in accordance with the manufacturer’s recommendations for use as specified in an approved SSD registration certificate.

Discussion: The typical license authorizes persons to perform source exchanges and to conduct industrial radiography at temporary jobsites, field stations, or permanent radiographic installations. Unusual uses will be evaluated on a case-by-case basis, and the authorized use condition will reflect approved uses. Applicants who plan to perform radiographic operations on lay-barges, on offshore platforms, or underwater must specifically request these operations and provide specific operating and emergency procedures to address these unique operations.

The NRC will authorize radiography for lay-barges, offshore platforms, and underwater by specific license conditions.

Response from Applicant:

- Indicate using Appendix C of this NUREG that the equipment will be only used for industrial radiography.

AND

- If applicable, specify the purposes for which the source(s) and device(s) will be used, other than for industrial radiography, as specified on the SSD registration certificate. (An example of a use other than industrial radiography is a cesium-137 sealed source in an instrument calibrator to calibrate radiation survey meters).

AND

- If applicable, specify the purposes for which the source(s) and device(s) will be used for uses other than those specified and approved in the SSD registration certificate.

AND

- In addition, specify any plans to perform industrial radiography underwater, on lay-barges, or on offshore platforms. Refer to Appendix D of this NUREG.

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

8.7.1 Radiation Safety Officer

Regulations: 10 CFR 34.13(f), 10 CFR 34.13(g), 10 CFR 34.42, 10 CFR 34.43

Criteria: RSOs and potential designees responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures must have adequate training and experience.

Discussion: The person responsible for the radiation protection program is the RSO. The RSO is the key to overseeing and ensuring safe and secure operation of the licensee's radiography program. The RSO should have independent authority to stop operations that he or she considers unsafe. He or she should have sufficient time, support, and commitment from management to fulfill certain duties and responsibilities to ensure that radioactive materials are used in a safe and secure manner. This management support includes resource allocation. He or she should be involved with developing and implementing a security program in accordance with 10 CFR Part 37. The RSO may delegate certain day-to-day tasks of the radiation protection program to other responsible individuals (potential designees). For example, a large testing company with multiple field stations may appoint individuals, designated as "site RSOs," who assist the RSO and are responsible for the day-to-day activities at the field stations. Licensees may also appoint other individuals who may "step in" as an emergency contact when the RSO is unavailable. The potential designees do not need to meet the required RSO qualifications; however, these individuals should be qualified, experienced radiographers who have adequate knowledge of the activities to which they are assigned. Designees should have the same management support and decision-making authority as the RSO necessary to manage daily program activities. Applicants do not have to identify other responsible individuals if day-to-day tasks will not be delegated.

Figure 8-2 illustrates typical RSO duties. The NRC requires the name of the RSO on the license to ensure that licensee management has always identified a responsible, qualified person and that the named individual knows of his or her designation as RSO. Applicants should provide the 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, applicants should show in the organizational chart the position of the certifying officer who signs the application in Item 13 of NRC Form 313.

To be considered eligible for the RSO position, an individual must be a qualified radiographer, have a minimum of 2,000 hours (1 year full-time field experience) of hands-on experience as a qualified radiographer, and have formal training in establishing and maintaining a radiation protection program. This should be a course specifically designed to provide training in managing and implementing a radiation safety program; a basic radiation safety course is not acceptable. While a course particular to industrial radiography would be highly encouraged, this is not required. Acceptable training programs would be a classroom course typical of those

provided through universities or commercial training facilities. Hands-on experience means experience in all areas considered to be directly involved in the radiography process. This includes taking radiographs, surveying devices and radiation areas, transporting the radiography equipment to temporary jobsites, securing the materials, posting work sites with necessary warning signs, conducting radiation area surveillance, completing and maintaining records, and other tasks. Excessive time spent in only one or two of these operations (film development or area surveillance) should not be counted toward the 2,000 hours. Experience with radiography using x-rays can be included; however, the majority of experience should be in radiography using sealed sources. See NUREG-1556, Volume 2, Revision 1, Appendix O, "Model Delegation of Authority," as an example of how to document a person accepting the responsibility of becoming an RSO.

Note: The NRC will consider individuals with alternative training and experience as RSOs. For example, a person certified in health physics or industrial hygiene with previous experience in managing a radiation safety program of comparable size and scope could be considered as an individual case. The qualifications, training, and experience required of the RSO may vary, depending upon the complexity of the applicant's operations and number of radiography personnel.

Response from Applicant: Provide the following:

- The name of the proposed RSO and other potential designees 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 organizational chart, by position, demonstrating day-to-day oversight and coordination with management in radiation safety activities.

AND EITHER

- The specific training and experience of the RSO and other potential designees. Include the specific dates of certification or training, or both, in radiation safety.
- Documentation to show that the RSO has a minimum of 2,000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations.
- Documentation to show that the RSO has obtained 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., certification by the American Board of Health Physicists, completion of a bachelor's or master's degree in the sciences with at least 1 year of experience in the conduct of a radiation safety program of comparable size and scope).

- Documentation to show that the RSO has obtained formal training in the establishment and maintenance of a radiation protection program.

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

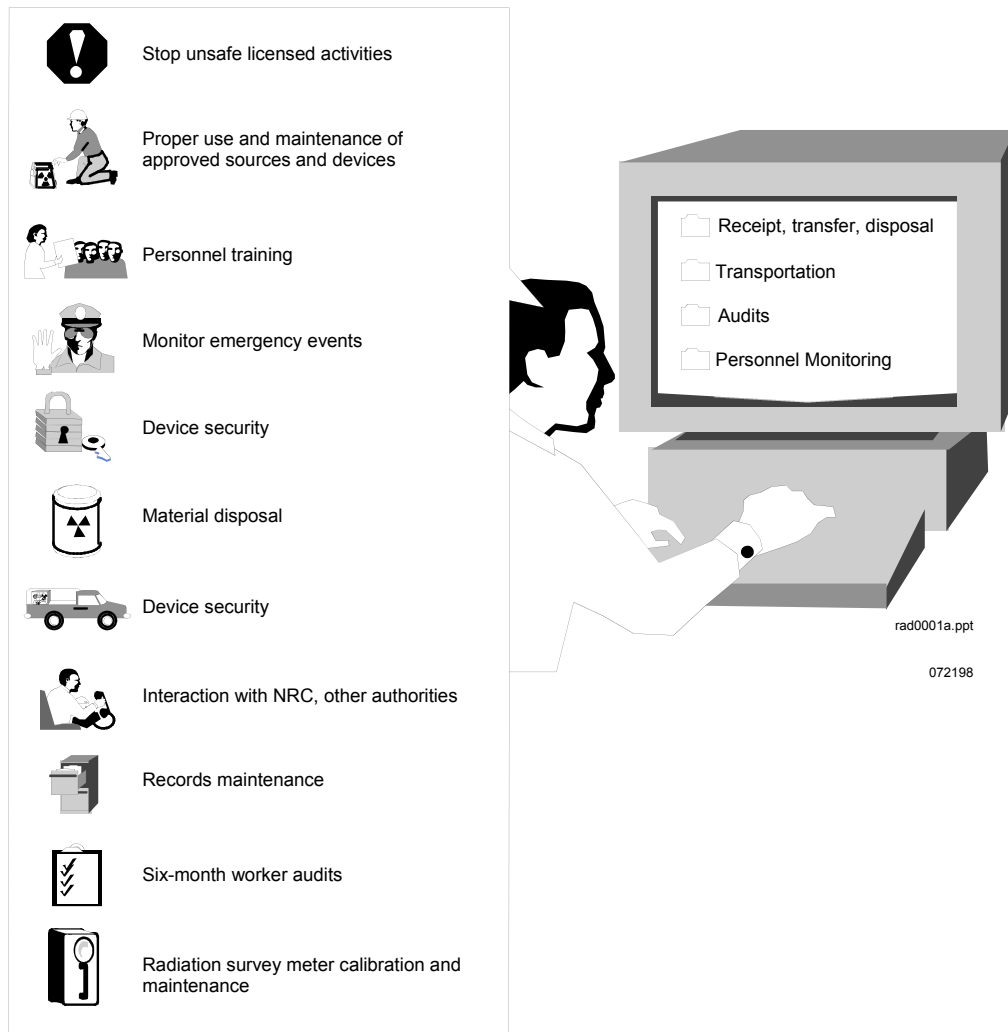


Figure 8-2. Typical Duties and Responsibilities of RSOs

8.8 Item 8: Training for Radiographers and Radiographer's Assistants

Regulations: 10 CFR 19.12, 10 CFR 30.33, 10 CFR 34.13, 10 CFR 34.43, 10 CFR 37.43

Criteria: Radiographers and radiographer's assistants must have adequate training and experience. Any licensee that possesses and aggregated Category 1 or Category 2 quantity of radioactive material must implement a training program for those individuals implementing the security program.

Discussion:

- A radiographer is a person who performs or personally supervises industrial radiography and is responsible for ensuring compliance with NRC regulations, license conditions, and the safe use and security of radioactive materials.
- A certified radiographer is an individual who has been certified by a certifying entity that he or she has met established radiation safety, testing, and experience criteria.
- A radiographer's assistant is an individual, who under the direct supervision (in the physical presence) of the radiographer, uses radiographic equipment (sealed sources containing byproduct material or related handling tools, exposure devices, and radiation survey instruments) in performing industrial radiographic operations.

The regulations in 10 CFR 34.43 describe specific training requirements for radiographers and radiographer's assistants and require that all radiographers be certified by a certifying entity. The regulations also address annual refresher training and semiannual audits of radiographers and radiographer's assistants.

The applicant must submit a description of its training program for radiographers and radiographer's assistants. Refer to Appendix E of this NUREG as an aid to determining the specific training requirements for radiographers and radiographer's assistants. For existing licensees, no licensing actions are required when radiographers are certified. The NRC will verify radiographer certification during routine NRC inspections.

Since 10 CFR Part 34 contains different requirements for radiographers and radiographer's assistants, include training programs for each. When describing the training programs for these positions, include the sequence of events from the time of hiring through the designation of individuals as radiographers or radiographer's assistants. Experienced radiographers who have worked for another licensee should receive formal instruction in company operations similar to that given to prospective radiographer's assistants. This instruction must include training in the applicant's operating and emergency procedures, in the use of the applicant's exposure devices and associated equipment, and in the use of radiation survey meters and other radiation monitoring devices.

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 radiographers. Individuals who provide instruction in the hands-on use of radiography equipment should be qualified radiographers with at least 1 year of experience in performing radiography or should possess a thorough understanding of the operation of radiographic equipment (e.g., a manufacturer's service representative).

An internal inspection program (audit program) of the job performance of each radiographer and radiographer's 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 radiographer and radiographer's assistant during an actual industrial radiographic operation at intervals not to exceed 6 months. If a radiographer or radiographer's assistant has not participated in an industrial radiographic operation for more than 6 months, the individual must demonstrate knowledge of the training requirements by

practical examination before participating in a radiographic operation. The person conducting internal inspections should have a minimum of 1 year of actual experience as a radiographer.

In accordance with 10 CFR Part 37, any licensee that possesses an aggregated Category 1 or Category 2 quantity of radioactive material must implement a training program in accordance with 10 CFR 37.43, "General security program requirements," to ensure that those individuals who may have a responsibility to implement portions of the security program possess and maintain the knowledge, skills, and abilities to carry out their assigned duties and responsibilities effectively. For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG-2155, "Implementation Guidance for 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material." Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG-2166, "Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material."

Please note, under 10 CFR Part 37, security plans are not to be submitted to the NRC for review and approval.

Response from Applicant:

- Submit an outline of the training to be given to prospective radiographers and radiographer's assistants. Submit your procedures for experienced radiographers 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.
- Submit all training program descriptions noted in 10 CFR 34.43, except for those training and examination program topics listed in 10 CFR 34.43(g).
- Specify the qualifications of your instructors in radiation safety principles and describe their experience with radiography. If training will be conducted by someone outside the applicant's organization, identify the course by title and provide the name and address of the company providing the training.
- Describe the practical field examination that will be given to prospective radiographers and radiographer's assistants. This should include the use of the exposure device, sealed sources, daily inspection of devices and associated equipment, and the use of survey instruments. The NRC suggests using the checklist in Appendix F of this NUREG as a source of potential areas to review during the practical examination.
- Describe the annual refresher training program, including topics to be covered and how the training will be conducted. Topics for discussion might include examples, such as those found in Appendix E of this NUREG.
- Submit your procedures for verifying and documenting the certification status of radiographers and for verifying that their certification remains valid. As a minimum, your procedures for newly hired, previously certified individuals should require documentation that you contacted the certifying entity and confirmed the certification. Your procedures should also ensure that you are aware of certification expiration dates and that individuals with expired certifications do not act as radiographers.

- Submit a description of your program for inspecting the job performance of each radiographer and radiographer's assistant at intervals not to exceed 6 months, as described in 10 CFR 34.43(e). Appendix F of this NUREG provides a sample checklist.

Experience and training with radiography using x-ray training by itself will not be considered adequate experience for performing radiography using sealed sources.

8.9 Item 9: Facilities and Equipment

Regulations: 10 CFR 20.1301, 10 CFR 20.1601, 10 CFR 20.1801, 10 CFR 20.1802, 10 CFR 30.33, 10 CFR 34.13(j), 10 CFR 34.33, 10 CFR 34.89, 10 CFR Part 37

Criteria: Licensees must specifically identify and describe permanent radiographic installations and field stations and any other locations where radiography will be conducted and provide physical protection of Category 1 and Category 2 quantities of radioactive material.

Discussion: A permanent radiographic installation is an enclosed shielded room, cell, or vault in which radiography may be performed. A facility is considered "permanent" if it is intended to be used for radiography, even if radiography is rarely performed there. The nature of the facility, rather than the frequency of use, determines a permanent radiographic installation. All radiographic operations conducted at locations of use authorized on the license must be conducted in a permanent radiographic installation, unless specifically authorized by the NRC. If licensees need to perform radiography at their place of business outside of a permanent facility because of unique circumstances (the item to be radiographed is too large for the facility), then the NRC must authorize this method of use. In this case, two individuals must be present whenever radiographic operations occur outside of a permanent radiographic installation.

The one primary (and perhaps the most important) reason licensees have for conducting radiography in a permanent radiographic installation is that they do not have to implement additional access-control requirements to assure public safety. To ensure this control, a permanent radiographic installation, if located on the ground, must be enclosed by a minimum of four shielded walls (otherwise the floor must also be shielded). The use of materials that do not realistically provide shielding do not qualify. Areas outside of the facility generally should qualify as unrestricted areas. While the area outside of an installation should qualify as an unrestricted area (i.e., not exceed 2 millirem in any one hour), the regulation does not specify radiation limits to allow for design flexibility for moving equipment into and out of the installation or other considerations. Radiation levels slightly exceeding these levels outside of the facility should only be considered or allowed when the higher levels result from "sky shine" or the need for equipment movement. If the roof of the facility does not qualify as a restricted area, or if no roof exists, mechanical access restrictions (e.g., fence) must be utilized, and additional administrative controls must be imposed to meet regulatory exposure requirements in 10 CFR 20.1301, "Dose limits for individual members of the public," and 20.1601, "Control of access to high radiation areas," and security requirements in 10 CFR 20.1801, "Security of stored material," and 20.1802, "Control of material not in storage," (see Section 8.10.10, "Security Program for Category 1 and Category 2 Radioactive Material"). An NRC licensee must implement enhanced security measures, as required by 10 CFR Part 37, for aggregated radioactive material of Category 2 or greater. All entrance ways into the facility must be interlocked with control devices required by 10 CFR Part 34. Unless all entrance ways are locked, at least one radiographer must be present at the facility whenever radiography is being

conducted. In addition, the new permanent radiographic installation must be authorized on the license before licensed material is transferred to it.

The following requirements in 10 CFR 34.33, "Permanent radiographic installations," apply to a permanent installation:

Visible-audible signals

Each access point is equipped with a visible-audible signal system. The visible signal is activated by radiation whenever the source is exposed. The audible signal will sound if anyone tries to enter the installation while the source is exposed. The requirement for the visible-audible signal system is in addition to other measures that may be taken to prevent access to the installation, such as locked doors.

As an alternative to the visible-audible alarm system, it is acceptable to use a control system that will reduce the radiation level if the entrance to a high-radiation area is opened while the source is out. The system must be automatic and independent of radiography personnel action. If this alternative is planned, provide a description of the system.

Diagram depicting the shielding, layout, and visible-audible alarms

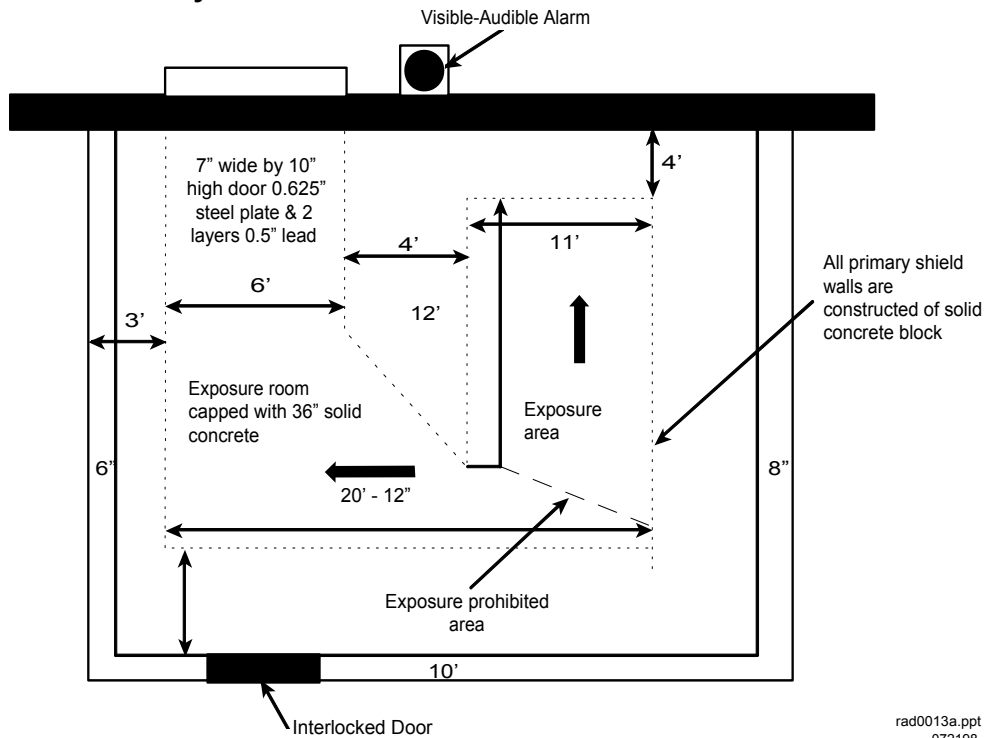
A diagram of the installation is helpful in evaluating the shielding and determining compliance with regulations regarding restricted and unrestricted areas, location of access points, and locations of audible-visible signals. Figure 8-3 shows an example installation diagram. Diagrams of facilities should be marked: "Security-Related Information—Withhold under 10 CFR 2.390."

Calculations or survey results of radiation levels

For a determination of installation adequacy, provide information showing that the radiation level in all directions around the installation, including the roof, will not exceed a dose of 0.02 millisievert (mSv) [2 mrem] in any one hour. Take into account the highest quantity of radioactive material that will be used in the installation and any limitations on source positioning in the installation. Radiation levels in all directions around the installation that are below 0.02 mSv [2 mrem] in any one hour are considered acceptable. If the radiation levels will exceed 0.02 mSv [2 mrem] in any one hour, then steps should be taken (use lower activity source, use collimator, or move setup farther away) to reduce the radiation to the acceptable level.

A radiation level on the roof that exceeds 1.0 mSv [100 mrem] in 1 hour at 30 cm [1 ft] from the surface is considered a "high-radiation area" and requires special precautions to control access to the area. Licensees should make efforts to lower a radiation level exceeding 1.0 mSv [100 mrem] in any one hour by using additional shielding, collimators, or other engineering controls. The roof of a fixed radiography cell is a potentially occupied area, and applicants must demonstrate that no individual member of the public could receive effective doses in excess of 0.02 mSv [2 mrem] in any one hour or 1 mSv [100 mrem] in a year.

Security-Related Information—Withhold under 10 CFR 2.390*



*This diagram is an example only and does not contain real security-related information.

Figure 8-3. Example Diagram of a Permanent Radiographic Installation

A field station is a facility where licensed material may be stored or used and from which equipment may be dispatched. Radiographic operations may be conducted outside a permanent radiographic installation, outside a field station or outside the place of business, as if the work was performed "in the field" at a temporary jobsite, provided the licensee complies with all NRC regulatory requirements.

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

Note: A restricted area is an area that licensees limit access for the purpose of protecting individuals from undue risks from exposure to radiation and radioactive materials. A restricted area cannot include areas used as residential quarters. Consequently, industrial radiography devices must not be stored in motel rooms or similar locations.

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

- implement the physical protection requirements in 10 CFR Part 37 for material in use and storage, at both permanent and temporary jobsites; and
- in accordance with 10 CFR 37.49 and 10 CFR 37.53, be able to monitor and immediately detect and assess any unauthorized entries into security zones, including those surrounding mobile devices.

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

Please note, under 10 CFR Part 37, security plans are not to be submitted to the NRC for review and approval.

Response from Applicant: Provide the following:

Provide the following for each Permanent Radiographic Installation.

If radiography is planned in a permanent radiographic installation or installations (including field stations with permanent exposure cells), provide the following information for each installation:

- An annotated sketch or drawing of the facility and its surroundings (properly marked as “Security Related Information—Withhold under 10 CFR 2.390”).
- The scale to which the sketch or drawing is made. The same scale should be used for all sketches and drawings. The recommended scale is 1/4 in = 1 ft. Drawings to this scale that do not fit on 8-1/2 × 11-inch paper may be provided as sectional drawings. Sketches or drawings should also include a compass directional arrow to indicate “North.”
- The type, thickness, and density of shielding materials on all sides, including the floor and the roof.
- The locations of entrance ways and other points of access to the facility.
- A description of the areas adjacent to the facility and the distance to these areas. Include information on areas adjacent to, above, and below the facility.
- A description of the general location of each proposed permanent radiographic installation listed in Item 3 (e.g., located in an industrial park, an office complex) and its current use. If any proposed permanent radiographic installation is a private residence, provide diagrams of the installation that include the building, the proposed restricted area or areas, and adjacent areas, including above and below the restricted areas; provide commitments that restricted areas do not include residential quarters, and explain how radiation levels in unrestricted areas will be maintained at less than 0.02 mSv [2 mrem] in any one hour and less than 1 mSv [100 mrem] per year.

- A description of the visible-audible signal system or entrance control system and its location.
- The results of radiation-level calculations or actual radiation measurements adjacent to, above, and below the installation. Provide the radiation level in all directions around the installation, including the roof. The radiation level should not exceed 0.02 mSv [2 mrem] in any one hour. Clearly identify the type of sealed source (radionuclide), the amount of radioactive material in the sealed source (activity), and the position or location of the sealed source within the installation for the calculations or measurements.
- Indicate whether or not radiography will be performed at the place of business outside of a permanent radiographic installation. If radiography will be performed at a site outside of a permanent radiographic installation, provide a diagram of the location where radiography may be performed and its surroundings, including a description of adjacent property.

Note: Mark drawings and diagrams that provide exact location of materials or depict specific locations of safety or security equipment as “Security Related Information—Withhold under 10 CFR 2.390.”

Note: Local municipalities may limit the use of radioactive material to certain zone areas.

Variances will be considered if construction requirements preclude shielding the radiographic installation roof¹ to meet the requirement not to exceed 0.02 mSv [2 mrem] in any one hour.

Provide the following information to obtain approval for a variance:

- procedures for ensuring that no individual is on the roof or could gain access to the roof during radiography
- means of preventing access to the roof
- a commitment that the roof will be posted with signs stating “Caution (or Danger) Radiation Area”
- steps taken to minimize radiation on the roof
- limitations (if needed) on positioning of sealed sources or type (radionuclide) and amount of radioactive material that may be used in the installation to ensure that areas adjacent to, above, and below the installation will be unrestricted areas during the performance of radiography

If radiation levels on the radiographic installation roof exceed 1.0 mSv [100 mrem] in any one hour, then provide the following information in addition to the items above to apply for this variance:

¹Facilities for exposures only may or may not have a roof. Applicants are required to explain how these areas around the installation will be controlled to keep exposures to appropriate levels.

- a commitment that the roof will be posted with signs stating “Caution (or Danger) High Radiation Area”
- evidence of constant surveillance of the roof by closed-circuit television
- a description of a control device that would automatically reduce the radiation level to 1 mSv [100 mrem] in any one hour at 30 cm [1 ft] from the radiation source if someone enters the roof
- a description of a control device that activates a visible-audible signal so that both an individual entering the roof and the radiographer on duty are made aware of the entry

Provide the following information for each Field Station.

- Describe the storage location or locations at the address or addresses listed in Item 3 of the application and submit a diagram showing where the radiography camera will be stored at the field stations.
- Indicate whether or not industrial radiography will be performed at the place of business outside of a field station.
- If radiography will be performed at a site outside a field station, provide a diagram of the location where industrial radiography may be performed and its surroundings, including a description of adjacent property.

Note: Mark drawings and diagrams that provide exact location of materials or depict specific locations of safety or security equipment as “Security Related Information—Withhold under 10 CFR 2.390.”

Note: Certain records described in the regulations that pertain to radiation safety shall be on file at these field stations and each temporary jobsite. Applicant or licensee’s records containing security-related information should meet the applicant’s or licensee’s own security program requirements for marking documents.

Provide the following information for Temporary Jobsite.

- Indicate in Item 3 of the application that the applicant is requesting authorization to perform work at temporary jobsites anywhere in the U.S. where the NRC maintains jurisdiction for regulating the use of licensed material, including areas of exclusive Federal jurisdiction within Agreement States.

8.10 Item 10: Radiation Safety Program

Regulations: 10 CFR 20.1101, 10 CFR 30.33, 10 CFR 34.13

Criteria: A radiation safety program must be established and submitted to the NRC as part of the application. The program must be commensurate with the scope and extent of activities for the use of licensed materials in industrial radiography.

Each applicant for an industrial radiography license must develop, document, and implement a radiation protection program containing the following elements:

- steps to keep radiation exposures ALARA
- a description of equipment and facilities adequate to protect personnel, the public, and the environment
- conduct of licensed activities by individuals qualified by training and experience
- written operating and emergency procedures
- a program to inspect the job performance of radiographic personnel
- a description of organization structure and individuals responsible for ensuring implementation of radiation safety program
- records management

Discussion: The specific components of the applicant's radiation safety program are detailed in the following 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.

8.10.1 Audit and Review of Program

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

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

- compliance with NRC and U.S. Department of Transportation (DOT) regulations (as applicable) and the terms and conditions of the license
- occupational doses and doses to members of the public are ALARA
- access authorization program is effective and complies with 10 CFR Part 37, Subpart B
- security program is effective and complies with 10 CFR Part 37, Subpart C
- records of audits and other reviews of program content are maintained for 3 years

Discussion: Appendix G of this NUREG contains a suggested annual audit program that is specific to industrial radiography and is acceptable to the NRC. Since all areas indicated in Appendix G may not be applicable to every licensee and all items may not need to be addressed during each audit, licensees may wish to develop a program-specific audit checklist.

The NRC encourages licensee management to conduct performance-based reviews by observing work in progress, interviewing staff, and spot-checking required records. As a part of the audit program, applicants should consider proposing to perform unannounced audits of industrial radiography to observe whether radiation safety procedures are being followed. Licensees should consider providing specialized audit training, if staff other than the RSO are used to conduct audits of the performance of radiographers and radiographer's assistants. See Appendix G of this NUREG for applicable audit program areas for potential specialized training.

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

Licensees must maintain records of audits and other reviews of program content and implementation for 3 years from the date of the record, in accordance with 10 CFR 20.2102. The NRC has found audit records that contain the following information acceptable:

- date of audit
- name of person or persons who conducted the audit
- names of persons contacted by the auditor or auditors
- areas audited
- audit findings and corrective actions
- follow-up

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

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

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

Please note, under 10 CFR Part 37, security plans are not to be submitted to the NRC for review and approval.

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

References: The current version of the NRC's Enforcement Policy is included on the NRC's Web site at <http://www.nrc.gov/about-nrc/regulatory/enforcement.html>.

IN 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," dated May 1, 1996, can be found on the NRC's Generic Communications Web page under Information Notices: <http://www.nrc.gov/reading-rm/doc-collections/gen-comm/>.

8.10.2 Radiation Monitoring Instruments

Regulations: 10 CFR 30.33(a)(2), 10 CFR 34.25, 10 CFR 34.31, 10 CFR 34.65

Criteria: A radiation survey meter intended for industrial radiography that utilizes sealed sources should be capable of accurately measuring the radiation fields produced by the sealed source in use. Radiation survey instruments shall be visually checked for damage and for proper operation with a check source or other appropriate means, such as an exposure device, before use on each day it is to be used. The radiation survey meter shall be calibrated at intervals not to exceed 6 months and after each servicing (except for battery changes). Written procedures are required for inspection and routine maintenance of the radiation survey meters, which is to be performed at intervals not to exceed 3 months or before the first use thereafter, to ensure proper functioning of components important to safety.

Discussion: The licensee shall keep an adequate number of appropriate radiation survey instruments, which are both calibrated and operable, at each location where radioactive material is present to make the required radiation surveys. The radiation survey instruments must be capable of measuring a range from 0.02 mSv [2 mrem] per hour through 10 mSv [1 rem] per hour. Each radiation survey instrument shall be calibrated at intervals not to exceed 6 months and after each instrument servicing, except for battery changes. Records of survey instrument calibrations will be retained for a minimum of 3 years (10 CFR 34.65, "Records of radiation survey instruments"). Records are to be made of equipment problems and maintenance performed, and these shall be retained for 3 years (10 CFR 34.73, "Records of inspection and maintenance of radiographic exposure devices, transport and storage containers, associated equipment, source changes, and survey instruments").

Response from Applicant: Provide the following:

- A statement that: "We will possess and use calibrated and operable radiation survey meters."

AND

- If calibration is performed by a person or firm outside the applicant's organization, specify that the calibration will be performed by an NRC or Agreement State licensee specifically authorized to perform instrument calibration.

OR

- If the calibration is to be performed in-house, either state that the model procedures in Appendix H of this NUREG will be followed or describe alternative procedures. Identify the qualifications of the individuals who will perform the calibrations.

8.10.3 Material Receipt and Accountability

Regulations: 10 CFR 20.2207, 10 CFR 30.34(e), 10 CFR 30.41, 10 CFR 30.51, 10 CFR 34.29, 10 CFR 34.63, 10 CFR 34.69, 10 CFR 37.75, 10 CFR 37.77

Criteria: Licensees must do the following:

- Maintain records of receipt, transfer, and disposal of sealed sources and devices.
- Update transactions in the NSTS, including an annual inventory reconciliation required by 10 CFR 20.2207(g).
- Conduct physical inventories at quarterly intervals (not to exceed 3 months) to account for all sealed sources containing byproduct material and for devices containing depleted uranium.
- Preplan, coordinate, and provide advance notification of shipment of Category 1 quantities of radioactive material and coordinate shipment of Category 2 quantities of radioactive material.

Discussion: As illustrated in Figure 8-4, licensed materials must be tracked from “cradle to grave” to ensure accountability; identify when sealed sources/devices may be lost, stolen, or misplaced; and ensure that the possession limit stated on the license is not exceeded. Physical inventories, which shall be conducted at intervals not to exceed 3 months, shall account for all sealed sources and devices containing depleted uranium (i.e., specifically locate, verify the presence of the material, and account for it in material transfer and receipt records).

Receipt, inventory, transfer, and disposal records must be maintained for the times specified in Table 8-1. Typically, these records contain the following types of information:

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

Type of Record	How Long Record Must Be Maintained
Receipt	For 3 years after the date the record was made
Inventory	For 3 years after the date the record was made
Transfer	For 3 years after the date the record was made
Disposal	Until the NRC terminates the license
Important to Decommissioning*	Until the site is released for unrestricted use

*See Section 8.5.2, "Financial Assurance and Recordkeeping for Decommissioning," for more details.

The regulations in 10 CFR 20.2207 require that each licensee that manufactures, transfers, receives, disassembles, or disposes of a nationally tracked source shall complete and submit an NSTTR to the NRC. The NSTTRs are maintained in the NSTS, a secure computer system that tracks high-risk radioactive sources from the time they are manufactured or imported through the time of their disposal or export, or until the source activity decays enough to no longer be of concern.

In addition to general security requirements for shipment and transfer of Category 1 and Category 2 quantity of radioactive materials, in accordance with 10 CFR Part 37.75 and 37.77, any licensee that ships Category 1 quantities of radioactive material must preplan and coordinate shipment, and must provide advanced notification of shipments. Under 10 CFR 37.75, any licensee that ships Category 2 quantities of radioactive material must coordinate the shipment of such material. For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG-2155, "Implementation Guidance for 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material." Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG-2166, "Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material."

Please note, under 10 CFR Part 37, security plans are not to be submitted to the NRC for review and approval.

Note: Licensees who receive, transfer, and dispose of nationally tracked sources (i.e., sealed sources containing a quantity equal or greater than Category 1 or Category 2 levels of any radioactive material listed in Appendix E of 10 CFR Part 20) must complete and submit to the NSTS, a National Source Tracking Transaction Report by the close of the next business day after the transaction has occurred. In addition, licensees must reconcile the inventory of nationally tracked sources possessed by the licensee against that licensee's data in the NSTS. This reconciliation must be conducted during the month of January in each year. Licensees must submit to the NSTS confirmation that the data in NSTS is correct by January 31 of each year.

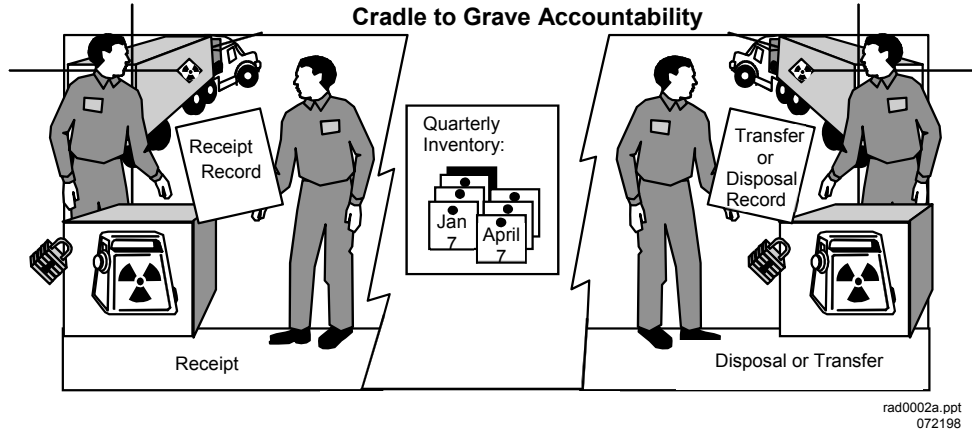


Figure 8-4. Material Receipt and Accountability. Licensees Must Maintain Records of Receipt, Transfer, and Disposal and Conduct Physical Inventories Quarterly (Not To Exceed 3 Months).

Response from Applicant: Provide the following statements:

- “Physical inventories will be conducted and documented at quarterly intervals (not to exceed 3 months) to account for all sealed sources containing byproduct material and devices containing depleted uranium received and possessed under the license.”

AND

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

AND

- “We will comply with the NSTS reporting requirement, as described in 10 CFR 20.2207.”

8.10.4 Minimization of Contamination

Regulations: 10 CFR 20.1406

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

Discussion: All applicants for new licenses need to consider the importance of designing and operating their facilities so as to minimize the amount of radioactive contamination generated at the site during its operating lifetime and the generation of radioactive waste during decontamination. Sealed sources and devices that are approved by the NRC or an Agreement State and located and used according to their respective SSD registration certificates usually pose minimal risk of contamination. Industrial radiography applicants usually do not need to address these issues as a separate item, because they are included in responses to other items of the application.

Leak tests performed, as specified in 10 CFR 34.27, “Leak testing and replacement of sealed sources,” should identify defective sources. Leaking sealed sources must be withdrawn from use and decontaminated, repaired, or disposed of according to NRC requirements. These steps minimize the spread of contamination and reduce radioactive waste associated with decontamination efforts. Other efforts to minimize radioactive waste do not apply to programs using only sealed sources and devices that have not leaked.

Response from Applicant: The applicant does not need to respond to this item under the following condition. The NRC will consider that the above criteria have been met if the applicant’s responses meet the criteria for the following sections: “Radioactive Material—Sealed Sources and Devices,” “Facilities and Equipment,” “Radiation Safety Program—Leak Tests,” “Radiation Safety Program—Operating and Emergency Procedures,” and “Waste Management—Sealed Source/DU Device Transfer and Disposal.”

8.10.5 Leak Tests

Regulations: 10 CFR 30.53, 10 CFR 34.13(h), 10 CFR 34.27, 10 CFR 34.67

Criteria: The NRC requires testing to determine whether there is any radioactive leakage from the sealed source or from devices containing depleted uranium shielding. The NRC finds testing to be acceptable if it is conducted by an organization licensed by the NRC or an Agreement State or if it is conducted in accordance with procedures submitted by the applicant and approved by the NRC or an Agreement State. Leak test records shall be retained for 3 years after they are made or until the source in storage is removed.

Discussion: The NRC or an Agreement State may authorize manufacturers, consultants, and other organizations to either perform the entire leak-test sequence for other licensees or provide leak-test kits to licensees. In the latter case, the licensee is expected to take the leak-test sample according to the device manufacturer’s and the kit supplier’s instructions and return it to the kit supplier for analysis and reporting results. Licensees may also be authorized to conduct the entire leak-test sequence themselves. Measurement of the leak-test sample is a quantitative analysis requiring that instrumentation used to analyze the sample be capable of detecting 185 Bq [0.005 microcurie (μCi)] of radioactivity.

Sealed sources containing byproduct material must be leak tested at intervals not to exceed 6 months, and depleted uranium devices must be tested at intervals not to exceed 12 months. Some Agreement States may model their regulations using the Suggested State Regulations (SSR). The SSR require, in part, that an applicant describe the procedures for performing leak testing of sealed sources or exposure devices containing depleted uranium shielding and that the description include the qualifications of the individual who analyzes the samples. In the comparable requirement in 10 CFR 34.13(h), there is a requirement to describe the qualifications of the person authorized to do leak testing, in addition to the qualifications of the person who analyzes the wipe samples. The NRC has determined that the SSR requirement for leak testing is compatible with the requirements in 10 CFR 34.13(h) and does not result in any conflicts, duplications, or gaps.

Response from Applicant: State either of the following:

- “Leak test sample collection and analysis will be performed by an organization authorized by the NRC or an Agreement State to provide leak testing services to other licensees; or by using a leak test sample collection kit supplied by an organization

licensed by the NRC or an Agreement State to provide leak test kits and sample analysis services to other licensees and according to the instructions provided in the leak test sample collection kit.”

OR

- “Leak testing and analysis will be done by the applicant.” Provide the information in Appendix I of this NUREG supporting a request to perform leak testing and sample analysis and either state that you will follow the model procedures in Appendix I or submit a description of alternative procedures.

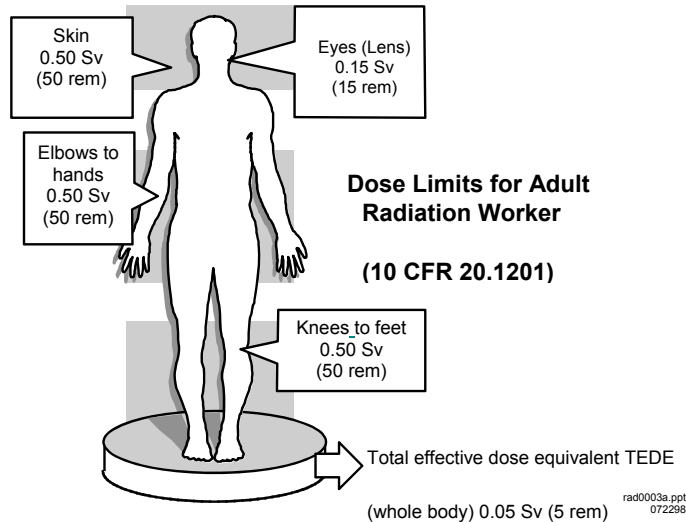
Note: Requests for authorization to perform leak testing and sample analysis will be reviewed on a case-by-case basis and, if approved, the NRC staff will authorize these activities via a license condition.

8.10.6 Occupational Dose

Regulations: 10 CFR 20.1201, 10 CFR 20.1207, 10 CFR 20.1208, 10 CFR 20.1501, 10 CFR 20.1502, 10 CFR 34.47

Criteria: Licensees must evaluate the potential occupational exposure of all workers and monitor occupational exposure. Provide to employees film, thermoluminescent dosimeters (TLDs), or other personal dosimetry processing that has been accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) operated by the National Institute of Standards and Technology (NIST).

Discussion: The licensee may not permit any individual to act as a radiographer or a radiographer’s assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a combination of a direct-reading dosimeter (pocket dosimeter or electronic personal dosimeter); an operating alarm ratemeter; and a film badge, TLD, or other personal dosimetry device. At permanent radiographic installations where other appropriate alarming or warning devices are in routine use, wearing an alarming ratemeter is not required. The pocket dosimeters must have a range from zero to 2 mSv [200 mrem], must be recharged at the start of each work shift, and must be checked for correct response to radiation at intervals not to exceed 12 months. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters and require special means to change the preset alarm function. Alarm ratemeters must be preset to give an alarm signal at a dose rate of 5 millisievert per hour (mSv/h) [500 millirem per hour (mrem/h)] and must be calibrated for correct response at intervals not to exceed 12 months.



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

Figure 8-5. Annual Dose Limits for Occupationally Exposed Adults

Film badges must be replaced at intervals not to exceed 1 month, and TLDs or other personal dosimetry devices that are evaluated using an accredited NVLAP processor must be replaced at intervals not to exceed 3 months.

Response from Applicant: Provide the following:

- A statement that film, TLD, or other personal dosimetry devices are processed and evaluated by an NVLAP-accredited processor.
- A statement that film, TLD, or other personal dosimetry devices will be exchanged at the required frequency and will be assigned to and worn by radiography personnel.
- A statement that the required personnel monitoring equipment, including 0-2 mSv [0-200 mrem] dosimeters or electronic personal dosimeters, will be worn by radiography personnel.
- A statement that alarming ratemeters will be worn by all radiography personnel, except those at permanent radiography installations where other appropriate alarming or warning devices are in use and are operational.
- A statement that pocket dosimeters and alarm ratemeters will be checked for correct response to radiation at intervals not to exceed 12 months. If adjustment is necessary, state either that the devices will be returned to the manufacturer or persons licensed by Agreement State or NRC to calibrate such devices or provide in-house procedures if adjustments are made in-house.

Note: The NIST maintains a directory of laboratories that are NVLAP-approved at <http://ts.nist.gov/standards/scopes/dosim.htm>.

8.10.7 Public Dose

Regulations: 10 CFR 20.1301, 10 CFR 20.1302

Criteria: Licensees must do the following:

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

Discussion: Public dose is defined in 10 CFR Part 20 as “the dose received by a member of the public from exposure to radiation or to radioactive material released by a licensee, or to any other source of radiation under the control of a licensee.” Public dose excludes doses received from background radiation and medical procedures. Whether the dose to an individual is an occupational dose or a public dose depends on the individual’s assigned duties. It does not depend on the area (restricted, controlled, or unrestricted) where the individual is when he or she receives the dose.

Operating and emergency procedures that address security and surveillance should be sufficient to limit exposure of the public during use and after accidents. Public dose is controlled, in part, by ensuring that devices not in use are stored securely (e.g., stored in a locked area) to prevent unauthorized access or use. If devices are not in storage, then authorized users must maintain constant surveillance and control.

Public dose is also affected by the choice of the permanent radiographic installation and storage locations and physical conditions. Since radiation levels around a permanent radiographic installation or storage area will vary based on the type and strength of sealed sources used, the frequency of use, and scatter radiation from radiographic operations, it is not sufficient to perform surveys with portable radiation survey meters to determine the annual public dose. Use of area monitors, such as environmental TLDs, may be an acceptable means of demonstrating compliance with the annual limit of 1 mSv [100 mrem] in unrestricted areas.

Use the concepts of time, distance, and shielding when choosing a permanent radiographic installation, field location, or storage area. Decreasing the time spent near radiographic operations, increasing the distance of the device from occupied locations, using shielding material (i.e., high-density concrete, solid block, or lead sheets), and implementing conservative operating procedures (i.e., use of collimators or limiting the direction of exposures towards the floor) will reduce the radiation exposure of personnel and members of the public. Alternatively, the remote location of and access to a permanent radiographic installation could prevent members of the public from receiving 1 mSv [100 mrem] in a year.

If, after an initial evaluation, a licensee makes changes affecting the permanent radiographic installation storage area (e.g., changing the location of devices within the storage area, removing shielding, adding devices, changing the occupancy of adjacent areas, moving the storage area to a new location), then the licensee must perform a new evaluation to ensure that the public dose limits are not exceeded and devices are properly secured.

Response from Applicant: No response is required from the applicant in a license application, but this matter will be examined during an inspection.

Appendix J of this NUREG provides additional information for determining that radiation doses for other licensee personnel and members of the public will not exceed allowable limits.

8.10.8 Quarterly Maintenance

Regulations: 10 CFR 34.31, 10 CFR 34.73, 10 CFR 71.101(g), 10 CFR 21

Criteria: The licensee shall have written procedures for inspecting and maintaining radiographic exposure devices, source changers, associated equipment, transport and storage containers, and survey instruments. Inspection and maintenance must be conducted at intervals not to exceed 3 months, or before the first use thereafter, to ensure the proper functioning of components important to safety. The licensee must also have procedures necessary to maintain the Type B packaging used to transport radioactive materials, ensure that Type B packages are shipped properly, and maintain Type B packages in accordance with the certificate of compliance (COC) issued by the NRC or other agencies approving such transport packages.

If equipment problems are found, the equipment must be withdrawn from service until repaired. Records of equipment problems and specific maintenance are required by 10 CFR 34.73. The licensee should evaluate whether the equipment problem meets a 10 CFR Part 21 reporting requirement.

Discussion: These procedures are intended to allow the licensee's staff to evaluate equipment used in radiography for safe continued use, to provide a record of this evaluation, and to guide the staff in maintenance. Equipment found to be unsuitable for service must be withdrawn until repair and an evaluation for return to service is made. These procedures may be based on the manufacturer's recommendations. The procedures are to be specific to the equipment. For example, radiography drive cable assemblies should be cleaned and lubricated (when operationally appropriate), in accordance with the recommendations of the equipment manufacturer or the cable manufacturer. Another example is the performance of a misconnect test on the radiographic camera, including the radioactive source assembly, to test the integrity of the entire locking system in accordance with the manufacturer's recommendations. The performance of this test will detect long-term wear or damage of control and locking mechanism components, including the control cable and sealed-source connectors, simultaneously. A radiographic camera must not be used if the camera fails a misconnect test.

Procedures are also required for Type B packaging used to transport radioactive materials. These procedures are to be used for shipping and maintenance and may be properly drawn from the manufacturer's procedures and information submitted as a basis for the COC or other transport package approval.

The assembly, disassembly, reassembly, and reinstallation of the locking mechanism and outlet port mechanism of a radiography camera can be performed by the licensee in accordance with the recommendations of the equipment manufacturer. This type of activity is considered nonroutine maintenance that needs to be reviewed by the NRC on a case by case basis. The applicant needs to submit to the NRC specific procedures in support for this type of nonroutine maintenance. If such procedures are approved, the NRC will specifically authorize this activity by license condition.

The general license requirements of 10 CFR 71.101, "Quality assurance requirements," apply to all NRC licensees that transport, or deliver to a carrier for transport, licensed material in an NRC-approved transport package. Transport package users must do the following:

Register with the NRC before their first use of the package.

- Obtain a copy of the COC, or other approval of the package, and comply with the terms and conditions of the certificate or approval.

NRC licensees using NRC-approved transport packages are responsible for ensuring that all of these requirements have been met and that they are using currently authorized packages (see list of approved packages on the U.S. Department of Energy's Web site for Information of Radioactive Material Packaging at

http://rampac.energy.gov/certificates/certificate_retrieval_page.htm

Response from Applicant:

- Submit the quarterly maintenance procedures to the NRC for review and approval. The applicant should develop procedures specific to its equipment and program. The guidance provided in Sections 8.10.8, "Quarterly Maintenance," and 8.10.9, "Operating and Emergency Procedures," of NUREG-1556, Volume 2, Revision 1 should be of assistance in the development of the applicant's procedures.

AND

- If applicable, submit nonroutine maintenance procedures for NRC review and approval. The applicant should develop procedures specific to its equipment and program, and in accordance with the recommendations of the equipment manufacturer.

AND

- State: "Before using a new sealed source/device combination, we will have written inspection and maintenance procedures that address the use of the new equipment as a Type B transport package. In addition, we will provide training to radiographic personnel before using a new sealed source/device combination."

8.10.9 Operating and Emergency Procedures

Regulations: 10 CFR 34.13(d), 10 CFR 34.41(c), 10 CFR 34.45, 10 CFR 37.21(a), 10 CFR 37.45

Criteria: As a part of the radiation safety program, operating and emergency procedures must be established and submitted to the NRC as part of the application package. Sections 8.10.9.1 through 8.10.9.13 discuss the specific operation and emergency procedures. In addition, if radiographers will perform other operations, such as source exchange, leak testing, quarterly (not to exceed 3 months) inspection and maintenance of equipment, and instrument calibration, the operating and emergency procedures should include appropriate procedures and instructions for these operations. Licensees that possess Category 1 or Category 2 quantities of radioactive material must also establish, implement, and maintain its access authorization

program and coordinate, to the extent practicable, with local law enforcement authorities, for responding to threats to the licensee's facility.

Each licensee should consider the following information when developing, implementing, and maintaining operating and emergency procedures:

- handling and use of sealed sources and devices to maintain radiographic exposures within dose limits
- conducting radiation surveys
- access control to radiographic areas
- securing of exposure devices during storage and transport
- personnel monitoring and use of personnel monitoring equipment
- transport of exposure devices to field locations in accordance with DOT requirements
- equipment maintenance and inspection program that includes the performance of misconnect tests. (Refer to section 8.10.8, "Quarterly Maintenance")
- immediate response actions to an off-scale dosimeter or ratemeter alarm
- reporting defects as required by 10 CFR Part 21
- actions to take and when to notify (licensee personnel and other agencies) when an incident occurs
- source recovery procedures, if authorization for source recovery is requested
- offshore platform, lay-barge, and/or underwater radiography procedures, if such authorization is requested (Refer to Appendix D of this NUREG for further guidance)
- record maintenance

Discussion: The purpose of operating and emergency procedures is to provide radiography personnel with specific guidance for all operations they will perform. These topics should be included in the operating and emergency procedures and need not be presented in order of importance. A sequential set of procedures and instructions from the beginning to the end of the workday is an acceptable format. Instructions for nonroutine operations [e.g., quarterly (not to exceed 3 months) inspection and maintenance or instrument calibration] may be included as separate appendices.

It is not necessary for operating and emergency procedures to be specific to a particular make and model of exposure device, source changer, or survey instrument. Procedures submitted to the NRC should provide sufficient guidance and instruction for each specific type of device, to include appropriate radiation safety practices. For example, you may submit a single operating procedure for crankout devices, regardless of the manufacturer or a single operating procedure for other categories of exposure devices, regardless of manufacturer.

Note: Providing specific operating and emergency procedures for a particular manufacturer's make and model number will require an amendment to the license to obtain the NRC's authorization for a new sealed source/device combination.

Note: The procedures required by 10 CFR 34.45, "Operating and emergency procedures," are not substitutes for the DOT requirements in 49 CFR Part 172, Subpart G—Emergency Response Information. Licensees must comply with the appropriate U.S. DOT regulations as applicable, including those involving Emergency Response Information, if needed when transporting radioactive material.

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

- in accordance with 10 CFR 37.21(a), establish, implement and maintain its access authorization program in accordance with the requirements of 10 CFR Part 37, Subpart B;
- in accordance with 10 CFR 37.45, attempt to coordinate with their local law enforcement agency (LLEA) for responding to threats to a licensee's facility. Such activities are recommended for temporary jobsites.

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

Please note, under 10 CFR Part 37, security plans are not to be submitted to the NRC for review and approval.

Applicants who plan to conduct lay-barge, offshore platform, or underwater radiography are required to have their procedures approved by the NRC in accordance with 10 CFR 34.45, "Operating and emergency procedures." If you plan to conduct lay-barge, offshore platform, or underwater radiography, your radiation safety program will be reviewed to ensure that it contains procedures that specifically address the following:

- transport of licensed material
- storage facilities for licensed material
- methods for restricting access to radiation areas
- radiation safety procedures and radiographer responsibilities unique to lay-barge, offshore platform, or underwater industrial radiography
- radiographic equipment and radiation safety procedures unique to underwater industrial radiography
- methods appropriate for use of industrial radiography equipment in water environments

- applicable inspection and maintenance procedures unique to lay-barge, offshore platform, or underwater industrial radiography equipment
- emergency procedures unique to lay-barge, offshore platform, or underwater industrial radiography
- operating and emergency procedures must be submitted to the NRC for review

8.10.9.1 Operating and Emergency Procedures: Handling and Use of Sealed Sources and Radiography Exposure Devices

Regulations: 10 CFR 34.41, 10 CFR 34.45, 10 CFR 34.46, 10 CFR 34.47, 10 CFR 34.49, 10 CFR 34.51

Criteria: Licensees must establish operating and emergency procedures.

Discussion: The crankout device is normally used for industrial radiography. Separate instructions are not necessary for each different model of a given type of exposure device since the operation of each type is essentially the same regardless of the manufacturer. Some applicants may choose to use one basic instruction for all crankout devices; others may choose to have separate instructions for each model. Either approach is acceptable.

Specific procedures should be required for performing source exchanges, including those at temporary jobsites, field stations, and in permanent radiographic installations. The procedures should contain warnings of areas of concern during sealed-source exchanges. Incidents of sources becoming dislodged from the shielded position indicate the importance of training personnel in the appropriate techniques. Procedures should require the use of radiation survey instruments, dosimetry, and surveys during and after movement of sealed sources.

Response from Applicant:

- Provide operating and emergency procedures with step-by-step instructions for using each type of radiographic device.
- Include operating and emergency procedures with instructions for performing source exchanges.
- Instructions for crankout devices should be separate from those for other categories of exposure devices.

Manufacturers' manuals, bulletins and updates, and similar documents should not be incorporated into the procedures; rather, information should be extracted from them and paraphrased.

Appendix K of this NUREG provides information for applicants to consider when developing their procedures for operating radiography equipment.

8.10.9.2 Operating and Emergency Procedures: Methods and Occasions for Conducting Required Radiation Surveys

Regulations: 10 CFR 20.1301(a)(2), 10 CFR 20.1302(a)(1), 10 CFR 20.1906, 10 CFR 34.20(a), 10 CFR 34.21, 10 CFR 34.27(c)(1), 10 CFR 34.27(e), 10 CFR 34.49(b), 10 CFR 34.49(c), 49 CFR 172.403, 49 CFR 173.441

Criteria: Perform radiation surveys during use, movement, and storage of licensed material to ensure its safe use and to comply with regulatory requirements.

Discussion: In general, surveys are required whenever a sealed source is manipulated or moved. Surveys should be made with a radiation survey instrument calibrated in accordance with 10 CFR 34.25, "Radiation survey instruments." The following table provides examples of surveys made during radiographic and associated operations that should be included in the operating and emergency procedures.

Response from Applicant: Submit operating and emergency procedures for conducting radiation surveys. Where applicable, the operating and emergency procedures must include each of the surveys included in Table 8-2.

Requirement	Frequency	Radiation Survey Limits
10 CFR 20.1301(a)(2)	During the first exposure for each set up of radiographic device	Boundary of restricted area at temporary jobsite does not exceed 0.02 mSv [2 mrem] in any one hour
10 CFR 20.1302(a)(1)	At intervals not to exceed 12 months	Unrestricted area in vicinity of permanent radiographic installation or storage area does not exceed 1 mSv [100 mrem] per year
10 CFR 20.1906	Each receipt of package	External radiation levels when a package is received does not exceed 2 mSv/h [200 mrem/h]
10 CFR 34.20(a)	Each installation of new source in exposure device	Exposure rate does not exceed 2 mSv/h [200 mrem/h] on surface and 0.1 mSv/h [10 mrem/h] at 1 meter
10 CFR 34.21	Each installation of new source in a storage container or source changer	Exposure rate does not exceed 2 mSv/h [200 mrem/h] at any exterior surface and 0.1 mSv/h [10 mrem/h] at 1 meter from any exterior surface with the sealed source in the shielded position
10 CFR 34.27(c)(1)	At intervals not to exceed 6 months	Contamination level for leak tests of sealed sources does not exceed 185 Bq [0.005 μ Ci]
10 CFR 34.27(e)	At intervals not to exceed 12 months	Contamination level for leak tests of S-tube of exposure device does not exceed 185 Bq [0.005 μ Ci]
10 CFR 34.49(b)	After every radiographic exposure	Confirm source has returned to a shielded position

Requirement	Frequency	Radiation Survey Limits
10 CFR 34.49(c)	After every sealed-source exchange or when an exposure device is placed in storage	Confirm source is in shielded position
49 CFR 172.403	Every movement of licensed material on public roads	Confirm exposure rates meet labeling of package (i.e., Yellow II) and determine Transport Index
49 CFR 173.441	Every movement of a package labeled Yellow III	Exposure rates in and around vehicle do not exceed 0.002 mSv/h [2 mrem/h] in driver's seat, 2 mSv/h [200 mrem/h] on surface and 0.1 mSv/h [10 mrem/h] at 2 meters from vehicle

8.10.9.3 Operating and Emergency Procedures: Methods for Controlling Access to Radiographic Areas

Regulations: 10 CFR 20.1801, 10 CFR 20.1802, 10 CFR 20.1902(a), 10 CFR 20.1902(b), 10 CFR 34.33, 10 CFR 34.41(a), 10 CFR 34.43, 10 CFR 34.51, 10 CFR 34.53, 10 CFR 37.49, 10 CFR 37.53

Criteria: Each licensee must control access to areas where licensed material is either used or stored to prevent the unnecessary exposure of members of the public, and to prevent theft and diversion. This can be achieved through the use of posting, by locking devices and areas where licensed materials are stored, and by maintaining constant control and continuous surveillance of areas where radiographic operations are conducted. Operating and emergency procedures should include steps for radiographic personnel to ensure that access to licensed materials is controlled for the types of operations that will be performed. Licensees that possess an aggregated Category 1 or Category 2 quantity of radioactive material must also be able to monitor and immediately detect and assess any unauthorized entries into security zones.

Discussion:

Field/Temporary Jobsites

When radiographic operations are performed outside a permanent radiographic installation, at least two qualified radiographic personnel must be present to provide constant surveillance of the operations and be capable of providing immediate assistance to prevent unauthorized entry to the restricted area. At least one of the individuals must be a radiographer; the other may be another radiographer or a trained radiographer's assistant. Operating procedures must comply with the two-man rule for radiographic operations at any locations other than permanent radiographic facilities.

Radiographic personnel are required to maintain continuous, direct visual surveillance of operations to protect against unauthorized entry to the high-radiation area during radiographic operations. Radiographic personnel should be instructed to keep the perimeter of the restricted area under continuous surveillance to prevent unnecessary exposure of individuals. Operating procedures should specify steps for responding to unauthorized entry to the restricted area. For

example, personnel should be instructed to terminate the radiographic exposure immediately before confronting the person who entered the restricted area.

All areas where radiographic operations are conducted require posting of the radiation areas and the high-radiation areas, as shown in Figure 8-6. Specific exceptions to posting listed in 10 CFR 20.1903, "Exceptions to posting requirements," do not apply to industrial radiography (10 CFR 34.53, "Posting"). However, it is acceptable to post the perimeter of the restricted area rather than the perimeter of the radiation area. Personnel should be instructed to post signs stating "Caution Radiation Area" at the point where radiation levels have been calculated to reach 0.02 mSv [2 mrem] in any one hour. A confirming survey during the first exposure of the source should be conducted to confirm the location of the boundary, and any necessary adjustments should be made. As a "rule of thumb," radiographers should establish the boundary where measured exposure levels do not exceed 0.02 mSv/h [2 mrem/h]. The perimeter of the high-radiation area must be posted with a sign or signs stating "Caution (or Danger) High-Radiation Area" at the point where radiation levels have been calculated to reach 1 mSv [100 mrem] in any one hour. A confirming survey of the high-radiation area perimeter should not be conducted, since such a survey could lead to unnecessary exposure of personnel.

Surveillance of the restricted area at facilities with multiple levels and multiple access points, or where members of the public are close to the radiographic operations (e.g., boilers, commercial manufacturing plants, or power plants during outages), can usually be performed only when more than two radiographic personnel are assigned to the job. Figure 8-7 provides one example of such a temporary jobsite. Operating procedures and instruction to personnel should include specific steps for these circumstances to ensure that access into the restricted area is properly controlled. These special instructions may include the use of additional personnel to assist radiographic personnel in controlling access into the restricted area, providing instruction to other workers in the area, or making announcements over the public address system before and during radiographic operations.

Permanent Radiographic Installations

For permanent radiographic installations, instruct personnel about posting each entrance to the facility with a sign or signs stating "Caution (or Danger) High-Radiation Area," and provide procedures to ensure that the visible-audible signal system is operable. The operability of the visible-audible system must be checked daily. The following procedures may be used:

- Expose a radiation source in the permanent installation with all entrances closed.
- Determine that each visible signal in and outside the installation is functional.
- Open the door to each entrance into the installation to activate the audible alarm.
- Close the entrance and confirm that the alarm stops. If the installation has more than one entrance, only one entrance should be tested at a time.
- Record results of test.

In the event that an entrance control device or an alarm fails to operate properly at the permanent radiographic installation, the installation may continue to operate for up to 7 days while the defective equipment is fixed, provided that the following is true:

- The entrance control device is labeled as defective.
- Radiography personnel maintain continuous, direct, and visual surveillance of access installation points.
- Radiography personnel use an alarming rate meter.
- The radiographer must be accompanied by at least one other qualified radiographer or radiographer's assistant.

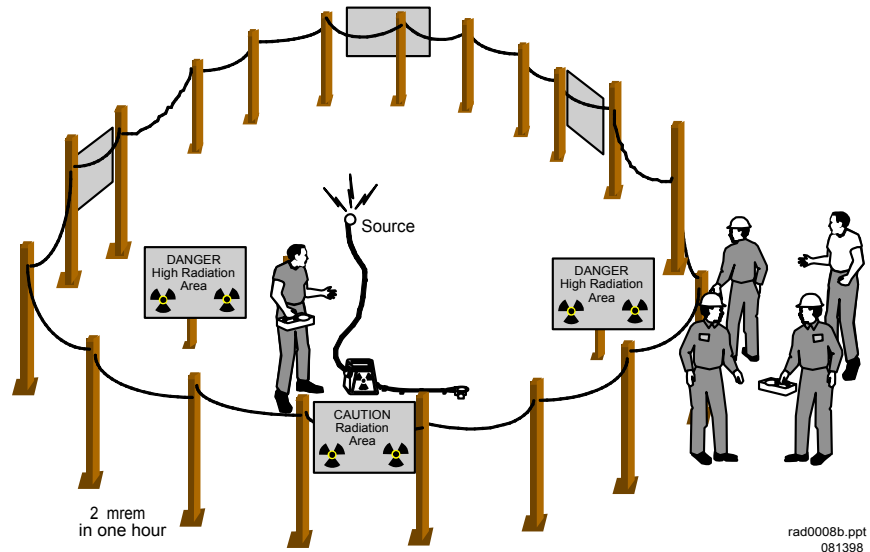


Figure 8-6. Posting. A Radiographer Is likely to Use Only a Single Rope Barrier. The Radiation Area and Restricted Area Would Be Combined Into One and Located at the Boundary of 2 mrem in any One Hour.

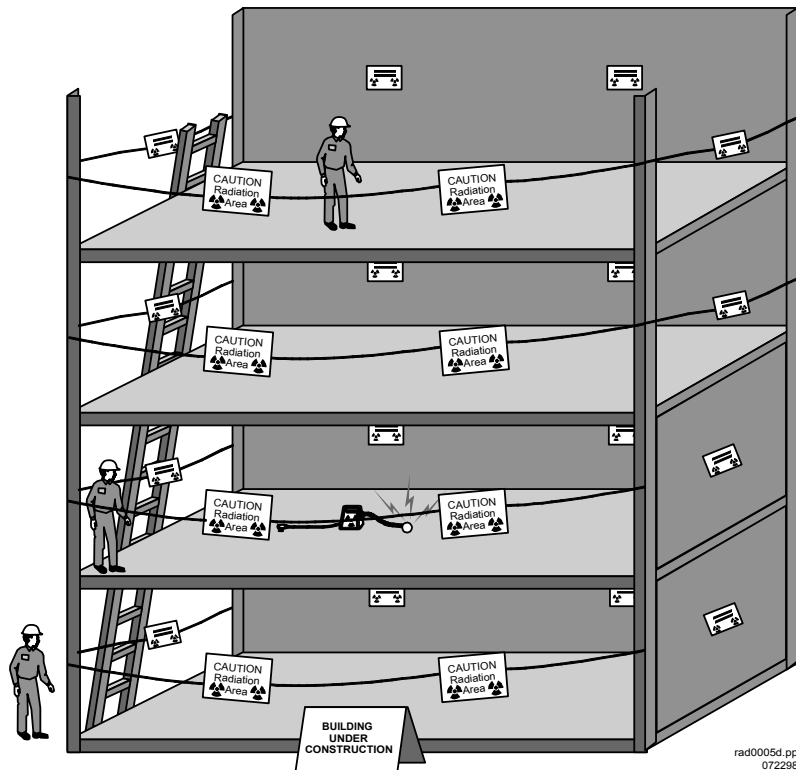


Figure 8-7. Surveillance and Posting at a Temporary Jobsite With Multiple Floors and Access Points. Adequate Control of the Restricted Area at This Type of Jobsite Requires Several Personnel and Many Postings.

Storage Areas

Radiographic equipment containing licensed materials stored in controlled or unrestricted areas must be secured from unauthorized removal or access. Operating procedures should specify how stored licensed materials should be secured.

A vehicle used to transport licensed material can also be used for storage at locations such as temporary jobsites or overnight lodging. If the applicant plans to use vehicles for storage, there should be procedures and instructions to personnel about proper posting of the vehicle. Vehicles should be posted with a sign stating “Caution—Radioactive Material” on the entrance to the area of the vehicle where licensed material is stored. A physical survey should be performed to confirm that the area around the storage facility is an unrestricted area. Radiation levels may not exceed 0.02 mSv/h [2 mrem/h] from any external surface of the vehicle, and the vehicle shall be locked when it is used for storage. Industrial radiographic exposure devices stored at temporary jobsites must be secured at a location that prevents access by unauthorized personnel. This usually requires that the equipment be locked in a cabinet or other secure area where key access is controlled by site management and radiographic personnel. It is not acceptable for an exposure device to be chained to a post and left unattended at the place of use during lunch, breaks, or after hours. Storage of exposure devices at a private residence is unacceptable, unless it has been identified and approved in a license.

In accordance with 10 CFR Part 37, any licensee that possesses an aggregated Category 1 or Category 2 quantity of radioactive material must implement the physical protection requirements for material in permanent radiographic installations, storage, and at temporary jobsites. In accordance with 10 CFR 37.49 and 37.53, licensees must be able to monitor and immediately detect and assess any unauthorized entries into security zones, including those surrounding mobile devices. For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG–2155, “Implementation Guidance for 10 CFR Part 37, “Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material.” Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG–2166, “Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material.”

Please note, under 10 CFR Part 37, security plans are not to be submitted to the NRC for review and approval.

Response from Applicant: Submit the procedures to control access to radiographic operations and storage areas.

8.10.9.4 Operating and Emergency Procedures: Methods and Occasions for Locking and Securing Radiographic Exposure Devices, Storage Containers, and Sealed Sources

Regulations: 10 CFR 34.20, 10 CFR 34.23, 10 CFR Part 37

Criteria: NRC regulations require radiographic equipment to be locked and secured to protect the public and radiographers from an inadvertent exposure to radiation and to prevent theft and diversion of Category 1 and Category 2 quantities of radioactive material.

Discussion: All radiographic equipment (i.e., radiographic cameras, sealed source storage containers, and source changers) are required to have a lock or outer locked container to maintain the sealed source in its shielded position. During radiographic operations, the sealed source must automatically be secured in the shielded position each time the sealed source is returned. Radiographers must not attempt to circumvent the automatic securing features or tamper with the safety features of radiographic devices. As shown in Figure 8-8, radiographers must never leave the exposure device at the temporary jobsite (including in a storage area or vehicle) without securing it properly from unauthorized removal or tampering. Radiographers and radiographer’s assistants must ensure that the exposure device and storage or source containers are maintained locked (and if key locked, with the key removed at all times) when they are not under the direct supervision of the radiographer or the radiographer’s assistant, except at permanent radiographic installations where all entryways are locked and the requirements of 10 CFR 34.33 are met.

In accordance with 10 CFR Part 37, any licensee that possesses an aggregated Category 1 or Category 2 quantity of radioactive material, must implement the physical protection requirements for material in use and storage, at both permanent and temporary jobsites, as well as during transport. For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG-2155, "Implementation Guidance for 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material." Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG-2166, "Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material."

Please note, under 10 CFR Part 37, security plans are not to be submitted to the NRC for review and approval.

Response from Applicant: Submit operating and emergency procedures that include procedures for locking and securing radiographic equipment.

8.10.9.5 Operating and Emergency Procedures: Personnel Monitoring and the Use of Personnel Monitoring Equipment

Regulations: 10 CFR 34.45(a)(5), 10 CFR 34.47

Criteria: Provide procedures for appropriate use of personnel monitoring equipment.

Discussion: As shown in Figure 8-9, all radiographers or radiographer's assistants are required to wear:

- direct-reading dosimeters and either film badges, TLDs, or other personal dosimetry devices

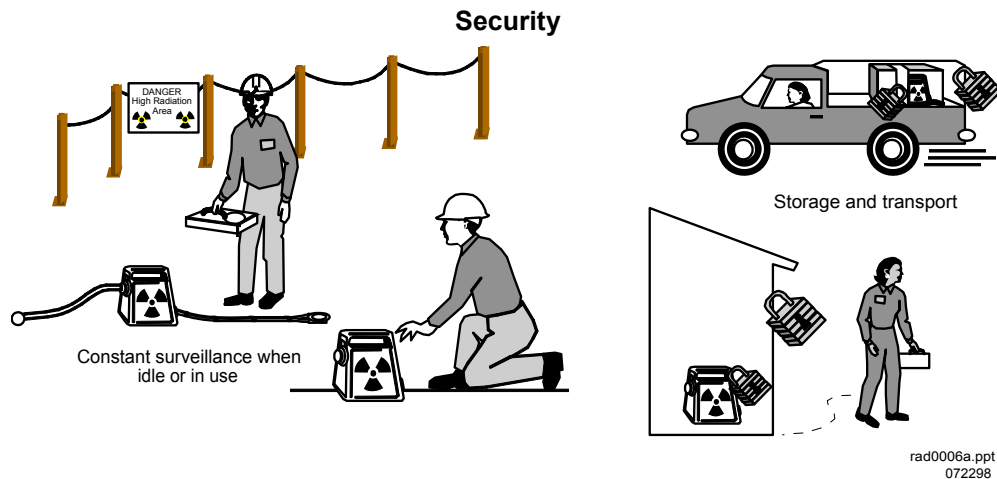


Figure 8-8. Security. To Avoid Lost or Stolen Devices, Licensees Must Keep the Radiographic Exposure Devices Under Constant Surveillance or Secured Against Unauthorized Use or Removal.

Alarm ratemeters when they are engaged in radiographic operations, except for a permanent radiographic installation. Film badges, TLDs, or other personal dosimetry devices must be assigned to and worn by only one individual. To ensure full-scale reading capability, direct-

reading dosimeters, such as pencil (pocket) dosimeters or electronic personal dosimeters, must be recharged or reset at the start of each work shift so that the dosimeters will be capable of reading the full scale. Personnel should be instructed that direct-reading dosimeters must be read and recorded at the beginning and end of each work shift. Proper operation of alarm ratemeters must be checked each day before use to ensure that the alarm functions properly. The manufacturer's recommended procedures should be followed.

Include instructions about how and where dosimetry devices are to be stored when not in use. The storage place should be dry, with a low-radiation background area, and cool so that the devices will not be affected by adverse environmental conditions.

It is good practice to check the direct reading dosimeter reading after each exposure and during the work shift; however, there is no regulatory requirement for the direct reading dosimeter to be read during the work shift.

All radiographers or radiographer's assistants are required to wear alarm ratemeters, except at permanent radiographic facilities where other appropriate alarm or warning devices (e.g., visible and audible alarms) are in routine use and are operable.

Response from Applicant: The operating procedures must include instructions for proper use of personnel monitoring equipment.

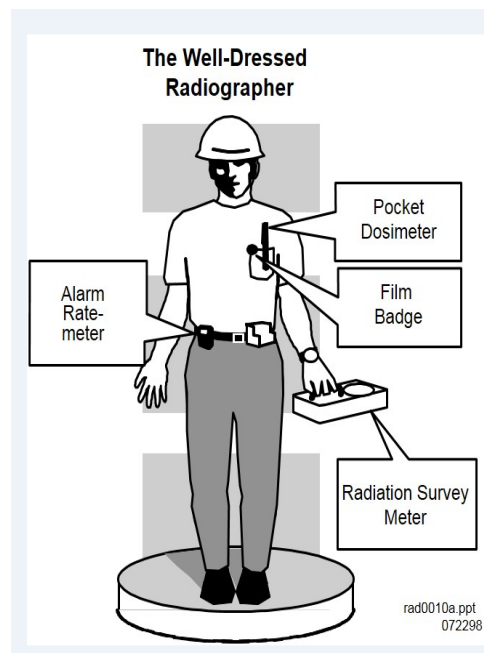


Figure 8-9. The Well-Dressed Radiographer. The Radiographer Is Equipped With the Required Personnel Monitoring Devices and Radiation Survey Instrument.

8.10.9.6 Operating and Emergency Procedures: Transporting Sealed Sources to Field Locations, Securing Exposure Devices and Storage Containers in Vehicles, Posting Vehicles, and Controlling Sealed Sources During Transportation

Regulations: 10 CFR Part 37, Subpart D, 10 CFR 71.5, 49 CFR Parts 171–178

Criteria: Licensees must develop, implement, and maintain procedures for transporting radioactive material to ensure compliance with DOT regulations. Licensees must also preplan, coordinate and provide advance notification of shipment of Category 1 quantities of radioactive material and coordinate shipment of Category 2 quantities of radioactive material.

Discussion: Figure 8-10 illustrates some often-overlooked DOT requirements. During an inspection, NRC uses the provisions of 10 CFR 71.5, “Transportation of licensed material,” and a memorandum of understanding with DOT to examine and enforce transportation requirements applicable to radiography licensees. Appendix L of this NUREG contains a list of major DOT regulations applicable to transporting radiographic devices.

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

- Labeling containers appropriately (i.e., when to use labels Radioactive White I, Radioactive Yellow II, or Radioactive Yellow III).
- Securing the radiographic exposure device or storage container within the transporting vehicle. The instructions should specify how to prevent the package from moving during transport, referred to as blocking and bracing.

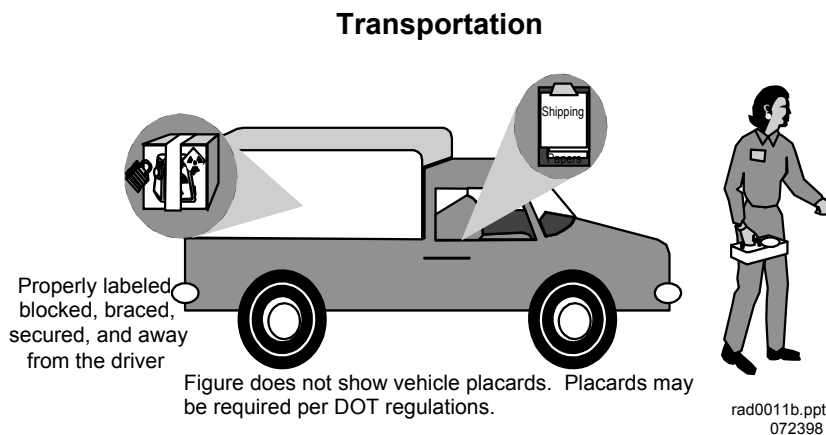


Figure 8-10. Transportation. Radiography Licensees Often Act as a “Private Carrier” to Transport Their Radiographic Exposure Devices to and From Sites and Must Ensure Compliance With DOT Regulations

- Preparing shipping papers. The instructions should specify that the papers must be completed before transporting the licensed material and must be accessible in the

driver's compartment at all times. Placarding both sides, the front and the back of the vehicle, with "RADIOACTIVE" placards if the package being transported requires a Radioactive Yellow III label. If the vehicle requires placarding and the package radiation levels exceed 2 mSv/h [200 mrem/h] or the transport index exceeds 10, the exterior surfaces and passenger compartment of the vehicle must be surveyed to ensure that the radiation levels do not exceed 0.02 mSv/h [2 mrem/h] from any exterior surface and 0.02 mSv/h [2 mrem/h] in the passenger compartment. Include instructions to personnel on the measures to take if the radiation level exceeds 0.02 mSv/h [2 mrem/h] in the passenger compartment (e.g., adding more shielding or repositioning the exposure device within the vehicle). If an exposure device is transported in an overpack, the procedures should include instructions that the overpack must be properly marked with the shipping name and identification number, labeled (e.g., Radioactive White I or Radioactive Yellow II), and marked when required with a statement that indicates the inner package complies with prescribed specifications.

The licensee may have authorization to possess and use several sealed source/device combinations that are registered by the NRC or an Agreement State and meet the safety performance requirements of 10 CFR 34.20. Therefore, the applicant must, before using a new sealed source/device combination, develop written inspection and maintenance procedures for it and for the corresponding Type B transport package. In addition, the applicant must provide adequate training for radiographic personnel before using a new sealed source/device combination.

The applicant's inspection and maintenance procedures for radiographic equipment, which are also used for Type B packages, must ensure that these packages are shipped and maintained in accordance with the COC.

In accordance with 10 CFR Part 37, any licensee transferring a Category 1 or Category 2 quantity of radioactive material must implement the physical protection in transit requirements in 10 CFR Part 37, Subpart D. For additional guidance on implementing 10 CFR Part 37 requirements, see NUREG-2155, "Implementation Guidance for 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material." Additional information regarding best practices for protection of risk-significant radioactive material is available in NUREG-2166, "Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material."

Please note, under 10 CFR Part 37, security plans are not to be submitted to the NRC for review and approval.

Response from Applicant: Submit operating and emergency procedures for transporting sealed sources containing byproduct material, radiographic exposure devices, and source changers.

8.10.9.7 Operating and Emergency Procedures: Daily Inspection and Maintenance of Radiographic Equipment

Regulations: 10 CFR 34.31, 10 CFR 34.33, 10 CFR 34.45(a)(7), 10 CFR 34.47, 10 CFR 34.73, 10 CFR 34.83

Criteria: The licensee shall perform visual and operability checks before using radiography equipment each day it is used.

Discussion: Visual and operability checks must be performed on radiographic exposure devices, radiation survey meters, associated equipment, and transport and storage containers before use each day that the equipment is used. These checks are intended to ensure that the equipment is in good working condition, the sealed sources are adequately shielded, and the required labeling is present. Licensees must check radiation survey instrument operability using check sources or other appropriate means. The radiographic exposure device may be used as a check source.

Inspection records shall contain information about equipment problems found in daily checks and quarterly (not to exceed 3 months) maintenance inspections. Records shall include the date of check or inspection, name of inspector, equipment involved, any problems found, and what repair or maintenance, if any, was done.

Instructions to personnel using radiographic equipment must clearly state that inspections are to be made before the equipment is used each day. While not a requirement, good practice would be to inspect the equipment before the start of each work shift, if the equipment is used on more than one work shift in the day.

The procedures should specify the items that are to be checked and the steps that are to be taken if any defects are found. If problems are found, the equipment must be removed from service until it is repaired.

Equipment manufacturers can provide a list of items that should be checked in the daily inspection of radiography equipment.

Permanent radiographic installation of visible and audible alarms must be checked for operability daily before use with a radiation source, and faulty radiographic equipment must be labeled and repaired within 7 days, with compensatory measures taken in the interim. Compensatory measures taken include the following:

- The faulty equipment is immediately taken out of service and labeled as defective.
- The radiographer or radiographer's assistant must be accompanied by at least one other qualified radiographer or individual who has at a minimum met the requirements of 10 CFR 34.43(c).
- Continuous surveillance requirements are implemented until repairs are completed.
- Alarm ratemeters shall be worn and checked for alarm function at the beginning of each work shift.
- Records must be maintained of faulty equipment.

Direct-reading dosimetry devices must be read and the exposures recorded at the beginning and end of each work shift. Alarm ratemeters shall be checked for alarm function at the beginning of each work shift. Records are to be maintained.

Appendix M of this NUREG provides example instructions for daily inspection of radiographic exposure devices and equipment.

Response from Applicant: Submit operating and emergency procedures for daily inspection and maintenance of radiographic equipment.

8.10.9.8 Operating and Emergency Procedures: Ratemeter Alarms or Off-Scale Dosimeter Readings

Regulations: 10 CFR 34.43(b)(2), 10 CFR 34.45(a)(8), 10 CFR 34.47(d)

Criteria: Licensees must instruct personnel in the following:

- appropriate handling and use of sealed radionuclide sources and radiographic exposure devices
- methods and occasions for conducting radiation surveys; controlling access to radiation areas; and locking, securing, and transporting storage containers, radiographic exposure devices, and sealed radionuclide sources
- the licensee's license and operating and emergency procedures
- actions to be taken if a dosimeter shows an off-scale reading or an alarm ratemeter alarms (e.g., sounds) unexpectedly
- procedures to be followed if a personal dosimeter (processed by an NVLAP processor) is lost or damaged
- procedures for notifying the proper persons in the event of an accident

Discussion: If an individual's self-reading pocket dosimeter is found to be off scale, an individual's electronic personal dosimeter reads above 2 mSv [200 mrem], or an alarm ratemeter alarms (e.g., sounds) unexpectedly, the RSO or designee must be notified immediately. If the RSO or designee cannot rule out radiation exposure to the individual as the root cause, the individual's personal dosimetry device must be sent for processing within 24 hours. The affected individual may not resume work with licensed radioactive material until the RSO or designee has determined the individual's radiation exposure. There are no exceptions to this requirement.

If any of the events described above should occur, personnel should be instructed to do the following, at a minimum:

- Stop work immediately and ensure that the sealed source is in the safe storage position in the radiographic exposure device, and vacate the radiation area.
- If the alarm ratemeter alarms (e.g., sounds), evaluate pocket dosimeter reading.
- Notify the individual specified in the emergency procedures.
- Notify the RSO or designee of the problem.
- If pocket dosimeter is off scale, do not resume operations until authorized by the RSO or designee.

- If the RSO or designee cannot rule out radiation exposure to the individual, then process the personal dosimetry device within 24 hours.

Response from Applicant: Submit operating and emergency procedures to address ratemeter alarms or off-scale dosimeters.

8.10.9.9 Procedure for Identifying and Reporting Defects and Noncompliance As Required By 10 CFR Part 21

Regulations: 10 CFR Part 21, 10 CFR 30.50, 10 CFR 34.101(a)(3)

Criteria: Licensees must notify the NRC if defects are found in radiography equipment.

Discussion: Equipment defects that could create a substantial safety hazard or equipment failures involving NRC-regulated activities must be reported to the NRC. In addition to reporting to the NRC, the licensee should contact the manufacturer regarding the equipment defects. For example, a failure of a lock box or a failure of the coupling between the source assembly and the control cable are defects that must be reported to the NRC. Radiography personnel should be instructed to report any malfunction or defect in radiography equipment to management, so that management can take appropriate action. IN 91-39, "Compliance with 10 CFR Part 21, Reporting of Defects and Noncompliance," dated June 17, 1991, provides additional guidance on determining whether a safety hazard exists and sample procedures for identifying and reporting defects.

Response from the Applicant: Submit operating and emergency procedures for notifying management of equipment malfunction or defect.

8.10.9.10 Notification of Proper Persons in the Event of an Accident or Emergency

Regulations: 10 CFR 30.50, 10 CFR 34.27, 10 CFR 34.45(a)(10), 10 CFR 34.101, 10 CFR 37.57, 10 CFR 37.81, 10 CFR 20.2201, 10 CFR 20.2202, 10 CFR 20.2203

Criteria: Operating and emergency procedures must ensure that appropriate notifications are made to the NRC during and after an incident.

Discussion: The emergency procedures should clearly identify the names and telephone numbers of the RSO and/or other persons who can provide assistance in an emergency or accident. Such persons may also include the exposure device manufacturer and State and local agencies. The emergency procedures should always be available to radiography personnel during radiography and must be up to date.

NRC regulations also require telephone notification and/or a written report based on the discovery of certain events. Licensees must notify the NRC when radiographic devices are lost or stolen or if there is indication of overexposure to individuals. Licensees must notify the NRC when radiographic device components fail, such as unintended source disconnects or locking mechanism failures. Refer to the regulations listed above or to Appendix N of this NUREG for additional guidance in the preparation of emergency procedures. Table 8-3 describes events that require notification or reports.

Table 8-3. Regulatory-Required Notifications			
Typical NRC Notifications Required for Radiography Licensees			
Event	Telephone Notification	Written Report	Regulatory Requirement
Theft or loss of material	immediate	30 days	10 CFR 20.2201(a)(1)(i) & (b)(1)
Whole body dose greater than 0.25 Sv [25 rem]	immediate	30 days	10 CFR 20.2202(a)(1)(i) 10 CFR 20.2203(a)(1)
Extremity dose greater than 2.5 Gy [250 rad]	immediate	30 days	10 CFR 20.2202(a)(1)(iii) 10 CFR 20.2203(a)(1)
Whole body dose greater than 0.05 Sv [5 rem] in 24 hours	24 hours	30 days	10 CFR 20.2202(b)(1)(i) 10 CFR 20.2203(a)(1)
Extremity dose greater than 0.5 Sv [50 rem] in 24 hours	24 hours	30 days	10 CFR 20.2202(b)(1)(iii) 10 CFR 20.2203(a)(1)
Whole body dose greater than 0.05 Sv [5 rem]	none	30 days	10 CFR 20.2203(a)(2)(i)
Dose to individual member of public greater than 1 mSv [100 mrem]	none	30 days	10 CFR 20.2203(a)(2)(iv)
Defect in equipment that could create a substantial safety hazard	2 days	30 days	10 CFR 21.21(d)(3)(i) & (ii)
Event that prevents immediate protective actions necessary to avoid exposure to radioactive materials that could exceed regulatory limits	immediate	30 days	10 CFR 30.50(a) & (c)(2)
Equipment is disabled or fails to function as designed when required to prevent radiation exposure in excess of regulatory limits	24 hours	30 days	10 CFR 30.50(b)(2) & (c)(2)
Unplanned fire or explosion that affects the integrity of any licensed material or device, container, or equipment with licensed material	24 hours	30 days	10 CFR 30.50(b)(4) & (c)(2)
Leak test of sealed source or guide tube greater than 185 Bq [0.005 µCi]	none	5 days	10 CFR 34.27(d)
Unintentional disconnect of source assembly from control cable	none	30 days	10 CFR 34.101(a)(1)
Inability to retract source assembly to its fully shielded position and secure it in this position	none	30 days	10 CFR 34.101(a)(2)
Failure of any component to perform its intended function which is critical for safe operation of device	none	30 days	10 CFR 34.101(a)(3)
Storage and use of licensed material at any location not on license for more than 180 days in a calendar year	notify NRC regional office	none	10 CFR 34.101(c)

Table 8-3. Regulatory-Required Notifications (Continued)			
Typical NRC Notifications Required for Radiography Licensees			
Event	Telephone Notification	Written Report	Regulatory Requirement
Determine that an unauthorized entry resulted in an actual or attempted theft, sabotage, or diversion of Category 1 or Category 2 quantity of radioactive material.	As soon as possible after initiating a response, but not at the expense of causing delay or interfering with the LLEA response, but no later than 4 hours after discovery.	30 days	10 CFR 37.57(a)&(c)
Assess any suspicious activity related to possible theft, sabotage, or diversion of Category 1 or Category 2 quantities of radioactive material	As soon as possible, but no later than 4 hours after notifying the LLEA.	none	10 CFR 37.57(b)
Determination that a shipment containing a Category 1 quantity of material is lost or missing in transport.	Within 1 hour of the determination notify LLEA and NRC operations center.	30 days and periodic updates [10 CFR 37.79(c)]	10 CFR 37.81(a)&(g)
Determination that a shipment containing a Category 2 quantity of material is lost or missing in transport.	Within 4 hours of the determination. Within 24 hours if the material has not yet been located and secured.	30 days	10 CFR 37.81(b)&(g)
Discovery along the route of any actual or attempted theft or diversion, or suspicious activity, related to a Category 1 quantity of material in transport.	Upon discovery notify LLEA and NRC operations center as soon as possible.	30 days (except no report for suspicious activity)	10 CFR 37.81(c)&(g)

Typical NRC Notifications Required for Radiography Licensees			
Event	Telephone Notification	Written Report	Regulatory Requirement
Discovery of any actual or attempted theft or diversion, or suspicious activity, related to a Category 2 quantity of material in transport.	As soon as possible.	30 days (except no report for suspicious activity)	10 CFR 37.81(d)&(g)
Upon recovery of any lost or missing Category 1 quantity of material.	As soon as possible.	None	10 CFR 37.81(e)
Upon recovery of any lost or missing Category 2 quantity of material.	As soon as possible.	None	10 CFR 37.81(f)

Note: Telephone notifications must be made to the NRC Operations Center at 301-816-5100 or by facsimile to 301-951-0550, except as noted. The Center is staffed 24 hours a day and accepts collect calls. NRC notification is required when licensed materials are lost or stolen or involved in an incident that may have resulted in doses in excess of NRC limits.

Response from Applicant: Submit operating and emergency procedures that include appropriate instructions for notifying the RSO and other personnel in the event of an accident or emergency. See Table 8-3. **Please note, under 10 CFR Part 37, security plans are not to be submitted to the NRC for review and approval.**

8.10.9.11 Minimizing Exposure of Persons in the Event of an Accident or Emergency

Emergency Procedures

Regulations: 10 CFR 34.45(a)(11)

Criteria: To maintain exposures as low as possible in the event of an emergency.

Discussion: An emergency situation may be considered to exist whenever an abnormal event occurs or the source has failed to return to the safe position. Since it is not possible to specify all possible situations that would constitute an emergency, a general instruction is acceptable, as shown in Figure 8-11. This general instruction should describe licensee actions to maintain the dose at a minimal level after an abnormal event is identified. The instruction should include routine emergency actions, such as evacuating personnel from the area, posting the restricted area, maintaining surveillance of the restricted area, and notifying the RSO. Appendix N of this NUREG provides an example of a routine emergency procedure.

Response from Applicant: Submit operating and emergency procedures that include instructions for minimizing exposure of persons in the event of an accident.

8.10.9.12 Source Recovery (Retrieval)

Regulations: 10 CFR 34.45(a)(12), 10 CFR 34.101(a), 10 CFR 34.101(b)

Criteria: Each licensee who intends to perform source recovery operations, also known as source retrieval, must have appropriate equipment, training, and procedures.

Discussion: Applicants must develop source recovery procedures if their own radiographic personnel with appropriate training and experience will conduct source recovery. If procedures and training and experience documentation are submitted, the NRC will review and approve applicants to perform source recovery. If source recovery procedures are not submitted for review, then source retrieval activities must be conducted by an NRC or Agreement State licensee whose license specifically authorizes these activities.

Licensees specifically approved to perform source recovery will have a specific license condition authorizing these activities. In addition, these individuals would be authorized to perform source recovery for other licensees.

The NRC will review the applicant's procedures for source recovery with respect to keeping exposures ALARA and controlling exposures to radiation. Since it is not possible to specify all potential exposure situations, a general procedure is acceptable. A recovery procedure should contain the following elements:

- Warnings stating that only specifically authorized individuals, or personnel supervised by such authorized individuals and working in their presence, are allowed to perform recovery.
- A clear statement that no sealed source or suspected sealed-source-containing items, such as a stuck source in a guide tube, will be handled directly.
- Expedient methods of reducing unintended exposure to staff and the public, such as cranking out the source fully into the collimator (if there are no kinks in the guide tube) to provide some shielding from the source (see Appendix N of this NUREG), using lead shot bags, sandbags, steel plates, remote handling devices, and culverts cut lengthwise.
- Additional dosimetry to be used during source recovery {e.g., pocket dosimeters with a range greater than 2 mSv [200 mrem] or finger badges}.
- Methods of restricting access to the area, including establishing a restricted area and obtaining outside help in controlling access.

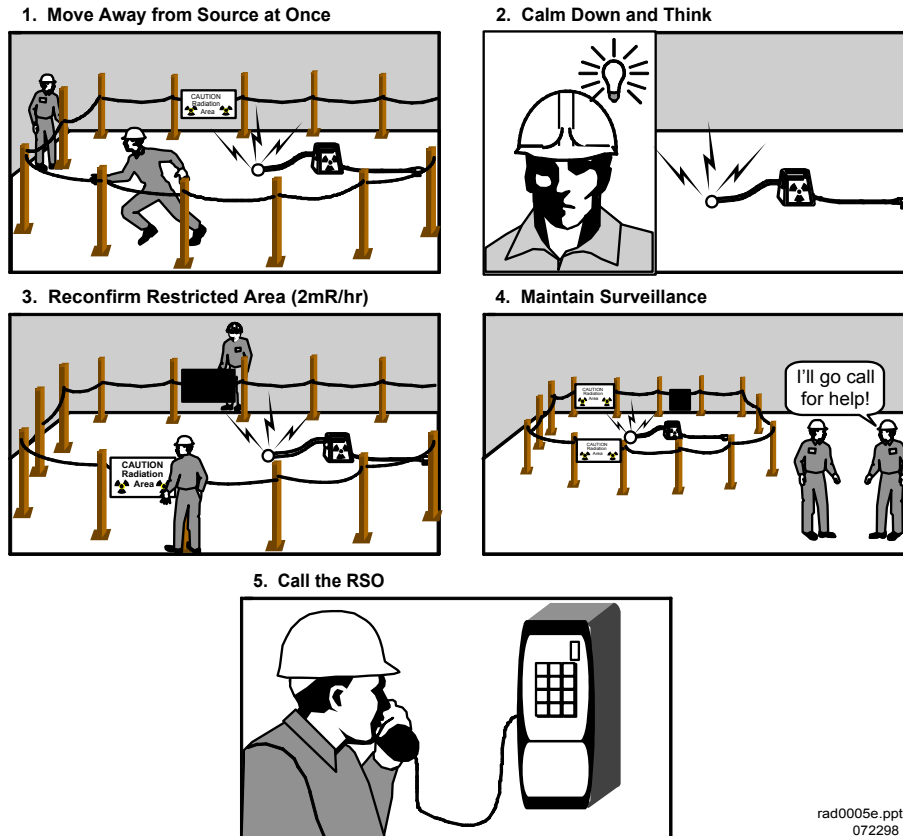


Figure 8-11. Emergency Procedures. These Steps Provide Guidance in an Emergency

- Appropriate use of radiation survey instruments, including a procedure prohibiting the use of alarming ratemeters or electronic dosimeters or pocket ionization chambers as substitutes for radiation survey instruments.
- Criteria for requesting outside assistance.
- Instructions for reducing the radiation exposure to other personnel and members of the public during recovery operations.
- Notification of the RSO, RSO designee, and management.
- Specific training with a dummy source, including practice with special tools, shielding, and additional dosimetry.
- Notification to the NRC or Agreement State.

Radiography personnel should not attempt to perform operations involving recovery of sealed sources, unless they have actual practice in recovery operations using a dummy sealed source with the appropriate handling tools, survey instruments, and dosimetry.

Response from Applicant:

- Submit the following statement: “We will not perform sealed source recovery and will use the services of a person specifically licensed by the NRC or an Agreement State to perform the recovery of our sealed sources.”

OR

- Submit operating and emergency procedures that include sealed source recovery instructions and specific training for NRC review, in accordance with the criteria listed above.

8.10.9.13 Maintenance of Records

Regulations: 10 CFR 34.45(a)(13), 10 CFR 34.47, 10 CFR 34.71, 10 CFR 34.73, 10 CFR 34.83, 10 CFR 34.85, 10 CFR 34.87, 10 CFR 34.89

Criteria: The licensee shall meet NRC record requirements to support operating and emergency procedures.

Discussion: Personnel must generate and maintain certain records when performing industrial radiography operations, including the following:

- utilization logs showing the following:
 - description, including the make, model, and serial number of the device used
 - identification and signature of the radiographer
 - where the device is used and dates of use and the dates the device is removed and returned to storage
- records of daily inspection of equipment
- pocket dosimeter readings made at the beginning and end of a work shift and recorded
- results of the physical radiation survey to ensure that the sealed source is in its shielded position when a radiographic exposure device is placed in a storage area (as defined in 10 CFR 34.3, “Definitions”) and an indication as to whether that survey was the last one performed in the workday

Examples of other operations that may require records include quarterly (not to exceed 3 months) inspection and maintenance, instrument calibration, and shipment of packages. Radiography personnel should also be aware of the records that must be maintained at each applicable field station and temporary jobsites in accordance with 10 CFR 34.89. Radiographers performing radiographic duties should be given specific instructions for recordkeeping. These should not include instructions about records that are the responsibility of management and supervision.

Response from the Applicant: Submit operating and emergency procedures that ensure proper maintenance of records.

8.10.10 Security Program for Category 1 and Category 2 Radioactive Material

Regulations: 10 CFR Part 37, 10 CFR 20.2207

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

Note: The regulations in 10 CFR Part 37 apply to licensees that possess an aggregated Category 1 or Category 2 quantity of radioactive material, as specified in Appendix A to 10 CFR Part 37. The requirements in 10 CFR 20.2207 for submitting National Source Tracking Transaction Reports (NSTTR) are applicable to those licensees that manufacture, transfer, receive, disassemble, or dispose of sealed sources containing a quantity equal to or greater than the Category 1 or Category 2 levels of radioactive material listed in Appendix E to 10 CFR Part 20.

Discussion:

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

In accordance with 10 CFR Part 37, licensees authorized to possess Category 1 or Category 2 quantities of radioactive material must establish, implement, and maintain a security program to ensure physical protection of the radioactive material.

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

Licensees authorized to hold Category 1 or Category 2 quantities of radioactive material must establish access authorization programs in accordance with 10 CFR Part 37, Subpart B. Before giving individuals unescorted access to such quantities of radioactive material, licensees must conduct prior background investigations of these individuals, in accordance with 10 CFR 37.25. This would include at least radiographers and radiographer’s assistants.

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

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

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

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

Requirements in 10 CFR 20.2207, “Reports of transactions involving nationally tracked sources”

The regulations in 10 CFR 20.2207 require that each licensee that manufactures, transfers, receives, disassembles, or disposes of a nationally tracked source shall complete and submit an NSTTR to the NRC. The NSTTRs are maintained in the NSTS, a secure computer system that tracks high-risk radioactive sources from the time they are manufactured or imported through the time of their disposal or export, or until the source activity decays enough to no longer be of concern.

Response from Applicant: No response is required from an applicant or licensee.

8.11 Item 11: Waste Management

8.11.1 Disposal or Transfer of Radiography Sealed Sources Containing Byproduct Material or Devices Containing Depleted Uranium

Regulations: 10 CFR 20.2001, 10 CFR 30.41, 10 CFR 30.51, 10 CFR 20.2207

Criteria: Licensed materials must be disposed of in accordance with NRC requirements by transfer to an authorized recipient. Appropriate records must be maintained.

Discussion: Licensees who dispose of industrial radiography sealed sources containing byproduct material, or dispose of radiography exposure devices containing depleted uranium, must transfer them to an authorized recipient licensed by either the NRC or an Agreement State. Before transferring radioactive material, a licensee must use one of the methods described in 10 CFR 30.41, “Transfer of byproduct material,” to verify that the recipient is properly authorized to receive it. In addition, all packages containing radioactive sources must be prepared and shipped in accordance with NRC and DOT regulations. Records of the transfer must be maintained, as required by 10 CFR 30.51, “Records.”

If source activity exceeds activities listed in Appendix E, “Nationally Tracked Source Thresholds,” to 10 CFR Part 20, the transfer transaction must be reported in accordance with 10 CFR 20.2207.

Response from Applicant: The applicant does not need to provide a response to this item during the licensing process. However, the applicant should establish and include waste disposal procedures in its radiation safety program for the transfer or disposal of licensed material.

Because of the difficulties and costs associated with disposal of sealed sources containing byproduct material and devices containing depleted uranium, applicants should preplan the disposal. Applicants may want to consider contractual arrangements with the sealed source and device supplier for the transfer or disposal of licensed material as part of a purchase agreement.
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8.12 Item 12: License Fees

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

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

8.13 Item 13: Certification

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

Notes:

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

9 LICENSE AMENDMENTS AND RENEWALS

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

Applicants for license amendment or renewal should do the following:

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

9.1 Timely Notification of Transfer of Control

Regulation: 10 CFR 30.34(b)

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

Discussion: Transferring control may be the result of mergers, buyouts, or majority stock transfers. Although it is not the NRC's intent to interfere with the business decisions of licensees, under 10 CFR 30.34(b) and the Atomic Energy Act, licensees must obtain prior NRC written consent before transferring control of the license to ensure the following:

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

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

Reference: For further information, see Regulatory Issue Summary (RIS) 2014-08, “Regulatory Requirements for Transfer of Control (Change of Ownership) of Specific Materials Licenses,” dated May 27, 2014. This RIS can be found on the NRC’s Generic Communications Web page under “Regulatory Issue Summaries”: <http://www.nrc.gov/reading-rm/doc-collections/gen-comm/>

10 APPLICATIONS FOR EXEMPTIONS

Regulations: Title 10 of the *Code Federal Regulations* (10 CFR) 19.31, 10 CFR 20.2301, 10 CFR 30.11, 10 CFR 34.111, 10 CFR 37.11

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

Discussion: Various sections of NRC's regulations address requests for exemptions (e.g., 10 CFR 19.31, "Application for exemptions;" 10 CFR 20.2301, "Applications for exemptions;" 10 CFR 30.11, "Specific exemptions;" 10 CFR 34.111, "Applications for exemptions;" and 10 CFR 37.11, "Specific exemptions"). These regulations state that the NRC may grant an exemption, acting on its own initiative or on an application from an interested person.

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

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

Regulations: Title 10 of the *Code Federal Regulations* (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)

Criteria: The licensee must do the following:

- Notify the U.S. Nuclear Regulatory Commission (NRC), in writing, within 60 days of the occurrence of any of the following:
 - Expiration of its license.
 - A decision to permanently cease principal activities¹ at the entire site
 - A decision to permanently cease principal activities¹ in any separate building or outdoor area that contains residual radioactivity such that the building or area is unsuitable for release according to NRC requirements.
 - No principal activities¹ under the license have been conducted for a period of 24 months.
 - No principal activities¹ have been conducted for a period of 24 months in any separate building or outdoor area that contains residual radioactivity such that the building or area is unsuitable for release according to NRC requirements.
- Submit a decommissioning plan, if required by 10 CFR 30.36(g).
- Conduct decommissioning, as required by 10 CFR 30.36(h) and 10 CFR 30.36(j).
- Submit, to the appropriate NRC regional office, a completed NRC Form 314, “Certificate of Disposition of Materials” (or equivalent information) and information demonstrating that the premises are suitable for release for unrestricted use (e.g., results of final survey, leak test results).
- Before a license is terminated, send the records required by 10 CFR 30.51(f) to the appropriate NRC regional office. If licensed activities are transferred or assigned in accordance with 10 CFR 30.34(b), transfer records important to decommissioning to the new licensee in accordance with 10 CFR 30.35(g).

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

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

For guidance on the disposition of licensed material, see Section 8.11, “Waste Management.” For guidance on decommissioning records, see Section 8.5.2, “Financial Assurance and Recordkeeping for Decommissioning.”

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

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

APPENDIX A

LIST OF DOCUMENTS CONSIDERED IN DEVELOPMENT OF THIS NUREG

List of Documents Considered in Development of this NUREG

Office of Nuclear Material Safety and Safeguards Letter

FSME-10-019, "Reporting Requirements for Industrial Radiography," March 12, 2010, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML100610424).

NUREGs

NUREG-2155, "Implementation Guidance for 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material," February 2013 (ADAMS Accession No. ML13053A061)

NUREG-2166, "Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material" (ADAMS Accession No. ML14150A382)

Regulatory Issue Summaries (RISs)

RIS 2005-10 "Performance-Based Approach for Associated Equipment in 10 CFR 34.20," June 10, 2005 (ADAMS Accession No. ML051590049).

RIS 2005-15 "Reporting Requirements for Damaged Industrial Radiographic Equipment," August 3, 2005 (ADAMS Accession No. ML052100127).

RIS-2005-31 "Control of Security-Related Sensitive Unclassified Non-Safeguards Information Handled by Individuals, Firms, and Entities Subject to NRC Regulation of the Use of Source, Byproduct, and Special Nuclear Material," December 2005 (ADAMS Accession No. ML053480073).

RIS-2007-04 "Personally Identifiable Information Submitted to the U. S. Nuclear Regulatory Commission," March 9, 2007 (ADAMS Accession No. ML063470597).

RIS-2007-07 "Clarification of Increased Controls for Licensees That Possess Collocated Radioactive Material During Transportation Activities," April 5, 2007 (ADAMS Accession No. ML070250497).

RIS-2007-14 "Fingerprinting Requirements for Licensees Implementing the Increased Control Order," June 5, 2007 (ADAMS Accession No. ML071500056).

RIS-2007-23, "Date for Operation of National Source Tracking System," October 4, 2007 (ADAMS Accession No. ML072680241).

RIS-2008-02, "Actions To Increase the Security of High Activity Radioactive Sources," February 1, 2008 (ADAMS Accession No. ML080150638).

RIS 2008-24 "Security Responsibilities of Service Providers and Client Licensees," October 3, 2008 (ADAMS Accession No. ML082200597).

RIS 2009-15 "National Source Tracking System Annual Inventory Reconciliation," December 3, 2009 (ADAMS Accession No. ML093170822).

RIS 2014-08 "Regulatory Requirements for Transfer of Control (Change of Ownership) of Specific Materials Licenses," May 27, 2014 (ADAMS Accession No. ML13260A342)

RIS 2015-03 "Identifying and Reporting Security Incidents Under 10 CFR Part 37," February 24, 2015 (ADAMS Accession No. ML14255A037)

Information Notices (INs)

- IN 83-81 "Entry into High Radiation Areas from Areas Which Are Not Under Direct Surveillance," December 7, 1983 (ADAMS Accession No. ML0829703291).
- IN 84-25 "Recent Serious Violations of NRC Requirements by Radiography Licensees," April 16, 1984 (ADAMS Accession No. ML0829703570).
- IN 85-57 "Lost Iridium-192 Source Resulting in the Death of Eight Persons in Morocco," July 16, 1985 (ADAMS Accession No. ML0311801880).
- IN 87-45 "Recent Safety-Related Violations of NRC Requirements by Industrial Radiography Licensees," September 25, 1987 (ADAMS Accession No. ML031130602).
- IN 87-47 "Transportation of Radiography Devices," October 5, 1987 (ADAMS Accession No. ML082910458).
- IN 88-66 "Industrial Radiography Inspection and Enforcement," August 22, 1988 (ADAMS Accession No. ML031150170).
- IN 89-25 "Unauthorized Transfer of Ownership or Control of Licensed Activities," Rev. 1, December 7, 1994 (ADAMS Accession No. ML082320739).
- IN 90-15 "Reciprocity: Notification of Agreement State Radiation Control Directors Before Beginning Work in Agreement States," March 7, 1990 (ADAMS Accession No. ML031130264).
- IN 91-23 "Accidental Radiation Overexposures to Personnel Due to Industrial Radiography Accessory Equipment Malfunctions," March 26, 1991 (ADAMS Accession No. ML031190662).
- IN 91-60 "False Alarms of Alarm Ratemeters Because of Radiofrequency Interference," September 24, 1991 (ADAMS Accession No. ML031190235).
- IN 93-05 "Locking of Radiography Exposure Devices," January 14, 1993 (ADAMS Accession No. ML031080041).
- IN 93-69 "Radiography Events at Operating Power Reactors," September 2, 1993 (ADAMS Accession No. ML031070112).
- IN 95-44 "Ensuring Compatible Use of Drive Cables Incorporating Industrial Nuclear Company Ball-Type Male Connectors," September 26, 1995 (ADAMS Accession No. ML031060191).
- IN 96-20 "Demonstration of Associated Equipment Compliance with 10 CFR 34.20," April 4, 1996 (ADAMS Accession No. ML031060147).

- IN-96-28 "Suggested Guidance Relating to Development and Implementation of Corrective Action," May 1, 1996 (ADAMS Accession No. ML092450179).
- IN 96-53 "Retrofit to Amersham 660 Posilock Radiography Camera to Correct Inconsistency in 10 CFR Part 34 Compatibility," October 15, 1996 (ADAMS Accession No. ML031060041).
- IN 97-35 "Retrofit to Industrial Nuclear Company (INC) IR100 Radiography Camera to Correct Inconsistency in 10 CFR Part 34 Compatibility," June 18, 1997 (ADAMS Accession No. ML031050568).
- IN 97-86 "Additional Controls for Transport of the Amersham Model No. 660 Series Radiographic Exposure Devices," December 12, 1997 (ADAMS Accession No. ML031050028).
- IN 97-87 "Second Retrofit to Industrial Nuclear Company IR100 Radiography Camera to Correct Inconsistency in 10 CFR Part 34 Compatibility," December 12, 1997 (ADAMS Accession No. ML031050023).
- IN 97-91 "Recent Failures of Control Cables Used on Amersham Model 660 Posilock Radiography Systems," December 31, 1997 (ADAMS Accession No. ML031050007).
- IN 98-16 "Inadequate Operational Checks of Alarm Ratemeters," April 30, 1998 (ADAMS Accession No. ML031050179).
- IN 01-03 "Incident Report Requirements for Radiography Licenses," April 6, 2001 (ADAMS Accession No. ML010800026).
- IN 04-13 "Registration, Use, and Quality Assurance Requirements for NRC-Certified Transportation Packages," June 30, 2004 (ADAMS Accession No. ML041810535).
- IN 13-22 "Recent Licensing Submittals Containing Personally Identifiable Information," November 15, 2013 (ADAMS Accession No. ML13247A109)

APPENDIX B

U.S. NUCLEAR REGULATORY COMMISSION FORM 313

U.S. Nuclear Regulatory Commission Form 313

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

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

NRC FORM 313 (02-2016) 10 CFR 30, 32, 33, 34 35, 36, 37, 39, and 40	U.S. NUCLEAR REGULATORY COMMISSION APPLICATION FOR MATERIALS LICENSE	APPROVED BY OMB: NO. 3150-0120 Estimated burden per response to comply with this mandatory collection request: 4.3 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Send comments regarding burden estimate to the FOIA, Privacy, and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollections.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NE0B-10202, (3150-0120), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.	EXPIRES: 02/29/2016				
INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW. *AMENDMENTS/RENEWALS THAT INCREASE THE SCOPE OF THE EXISTING LICENSE TO A NEW OR HIGHER FEE CATEGORY WILL REQUIRE A FEE.							
APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH: MATERIALS SAFETY LICENSING BRANCH DIVISION OF MATERIAL SAFETY, STATE, TRIBAL AND RULEMAKING PROGRAMS OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS U.S. NUCLEAR REGULATORY COMMISSION WASHINGTON, DC 20555-0001 ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS: IF YOU ARE LOCATED IN: ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO: LICENSING ASSISTANCE TEAM DIVISION OF NUCLEAR MATERIALS SAFETY U.S. NUCLEAR REGULATORY COMMISSION, REGION I 2100 RENAISSANCE BOULEVARD, SUITE 100 KING OF PRUSSIA, PA 19406-2713		IF YOU ARE LOCATED IN: ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO: MATERIALS LICENSING BRANCH U.S. NUCLEAR REGULATORY COMMISSION, REGION III 2443 WARRENVILLE ROAD, SUITE 210 LISLE, IL 60532-4352 ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MISSISSIPPI, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND APPLICATIONS TO: NUCLEAR MATERIALS LICENSING BRANCH U.S. NUCLEAR REGULATORY COMMISSION, REGION IV 1600 E. LAMAR BOULEVARD ARLINGTON, TX 76011-4511					
PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTIONS.							
1. THIS IS AN APPLICATION FOR (Check appropriate item) <input type="checkbox"/> A. NEW LICENSE <input type="checkbox"/> B. AMENDMENT TO LICENSE NUMBER _____ <input type="checkbox"/> C. RENEWAL OF LICENSE NUMBER _____		2. NAME AND MAILING ADDRESS OF APPLICANT (Include ZIP code)					
3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED		4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">BUSINESS TELEPHONE NUMBER</td> <td style="width: 50%;">BUSINESS CELLULAR TELEPHONE NUMBER</td> </tr> <tr> <td colspan="2">BUSINESS EMAIL ADDRESS</td> </tr> </table>		BUSINESS TELEPHONE NUMBER	BUSINESS CELLULAR TELEPHONE NUMBER	BUSINESS EMAIL ADDRESS	
BUSINESS TELEPHONE NUMBER	BUSINESS CELLULAR TELEPHONE NUMBER						
BUSINESS EMAIL ADDRESS							
SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.							
5. RADIOACTIVE MATERIAL a. Element and mass number; b. chemical and/or physical form; and c. maximum amount which will be possessed at any one time.		6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.					
8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.		7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.					
10. RADIATION SAFETY PROGRAM.		9. FACILITIES AND EQUIPMENT.					
12. LICENSE FEES (Fees required only for new applications, with few exceptions*) (See 10 CFR 170 and Section 170.31)		11. WASTE MANAGEMENT.					
13. CERTIFICATION. (Must be completed by applicant) THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 37, 39, AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF. WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.		FEE CATEGORY <input type="text"/> AMOUNT ENCLOSED \$ <input type="text"/>					
CERTIFYING OFFICER -- TYPED/PRINTED NAME AND TITLE		SIGNATURE	DATE				
FOR NRC USE ONLY							
TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS		
APPROVED BY			\$	DATE			

NRC FORM 313 (02-2016)

APPENDIX C

**SUGGESTED FORMAT FOR PROVIDING INFORMATION REQUESTED IN
ITEMS 5 THROUGH 11 OF U.S. NUCLEAR REGULATORY COMMISSION
FORM 313**

Suggested Format for Providing Information Requested in Items 5 through 11 of U.S. Nuclear Regulatory Commission Form 313

Item No.	Title and Criteria	Yes	Description Attached
5	<p>RADIOACTIVE MATERIAL</p> <p>Sealed Sources and Devices</p> <ul style="list-style-type: none"> • Identify each radionuclide that will be used for performing radiography, maximum activity per source, and total possession limit. [] • Identify the manufacturer (or distributor) and model number of each sealed source. [] • Identify the manufacturer (or distributor) and model number of each exposure device. Indicate if a device is only to be used in a permanent radiographic installation. [] • Identify the manufacturer (or distributor) and model number of each source changer. [] • If depleted uranium is used as shielding material, specify the total amount (in kilograms). [] • Confirm that each sealed source, device, and source/device combination possessed is registered as an approved sealed source or device by the U.S. Nuclear Regulatory Commission (NRC) or an Agreement State and will be possessed and used in accordance with the conditions specified in the registration certificate. Obtain from the manufacturer/distributor a copy of the SSD certificate and provide the SSD registry number with the application. [] • Confirm that associated equipment is compatible with the exposure devices, source changers, and sealed sources containing byproduct material. [] • Confirm that only radiographic exposure devices, source assemblies or sealed sources, and associated equipment, which meet the requirements specified in Title 10 of the <i>Code of Federal Regulations</i> (10 CFR) 34.20, "Performance requirements for industrial radiography equipment," will be used in radiographic operations. [] • Identify each radionuclide and the manufacturer (or distributor) and model number of each sealed source and/or device containing byproduct material that will not be used for performing radiography. [] 		

Item No.	Title and Criteria	Yes	Description Attached
5	<p>RADIOACTIVE MATERIAL</p> <p>Financial Assurance and Recordkeeping for Decommissioning</p> <ul style="list-style-type: none"> • Pursuant to 10 CFR 30.35(g), we shall maintain records important to decommissioning and transfer these records to an NRC or Agreement State licensee before licensed activities are transferred or assigned, in accordance with 10 CFR 30.34(b). Furthermore, pursuant to 10 CFR 30.51(f), prior to license termination, we shall forward the records required by 10 CFR 30.35(g) to the appropriate NRC regional office. <p style="text-align: center;">AND</p> <ul style="list-style-type: none"> • If financial assurance is required, submit evidence following NUREG-1757, Volume 3. 	<p>[]</p>	<p>[]</p>
6	<p>PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED</p> <p>Equipment will be used for the following:</p> <ul style="list-style-type: none"> • industrial radiography • underwater radiography (see Appendix D) • lay-barge radiography (see Appendix D) • offshore platform radiography (see Appendix D) • other than radiography (example, Cs-137 instrument calibrator) 	<p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p>	<p>[]</p>

Item No.	Title and Criteria	Yes	Description Attached
7	<p>INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE</p> <p>Radiation Safety Officer (RSO)</p> <ul style="list-style-type: none"> • The name of the proposed RSO and other potential designees who will be responsible for ensuring that the licensee’s radiation safety program is implemented in accordance with approved procedures. <p style="text-align: center;">AND</p> <ul style="list-style-type: none"> • Demonstrate that the RSO has sufficient independence and direct communication with responsible management officials by providing a copy of an organizational chart, by position, demonstrating day-to-day oversight and coordination with management in radiation safety activities. <p style="text-align: center;">AND EITHER</p> <ul style="list-style-type: none"> • The specific training and experience of the RSO and other potential designees. Include the specific dates of certification and/or training in radiation safety. • Documentation to show that the RSO has a minimum of 2,000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations. • Documentation to show that the RSO has obtained formal training in the establishment and maintenance of a radiation protection program. <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> • Alternative information demonstrating that the proposed RSO is qualified by training and experience (e.g., certification by the American Board of Health Physicists, completion of a bachelor’s or master’s degree in the sciences with at least 1 year of experience in the conduct of a radiation safety program of comparable size and scope). • Documentation to show that the RSO has obtained formal training in the establishment and maintenance of a radiation protection program. 		<p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p>

Item No.	Title and Criteria	Yes	Description Attached
8	<p>TRAINING FOR RADIOGRAPHERS AND RADIOGRAPHER'S ASSISTANTS</p> <ul style="list-style-type: none"> • Submit an outline of the training to be given to prospective radiographers and radiographer's assistants. Submit your procedures for experienced radiographers 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. • Submit all training program descriptions noted in 10 CFR 34.43, except for those training and examination program topics listed in 10 CFR 34.43(g). • Specify the qualifications of your instructors in radiation safety principles and describe their experience with radiography. If training will be conducted by someone outside the applicant's organization, identify the course by title and provide the name and address of the company providing the training. • Describe the practical field examination that will be given to prospective radiographers and radiographer's assistants. • Describe the annual refresher training program, including topics to be covered and how the training will be conducted. • Submit your procedures for verifying and documenting the certification status of radiographers and for verifying that their certification remains valid. • Submit a description of your program for inspecting the job performance of each radiographer and radiographer's assistant at intervals not to exceed 6 months, as described in 10 CFR 34.43(e). 		<p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p>

Item No.	Title and Criteria	Yes	Description Attached
9	<p data-bbox="272 275 686 306">FACILITIES AND EQUIPMENT</p> <p data-bbox="272 342 799 373">Permanent Radiographic Installations</p> <p data-bbox="272 409 1127 474">Provide the following information for each permanent radiographic installation:</p> <ul data-bbox="272 510 1175 1736" style="list-style-type: none"> <li data-bbox="272 510 1175 678">• Provide an annotated sketch or drawing of the facility and its surroundings. (Note: Diagrams of facilities should be marked: "Security-related information—Withhold under 10 CFR 2.390.") Sketches or drawings should also include a compass directional arrow to indicate "North." <li data-bbox="272 678 1062 709">• Identify the scale to which the sketch or drawing is made. <li data-bbox="272 709 1159 783">• Identify the type, thickness, and density of shielding materials on all sides, including the floor and the roof. <li data-bbox="272 783 1170 846">• Identify the locations of entrance ways and other points of access to the facility. <li data-bbox="272 846 1122 951">• Describe the areas adjacent to the facility and the distance to these areas. Include information on areas adjacent to, above, and below the facility. <li data-bbox="272 951 1143 1056">• Describe the general location of each proposed permanent radiographic facility listed in Item 3 (e.g., located in an industrial park, an office complex) and its current use. <li data-bbox="272 1056 1149 1255">• If a proposed permanent radiographic facility is a private residence, provide diagrams of the installation that include the building, the proposed restricted area(s), and adjacent areas, including above and below the restricted areas. (Note: Local municipalities may limit the use of radioactive material to certain zone areas.) <li data-bbox="272 1255 987 1287">• Restricted areas do not include residential quarters. <li data-bbox="272 1287 1170 1392">• Explain how radiation levels in unrestricted areas will be maintained at less than 0.02 millisievert (mSv) [2 millirem (mrem)] in any one hour and less than 1 mSv [100 mrem] per year. <li data-bbox="272 1392 1117 1465">• Describe the visible-audible signal system or entrance control system and its locations. <li data-bbox="272 1465 1175 1539">• Provide the results of radiation-level calculations or actual radiation measurements adjacent to, above, and below the facility. <li data-bbox="272 1539 1175 1736">• Indicate whether or not radiography will be performed at the place of business outside of a permanent radiographic installation. If radiography will be performed at a site outside of a permanent radiographic installation, provide a diagram of the location where radiography may be performed and its surroundings, including a description of adjacent property. 		<p data-bbox="1333 510 1365 541">[]</p> <p data-bbox="1333 678 1365 709">[]</p> <p data-bbox="1333 709 1365 741">[]</p> <p data-bbox="1333 783 1365 814">[]</p> <p data-bbox="1333 877 1365 909">[]</p> <p data-bbox="1333 972 1365 1003">[]</p> <p data-bbox="1333 1077 1365 1108">[]</p> <p data-bbox="1333 1245 1365 1276">[]</p> <p data-bbox="1333 1308 1365 1339">[]</p> <p data-bbox="1333 1413 1365 1444">[]</p> <p data-bbox="1333 1476 1365 1507">[]</p> <p data-bbox="1333 1539 1365 1570">[]</p>

Item No.	Title and Criteria	Yes	Description Attached
9	<p data-bbox="272 275 686 306">FACILITIES AND EQUIPMENT</p> <p data-bbox="272 342 799 373">Permanent Radiographic Installations</p> <p data-bbox="272 409 1146 510">Provide the following information to obtain approval for a variance if construction requirements preclude shielding the roof to meet the requirement not to exceed 2 mrem [0.02 mSv] in any one hour:</p> <ul data-bbox="272 546 1146 919" style="list-style-type: none"> <li data-bbox="272 546 828 577">• means of preventing access to the roof <li data-bbox="272 579 1146 646">• procedures for ensuring that no individual is on the roof or could gain access to the roof during radiography <li data-bbox="272 648 1076 716">• a commitment that the roof will be posted with “Caution (or Danger) Radiation Area” sign(s) <li data-bbox="272 718 898 749">• steps taken to minimize radiation on the roof <li data-bbox="272 751 1146 919">• limitations (if needed) on positioning of sealed sources or type (radionuclide) and amount of radioactive material that may be used in the installation to ensure that areas adjacent to, above, and below the installation will be unrestricted areas during the performance of radiography <p data-bbox="272 921 1133 1022">In addition to the above, provide the following information to obtain approval for a variance if radiation levels on the radiographic installation roof exceed 100 mrem [1.0 mSv] in any one hour:</p> <ul data-bbox="272 1058 1146 1432" style="list-style-type: none"> <li data-bbox="272 1058 1101 1125">• a commitment that the roof will be posted with a “Caution (or Danger) High-Radiation Area” sign(s) <li data-bbox="272 1127 1110 1194">• evidence of constant surveillance of the roof by closed-circuit television <li data-bbox="272 1197 1146 1327">• a description of a control device that would automatically reduce the radiation level to 100 mrem [1.0 mSv] in any one hour at 30 centimeters from the radiation source if someone enters the roof <li data-bbox="272 1329 1130 1432">• a description of a control device that activates a visible-audible signal so that both an individual entering the roof and the radiographer on duty are made aware of the entry 		<p data-bbox="1333 409 1360 441">[]</p> <p data-bbox="1333 546 1360 577">[]</p> <p data-bbox="1333 579 1360 611">[]</p> <p data-bbox="1333 648 1360 680">[]</p> <p data-bbox="1333 718 1360 749">[]</p> <p data-bbox="1333 787 1360 819">[]</p> <p data-bbox="1206 1058 1234 1089">[]</p> <p data-bbox="1333 1127 1360 1159">[]</p> <p data-bbox="1333 1226 1360 1257">[]</p> <p data-bbox="1333 1329 1360 1360">[]</p>

Item No.	Title and Criteria	Yes	Description Attached
9	<p>FACILITIES AND EQUIPMENT</p> <p>Field Stations</p> <p>Provide the following information for each field station:</p> <ul style="list-style-type: none"> Describe the storage location(s) at the address(es) listed in Item 3 of the application, and submit a diagram showing where the radiography camera will be stored at the field stations. Indicate whether or not industrial radiography will be performed at the place of business outside of a field station. If radiography will be performed at a site outside a field station, provide a diagram of the location where industrial radiography may be performed and its surroundings, including a description of adjacent property. <p>Temporary Jobsites</p> <p>Indicate in Item 3 of the application that the applicant is requesting authorization to perform work at temporary jobsites anywhere in the U.S. where the U.S. Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material, including areas of exclusive Federal jurisdiction within Agreement States.</p>	 	
10	<p>RADIATION SAFETY PROGRAM</p> <p>1. Audit and Review of Program</p> <p>The applicant is <u>not</u> required to, and should not, submit its audit program to the NRC for review during the licensing phase. (See Appendix G for a sample radiation safety program audit). Audits will be reviewed during inspections to determine compliance with NRC regulations.</p>		<p>Need Not Be Submitted With Application</p>

Item No.	Title and Criteria	Yes	Description Attached
10	<p>RADIATION SAFETY PROGRAM</p> <p>2. Instruments</p> <p>We will possess and use calibrated and operable radiation survey meters.</p> <p style="text-align: center;">AND</p> <p>Calibration will be performed by an NRC or Agreement State licensee specifically authorized to perform instrument calibration.</p> <p style="text-align: center;">OR</p> <p>Calibration is to be performed in-house, and the model procedures in Appendix H will be followed.</p> <p>Calibration is to be performed in-house, and alternate procedures will be followed.</p> <p>Identify the qualifications of the individuals who will perform the calibrations.</p> <p>3. Material Receipt and Accountability</p> <p>Physical inventories will be conducted and documented at quarterly intervals (not to exceed 3 months) to account for all sealed sources containing byproduct material and devices containing depleted uranium received and possessed under the license.</p> <p style="text-align: center;">AND</p> <p>We will develop, implement, and maintain procedures for ensuring accountability of licensed materials at all times.</p> <p style="text-align: center;">AND</p> <p>We will comply with NSTS reporting requirements as described in 10 CFR 20.2207</p>	<p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p>	<p>[]</p> <p>[]</p>

Item No.	Title and Criteria	Yes	Description Attached
10	<p>RADIATION SAFETY PROGRAM</p> <p>4. Minimization of Contamination</p> <p>The applicant is <u>not</u> required to provide a response to the minimization of contamination, if the applicant’s responses meet the criteria for the following sections: “Radioactive Material—Sealed Sources and Devices;” “Facilities and Equipment;” “Radiation Safety Program—Leak Tests;” “Radiation Safety Program—Operating and Emergency Procedures;” and “Waste Management—Sealed Source/DU Device Transfer and Disposal.”</p> <p>5. Leak Tests</p> <p>Leak tests sample collection and analysis will be performed by an organization authorized by the NRC or an Agreement State to provide leak-testing services to other licensees; or by using a leak-test sample collection kit supplied by an organization licensed by the NRC or an Agreement State to provide leak-test kits and sample analysis services to other licensees and according to the instructions provided in the leak-test sample collection kit.</p> <p style="text-align: center;">OR</p> <p>Leak testing will be done by the applicant.</p> <ul style="list-style-type: none"> • The information in Appendix I supporting a request to perform leak testing and sample analysis is attached. • We will follow the model procedures in Appendix I of NUREG—1556, Volume 2, Revision 1. • We will follow alternate procedures. 		<p>Need Not Be Submitted With Application</p> <hr/> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p>

Item No.	Title and Criteria	Yes	Description Attached
10	<p>RADIATION SAFETY PROGRAM</p> <p>6. Occupational Dosimetry</p> <p>Radiography personnel will wear film, thermoluminescent dosimeter, or other personal dosimetry processed and evaluated by a processor accredited by the National Voluntary Laboratory Accreditation Program and exchanged at the required frequency.</p> <p>Radiographic personnel will wear the required personnel monitoring equipment, including 0–200 mrem [0–2 mSv] dosimeters or electronic personal dosimeters.</p> <p>All radiography personnel will wear alarming ratemeters, except those personnel at permanent radiography installations where other appropriate alarming or warning devices are in use and are operational.</p> <p>Pocket dosimeters and alarm ratemeters will be checked for correct response to radiation at intervals not to exceed 12 months.</p> <ul style="list-style-type: none"> • If adjustment is necessary, the devices will be returned to the manufacturer. • If adjustment is necessary, in-house procedures for adjustments are described. <p>7. Public Dose</p> <p>The applicant is <u>not</u> required to, and should not, submit a response to the public dose section during the licensing phase. Public dose will be reviewed during inspections to determine compliance with NRC regulations. Appendix J provides additional information for determining that radiation doses for other licensee personnel and members of the public will not exceed allowable limits.</p>	<p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p>	<p>[]</p> <hr/> <p>Need Not Be Submitted With Application</p>

Item No.	Title and Criteria	Yes	Description Attached
10	<p>RADIATION SAFETY PROGRAM</p> <p>8. Quarterly Maintenance</p> <p>Submit the quarterly maintenance procedures to the NRC for review and approval. The applicant should develop procedures specific to its equipment and program. The guidance provided in Sections 8.10.8, "Quarterly Maintenance," and 8.10.9, "Operating and Emergency Procedures," of NUREG-1556, Volume 2 should be of assistance in the development of the applicant's procedures.</p> <p>If applicable, submit nonroutine maintenance procedures for NRC review and approval. The applicant should develop procedures specific to its equipment and program, and in accordance with the recommendations of the equipment manufacturer.</p> <p>Before using a new sealed source/device combination, we will have written inspection and maintenance procedures that address the use of the new equipment as a Type B transport package. In addition, we will provide training to radiographic personnel before using a new sealed source/device combination.</p> <p>9. Operating and Emergency Procedures (Note: If requesting authorization for underwater, lay-barge, or offshore radiography, provide appropriate additional information as described in Appendix D).</p> <p>Handling and Use of Sealed Sources and Radiography Exposure Devices</p> <p>Submit operating and emergency procedures that provide step-by-step instructions for using each type of radiographic device. Submit operating and emergency procedures that provide instructions for performing source exchanges. Instructions for crankout devices should be separate from those for other categories of exposure devices.</p> <p>Methods and Occasions for Conducting Radiation Surveys</p> <p>Submit operating and emergency procedures that, where applicable, include each of the radiation surveys included in Table 8-2.</p>		<p>[]</p> <p>[]</p> <p>[]</p> <p>[]</p>
10	<p>RADIATION SAFETY PROGRAM</p> <p>Methods for Controlling Access to Radiographic Areas</p> <p>Submit the procedures to control access to radiographic operations and storage areas.</p>		<p>[]</p>

Item No.	Title and Criteria	Yes	Description Attached
	<p>Methods and Occasions for Locking and Securing Radiographic Exposure Devices, Storage Containers, and Sealed Sources</p> <p>Submit operating and emergency procedures that include procedures for locking and securing radiographic equipment.</p>		[]
	<p>Personnel Monitoring and the Use of Personnel Monitoring Equipment</p> <p>Submit operating procedures that include instructions for proper use of personnel monitoring equipment.</p>		[]
	<p>Transporting Sealed Sources to Field Locations, Securing Exposure Devices and Storage Containers in Vehicles, Posting Vehicles, and Controlling Sealed Sources during Transportation</p> <p>Submit operating and emergency procedures for transporting sealed sources containing byproduct material, radiographic exposure devices, and source changers.</p>		[]
	<p>Daily Inspection and Maintenance of Radiographic Equipment</p> <p>Submit operating and emergency procedures for daily inspection and maintenance of radiographic equipment.</p>		[]
	<p>Ratemeter Alarms or Off-Scale Dosimeter Readings</p> <p>Submit operating and emergency procedures to address ratemeter alarms or off-scale dosimeters.</p>		[]
	<p>Procedure for Identifying and Reporting Defects and Noncompliance as Required by 10 CFR Part 21</p> <p>Submit operating and emergency procedures for notifying management of equipment malfunction or defect.</p>		[]
10	<p>RADIATION SAFETY PROGRAM</p> <p>Notification of Proper Persons in the Event of an Accident or Emergency</p> <p>Submit operating and emergency procedures that include appropriate instructions for notifying the RSO and other personnel in the event of an accident or emergency. See Table 8-3.</p>		[]
	<p>Minimizing Exposure of Persons in the Event of an Accident or Emergency—Emergency Procedures</p> <p>Submit operating and emergency procedures that include instructions for minimizing exposure of persons in the event of an accident.</p>		[]

Item No.	Title and Criteria	Yes	Description Attached
	<p>Source Recovery (Retrieval)</p> <p>We will not perform sealed source recovery and will use the services of a person specifically licensed by the NRC or an Agreement State to perform the recovery of our sealed sources.</p> <p style="text-align: center;">OR</p> <p>Submit operating and emergency procedures that include instructions for sealed source recovery procedures and specific training.</p>	[]	[]
	<p>Maintenance of Records</p> <p>Submit operating and emergency procedures that ensure proper maintenance of records</p>		[]
	<p>10. Security Program</p> <p>Licensees must ensure the security and control of licensed material. In accordance with 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material," licensees authorized to possess Category 1 or Category 2 quantities of radioactive material must establish, implement, and maintain a security program to ensure physical protection of the radioactive material.</p>		Need Not Be Submitted With Application
11	<p>WASTE MANAGEMENT</p> <p>Disposal or Transfer of Radiography Sealed Sources Containing Byproduct Material or Devices Containing Depleted Uranium</p> <p>The applicant does not need to provide a response to this item during the licensing process. However, the applicant should establish and include waste disposal procedures in its radiation safety program for the transfer or disposal of licensed material.</p>		Need Not Be Submitted With Application

Note: Under 10 CFR Part 37, security plans are not to be submitted to the NRC for review and approval.

APPENDIX D

LICENSING GUIDANCE FOR LAY-BARGE, OFFSHORE PLATFORM, AND UNDERWATER RADIOGRAPHY

Licensing Guidance for Lay-Barge, Offshore Platform, and Underwater Radiography

Basic Description of an Offshore Platform

An offshore platform, often referred to as an oil platform or oil rig, is a large structure used to house workers and machinery needed to drill wells in the ocean bed, extract oil or natural gas, process the produced fluids, and ship them to shore. Depending on the circumstances, the platform may be attached to the ocean floor, consist of an artificial island, or be floating.



Figure D-1. Offshore Platform

Offshore Platform Radiography Safety Issues

- The use of crankout devices for offshore platform radiography has some inherent risk. If a sealed source cannot be retracted and/or a disconnect were to occur, source recovery resources and expertise may not be readily available. Licensee staff may need the appropriate training to perform sealed source recovery operations and be authorized to perform such operations under their current license. The licensee should also consider

that shielding may not be available and the difficulty of keeping people away from the exposure area.

- There may be specific physical or space configurations that the licensee needs to consider to ensure compliance with the limit of 0.02 mSv [2 mrem] in any one hour in unrestricted areas required by Title 10 of the *Code of Federal Regulations* (10 CFR) 20.1301.
- Members of the public on an offshore platform (e.g., welders, divers) could receive doses well above regulatory limits in the event of a source disconnect event.
- Offshore platform operators (who are production oriented) cannot override industrial radiography companies on radiation safety issues. Written arrangements should be in place to allow radiography company representatives to stop work if there is a radiation safety issue.

As required by 10 CFR 34.41(c), a licensee may only conduct lay-barge, offshore platform, or underwater radiography if procedures have been approved by the U.S. Nuclear Regulatory Commission (NRC) or by an Agreement State. Based on the above potential hazardous conditions, licensees must provide operating and emergency procedures for lay-barge, offshore platform, or underwater radiography that address the following safety aspects:

- (1) Procedures, as required to comply with 10 CFR 34.45(a), that are unique to offshore platform radiography, should minimize the potential for a sealed source disconnect.
- (2) Emergency procedures, as required by 10 CFR 34.45(a), unique to offshore platform industrial radiography, should address unintentional sealed source disconnects and recovery. These procedures should address minimizing radiation exposure for all personnel on the offshore platform during a disconnect event, including considerations such as staff training, availability of portable shielding, radiation survey instruments, dosimetry, and other equipment.
- (3) Operating procedures and practices unique to offshore platform radiography should ensure compliance with the requirements of 10 CFR 34.41, "Conducting Industrial Radiographic Operations," for personnel to be present during industrial radiography and 10 CFR 34.46, "Supervision of radiographers' assistants," for supervision of radiography assistants.
- (4) Operating and emergency procedures and practices, as required to comply with 10 CFR 34.45(a), should ensure that industrial radiography personnel have the authority necessary to protect personnel on an offshore platform from radiation doses in excess of regulatory limits. These procedures and practices should include provisions to ensure that radiographic operations are conducted only in those locations shielded for such operations (if those enclosures are relied upon to control dose) and that radiographic personnel can direct personnel, as necessary, for radiation safety both during normal operations and in the event that the sealed source cannot be fully retracted or other emergency.

Basic Description of Lay-Barges

An aspect of the petroleum industry is the ability to transport the petroleum from the ocean floor to the coastal refineries for processing. This transport is facilitated by use of underwater pipelines that are laid on the ocean floor by pipe lay-barges. These lay-barges allow sections of piping to be welded together on deck, radiographed to ensure weld quality, coated to prevent corrosion, and subsequently lowered to the ocean floor. These activities are performed sequentially, as an assembly-line process, onboard the barges. These pipe lay-barges are configured in either a side-lay or center-lay arrangement, which dictates how the pipe is assembled on the lay-barge. Work onboard these lay-barges can be hazardous because of the close proximity of the pipe to the workers, as well as the relative motion that is created between components and personnel as a result of ocean waves and currents.



Figure D-2. Lay-Barge

Lay-Barge Radiography Safety Issues

- The use of crankout devices for lay-barge radiography has some inherent risk because of motion between source (attached to pipe) and crankout device (attached to barge).
- If a sealed source cannot be retracted and/or a disconnect were to occur, source recovery resources and expertise may not be readily available. Licensee staff may need the appropriate training to perform sealed source recovery operations and be authorized to perform such operations under their current license. The licensee should also consider that shielding may not be available and the difficulty of keeping people away from the exposure area.
- There may be specific physical or space configurations that the licensee needs to consider to ensure compliance with the limit of 0.02 msv [2 mrem] in any one hour in an unrestricted area required by 10 CFR 20.1301. For lay-barges, industrial radiography

should be restricted to the shielded enclosures on the barges, where it is intended to be done.

- Members of the public on the lay-barge (e.g., welders, divers) could receive doses well above regulatory limits, in the event of a sealed source disconnect event.
- Lay-barge operators (who are production oriented) cannot override industrial radiography companies on radiation safety issues. Written arrangement should be in place to allow radiography company representatives to stop work if there is a radiation safety issue.

As required by 10 CFR 34.41(c), a licensee may only conduct lay-barge, offshore platform, or underwater radiography if procedures have been approved by the NRC or by an Agreement State. Based on the above potential hazardous conditions, licensees must provide operating and emergency procedures for lay-barge, offshore platform, or underwater radiography that address the following safety aspects.

- (1) Procedures, as required by 10 CFR 34.45(a) and unique to lay-barge radiography, are designed to minimize the potential for a source disconnect.
- (2) Emergency procedures, as required by 10 CFR 34.45(a) and unique to lay-barge radiography, address unintentional source disconnects and recovery. These procedures should address minimizing radiation exposure for all personnel onboard the lay-barge during a disconnect event, considering issues such as staff training, availability of portable shielding, survey instruments, dosimetry, and other equipment.
- (3) Operating procedures and practices unique to lay-barge radiography should ensure compliance with the requirements of 10 CFR 34.41 for personnel to be present during radiography and the requirements of 10 CFR 34.46 for supervision of radiography assistants.
- (4) Operating and emergency procedures and practices, as required by 10 CFR 34.45(a), should ensure that radiography personnel have the authority necessary to protect personnel onboard the lay-barges from radiation doses in excess of regulatory limits. These procedures and practices should include provisions to ensure that radiographic operations are conducted only in those locations shielded for such operations (if those enclosures are relied upon to control dose), that radiographic personnel can direct personnel as necessary for radiation safety both during normal operations and in the event that the sealed source cannot be fully retracted, or other emergency.

Basic Description of Underwater Radiography

Underwater radiography is a specialized technique that requires additional safety considerations because of the use of radiographic equipment submerged in water. For underwater radiography, exposure devices are to be provided with additional safety features. The necessary features include:

- A depth rating stating the maximum depth at which the device may be safely used.

- Seals that either prevent the entry of gas or water into parts that are not designed to withstand them or, if designed to cope with water and gas, allow them to escape during ascent to the surface.
- A windout exposure or shutter control mechanism that can be operated outside the controlled area.

Underwater Radiography Safety Issues

- Adequacy of the design of the industrial radiography equipment that is going to be used in a water environment.
- If a sealed source cannot be retracted and/or a disconnect were to occur underwater, source recovery resources and expertise may not be readily available. Licensee staff may need the appropriate training to perform sealed source recovery operations underwater and be authorized to perform such underwater operations under their current license.
- Adequacy of radiation safety training of divers.
- Before the radiographic equipment is taken into the water, the control mechanism and guide tube are to be connected to the exposure container; the connections need to be confirmed to be secure; and the source assembly has to be in the secured position.
- A short line with a buoy and an emergency location device (for example, a strobe light) are to be securely attached to the exposure device. This will aid recovery from the water if the exposure device is dropped.
- All equipment, such as radiation survey meters to be used underwater, needs to be specifically suited to the purpose.
- Divers could receive doses well above regulatory limits in the event of a sealed source disconnect event.
- Written arrangement should be in place to allow radiography company representatives to stop work if there is a radiation safety issue.

As required by 10 CFR 34.41(c), a licensee may only conduct lay-barge, offshore platform, or underwater radiography if procedures have been approved by the NRC or by an Agreement State. Based on the above potential hazardous conditions, licensees must provide operating and emergency procedures for lay-barge, offshore platform, or underwater radiography that address the following safety aspects.

- (1) Procedures, as required by 10 CFR 34.45(a) and unique to underwater radiography, are designed to minimize the potential for a source disconnect.
- (2) Emergency procedures, as required by 10 CFR 34.45(a) and unique to underwater radiography, address unintentional source disconnects and recovery. These procedures should address minimizing radiation exposure for all personnel (including divers) during

a disconnect event, considering issues such as staff training, availability of portable shielding, survey instruments, dosimetry, and radiographic equipment that is appropriate for underwater use.

- (3) Operating procedures and practices unique to underwater radiography should ensure compliance with the requirements of 10 CFR 34.41 for personnel to be present during radiography and the requirements of 10 CFR 34.46 for supervision of radiography assistants.
- (4) Operating and emergency procedures and practices, as required by 10 CFR 34.45(a), should ensure that radiography personnel have the authority necessary to protect personnel from radiation doses in excess of regulatory limits. These procedures and practices should include provisions to ensure that underwater radiographic operations are conducted only in those locations shielded for such operations. The procedures and practices should also ensure that radiographic personnel can direct personnel as necessary for radiation safety, both during normal operations, and in the event that the sealed source cannot be fully retracted or during any other emergencies.

APPENDIX E

RADIOGRAPHER AND RADIOGRAPHER'S ASSISTANT TRAINING

Radiographer and Radiographer's Assistant Training

Table E-1. 10 CFR Part 34, "Radiographer and Radiographer's Assistant Training Requirements"

Requirement	Training Criteria
34.43(a)(1)	Radiographer
A. Receive Training in 10 CFR 34.43(g) Topics (Classroom Training— Approximately 40 hours in Length)	<p>Topics in 10 CFR 34.43(g)</p> <p>Fundamentals of Radiation Safety</p> <ul style="list-style-type: none"> • characteristics of gamma radiation • units of radiation dose and quantity of radioactivity • hazards of exposure to radiation • levels of radiation from licensed material • methods of controlling radiation dose (time, distance, and shielding) <p>Radiation Detection Instruments</p> <ul style="list-style-type: none"> • use, operation, calibration, and limitations • survey techniques • personnel monitoring equipment <p>Equipment to be Used</p> <ul style="list-style-type: none"> • operation and control of radiographic exposure equipment, remote handling equipment, storage containers, and pictures or models of source assemblies (pigtailed) • storage, control, and disposal of licensed material • inspection and maintenance of equipment <p>Requirements of Pertinent Federal Regulations</p> <p>Case Histories of Accidents in Radiography</p>
B. On-the-Job Training— 2 months or 320 hours	Under the supervision of a qualified radiographer
C. Certification by a Certifying Entity	<p>Radiographer Certification</p> <p>Radiographers must be certified by a certifying entity and the licensee must ensure that training on the subjects listed in 10 CFR 34.43(g) has been conducted.</p>

Table E-1. 10 CFR Part 34, “Radiographer and Radiographer’s Assistant Training Requirements” (Continued)

Requirement		Training Criteria
34.43(b)		Radiographer
D.	Must Receive Copies of and Instruction in:	<p>NRC Regulations</p> <p>10 CFR Part 34</p> <ul style="list-style-type: none"> • 10 CFR 30.7, 10 CFR 30.9, 10 CFR 30.10, and • 10 CFR 37.43 • applicable parts of 10 CFR Part 19 and 10 CFR Part 20 • applicable DOT regulations and 10 CFR Part 71 <p>The NRC License</p> <p>The Licensee’s Operating and Emergency Procedures</p>
E.	Pass Written or Oral Examination on Licensee’s Operating and Emergency Procedures	<ul style="list-style-type: none"> • 50 questions • Passing Grade 70 percent (suggested)
F.	Receive Equipment Training	<p>Training includes:</p> <ul style="list-style-type: none"> • exposure devices • sealed sources • associated equipment • radiation survey meters • daily inspection
G.	Demonstrate Understanding in Use of Equipment by Passing Practical Exam	<p>Questions on topics determined by the licensee.</p> <p>Use the Six-Month Radiographer/Radiographer’s Assistant Inspection Checklist (Appendix F of this NUREG) as a potential source of questions.</p>
H.	Annual Refresher Training	<p>Review the following:</p> <ul style="list-style-type: none"> • radiation safety review • new procedures or equipment • new regulations • observations and deficiencies during audits and discussion of any significant incidents or accidents involving radiography • employee questions
I.	Records	To be maintained in accordance with 10 CFR 34.79

Table E-1. 10 CFR Part 34, “Radiographer and Radiographer’s Assistant Training Requirements” (Continued)

Requirement		Training Criteria
34.43(c)		Radiographer’s Assistant
A.	Must Receive Copies of and Instruction in: (Training—Approximately 8 hours in Length)	NRC Regulations: <ul style="list-style-type: none"> • 10 CFR Part 34 • 10 CFR 30.7, 10 CFR 30.9, 10 CFR 30.10, and 10 CFR 37.43 • applicable parts of 10 CFR Part 19 and 10 CFR Part 20 • applicable DOT regulations and 10 CFR Part 71 The NRC License The Licensee’s Operating and Emergency Procedures
B.	Pass Written Exam	<ul style="list-style-type: none"> • 25–50 questions • closed book • passing grade 70 percent (suggested)
C.	Receive Equipment Training (Approximately 4 hours in Length)	Training under the supervision of a qualified radiographer that includes: <ul style="list-style-type: none"> • exposure devices • sealed sources • associated equipment • radiation survey meters • daily inspection
D.	Demonstrate Understanding in Use of Equipment by Passing Practical Exam	25–50 questions on topics determined by the licensee. The NRC suggests using the Six-Month Radiographer/Radiographer’s Assistant Inspection Checklist (Appendix F of this NUREG) for a potential source of questions.
E.	Annual Refresher Training	Review the following: <ul style="list-style-type: none"> • any significant item identified in the annual review of the radiation safety program • new procedures or equipment • new regulations • observations and deficiencies during audits and discussion of any significant incidents or accidents involving radiography • employee questions
F.	Records	To be maintained in accordance with 10 CFR 34.79.

APPENDIX F

**SIX-MONTH RADIOGRAPHER/RADIOGRAPHER'S ASSISTANT INSPECTION
CHECKLIST**

Six-Month Radiographer/Radiographer's Assistant Inspection Checklist

Date: _____ Time: _____

Radiographic Location: _____

Radiographer/Radiographer Assistant: _____

Last Six-Month Performance Observation: Date: _____ By: _____

Device Model No.: _____ Serial No.: _____

Radiation Survey Meter Functionality: Yes _____ No _____

Calibrated: Yes _____ No _____ Daily/Source Check for Operation: Yes _____ No _____

Dosimetry: TLD/Film Badge/Other Personal dosimetry device and Pocket Dosimeter:

Yes _____ No _____

Calibrated: Yes _____ No _____

Alarming Ratemeter: Yes _____ No _____ Calibrated: Yes _____ No _____

- Were other individuals working within the restricted area wearing film badges/TLDs, dosimeters, and alarming ratemeters?
- Was the restricted area posted with a "CAUTION (or DANGER) RADIATION AREA" sign(s)?
- Was the restricted area properly controlled to prevent unauthorized entry?
- Was the high-radiation area posted with a "CAUTION (OR DANGER) HIGH-RADIATION AREA" sign(s)?
- Was the utilization log properly filled out?
- Did the radiographer/radiographer's assistant have sufficient knowledge of safety rules? (Ascertained by oral questions)
- Was the radiographer working with properly inspected and operable equipment?
- Did the radiographer/radiographer's assistant properly survey the radiographic camera?
- Did the radiographer properly supervise the radiographer's assistant?
- Was the radiographic camera properly locked and secured to prevent unauthorized removal (two independent barriers)?
- Were the security requirements in 10 CFR Part 37 implemented?
- Was the restricted area properly controlled for radiological exposure?

- Were calculations or surveys performed to determine the restricted area boundary?
- Was the high-radiation area under continuous direct observation except where entry is prevented at permanent radiographic installations.
- Were sealed sources stored properly and kept locked to prevent removal?
- Was the storage area posted with a "CAUTION (or DANGER) RADIOACTIVE MATERIAL" sign(s)?
- Did the radiographer/radiographer's assistant possess and use a copy of the operating and emergency procedures and (NRC rules and regulations for protection against radiation?
- Were there any other safety items found to be lacking? If yes, explain in Remarks.

Remarks:

Audit performed by: _____

APPENDIX G
RADIATION SAFETY PROGRAM AUDIT

**Radiation Safety Program Audit [20.1101(c)]
Annual Radiation Protection Industrial Radiography Audit**

Date of this Audit _____ Date of Last Audit _____

Next Audit Date _____

Auditor _____ Date _____
(Signature)

Management Review _____ Date _____
(Signature)

Note: Except where noted, references are to Title 10 of the *Code of Federal Regulations* (10 CFR).

Organization and Scope of Program

- A. Organizational structure (specify any changes)
 - 1. Matches license requirements [L/C¹]
 - 2. Multiple authorized locations of use and/or field sites authorized
 - 3. List of location(s) inspected—attached or reference
 - 4. Brief description of scope of activities, including types of equipment, types and quantities of use involving byproduct material, frequency of use, staff size, etc.
- B. Radiation Safety Officer (RSO)
 - 1. Named on license [L/C]
 - 2. Fulfills duties as RSO [34.42(c)]
 - 3. Meets requirements [34.42]
 - 4. Potential RSO designee(s) identified, if applicable (34.13)
- C. Radiographers and radiographer's assistants named in documents [34.43, 34.79; L/C].
- D. Commensurate security program implemented (37).

Training, Retraining, and Instructions to Workers

- A. Instructions to workers [19.12]
- B. Parts 19, 20, 21, 34; 37, the license; and operating and emergency procedures are furnished to all radiographers and radiographer's assistants [34.43(b)(1), (c)(1)]
- C. Training program description the same as that submitted with license application or as amended? [34.13(b); 34.43; L/C]
 - 1. Written tests completed by all radiographers and radiographer's assistants.

¹L/C refers to license condition.

2. Oral tests
 3. All radiographers completed on-the-job training
 4. Periodic training program implemented
 5. Records maintained [34.79]
- D. Part 20. Workers cognizant of requirements for:
1. Radiation safety program [20.1101]
 - a. Occupational exposure annual limits [20.1201; 20.1202]
 - b. Public annual dose limits [20.1301; 20.1302]
 2. U.S. Nuclear Regulatory Commission (NRC) Forms 4 and 5
 3. 10 percent monitoring threshold [20.1502]
 4. Dose limits to embryo/fetus and declared pregnant worker [20.1208]
 5. Procedures for opening packages [20.1906]

Operating and Emergency Procedures

- A. Procedures current? [34.45; 34.81; 34.89(b)(7)]
- B. Procedures contain information specified
- C. Procedures submitted to the NRC [34.13(d)]

Internal Audits or Inspections

- A. Audits/inspections of each radiographer and radiographer's assistants conducted at 6-month intervals or after as appropriate [34.43(e); 34.42(e); L/C]
- B. Equipment check before use each day [34.31(a)]
- C. Equipment inspection and maintenance performed at 3-month intervals [34.31(b)]
- D. Records maintained [34.73]

Facilities

- A. Permanent radiographic installation [34.3; 34.33]
 1. High-radiation area posted [20.1601(a); 20.2902(b)]
 2. Entrance controls are as described [20.1601(a); 34.33(a)L/C]
 - a. Visible and audible radiation signals
 - b. Visible signal actuates if entry is attempted when source is exposed
 - c. Audible signal actuates if entry is attempted when source is exposed
 - d. System tested daily with radiation source
 - e. Records maintained for 3 years [34.75]
- B. Temporary high-radiation area entry controlled [20.1601(b); 34.31]
- C. Storage area

1. Storage facilities as described in license [L/C]
 2. Sealed Sources locked in exposure devices [34.23]
 3. Exposure devices secured to prevent tampering or unauthorized removal [34.23; 20.1801; 20.1802]
 4. NRC notified of any temporary jobsite exceeding 180 days (34.101(c))
 5. Current storage locations comply with the applicable enhanced security program requirements [37.74]
- D. Industrial radiography conducted at location identified on license [L/C]
- E. Security of radioactive materials [10 CFR 37]
- Background Investigations and Access Control Program [10 CFR 37, Subpart B]
 - Physical Protection Requirements During Use [10 CFR 37, Subpart C]
 - Physical Protection in Transit [10 CFR 37, Subpart D]
 - Records [10 CFR 37, Subpart F]

Equipment

- A. Radiography exposure devices, sealed source assemblies, and source changers in use meet requirements [34.20]
- B. Associated equipment in use complies with requirements [34.20]
- C. Awareness that associated equipment must comply with [34.20; 34.43(b)(3)]
- D. Source changers and storage containers meet radiation level limits [34.21]
- E. Equipment exempted by specific license condition is used in accordance with license commitments and authorization

Materials

- A. Isotope, chemical/physical form, quantity, and use as authorized [L/C]
- B. All sealed sources not fastened to or contained in an exposure device are tagged [34.20(b)]
- C. During radiographic operations, sealed sources are secured in the shielded position each time the source is returned to that position [34.49(b)]
- D. Leakage and contamination tests
 1. Sealed sources
 - a. Leak-test method approved [34.27(a)]
 - b. Leak tests performed at 6-month intervals [34.27(c)]
 - c. Leakage is less than 185 becquerels (Bq) (0.005 microcuries (μCi)) [34.27(d)]
 2. Depleted uranium (DU) shielding with S-tubes
 - a. Test every 12 months [34.27(e)]

- b. DU is less than 185 Bq (0.005 μ Ci)
- 3. Records maintained for 3 years [34.67]
- E. Inventories
 - 1. Conducted quarterly (not to exceed 3 months) [34.29(a)]
 - 2. Contain all required information [34.69]
 - 3. Most recent inventory conducted on: < date >
 - 4. Annual reconciliation conducted on: < date >
- F. Utilization Logs
 - 1. Utilization logs maintained [34.71]
 - 2. Contain all required information [34.71]

Instrumentation

- A. Describe the survey instruments possessed:
Model No. Range: _____
- B. Capable of measuring 0.02 millisievert (mSv) (2 millirem (mrem)) per hour (h) through 0.01 Sv (1 rem)/h [34.25(a)]
- C. Operable and calibrated radiation survey instruments available and used on each job [34.25(a)]
- D. Calibration performed at intervals not to exceed 6 months or after servicing [34.25(b)]
- E. Records maintained for 3 years [34.65]

Radiation Surveys

- A. Area or facility surveys conducted to show compliance with 20.1301 and 20.1302(a) (dose limits to individuals members of the public in accordance with) [20.1501(a)]
- B. Records maintained [20.2103]
- C. Survey after each exposure, including the exposure device and the guide tube, ensuring that the sealed source has returned to the shielded position [34.49(b)]
- D. Survey of device any time the source is exchanged and when placed in storage (including vehicles) to ensure sealed source is in the shielded position [34.49(c)]
- E. Protection of members of the public [20.1301 and 20.1302]
 - 1. Adequate surveys made to demonstrate:
 - a. the total effective dose equivalent to the individual likely to receive the highest dose does not exceed 0.1 mSv [100 mrem] in a year [20.1301(a)(1)], or
 - b. for an individual continuously present in an unrestricted area, the external dose would not exceed 0.02 mSv [2 mrem] in an hour and 0.5 mSv [50 mrem] in a year [20.1302(b)(2)]
 - 2. Unrestricted area radiation levels do not exceed 0.02 mSv [2 mrem] in any one hour [20.1301(a)(2)]

3. Records maintained [20.2103, 20.2107]

Personnel Radiation Protection

A. Dosimetry

1. Workers monitored as required [20.1502; 34.47(a); L/C]
2. Exchange Frequency _____ Supplier _____
Type of Dosimeter _____
3. Verify supplier is approved by the National Voluntary Laboratory Accreditation Program [20.1501(c), 34.47(a)]
4. Dosimeters exchanged at required frequency [34.47(a)(3); L/C]
5. Dosimetry records maintained [20.2106; 34.83(c)]

B. Pocket Dosimeters and Electronic Personal Dosimeters

1. Model No. _____ Range _____
Model No. _____ Range _____
2. Read and recorded at start of each shift [34.47(b)]
3. Daily readings recorded [34.47(b)]
4. Dosimeters checked for response (± 20 percent) at intervals not to exceed 12 months [34.47(c)]
5. Off-scale dosimeter procedure and records [34.47; 34.83(d)]
6. Dosimetry records maintained [20.2106; 34.83(a)]

C. Alarm Ratemeters

1. Model No. _____ Range _____
2. Checked that alarm functions properly at start of each shift [34.47(g)(1)]
3. Preset at 5 mSv [500 mrem]/h with an accuracy of ± 20 percent of the true radiation dose rate [34.47(g)(2)]
4. Calibrated at intervals not to exceed 12 months [34.47(g)(4)]
5. Records maintained [34.83(b)]

D. Dosimetry Reports

1. Reviewed by _____ Frequency _____
2. Reviewed personnel monitoring records for interval (from _____ to _____)
3. Maximum exposures: TEDE _____ extremity _____
other _____
4. NRC Forms (or equivalent) [20.2104(d); 20.2106(c)]
 - a. NRC Form 4—occupational exposure history
 - b. NRC Form 5—current occupational exposure
5. Maximum exposures in compliance with annual limits [20.1201]

6. Fetal and pregnant worker exposure [20.2106(e)]
 - a. Worker declared pregnancy in writing during the audit interval
 - b. If yes, licensee in compliance? Records maintained?
 7. Dosimetry records maintained [34.83]
- E. Radiation Protection Program
1. Program includes provisions for keeping dose as low as is reasonably achievable (ALARA) [20.1101]
 2. Procedures and engineering controls used to achieve ALARA [20.1101(b)]
 3. Content and implementation reviewed annually by licensee [20.1101(c)]
 4. Records of program reviews maintained [20.2102(a)(2)]
- F. Planned Special Exposures (PSEs) [20.1206]
1. PSEs performed?
 2. If so, when, where, and why?
 3. Records maintained [20.2105; 20.2106; 20.2204]

Receipt and Transfer of Radioactive Material

- A. Procedures established and followed for picking up, receiving, and opening packages [20.1906(e)]
- B. Incoming packages surveyed [20.1906(b)(2); L/C]
- C. Shipment of sources since last inspection
 1. Used container authorized by license or certificate of compliance (COC) [L/C; COC]
 2. Transfers [30.41]
 3. All sources surveyed before shipment and transfer [20.1501(a); 49 CFR 173.475(i); L/C]
- D. Records of surveys and receipt/transfer/disposal maintained [20.2103(a); 30.51; 34.63]
- E. Transactions entered into the National Source Tracking System, including annual reconciliation [20.2207]

Transportation [10 CFR 71.5(a) and 49 CFR 170–189]

- A. Shipments are:
 - Delivered to common carriers
 - Transported in company's private vehicle
 - Both
 - No shipments since last audit
- B. HAZMAT training [49 CFR 172.700–172.704]
- C. Packages:
 1. Authorized packages used [49 CFR 173.415; 173.416]
 2. Performance test records on file

- a. Special form sources [49 CFR 173.476(a)]
 - b. DOT-7A packages [49 CFR 173.415(a)]
 - 3. COCs on file with the NRC for Type B [71.17(c)(1)]
 - 4. Two labels with Transport Index, Nuclide, Hazard Class [49 CFR 172.403; 172.441]
 - 5. Properly marked (Shipping name, UN number², Package type, Reportable quantity (RQ), Name and address of consignee [49 CFR 172.301; 172.310; 172.324; 172.101]
 - 6. Closed and sealed during transport [49 CFR 173.475(f)]
- D. Shipping papers
- 1. Prepared and used [49 CFR 172.200(a)]
 - 2. Proper (Shipping name, Hazard class, UN number, Quantity, Package type, Nuclide, RQ, Radioactive material, Physical and chemical form, Category of label, Transport Index, Shipper's name, Certification and signature, Emergency response phone number, "Limited Quantity," "Cargo Aircraft Only" if applicable) [49 CFR 172.200–172.204; 175.700]
 - 3. Readily accessible during transport
- E. Vehicles
- 1. Placarded [49 CFR 172.504]
 - 2. Cargo blocked and braced [49 CFR 177.842(d)]
 - 3. Proper overpacks (shipping name, UN number label, statement of inner packaging complies with specification packaging) [49 CFR 173.25]
- F. Security Plans
- 1. Components of a security plan [49 CFR 172.802]
- G. Any transportation incidents reported to DOT National Response Center (49 CFR 171.15; 171.16)

Auditor's Independent Measurements

- A. Survey Instrument
Serial No.
Last Calibration
- B. Auditor's measurements were compared with audited person's measurement
- C. Describe the type, location, and results of measurements; attach a diagram/survey sheet and refer to this section

²The UN number identifies the hazardous substance. The UN number is universally recognized and assigned by the United Nations.

Notifications and Reports

- A. Reports to individuals, public and occupational, monitored to show compliance with Part 20 [19.13; 30.50]
- B. Theft or loss [20.2201; 30.50]
- C. Incidents [20.2202; 30.50; 34.101]
- D. Overexposures and high radiation levels [20.2203; 30.50]
- E. Annual reports furnished to the NRC [20.2206(b), (c)]
- F. Reporting of defects and noncompliance [21.21]

Posting and Labeling

- A. Radiation areas [20.1902(a)]
- B. High-radiation areas [20.1902(b)]
- C. Use or storage areas [20.1902(e)]
- D. Containers or devices labeled [20.1904(a)]
- E. NRC Form 3 [19.11]
- F. Parts 19, 20, 21 (Section 206 of Energy Reorganization Act) OR notification of location of required documents [19.11; 21.6]
- G. Other posting and labeling [20.1902; 20.1904]

Recordkeeping for Decommissioning

- A. Decommissioning records in independent and identifiable location [30.35(g)]
- B. Decommissioning records include all required data [30.35(g)]

Generic Communications and Newsletters

- A. Communications received and reviewed
- B. Appropriate response to bulletin, generic letters, etc.

Special License Conditions or Issues

Evaluate special license conditions for data, actions

Performance Evaluation Factors

These indicators may provide an indication of the status of the radiation safety program as perceived by management.

- A. Lack of senior management involvement with the radiation safety program and/or RSO oversight
- B. RSO too busy with assignments other than radiation safety
- C. Insufficient staffing
- D. Inadequate consulting service or inadequate audits

APPENDIX H

MODEL RADIATION SURVEY INSTRUMENT CALIBRATION PROGRAM

Model Radiation Survey Instrument Calibration Program

Note: This model provides acceptable procedures for calibrating radiation survey instruments. Applicants may either adopt this model procedure or develop an alternate procedure to meet the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) 34.25, “Radiation survey instruments.”

Training

Before independently calibrating radiation survey instruments, an individual should complete both classroom and on-the-job training as follows:

- Classroom training may be in the form of lecture, video, computer-based, or self-study and will cover the following subject areas:
 - principles and practices of radiation protection
 - radioactivity measurements, monitoring techniques, and the use of radiation detection instruments
 - mathematics and calculations basic to using and measuring radioactivity
 - biological effects of radiation

- On-the-job training will be considered complete if the individual has completed both of the following:
 - observing authorized personnel performing radiation survey instrument calibration
 - conducting radiation survey meter calibrations under the supervision and in the physical presence of an individual authorized to perform calibrations

Facilities and Equipment

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

The calibration source used for calibrating dose and dose rate measuring instruments should be well-collimated, and the calibration area should be designed to minimize scatter of radiation, which could affect the calibration process.

The calibration area should be appropriately controlled so that persons entering the area will be aware if a radiation source is in use. Posting signs signaling a radiation area may also be required.

Individuals conducting calibrations of radiation survey instruments will wear assigned dosimetry.

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

Calibration Sources for Dose and Dose Rate Measuring Instruments

A radioactive sealed source or sealed sources will be used for calibrating dose and dose rate measuring radiation survey instruments, and this source should have the following characteristics:

- The source should approximate a point source.
- Calibration fields from gamma sources should be known with an accuracy when compared to secondary or primary national standards of 5 percent for dose rates greater than or equal to 1.0 $\mu\text{Gy/h}$ [0.1 mrad/h] and 10 percent for dose rates less than 1.0 $\mu\text{Gy/h}$ [0.1 mrad/h].
- The source should contain a radionuclide that emits radiation of identical or similar type and energy as the environment in which the calibrated device will be used..
- The source should be strong enough to give an exposure rate of at least 7.7×10^{-6} coulombs/kilogram/hour [30 milliroentgen/hour] at 100 centimeters (cm) {e.g., 3.1 gigabecquerels [85 mCi] of cesium-137 or 7.8×10^2 megabecquerels [21 mCi] of cobalt-60}.

Note: Inverse square and radioactive decay laws should be used to correct changes in exposure rate due to changes in distance or source decay.

Calibration of Dose or Dose Rate Measuring Instruments

There are three kinds of scales frequently used on dose or dose–rate radiation survey meters. These are calibrated as follows:

- **Linear readout instruments** with a single calibration control for all scales will be adjusted at the point recommended by the manufacturer or at a point within the normal range of use. Instruments with calibration controls for each scale will be adjusted on each scale. After adjustment, check the response of the instrument at approximately 20 percent and 80 percent of full scale. Instrument readings should be within $\pm x$ of the conventionally true value for the following ranges:
 - background to 10 $\mu\text{Gy/h}$ [1.0 mrad/h]; $\pm x = \pm 30$ percent
 - 10 $\mu\text{Gy/h}$ [1.0 mrad/h] to 1.0 mGy/h [100 mrad/h]; $\pm x = \pm 20$ percent
 - 1.0 mGy/h [100 mrad/h] to 10 Gy/h [1000 Rad/h]; $\pm x = \pm 10$ percent
- **Logarithmic readout instruments**, which commonly have a single readout scale spanning several decades, normally have two or more adjustments. Adjust the instrument for each scale according to site specifications or the manufacturer's specifications. After adjustment, check the calibration at a minimum of one point on each decade. Instrument readings should have a maximum deviation from the conventionally true value, as described for linear readout instruments.
- **Digital readout instruments** should be calibrated the same as linear readout instruments.

Note: Readings above 2.58×10^{-4} coulomb/kilogram/hour [1 roentgen/hour] need not be calibrated, unless the licensee expects to make measurements at higher dose rates; regardless, such scales should be checked for operation and response to radiation.

Calibration of Surface Contamination Measurement Instruments

Instruments used to detect surface contamination usually consist of a count-rate meter and a detector that is appropriate for the type of radiation(s) being measured.

The efficiency of radiation survey meters must be determined by using radiation sources with similar energies and types of radiation that users of the radiation survey instrument intend to measure.

If each scale has a calibration potentiometer, the reading should be adjusted to respond to the calibration source at approximately 80 percent of full scale, and the response at approximately 20 percent of full scale should be observed. If only one calibration potentiometer is available, the response should be adjusted at mid-scale on one of the scales, and response on the other scales should be observed. The instrument efficiency factor (e.g., cpm/dpm) thus obtained should have a signal-to-noise ratio, including the compilation of source and instrument uncertainties, of $\pm x$ for the following ranges:

- alpha measurement
0.01 Bq/cm² to 2.0 Bq/cm² (60 to 12,000 dpm/100 cm²); $\pm x = \pm 20\%$
2.0 Bq/cm² to 200 Bq/cm² (12,000 to 1,200,000 dpm/100 cm²); $\pm x = \pm 10\%$
- beta measurement
0.05 Bq/cm² to 2.0 Bq/cm² (300 to 12,000 dpm/100 cm²); $\pm x = \pm 20\%$
2.0 Bq/cm² to 200 Bq/cm² (12,000 to 1,200,000 dpm/100 cm²); $\pm x = \pm 10\%$

Calibration Records

Calibration records, for all radiation survey instruments, should indicate the procedure used and the results of the calibration. The records should include the following:

- the owner or user of the radiation survey instrument
- a description of the radiation survey instrument, including the manufacturer's name, model number, serial number, and type of detector
- a description of the calibration source, including the exposure rate at a specified distance or activity on a specified date
- for each calibration point, the calculated exposure rate or count rate, the indicated exposure rate or count rate, the deduced correction factor (the calculated exposure rate or count rate divided by the indicated exposure rate or count rate), and the scale selected on the instrument
- the exposure reading indicated with the radiation survey instrument in the "battery check" mode (if available on the instrument)

- for radiation survey instruments with external detectors, the angle between the radiation flux field and the detector (i.e., parallel or perpendicular)
- for radiation survey instruments with internal detectors, the angle between radiation flux field and a specified surface of the instrument
- for radiation detectors with removable shielding, an indication of whether the shielding was in place or removed during the calibration procedure
- the exposure rate or count rate from a check source, if used
- the name and signature of the individual who performed the calibration and the date on which the calibration was performed

The following information will be attached to the radiation survey instrument as a calibration sticker or tag:

- for dose and dose rate measuring instruments, the source radionuclide used to calibrate the radiation survey instrument (with correction factors) for each scale
- for surface contamination measurement instruments, the efficiency of the radiation survey instrument, for each of the radionuclides the instrument will be used to measure (if efficiency is not calculated before each use)
- for each scale or decade not calibrated, an indication that the scale or decade was checked only for function but not calibrated
- the date of calibration and the next calibration due date
- the apparent exposure rate or count rate from the check source, if used

Reference: Detailed information about portable radiation survey instrument calibration may be obtained by referring to American National Standards Institute (ANSI)-N323AB-2013, "American National Standard for Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments."

APPENDIX I

REQUESTS TO PERFORM LEAK TESTING AND SAMPLE ANALYSIS

Requests to Perform Leak Testing and Sample Analysis

Note: *This model provides acceptable procedures for performing leak testing and sample analysis. Applicants may either adopt this model procedure or develop an alternate procedure to meet the requirements of Title 10 of the Code of Federal Regulations (10 CFR) Section 34.27, "Leak testing and replacement of sealed sources."*

Training

Before allowing an individual to perform leak testing, the licensee must ensure that he or she has sufficient classroom and on-the-job training to show competency in performing leak testing and sample analysis independently.

Classroom training may be in the form of lecture, online, video, hands-on, or self-study and should cover the following subject areas:

- principles and practices of radiation protection
- radioactivity measurements, monitoring techniques, and instrument use
- mathematics and calculations used for measuring radioactivity
- biological effects of radiation

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

- observing authorized personnel collecting and analyzing leak-test samples
- collecting and analyzing leak-test samples under the supervision and in the physical presence of an individual authorized to perform leak testing and sample analysis

Facilities and Equipment

- To ensure achieving the required sensitivity of measurements, analyze leak tests in a low-background area.
- Use a calibrated and operable survey instrument to check leak-test samples for gross contamination before they are analyzed.
- Analyze the leak test sample using an instrument that is appropriate for the type of radiation to be measured (e.g., NaI(Tl) well-counter system for gamma emitters, liquid scintillation for beta emitters, and gas-flow proportional counter for alpha emitters).
- If the sensitivity of the counting system is unknown, determine the minimum detectable activity (MDA). The MDA may be determined using the following formula:

$$MDA = \frac{2.71 + 4.65 \sqrt{bkg \times t}}{t \times E}$$

where: *MDA* = minimum detectable activity in disintegrations per minute (dpm)
bkg = background count rate in counts per minute (cpm)
t = background counting time in minutes
E = detector efficiency in counts per disintegration

For example:

$$\begin{aligned} \text{where: } bkg &= 200 \text{ cpm} \\ E &= 0.1 \text{ counts per disintegration (10 percent efficient)} \\ t &= 2 \text{ minutes} \end{aligned}$$

$$\begin{aligned} \text{MDA} &= \frac{2.71 + 4.65 \sqrt{200 \text{ cpm} \times 2 \text{ minutes}}}{2 \times 0.1} = \frac{2.71 + 4.65 \sqrt{400}}{0.2} \\ &= \frac{2.71 + 4.65(20)}{0.2} = \frac{2.71 + 93}{0.2} = \frac{95.71}{0.2} \\ &= \frac{478.55 \text{ disintegrations}}{\text{minute}} \end{aligned}$$

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

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

Note: The MDA equation shown above assumes that counting times for the background measurement and for the sample will be equal. MDA equations for non-equal counting times, as well as derivations of equations and discussions of limitations, can be found in “Decommissioning Health Physics—A Handbook for MARSSIM Users,” Eric W. Abelquist, published by Taylor & Francis Group, 2001.

Frequency for Conducting Leak Tests of Sealed Sources

Leak tests will be conducted at the frequency specified in the respective Sealed Source and Device registration certificate.

Procedure for Performing Leak Testing and Analysis

- For each sealed source to be tested, list identifying information such as sealed source serial number, manufacturer, model number, radionuclide, and activity.
- Use a radiation survey meter to monitor exposure.
- Prepare a separate wipe sample (e.g., cotton swab or filter paper) for each source.
- Number each wipe to correlate with identifying information for each source.

- Wipe the most accessible area where contamination would accumulate if the sealed source were leaking (see manufacturer’s instructions).
- Select instrumentation that is sensitive enough to detect 185 Bq [0.005 microcuries (μCi)] of the radionuclide contained in the sealed source.
- Using the selected instrument, count and record background count rate.
- Check the instrument’s counting efficiency using a standard source of the same radionuclide as the source being tested or one with similar energy characteristics. The calibration source must be in the same configuration as the sample. Accuracy of standards should be within ±5 percent of the stated value and traceable to primary radiation standards such as those maintained by the National Institute of Standards and Technology.
- Calculate the counting efficiency of the detector.

$$\text{Efficiency in cpm/Bq} = \frac{[(\text{cpm from std}) - (\text{cpm from bkg})]}{\text{activity of std in Bq}}$$

where: cpm = counts per minute
 std = standard
 bkg = background
 Bq = becquerel

- Count each wipe sample; determine net count rate.
- For each sample, calculate and record estimated activity in Bq (or millicuries). The activity of the sample in becquerels may be calculated using the following formula:

$$\text{Activity of sample [Bq]} = \frac{[(\text{cpm from wipe sample}) - (\text{cpm from bkg})]}{\text{efficiency in cpm/Bq}}$$

- Sign and date the list of sources, data, and calculations. Retain records for 3 years [10 CFR 20.2103(a)].
- If the wipe test activity is 185 Bq [0.005 μCi] or greater, notify the radiation safety officer (RSO), so that the source can be withdrawn from use and disposed of properly. Also notify the U.S. Nuclear Regulatory Commission (NRC) in accordance with 10 CFR 34.27.

Reference: See NUREG–1556, Volume 18, “Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Service Provider Licenses, if the applicant wants to provide leak testing and sample analysis as a commercial service provider.

Sampling and Analysis for Depleted Uranium as a Result of S-Tube Breakthrough

Note: As an ALARA safety measure for devices with an S-tube configuration, the source should be transferred to a source changer before the S-tube is tested for breakthrough.

The wipe test sample should be obtained from the areas of the tube where wear is likely to be most severe, at the first curve nearest the ends of the radiography device. The sample should be analyzed for alpha contamination. Alpha contamination present indicates that wear has broken through the S-tube to expose the depleted uranium.

Alpha counting sensitivity should be able to detect 185 Bq [0.005 μ Ci] of contamination.

A worn S-tube could create equipment operating difficulties. Upon verification of the presence of alpha-particle emitting uranium, the radiographic exposure device should be removed from use until an evaluation of the wear of the S-tube has been made. Should the evaluation reveal that the S-tube is worn through, the device may not be used again. No user repairs are permitted.

APPENDIX J

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

Guidance for Demonstrating That Individual Members of the Public Will Not Receive Doses Exceeding the Allowable Limits

Licensees must ensure the following:

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

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

- The radiation dose in unrestricted areas does not exceed 0.02 mSv [2 mrem] in any one hour.
- Typical unrestricted areas may include offices, shops, laboratories, areas outside buildings, property, and nonradioactive equipment storage areas. The licensee does not control access to these areas for purposes of controlling exposure to radiation or radioactive materials. However, the licensee may control access to these areas for other reasons, such as security.
- Licensees must show compliance with both portions of the regulation. Radiographic operations at temporary jobsites must be demonstrated to have doses to the public in unrestricted areas that do not exceed 0.02 mSv [2 mrem] in any one hour. For storage areas and permanent radiographic facilities, calculations or a combination of calculations and measurements [e.g., an environmental thermoluminescent device (TLD)] is often used to prove compliance with levels of 0.02 mSv [2 mrem] in any one hour and 1 mSv [100 mrem] in a calendar year.

Calculational Method

For ease of use by most industrial radiography licensees, the examples in this appendix use conventional units. The conversions to International System of Units (SI) units are as follows: 1 foot (ft) = 0.305 meter (m); 1 mrem = 0.01 mSv.

The calculational method takes a tiered approach, going through a three-part process starting with a worst-case situation and moving toward more realistic situations. It makes the following simplifications: (1) each device is a point source; (2) typical radiation levels encountered when the sealed source is in the shielded position are taken from either the sealed source and device (SSD) registration certificate, the maximum dose levels allowed for a transport package (exposure device) labeled YELLOW III, or the manufacturer's literature; and (3) no credit is taken for any shielding found between the devices and the unrestricted areas.

Part 1 of the calculational method is simple but conservative. It assumes that a member of the public is present 24 hours a day, and it uses only the inverse square law to determine if the distance between the radiography exposure device and the affected member of the public is sufficient to show compliance with the public dose limits. Part 2 considers not only distance, but also the time that a member of the public is actually in the area under consideration. Part 3 considers distance and the portion of time that both the radiography exposure device and the

affected member of the public are present. Part 4 considers the distance, the portion of time that both the device and the affected member of the public are present, and the shielding provided by the structural materials or shielding materials specifically added by the licensee. Using this approach, licensees make only those calculations that are needed to demonstrate compliance. In many cases, licensees will need to use the calculational method through Part 1 or Part 2. These calculations typically result in higher radiation levels than would exist at typical facilities, but provide a method for estimating conservative doses that could be received.

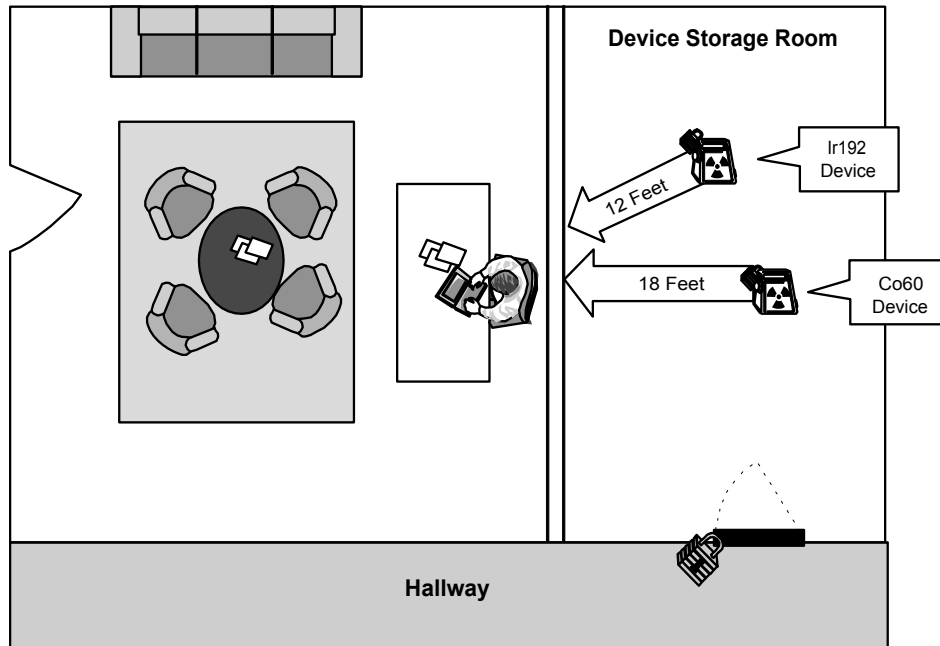
Example 1

To better understand the calculational method, Mo-Rad, Inc., a hypothetical industrial radiography licensee, is demonstrated. Yesterday, the company’s president noted that the new device storage area is close to his secretary’s desk and he asked Joe, the Radiation Safety Officer (RSO), to determine if the company is complying with the U.S. Nuclear Regulatory Commission’s (NRC’s) regulations.

The secretary’s desk is near the wall separating the reception area from the designated, locked device storage area, where the company is storing its two devices. Joe measures the distances from each device to the wall and assumes that each device would have the maximum dose rate allowed under NRC or U.S. Department of Transportation (DOT) regulations: 2 millisievert per hour (mSv/h) [200 millirem per hour (mrem/h)] on the surface and 0.1 mSv/h [10 mrem/h] at 1 m [3.3 ft]. Figure J–1 is Joe’s sketch of the areas in question, and Table J–1 summarizes the information Joe has on each device.

Description of Known Information	Device 1	Device 2
How device is stored	Ir-192 exposure device (Type B container)	Co-60 exposure device (Type B container)
Dose rate in mrem/h encountered at specified distance from the device	10 mrem/h at 1 m [3.3 ft]	10 mrem/h at 1 m [3.3 ft]
Distance in ft to secretary’s chair	12 ft	18 ft

A Bird's Eye View of Office and Device Storage Area



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Figure J-1. Diagram of Office and Radiography Exposure Device Storage Area. This Sketch Shows the Areas Described in Examples 1 and 2.

Example 1: Part 1

Joe's first thought is that the distance between the devices and the secretary's chair may be sufficient to show compliance with the regulation in Title 10 of the *Code of Federal Regulations* (10 CFR) 20.1301. Taking a worst-case approach, he assumes that (i) the radiography exposure devices are constantly present (i.e., 24 hours per day), (ii) both devices remain in storage with no other use, and (iii) the secretary is constantly sitting in the desk chair (i.e., 24 hours per day). Joe proceeds to calculate the dose she might receive hourly and yearly from each device, as shown in Tables J-2 and J-3 below:

Table J-2. Calculational Method, Part 1: Hourly and Annual Dose Received From Device 1

Step No.	Description	Device 1 Input Data	Results
1	Dose received in 1 hour at known distance from exposure device (e.g., from manufacturer's data), in mrem/h	10	10
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft ²	(3.3) ²	10.9
3	Square of the distance (ft) from the exposure device the secretary's desk in an unrestricted area, in ft ²	(12) ²	144
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	10 × 10.9 = 109	

Table J-2. Calculational Method, Part 1: Hourly and Annual Dose Received From Device 1

Step No.	Description	Device 1 Input Data	Results
5	Divide the result of Step 4 by the result of Step 3 to calculate the dose received by an individual at the secretary's desk, HOURLY DOSE RECEIVED FROM DEVICE 1 , in mrem in 1 hour.	$109/144 = 0.76$	
6	Multiply the result of Step 5 by 24 hours per day (h/d) \times 365 days per year (d/yr) = MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICE 1 , in mrem in a year.	$0.76 \times 24 \times 365 = 0.76 \times 8,760 = 6,658$	

Table J-3. Calculational Method, Part 1: Hourly and Annual Dose Received from Device 2

Step No.	Description	Device 2 Input Data	Results
1	Dose received in 1 hour at known distance from exposure device (e.g., from manufacturer's data), in mrem/h	10	10
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft ²	$(3.3)^2$	10.9
3	Square of the distance (ft) from the exposure device to the secretary's desk in an unrestricted area, in ft ²	$(18)^2$	324
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	$10 \times 10.9 = 109$	
5	Divide the result of Step 4 by the result of Step 3 to calculate dose received in 1 hour by an individual at the secretary's desk, HOURLY DOSE RECEIVED FROM DEVICE 2 , in mrem in 1 hour	$109/324 = 0.34$	
6	Multiply the result of Step 5 by 24 h/d \times 365 d/yr = MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICE 2 , in mrem in a year	$0.34 \times 24 \times 365 = 0.34 \times 8,760 = 2,978$	

To determine the total hourly and total annual dose received, Joe adds the pertinent data from the preceding tables.

Table J-4. Calculational Method, Part 1: Total Hourly and Annual Dose Received From Devices 1 and 2

Step No.	Description	Device 1	Device 2	Sum
7	TOTAL HOURLY DOSE RECEIVED from Step 5 of Tables J.2 and J.3, in mrem in 1 hour	0.76	0.34	$0.76 + 0.34 = 1.1$

Table J-4. Calculational Method, Part 1: Total Hourly and Annual Dose Received From Devices 1 and 2

Step No.	Description	Device 1	Device 2	Sum
8	TOTAL ANNUAL DOSE RECEIVED from Step 6 of Tables J.2 and J.3, in mrem in a year	6,658	2,978	6,658 + 2,978 = 9,636

Note: The sum in Step 7 demonstrates compliance with the limit of 2 mrem in any one hour. Reevaluate if assumptions change. If the sum in Step 8 exceeds 100 mrem in a yr, proceed to Part 2 of the calculational method.

At this point, Joe is pleased to see that the total dose that an individual could receive in any one hour is only 1.1 mrem, but notes that an individual could receive a dose of 9,580 mrem in a year, much higher than the 100-mrem limit.

Example 1: Part 2

Joe reviews his assumptions and recognizes that the secretary is not at the desk 24 hours per day. He decides to make a realistic estimate of the number of hours the secretary sits in the chair at the desk, keeping his other assumptions constant (i.e., the devices are constantly present (24 hours per day), both radiography exposure devices remain in storage with no other use). He then recalculates the annual dose received.

Table J-5. Calculational Method, Part 2: Annual Dose Received From Devices 1 and 2

Step No.	Description	Results
9	A. Average number of hours per day that individual spends in area of concern (e.g., secretary sits at desk 5 h/d; the remainder of the day the secretary is away from the desk area copying, filing, etc.)	5
	B. Average number of days per week in area (e.g., secretary is part time and works 3 days/week)	3
	C. Average number of weeks per year in area (e.g., secretary works all year)	52
10	Multiply the results of Step 9.A by the results of Step 9.B by the results of Step 9.C = AVERAGE NUMBER OF HOURS IN AREA OF CONCERN PER YEAR	$5 \times 3 \times 52 = 780$
11	Multiply the sum in Step 7 by the results of Step 10 = ANNUAL DOSE RECEIVED FROM DEVICES CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN, in mrem in a year	$1.1 \times 780 = 858$

Note: If Step 11 exceeds 100 mrem in a year, proceed to Part 3 of the calculational method.

Although Joe is pleased to note that the calculated annual dose received is significantly lower, he realizes it still exceeds the annual limit of 100 mrem.

Example 1, Part 3

Again Joe reviews his assumptions and recognizes that the devices are not always in storage when the secretary is seated at the desk. As he examines the situation, he realizes he must consider each device individually.

Table J-6. Calculational Method, Part 3: Summary of Information

Summary	
Information on When Devices Are Present in the Storage Area:	
•	Device 1: An iridium-192 exposure device located in the storage area overnight and used every day at temporary jobsites all year and returned to the storage location at the end of each day. The device is usually present during the secretary's first and last hours of work each day.
•	Device 2: A cobalt-60 exposure device located in the storage area continuously (24 h/d) for 8 months of the year; for the remaining 4 months of the year, it is at temporary jobsites.
Information from Example 1, Part 2, on When the Secretary Is Sitting at the Desk:	
•	5 days per week
•	3 days per week
•	52 weeks per year

Table J-7. Calculational Method, Part 3: Annual Dose Received From Devices 1 and 2

Step No.	Description	Device 1	Device 2
12	Average number of hours per day device is in storage while secretary is present	2	5
13	Average number of days per week device is in storage while secretary is present	3	3
14	Average number of weeks per year device is in storage while secretary is present	52	32
15	Multiply the results of Step 12 by the results of Step 13 by the results of Step 14 = TOTAL HOURS EACH DEVICE IS STORED PER YEAR WHILE SECRETARY IS PRESENT	$2 \times 3 \times 52 = \mathbf{312}$	$5 \times 3 \times 32 = \mathbf{480}$
16	Multiply the results of Step 15 by the results of Step 7 = ANNUAL DOSE RECEIVED FROM EACH DEVICE , in mrem in a year	$312 \times 0.76 = \mathbf{237}$	$480 \times 0.34 = \mathbf{163}$

Table J-7. Calculational Method, Part 3: Annual Dose Received From Devices 1 and 2

Step No.	Description	Device 1	Device 2
17	Sum the results of Step 16 for each device = TOTAL ANNUAL DOSE RECEIVED CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN AND TIME DEVICE IS IN STORAGE, in mrem in a year	237 + 163 = 400	

Note: If the result in Step 17 is greater than 100 mrem in a yr, the licensee must take corrective actions. Joe notes that the result in Step 17 does not show compliance with the limit of 100 mrem in a yr. Since the result in Step 17 is higher than 100 mrem in a yr, Joe has to do one or more of the following:

- Consider whether the assumptions used to determine occupancy and the time each device is in storage are accurate, revise the assumptions as needed, and recalculate using the new assumptions.
- Calculate the effect of any shielding located between the device storage area and the secretarial workstation. Listed below are typical half-value layers (HVLs) for iridium-192 and cobalt-60.

Table J-8. Approximate Half-Value Layers for Typical Shielding Materials in Inches

	Steel	Lead	Concrete
Ir-192	0.5	0.25	1.7
Co-60	0.8	0.5	2.1

- Take corrective action (e.g., move radiation exposure devices within storage area, move the storage area, move the secretarial workstation) and perform new calculations to demonstrate compliance.
- Designate the area outside the storage area as a restricted area and the secretary as an occupationally exposed individual. This would require controlling access to the area for purposes of radiation protection and training the secretary, as required by 10 CFR 19.12, "Instruction to workers."

Example 1, Part 4

Joe decides to take into account the amount of shielding provided by the wall between the secretary's desk and the storage area where the two devices are located. The wall between the secretary's office and the storage area is a 4-inch-thick concrete firewall.

Table J-9. Calculational Method, Part 4: Annual Dose Received From Devices 1 and 2

Step No.	Description	Device 1	Device 2
18	Annual dose received from each device from Step 16	237	163
19	Number of HVLs (thickness of shielding material divided by thickness for one HVL); if more than one shielding material, evaluate each shielding material separately by type of radionuclide.	$4.0/1.7 = 2.35$	$4.0/2.1 = 1.9$
20	Fraction of radiation dose transmitted through shield: 0.5 (total number of HVLs from step 19); if more than one shielding material, then sum the number results from Step 19 by radionuclide.	$0.5/2.35 = 0.2$	$0.5/1.9 = 0.26$
21	Multiply the results of Step 20 by the results of Step 18 = ANNUAL DOSE RECEIVED FROM EACH DEVICE , in mrem in a year.	$0.2 \times 237 = 47$	$0.26 \times 163 = 42$
22	Sum the results of Step 21 for each device = TOTAL ANNUAL DOSE RECEIVED CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN, TIME DEVICE IS IN STORAGE, AND SHIELDING OF STRUCTURAL MATERIALS , in mrem in a year.	$47 + 42 = 89$	

Note: If the result in Step 22 is greater than 100 mrem in a yr, the licensee must take corrective actions.

Joe is glad to see that the results in Step 22 show compliance with the annual limit of 100 mrem.

Note that in the example, Joe evaluated the unrestricted area outside only one wall of the device storage area. Licensees also need to make similar evaluations for other unrestricted areas and to keep in mind the principle of maintaining doses as low as is reasonably achievable (ALARA), taking reasonable steps to keep radiation dose received below regulatory requirements. In addition, licensees need to be alert to changes in situations (e.g., moving any of the devices closer to the secretarial workstation, adding a device to the storage area, changing the secretary to a full-time worker, or changing the estimate of the portion of time spent at the desk) and to perform additional evaluations, as needed.

RECORDKEEPING: As required by 10 CFR 20.2107, "Records of dose to individual members of the public," licensees must maintain records demonstrating compliance with the dose limits for individual members of the public.

Combination Measurement—Calculational Method

This method, which allows the licensee to take credit for shielding between the radiographic exposure device and the area in question, begins by measuring radiation levels in the areas, as opposed to using manufacturer-supplied rates at a specified distance from each device. These measurements must be made with calibrated radiation survey meters sufficiently sensitive to measure background levels of radiation. However, licensees must exercise caution when

making measurements with currently calibrated radiation survey instruments. A maximum dose of 1 mSv [100 mrem] received by an individual over an interval of 2,080 hours (i.e., a work year of 40 hours per week for 52 weeks per year) is equal to less than 0.5 microsievert [0.05 mrem] per hour.

This rate is well below the minimum sensitivity of most commonly available Geiger-Mueller radiation survey instruments.

Instruments used to make measurements for calculations must be sufficiently sensitive. An instrument equipped with a scintillation-type detector [e.g., NaI (TI)] or a micro-R meter used in making very low gamma radiation measurements should be adequate.

Licensees may also choose to use environmental TLDs. TLDs used for personnel monitoring (e.g., lithium fluoride) may not have sufficient sensitivity for this purpose. Generally, the minimum reportable dose received is 0.1 mSv [10 mrem]. Suppose a TLD monitors dose received and is changed once a month. If the measurements are at the minimum reportable level, the annual dose received could have been about 1.2 mSv [120 mrem], a value in excess of the limit of 1 mSv in a yr [100 mrem in a yr]. If licensees use TLDs to evaluate compliance with the public dose limits, they should consult with their TLD supplier and choose more sensitive TLDs, such as those containing calcium fluoride, that are used for environmental monitoring in unrestricted areas next to the device storage area for monitoring. This direct measurement method would provide a definitive measurement of actual radiation levels in unrestricted areas without any restrictive assumptions. Records of these measurements can then be evaluated to ensure that rates in unrestricted areas do not exceed the limit of 1 mSv in a yr [100 mrem in a yr].

Example 2

As in Example 1, Joe is the RSO for Mo-Rad, Inc., an industrial radiography licensee. The company has two devices stored in a designated, locked storage area that adjoins an unrestricted area where a secretarial workstation is located. See Figure J–1 and Table J–1 for information. Joe wants to see if the company complies with the public dose limits at the secretarial station.

During the winter while all the devices were in storage, Joe placed an environmental TLD badge in the secretarial workspace for 30 days. Joe chose a winter month so he did not have to keep track of the number of hours that each device was in the storage area. The TLD processor sent Joe a report indicating that the TLD received 100 mrem.

Table J–10. Combination Measurement—Calculational Method		
Step No.	Description	Input Data and Results
Part 1		
1	Dose received by TLD, in mrem	100
2	Total hours TLD exposed	24 h/d × 30 d/mo = 720
3	Divide the results of Step 1 by the results of Step 2 to determine HOURLY DOSE RECEIVED , in mrem in 1 hour	100/720 = 0.14

Table J-10. Combination Measurement—Calculational Method

Step No.	Description	Input Data and Results
4	Multiply the results of Step 3 by 365 d/yr × 24 h/d = 8,760 hours in 1 year = MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICES , in mrem in a year	365 × 24 × 0.14 = 8,760 × 0.14 = 1,226
Part 2 (This Part is calculated in the same manner as shown in Part 2 of Example 1)		
Part 3 (This Part is calculated in the same manner as shown in Part 3 of Example 1)		

Note: For the conditions described above, Step 3 indicates that the dose received in any one hour is less than the limit of 2 mrem in any one hour. However, if there were any changes, then the licensee would need to reevaluate the potential doses that could be received in any one hour. Step 4 indicates that the annual dose received would be much greater than the annual limit of 100 mrem allowed by the regulations.

In Step 2, Joe can adjust for a realistic estimate of the time the secretary spends in the area as he did in Part 2 of Example 1.

If the results of Joe's evaluation in Part 2 show that the annual dose received in a year exceeds 100 mrem, then he can make adjustments for realistic estimates of the time spent in the area of concern while the devices are actually in storage, as in Part 3 of Example 1. (Recall that the TLD measurement was made while all the devices were in storage—that is, 24 hours per day for the 30 days that the TLD was in place.)

APPENDIX K

**INFORMATION FOR APPLICANTS TO CONSIDER WHEN DEVELOPING
PROCEDURES FOR OPERATING RADIOGRAPHY EQUIPMENT**

Information for Applicants To Consider When Developing Procedures for Operating Radiography Equipment

Caution: Always use a calibrated, operable radiation survey meter and wear proper dosimetry while performing the following operations:

Crankout Device

- Establish and post the restricted area and high-radiation area.
- Locate the source shield at the desired distance from the object to be radiographed.
- Mount the source tip firmly, using jigs or other attachments, with the tip in the exact exposure position.
- Locate the control unit at a maximum distance from the source shield with the control tubes laid out as straight as possible.
- Join the control cable to the unit following the manufacturer's instructions.
- Unlock the device.
- Turn the handcrank steadily to move the source out of the source shield to the exposure position.
- Survey the perimeter of the restricted area to be sure that radiation levels do not exceed 0.02 millisievert (mSv) [2 millirem (mrem)] in any one hour.
- Maintain continuous surveillance over the restricted area during an exposure, keeping all persons from entering.
- After completing the exposure, retract the source by turning the crank until the "safe" position is indicated.
- Survey the radiographic exposure device and the guide tube to determine that the sealed source is in a shielded position.
- Lock the device and remove the key.

Note: The U.S. Nuclear Regulatory Commission considers the following very important: radiation surveys of the restricted area, continuous surveillance of the restricted area during an exposure, the survey of the device and guide tube, and locking the device.

Source Exchange

Removing the Old Source

- (1) Survey the shipping container upon receipt with a radiation survey meter. Note that the surface reading should not exceed 2 millisievert per hour (mSv/h) [200 millirem per hour (mrem/h)].

- (2) Establish and post the restricted and high-radiation areas.
- (3) Attach the end of the sealed source guide tube to the exposure device.
- (4) Connect the other end of the source guide tube to the empty side of the source changer.
- (5) Unlock the empty side of the source changer.
- (6) Unlock the camera and crank out the sealed source from the camera into the source changer.
- (7) Survey the source changer and guide tube to verify that the sealed source is in the fully shielded position inside the source changer.
- (8) Lock the source changer.
- (9) Disconnect the source guide tube and drive cable to the source pigtail. Replace the dust cap on the source changer.
- (10) Remove the sealed source identification plate from the radiography exposure device and affix the plate to the side of the sealed source changer loaded with the old source.

Installing the New Source

- (1) Remove the dust cap on the source changer lock body identified with the new source tag.
- (2) Align the camera and source guide tube with the source changer.
- (3) Connect the new sealed source to the drive cable.
- (4) Connect the source guide tube to the source changer.
- (5) Unlock the source changer and retract the new sealed source into the exposure device.
- (6) Survey the exposure device and guide tube to ensure that the sealed source is in the fully shielded position.
- (7) Lock the exposure device.
- (8) Disconnect the source guide tube and drive accessories.
- (9) Affix the new sealed source identification plate on the exposure device.

APPENDIX L
TRANSPORTATION

Transportation

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

The following are the major areas in U.S. Department of Transportation (DOT) regulations most relevant for transporting radiographic exposure devices and source changers that are shipped as Type B quantities:

- A. Table of Hazardous Materials and Special Provisions—49 CFR 172.101
 - 1. 49 CFR 172.101—Hazardous Materials Table [proper shipping name, hazard class, identification number]
 - 2. 49 CFR 172.101, Table 2 to Appendix A-Radionuclides —List of Hazardous Substances and Reportable Quantities [for radionuclides]
- B. Shipping Papers—49 CFR 172.200
 - 1. 49 CFR 172.201—General entries [on shipping papers]
 - 2. 49 CFR 172.202—Description of hazardous material on shipping papers
 - 3. 49 CFR 172.203—Additional description requirements
 - 4. 49 CFR 172.204—Shipper’s certification [if applicable]
- C. Package Markings—49 CFR 172.300
 - 1. 49 CFR 172.301—General marking requirements for non-bulk packaging
 - 2. 49 CFR 172.304—Marking requirements
 - 3. 49 CFR 172.310—Radioactive material [Type B]
 - 4. 49 CFR 172.324—Hazardous substances in nonbulk packaging [designation of “reportable quantities” with the letters “RQ”]
- D. Package Labeling—49 CFR 172.400
 - 1. 49 CFR 172.400(a)—General labeling requirements
 - 2. 49 CFR 172.403—Radioactive materials [types and contents of labels]
 - 3. 49 CFR 172.406—Placement of labels

- E. Placarding of Vehicles—49 CFR 172.500
 - 1. 49 CFR 172.504—General placarding requirements
 - 2. 49 CFR 172.516—Visibility and display of placards
 - 3. 49 CFR 172.556—RADIOACTIVE placard
- F. Emergency Response Information—Subpart G
 - 1. 49 CFR 172.600—Applicability and general requirements
 - 2. 49 CFR 172.602—Emergency response information
 - 3. 49 CFR 172.604—Emergency response telephone number
- G. Training—Subpart H
 - 1. 49 CFR 172.702—Applicability and responsibility for training and testing [for HAZMAT employees]
 - 2. 49 CFR 172.704—Training requirements (includes types of training, when it must be conducted, need for refresher training every 3 years, recordkeeping)
- H. Safety and Security Plans—49 CFR Part 172, Subpart I
 - 1. 49 CFR 172.800—Applicability and purpose
 - 2. 49 CFR 172.802—Components of a security plan
- I. Shippers—General Requirements for Shipments and Packaging—49 CFR Part 173
 - 1. 49 CFR 173.25—Requirements for use and labeling of overpacks
 - 2. 49 CFR 173.403—Definitions
 - 3. 49 CFR 173.411—General design requirements
 - 4. 49 CFR 173.413—Additional design requirements for Type B packages
 - 5. 49 CFR 173.416—Authorized Type B packages [includes packaging certification requirements]
 - 6. 49 CFR 173.441—Radiation levels
 - 7. 49 CFR 173.471—Additional requirements for Type B packages approved by NRC
 - 8. 49 CFR 173.476—Approval of special form radioactive materials [includes requirement for documentation of special form status]

J. Carriage by Public Highway—49 CFR Part 177

1. 49 CFR 177.817—Shipping paper [location of shipping papers during transport]
2. 49 CFR 177.842—Class 7 (radioactive) material [includes requirement for blocking and bracing during transport]

Applicants should visit the U.S. DOT Web site for additional information on transportation requirements: <http://www.dot.gov/>.

1. Minimum Required Packaging for Class 7 (Radioactive) Material ^[1] (49 CFR 173 and 10 CFR 71) ^[2]					
These are basic reference charts; refer to current U.S. DOT & NRC regulations for complete requirements.					
Minimum Packaging Required for Radioactive Materials other than Low Specific Activity (LSA) Material and Surface Contaminated Objects (SCO) based on Activity of Package Contents					
Radioactive Material Quantity ^[3]		Excepted Quantities and Articles	Type A ^[4]	Type B	
Activity Restrictions		≤ the limits specified in Table 4 of §173.425	≤ A ₁ for special form ≤ A ₂ for normal form	> A ₁ for special form > A ₂ for normal form	
Contents of Package	Non-fissile and Fissile Excepted	Excepted Package	Type A Package	Type B(U) or Type B(M) package	
	Fissile	N/A	Type AF package	Type B(U)F or Type B(M)F package	
Minimum Packaging Required for LSA Material and SCO ^[3,5]					
Type(s) of LSA and/or SCO	LSA-I	LSA-II	LSA-III	SCO-I	SCO-II
Category of Package for Domestic or International Transport ^[7,8]	Unpackaged ^[9] IP-1: solids, or liquids/exclusive use IP-2: liquids/non-exclusive use Specification tank cars or cargo tank motor vehicles: liquids/exclusive use	- - IP-2: exclusive use IP-3: liquids or gases/non-exclusive use	- - IP-2: exclusive use IP-3: non-exclusive use	Unpackaged ^[9] IP-1 - -	- - IP-2 -
Alternative Provisions for Domestic only Transport ^[9]	Packaging shall meet the requirements of §§173.24, 24a, and 410 Transportation shall be an exclusive use shipment Activity per shipment must be less than an A ₂ quantity				

- [1] Additional provisions may apply for radioactive materials that are pyrophoric, oxidizing, fissile excepted, or uranium hexafluoride.
 [2] Each NRC licensee shall comply with the applicable requirements of the DOT regulations in 49 CFR parts 107, 171 through 180, and 390 through 397 (see §71.5).
 [3] Materials that contain radionuclides, where both the activity concentration and the total activity in the consignment exceed either the values specified in the table in §173.436 or the values derived according to the instructions in §173.433, must be regulated in transport as Class 7 (radioactive) material.
 [4] Except for LSA material and SCO, a Type A package may not contain a quantity of Class 7 (radioactive) materials greater than A₁ or A₂.
 [5] The external dose rate from LSA material or SCO in a single package may not exceed 10 mSv/h (1 rem/h) at 3 m from the unshielded material or objects (see §173.427(a)(1)).
 [6] LSA material and SCOs that are or contain fissile material in quantities that are not fissile excepted must be packaged in appropriate Type AF or Type BF packages. For alternate domestic transport provisions, see §173.427(b)(4). For comprehensive guidance on packaging and transportation of LSA material and SCO, see NUREG-1808.
 [7] For LSA material and SCO, transport of combustible solids, all liquids and all gases classified as LSA-II and LSA-III material, and transport of all SCO-I and SCO-II is limited to a maximum activity of 100 A₂ in a conveyance (see §173.427(a)(2)).
 [8] Unless excepted by §§173.427(c) or (d), the material or object(s) shall be appropriately packaged in a Type IP, DOT-7A Type A or Type B package.
 [9] Certain LSA-I and SCO-I may be transported unpackaged under the conditions specified in §173.427(c).

2. Radiation Level, TI and CSI Limits for Transportation by Road, Rail and Air ^[1] (49 CFR 172 - 177, and 10 CFR 71)					
Type of Transport	Non-exclusive use		Exclusive use		
Mode of Transport	Road, Rail, Vessel and Air		Road and Rail	Vessel	Air (cargo only)
Radiation Level Limits ^[2]					
Package Surface ^[1]	2 mSv/h (200 mrem/h)		2 mSv/h (200 mrem/h): other than closed vehicles 10 mSv/h (1000 mrem/h): closed vehicles	None specified	2 mSv/h (200 mrem/h) ^[3]
Conveyance ^[4]	N/A		2 mSv/h (200 mrem/h): outer surfaces (sides, top and underside) of vehicle ^[5] 0.1 mSv/h (10 mrem/h): at any point two (2) m (6.6 ft) from sides of the vehicle ^[5]	N/A	N/A
Occupied position	N/A		0.02 mSv/h (2 mrem/h): at any normally occupied area ^[6]	Requirement of §176.708 applies	N/A
Transport Index (TI) Limits ^[2]					
Package ^[1,7]	3: passenger aircraft 10: road, rail, vessels and cargo aircraft		No limit		10
Conveyance ^[4]	50: road, rail and passenger aircraft 50 to No limit: vessels ^[8] 200: cargo aircraft		No limit		200
Overpack	N/A: for road, rail 50 to 200: vessels ^[8] 3: passenger aircraft; 10: cargo aircraft		N/A	No limit ^[8]	N/A
Criticality Safety Index (CSI) Limit for fissile material ^[2]					
Package ^[1,7]	50		100	100	100
Conveyance ^[4]	50: road, rail and air 50: for holds, compartments or defined deck areas of vessels ^[8] 200 to No limit: for a total vessel ^[8]		100	200 to No limit: for a total vessel ^[8]	100
Overpack	50: road, rail, vessels ^[8] and air		N/A		

- [1] The limits in this table do not apply to excepted packages.
 [2] In addition to any applicable radiation level, TI and CSI limits, separation distance requirements apply to packages, conveyances, freight containers and overpacks; to occupied positions; and to materials stored in transit. Separation distances are based on the sum of the TIs and, for fissile materials, also the sum of the CSIs.
 [3] Higher package surface radiation levels may be allowed through an approved special arrangement.
 [4] Conveyance is, for transport by public highway or rail, any transport vehicle or large freight container; and for transport by air, any aircraft.
 [5] The outer surfaces (sides, top and underside) of vehicles are defined for road and rail vehicles in §173.441.
 [6] For rail, normally occupied areas include the transport vehicle and adjacent rail cars. The 0.02 mSv/h (2 mrem/h) limit does not apply to carriers operating under a State or federally regulated radiation protection program where personnel wear radiation dosimetry devices.
 [7] Additional TI and CSI limits apply for individual packages when non-fissile radioactive material packages are mixed with fissile material packages. Also, see CSI limits established by §71.59.
 [8] For details on TI and CSI limits for transport by vessel, see §176.708.

3. Contamination Limits and Quality Control for Class 7 (Radioactive) Materials:
(49 CFR 173.443 and 173.475, and 10 CFR 71)

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

Maximum Permissible Limits for Non-fixed Radioactive Contamination on Packages When Offered for Transport

The level of non-fixed (removable) radioactive contamination on external surfaces of packages offered for transport must be kept as low as reasonable achievable, and shall not exceed the values shown in the following table:

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

The non-fixed contamination shall be determined by:

- (a) wiping, with an absorbent material using moderate pressure, sufficient areas on the package to obtain a representative sampling of the non-fixed contamination;
- (b) ensuring each wipe area is 300 cm² in size;
- (c) measuring the activity on each single wiping material and dividing that value by the surface area wiped and the efficiency of the wipe procedure, where an actual wipe efficiency may be used, or it may be assumed to be 0.10.

Alternatively, the contamination level may be determined using alternative methods of equal or greater efficiency.

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

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

- must be kept as low as reasonable achievable; and
- may not exceed the limits set forth in §173.443(a), Table 9 (as shown above).

Provisions for Non-fixed (Removable) Contamination on Excepted and Empty Radioactive Material Packages

- The non-fixed radioactive surface contamination on the external surface of excepted and empty packages shall not exceed the limits specified in §173.443(a), Table 9 (as shown above).
- The internal contamination of an empty package must not exceed 100 times the limits in §173.443(a), Table 9 (as shown above).

Provisions for Non-fixed (Removable) Contamination on Packages and in Rail and Road Vehicles used for Exclusive Use Shipments of Radioactive Material

- The levels of non-fixed radioactive contamination on the packages (a) at the beginning of transport, may not exceed the levels prescribed in the above table, and (b) at any time during transport, may not exceed ten times the levels prescribed in §173.443(a), Table 9 (as shown above).
- Each transport vehicle used for transporting the radioactive material packages must be surveyed with appropriate radiation detection instruments after each use. If contamination values exceed acceptable levels, the transport vehicle may not be returned to service until the radiation dose rate at each accessible surface is demonstrated to be 0.005 mSv/h (0.5 mrem/h) or less, and that there is no significant non-fixed radioactive surface contamination specified in §173.443(a), Table 9 (as shown above).

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

- The contamination levels must not exceed 10 times the levels prescribed in §173.443(a), Table 9 (as shown above).
- Each vehicle shall be stenciled with the words "For Radioactive Materials Use Only" in letters at least 76 mm (3 in) high in a conspicuous place on both sides of the exterior of the vehicle.
- A survey of the interior surfaces of the empty closed vehicle must show that the radiation dose rate at any point does not exceed 0.1 mSv/h (10 mrem/h) at the surface or 0.02 mSv/h (2 mrem/h) at 1 m (3.3 feet) from the surfaces.
- Each vehicle shall be kept closed except for loading or unloading.

Provisions for Quality Control Prior to Each Shipment of Radioactive Material (§173.475)

- Before each shipment of any radioactive materials package, the offeror must ensure, by examination or appropriate tests, that:
 - (a) the packaging is proper for the contents to be shipped;
 - (b) the packaging is in unimpaired physical condition, except for superficial marks;
 - (c) each closure device of the packaging, including any required gasket, is properly installed, secured, and free of defects;
 - (d) for fissile material, each moderator and neutron absorber, if required, is present and in proper condition;
 - (e) each special instruction for filling, closing, and preparation of the packaging for shipment has been followed;
 - (f) each closure, valve, or other opening of the containment system is properly closed and sealed;
 - (g) each packaging containing liquid in excess of an A₂ quantity and intended for air shipment has been tested to show that it will not leak under an ambient atmospheric pressure of not more than 25 kPa, absolute (3.6 psia), where the test must be conducted on the entire containment system, or on any receptacle or vessel within the containment system, to determine compliance with this requirement;
 - (h) the internal pressure of the containment system will not exceed the design pressure during transportation; and
 - (i) the external radiation and contamination levels are within the allowable limits specified in §173.441 and 443.

4. Hazard Communications for Class 7 (Radioactive) Materials: Shipping Papers (49 CFR 172, Subpart C)

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

Shipping Paper Entries

Always Required	Sometimes Required	Optional Entries
<p><u>Basic description (in sequence):</u></p> <ul style="list-style-type: none"> • UN Identification number • Proper Shipping Name • Hazard Class (7) • Total activity contained in each package in SI units (e.g. Bq, TBq, etc.), or in both SI and customary units (e.g. Ci, mCi, etc.) with customary units in parentheses following the SI units • Number and type of packages <p><u>Additional description:</u></p> <ul style="list-style-type: none"> • Name of each radionuclide^[1] • Description of physical and chemical form (unless special form) • Category of label used • Transport index (TI) of each package bearing a Yellow-II or Yellow-III label <p><u>Additional entry requirements:</u></p> <ul style="list-style-type: none"> • 24 hour emergency telephone number • Shipper's Certification shall be provided by each person offering radioactive material for transportation^[2] • Proper page numbering (e.g. Page 1 of 4) 	<p><u>Materials-based Requirements:</u></p> <ul style="list-style-type: none"> • The criticality safety index (CSI) or "Fissile Excepted" for fissile material • The words "Highway route controlled quantity" or the term "HRCQ" entered in the basic description for highway route controlled quantities • The letters "RQ" entered on the shipping paper either before or after the basic description for each hazardous substance (see §171.8) • Enter applicable subsidiary hazard class(es) in parentheses immediately following the primary hazard class when a subsidiary hazard label is required • A hazardous waste manifest and the word "Waste" preceding the proper shipping name is required for radioactive material that is hazardous waste <p><u>Package-based Requirements:</u></p> <ul style="list-style-type: none"> • The applicable DOE or NRC package approval identification marking for certified Type AF and Type B packages • The International Atomic Energy Agency (IAEA) Certificate of Competent Authority identification marking for export shipment or shipment in a foreign made package <p><u>Shipment- and Administrative-based Requirements:</u></p> <ul style="list-style-type: none"> • Specify "exclusive use shipment" as required • Specify instructions for maintaining exclusive use controls for shipments of LSA material or SCO under exclusive use • Specify the notation "DOT-SP" followed by the special permit number^[3] for a special permit shipment 	<ul style="list-style-type: none"> • The weight in grams or kilograms of radionuclides may be inserted instead of activity units for fissile radionuclides, except for Pu-239 and Pu-241 • The weight in grams of Pu-239 and Pu-241 may be inserted in addition to the activity units • The words "RESIDUE: Last Contained * * *" may be included in association with the basic description of the hazardous material last contained in the packaging • Other information is permitted provided it does not confuse or detract from the proper shipping name or other required information

Special Considerations/Exceptions for Shipping Papers

- For shipments of multiple cargo types, any HAZMAT entries must appear as the first entries on the shipping papers, or be entered in a color that readily contrasts with any description on the shipping papers or highlighted on the shipping papers in a contrasting color, or be designated by an "X" (or "RQ" if appropriate).
- Emergency response information consistent with §§172.600-606 shall be readily available on the transport vehicle.
- Shipments of limited quantities of radioactive material in excepted packages, under UN2908, 2909, 2910 and 2911, are excepted from shipping paper requirements if (a) the package does not contain fissile material unless excepted by §173.453, and (b) the limited quantity of radioactive material is not a hazardous substance or hazardous waste.
- For road transport, the shipping papers shall be (a) readily available to authorities in the event of accident or inspection, (b) stored within the driver's immediate reach while he is restrained by the lap belt, (c) readily visible to a person entering the driver's compartment or in a holder which is mounted to the inside of the door on the driver's side of the vehicle, and (d) either in a holder mounted to the inside of the door on the driver's side of the vehicle or on the driver's seat.

[1] For mixtures of radionuclides, the radionuclides to be shown must be determined in accordance with §173.433(g), which is commonly known as the 95% rule; abbreviations (symbols) are authorized.



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

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

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

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

Markings on Packages

Markings Always Required Unless Excepted ^[1]	Additional Markings Sometimes Required	Optional Markings
<p>Markings for Non-bulk Packagings:</p> <ul style="list-style-type: none"> • Proper shipping name • Identification number (preceded by "UN" or "NA," as appropriate) • Name and address of consignor or consignee, unless the package is: <ul style="list-style-type: none"> ▪ highway only and no motor carrier transfers; or ▪ part of a rail carload or truckload lot or freight container load, and entire contents of railcar, truck, or freight container are shipped from one consignor to one consignee <p>Markings for Bulk Packagings:</p> <ul style="list-style-type: none"> • Identification number on orange rectangular panel: <ul style="list-style-type: none"> ▪ on each side and each end, if the packaging has a capacity of 3,785 L (1,000 gallons) or more, or ▪ on two opposing sides, if the packaging has a capacity of less than 3,785 L (1,000 gallons), or ▪ on each side and end of motor vehicle carrying cylinders permanently installed on a tube trailer 	<p>Package-based marking requirements:</p> <ul style="list-style-type: none"> • Gross mass, including the unit of measurement (which may be abbreviated) for each package with gross mass greater than 50 kg (110 lb) • Package type as appropriate, i.e., "TYPE IP-1," "TYPE IP-2," "TYPE IP-3," "TYPE A," "TYPE B(U)" or "TYPE B(M)"^[1] • Marked with international vehicle registration code of country of origin for IP-1, IP-2, IP-3 or Type A package design^[2] • Radiation (trefoil) symbol^[3] on outside of outermost receptacle of each Type B(U) or Type B(M) packaging design  • For NRC or DOE packaging, model number, serial number, gross weight, and package identification number for each certified package (Type AF, Type B(U), Type B(M), Type B(U)F, and Type B(M)F) • For Specification 7A packaging, mark on the outside with "USA DOT 7A Type A", and the name and address or symbol of the manufacturer satisfying §178.3 and §178.350. <p>Materials-based requirements:</p> <ul style="list-style-type: none"> • For non-bulk IP-1 package containing a liquid, use underlined double arrow symbol indicating upright orientation^[4], where the symbol is placed on two opposite sides of the packaging  • If a hazardous substance in non-bulk package, mark outside of each package with the letters "RQ" in association with the proper shipping name <p>Administrative-based requirements:</p> <ul style="list-style-type: none"> • For each Type B(U), Type B(M) or fissile material package destined for export shipment, mark "USA" in conjunction with specification marking, or certificate identification; and package identification indicated in U.S. Competent Authority Certificate • Mark "DOT-SP" followed by the special permit number assigned for each package authorized by special permit • Competent authority identification marking and revalidation for foreign made Type B(U), Type B(M), Type C, Type CF, Type H(U), Type H(M), or fissile material package for which a Competent Authority Certificate is required 	<ul style="list-style-type: none"> • Both the name and address of consignor and consignee is recommended. • Other markings on packages such as advertising are permitted, but must be located away from required markings and labeling.
Special Considerations for Marking Requirements		
<ul style="list-style-type: none"> • All markings are to be (a) on the outside of each packaging, (b) durable and legible, (c) in English, (d) printed on or affixed to the surface of a package or on a label, tag, or sign, (e) displayed on a background of sharply contrasting color, and (f) unobscured by labels or attachments. 		

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

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

[3] The radiation symbol shall be resistant to the effects of fire and water, plainly marked by embossing, stamping or other means resistant to the effects of fire and water that conform to the requirements of Appendix B to Part 172.

[4] The arrows must be either black or red on white or other suitable contrasting background and commensurate with the size of the package; depicting a rectangular border around the arrows is optional.

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




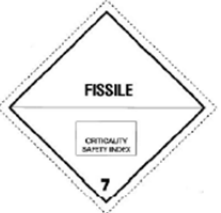

These are basic reference charts; refer to current U.S. DOT & NRC regulations for complete requirements.
NOTE: IAEA, IATA/ICAO, and IMO may require additional hazard communication information.

Requirements for Labels ^[1]

- Label each package except for (a) excepted packages containing a limited quantity of radioactive material; and (b) Low Specific Activity (LSA) material and Surface Contaminated Objects (SCO), packaged or unpackaged, when transported domestically and when material or object contains less than an A₂ quantity.
- Labeling is required to be (a) printed or affixed to a surface other than the bottom of the package, (b) placed near the proper shipping name marking, (c) printed or affixed to a background of contrasting color or have a dotted or solid line outer border, (d) clearly visible, (e) un-obscured by markings or other attachments, and (f) representative of hazardous material content.
- Display duplicate labels on at least two opposite sides or two ends (other than the bottom) of all non-bulk packages of radioactive material except as noted above for excepted packages, and packaged or unpackaged LSA material and SCO.

Radioactive Category Labels ^[3]

Other Labels ^[2]

					
White-I	Yellow-II	Yellow-III	Fissile	Empty	
Radiation Surface Level (RSL):			Fissile labels required for each package containing fissile material, other than fissile-excepted material; and labels must be affixed adjacent to radioactive category labels.	Empty labels required for shipments of empty Class 7 (radioactive) packages satisfying §173.428; and any previously-used labels cannot be visible	
mSv/h:	RSL ≤ 0.005	0.005 < RSL ≤ 0.5			0.5 < RSL ≤ 2 ^[4]
mrem/h:	RSL ≤ 0.5	0.5 < RSL ≤ 50			50 < RSL ≤ 200 ^[4]
Transport Index (TI):^[4]					
	TI = 0 ^[4]	0 ^[4] < TI ≤ 1	1 < TI ≤ 10 ^[4, 5]		

Contents on Labels

- Each radioactive category label must contain: (a) Except for LSA-I material, the names of the radionuclides in the package where, for mixtures of radionuclides, the names listed must be in accordance with the 95% rule specified in §172.433(g); and, for LSA-I material, the term "LSA-I"; (b) activity in appropriate SI units (e.g. Bq, TBq), or appropriate customary units (e.g. Ci, mCi) in parentheses following SI units; and (c) for Yellow-II or Yellow-III labels the Transport Index (TI). Abbreviations and symbols may be used. Except for Pu-239 and Pu-241, the weight in g or kg of fissile radionuclides may be inserted instead of activity units; for Pu-239 and Pu-241, the weight in g of fissile radionuclides may be inserted in addition to the activity units.
- Each fissile label must contain the relevant Criticality Safety Index (CSI).

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

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

[3] The category of the label must be the higher of the two values specified for RSL and TI; see §172.403(b).

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

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

7. Hazard Communications for Class 7 (Radioactive) Materials: Placarding (49 CFR 172, Subpart F)

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

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

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

Visibility and Display of Radioactive Placards [§172.516]

- Placards are required to:
 - be clearly visible, on a motor vehicle and rail car, from the direction they face, except from the direction of another transport vehicle or rail car to which the motor vehicle or rail car is coupled^[3];
 - be securely attached or affixed thereto or placed in a holder thereon;
 - be located clear of appurtenances and devices such as ladders, pipes, doors, and tarpaulins;
 - be located, so far as practical, so dirt or water is not directed to it from transport vehicle wheels;
 - be located at least 3 inches (76.0 mm) away from any marking (e.g. advertising) that could reduce its effectiveness;
 - have authorized words or identification number printed on it displayed horizontally, reading from left to right;
 - be maintained by the carrier so format, legibility, color, and visibility of the placard will not be substantially reduced due to damage, deterioration, or obscurement by dirt or other matter;
 - be affixed to background of contrasting color, or dotted or solid line outer border which contrasts with the background color.

Radioactive Placards

PLACARD (FOR OTHER THAN HRCQ)



White triangular background color in the lower portion with yellow triangle in the upper portion; trefoil symbol, text, class number and inner and outer borders in black.
[see §172.556 for detailed requirements]

PLACARD FOR HRCQ



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

Special Considerations/Exceptions for Placarding

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

[1] See §172.512 for exceptions and variations to the placarding requirements for freight containers and aircraft unit load devices.
[2] See §173.403 for definition of Highway Route Controlled Quantity (HRCQ). A package containing an HRCQ must be labeled with RADIOACTIVE Yellow-III labels; see §172.507(a).
[3] Required placarding of the front of a motor vehicle may be on the front of a truck tractor instead of or in addition to the placarding on the front of the cargo body to which a truck tractor is attached; §172.516(b).

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

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

Provisions for Persons Who Offer or Transport Class 7 (Radioactive) Materials (49 CFR 107, Subpart G)

- Any person, other than those excepted by §107.606, who offers for transportation, or transports, in foreign, interstate or intrastate commerce any of the following Class 7 (radioactive) materials must satisfy registration and fee requirements of Part 107, Subpart G:
 - a highway route-controlled quantity of radioactive material;
 - a shipment in a bulk packaging with a capacity $\geq 13,248$ L (3,500 gallons) for liquids or gases, or > 13.24 cubic meters (468 cubic feet) for solids; or
 - any quantity of radioactive material that requires placarding, under provisions of Part 172, Subpart F.
- Any person required to register must submit a complete and accurate registration statement on DOT Form F 5800.2 by June 30th for each registration year, or in time to have on file a current Certificate of Registration in accordance with §107.620.
- Each registrant or designee must maintain for a period of 3 years from the date of issuance a copy of the registration statement and Certificate of Registration issued by PHMSA and must furnish its Certificate of Registration (or a copy thereof) and related records to an authorized representative or special agent of DOT upon request.
- Each motor carrier subject to registration requirements of this subpart must carry a copy of its current Certificate of Registration or another document bearing the registration number on board each truck and truck tractor, and the Certificate of Registration or document must be made available, upon request, to enforcement personnel.
- The amount of fees to be paid and procedures to be followed are found at §§107.612 and 616.

Provisions for Providing and Maintaining Emergency Response Information (49 CFR 172, Subpart G)

- When shipping papers for the transportation of radioactive materials are required (see Part 172, Subpart C), emergency response information shall
 - be provided and maintained during transportation and at facilities where materials are loaded for transportation, stored incidental to transportation, or otherwise handled during any phase of transportation;
 - be provided by persons who offer for transportation, accept for transportation, transfer or otherwise handle hazardous materials during transportation;
 - be immediately available for use at all times the hazardous material is present; and
 - include and make available the emergency response telephone number (see §172.604) to any person, representing a Federal, State or local government agency, who responds to an incident involving the material or is conducting an investigation which involves the material
- Emergency response information is information that can be used in mitigating an incident involving radioactive materials. It must contain at least the information specified in §§172.602 and 604; and includes an emergency response telephone number that is monitored at all times the material is in transportation by (a) knowledgeable person, or (b) a person who has immediate access to a knowledgeable person, or (c) an organization capable of accepting responsibility for providing the necessary detailed information concerning the material.
- Each carrier who transports or accepts for transportation radioactive material for which a shipping paper is required shall instruct, according to the requirements of §172.606, the operator of a conveyance to contact the carrier in the event of an incident involving the material.

Actions to be Taken in the Event of Spillage, Breakage, or Suspected Contamination by Radioactive Material

- Except for a road vehicle used solely for transporting Class 7 (radioactive) material, if radioactive material has been released in a road, rail, or air transport conveyance, the conveyance must be taken out of and remain out of service until the radiation dose rate at every accessible surface is less than 0.005 mSv/h (0.5 mrem/h) and the non-fixed radioactive surface contamination levels are below the values the limits in §173.443(a), Table 9 [see Chart 3].
- Each aircraft used routinely, and each motor vehicle used, for transporting radioactive materials under exclusive use, must be (a) periodically checked for radioactive contamination, (b) taken out of service if contamination levels are above acceptable limits, and (c) remain out of service until the radiation dose rates at accessible surfaces are less than 0.005 mSv/h (0.5 mrem/h) and non-fixed radioactive surface contamination levels are below the limits in §173.443(a), Table 9 [see Chart 3].
- Following any breakage, spillage, release or suspected radioactive contamination incident, any rail or air carrier shall notify, as soon as possible, the offeror (i.e. the consignor); special provisions apply for buildings, areas, and equipment that might become contaminated during rail transport. Alternative provisions may apply for motor vehicles transporting radioactive materials under exclusive use. [see §§174.750(a) and 750(e), and §177.843(b)]

Provisions for Immediate Notification for Reportable Incidents Involving Radioactive Materials (§§171.15 and 16)

- Each person in physical possession of radioactive material must provide notice in the event of a reportable incident (see §171.15(b)) as soon as practical, but no later than 12 hours after the occurrence of the reportable incident, to the National Response Center (NRC) by telephone at 800-424-8802 (toll free) or 202-267-2675 (toll call) or online at <http://www.nrc.uscg.mil>.
 - Each notice must include the information specified in §171.15(a)(1) – (a)(7).
- A detailed incident report must also be submitted as required by §171.16.

Guidance on Responding to Emergencies (Emergency Response Guidebook)

- The DOT issues guidance to aid first responders in quickly identifying the specific or generic hazards of the dangerous goods involved in an accident or incident, and for protecting themselves and the general public during the initial response to the accident or incident. For each name or UN ID Number, the user is led to a specific guide that provides insight into potential hazards and steps to be taken for public safety and emergency response.
- The Emergency Response Guidebook 2012 (ERG2012) is available at the following URL:
http://phmsa.dot.gov/pv_obj_cache/pv_obj_id_7410989F4294AE44A2EBF6A80ADB640BCA8E4200/filename/ERG2012.pdf



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

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

Provisions for Training (49 CFR 172, Subpart H)

- For any person who is employed by an employer or is self-employed, and who directly affects radioactive materials transportation safety, a systematic program shall be established to ensure that the person:
 - has familiarity with the general provisions of [Part 172, Subpart H](#);
 - is able to recognize and identify radioactive materials;
 - has knowledge of specific requirements of [Part 172](#) that are applicable to functions performed by the employee;
 - has knowledge of emergency response information, self protection measures and accident prevention methods and procedures; and
 - does not perform any function related to the requirements of [Part 172](#) unless instructed in the requirements that apply to that function.
- The person shall be trained pursuant to the requirements of [§§172.704\(a\) and \(b\)](#), may be trained by the employer or by other public or private sources, and shall be tested by appropriate means. The training must include the following:
 - (a) general awareness training providing familiarity with applicable regulatory requirements;
 - (b) function-specific training applicable to functions the employee performs;
 - (c) safety training concerning emergency response information, measures to protect the employee from hazards, and methods and procedures for avoiding accidents;
 - (d) security awareness training providing awareness of security risks and methods designed to enhance transportation security; and
 - (e) in-depth security training if a security plan is required for the shipment(s) involved.
- Initial and recurrent training shall comply with the requirements of [§172.704\(c\)](#)
- Records of training shall be created and retained in compliance with the requirements of [§172.704\(d\)](#).

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

- A security plan for hazardous materials that conforms to the requirements of [Part 172, Subpart I](#) must be developed and adhered to by each person who offers for transportation in commerce or transports in commerce in a motor vehicle, rail car, or freight container any of the following radioactive materials:
 - (a) IAEA Code of Conduct Category 1 and 2 materials (see [§172.800\(b\)\(15\)](#));
 - (b) a highway route controlled quantity (HRCQ) of radioactive material as defined in [§173.403](#) (see [§172.800\(b\)\(15\)](#));
 - (c) known radionuclides in forms listed as radioactive material quantities of concern (RAM-QC) by the NRC (see [§172.800\(b\)\(15\)](#)); or
 - (d) a quantity of uranium hexafluoride requiring placarding under [§172.505\(b\)](#) (see [§172.800\(b\)\(14\)](#)).
- The security plan must include an assessment of possible transportation security risks and appropriate measures to address the assessed risks.
- Specific measures put into place by the plan may vary commensurate with the level of threat at a particular time.
- At a minimum, a security plan must address personnel security, unauthorized access, and en route security.
- The security plan must be
 - (a) in writing;
 - (b) retained for as long as it remains in effect;
 - (c) available as copies or portions thereof to the employees who are responsible for implementing it, consistent with personnel security clearance or background investigation restrictions and a demonstrated need to know;
 - (d) revised and updated as necessary to reflect changing circumstances; and
 - (e) maintained (all copies) as of the date of the most recent revision, when it is updated or revised.
- Security plans that conform to regulations, standards, protocols, or guidelines issued by other Federal agencies, international organizations, or industry organizations may be used to satisfy the requirements in [Part 172](#), provided such security plans address the requirements specified in [Part 172, Subpart I](#).
- Additional security planning requirements may apply for rail transport of a highway route controlled quantity of radioactive material (see [§§172.820 and 173.403](#)).

APPENDIX M

DAILY MAINTENANCE CHECK OF RADIOGRAPHIC EQUIPMENT

Daily Maintenance Check of Radiographic Equipment

The radiographer or radiographer's assistant shall perform a daily maintenance check of the radiographic exposure device and related radiographic equipment. This inspection will be performed before using the equipment on each day the equipment is to be used. Report defective equipment to the Radiation Safety Officer (RSO) immediately. Do **not** attempt to use defective equipment. After the inspection, document the results of the inspection.

- (1) Inspect the radiation survey meter for battery check, zero, and operation. If batteries are low, replace then check for operability. If not able to correct a problem with the radiation survey meter, obtain another meter and start over.
- (2) Check the radiation survey meter for an appropriate reading with a check source or the radiographic exposure device. If reading is not acceptable, obtain another radiation survey meter and start again.

Note: The RSO or calibration vendor should determine the acceptable radiation survey meter reading for each survey meter and post the expected reading on each instrument. This reading shall be obtained and noted at the time of calibration.

- (3) Inspect the remote-control radiographic equipment, as follows:
 - Inspect the cables for cuts, breaks, crimping, kinking, and broken fittings.
 - Carefully inspect approximately 1 foot of the drive cable immediately next to the male connector. Take care not to introduce any dirt or dust on the drive cable during this inspection. In addition to the previously mentioned items, the examination of the cable should look for any of the following:
 - excessive or uneven wearing
 - fraying
 - unraveling
 - nicks
 - kinks or bends
 - loss of flexibility (abnormal stiffness)
 - excessive grit or dirt
 - stretching
 - Inspect the crank unit for damage and loose hardware.
 - Check operation of the control for freedom of drive cable movement.
 - Inspect the guide tube for cuts, crimps, and broken fittings.
 - Survey for radiation levels and record readings. The radiation levels should be about the same as those in the previous day's inspection, unless there has been a source change.
 - Check that all safety plugs are in place.
 - Inspect the radiographic exposure device for damage to fittings, lock, fasteners, and labels.

- Check for any impairment of the locking mechanism.
 - If provided by the manufacturer or distributor, use the go/no-go tool to determine if the locking ball will function as intended.
- (4) Record the results of the daily inspection.

APPENDIX N

SUGGESTED EXAMPLE OF A ROUTINE EMERGENCY PROCEDURE

Suggested Example of a Routine Emergency Procedure

Emergency Procedure

If the sealed source fails to return to the shielded position or if any other emergency or unusual situation arises (e.g., vehicle accident, off-scale dosimeter), take the following actions:

- Attempt to crank out the source fully into the collimator, which will provide some shielding to prevent exposures to the radiographer, radiographer assistant, and members of the public.

Note: Almost all the time that a source cannot be returned to the radiographic camera, the source is able to be pushed out to the collimator. The only time this is not the case is when there is a kink in the guide tube sufficient to prevent movement of the control assembly altogether.

- Immediately secure the area and post the restricted area at the 0.02 millisievert per hour (mSv/h) [2 millirem per hour (mrem/h)] radiation level; maintain continuous surveillance and restrict access to the restricted area.
- Notify the radiation safety officer (RSO) or management personnel.
- Take no further actions until instructions are received from the RSO.
- Do **not** attempt source recovery until the situation has been discussed with the RSO or other knowledgeable personnel.
- Do not panic. Sealed source recovery can be performed with very little exposure when properly planned by trained personnel who are specifically authorized by the U.S. Nuclear Regulatory Commission (NRC) or an Agreement State to conduct sealed source recovery operations.
- Notify the persons listed below of the situation, in the order shown.

Name*	Work Phone Number*	Home Phone Number*
* Fill in with (and update, as needed) the names and telephone numbers of appropriate personnel (e.g., the RSO or other knowledgeable licensee staff, licensee's consultant, device manufacturer) to be contacted in case of emergency.		

- Follow the directions provided by the person contacted above.

Radiation Safety Officer and Licensee Management

Discuss emergency operating procedures and ensure no operations are conducted until the situation has been discussed with and approved by the RSO or other knowledgeable staff, consultants, or device manufacturer. Management should have access to emergency equipment to keep doses to radiographers as low as is reasonably achievable. Emergency equipment may include high-range dosimeters, extra lead shielding, or remote tongs.

Notify local authorities, as well as the NRC, as required. (Even if notification is not required, ANY incident may be reported to the NRC by calling the agency's Emergency Operations Center at 301-816-5100, which is staffed 24 hours a day and accepts collect calls.) NRC notification is required when sources or devices containing licensed material are lost or stolen; when radiographic sources or equipment are involved in incidents that may have cause or threaten to cause an exposure in excess of the limits found in Title 10 of the *Code of Federal Regulations* (10 CFR) 20.2202, "Notification of incidents;" and when radiographic exposure devices fail to operate as designed. Reports to the NRC must be made within the reporting timeframes specified by the regulations. Notification and reporting requirements are found in 10 CFR 20.2201–2203, 10 CFR 21.21, 10 CFR 34.101, 10 CFR 30.50, 10 CFR 37.57, and 10 CFR 37.81.

APPENDIX O
MODEL DELEGATION OF AUTHORITY

Model Delegation of Authority

Memo To: Radiation Safety Officer
From: Chief Executive Officer
Subject: Delegation of Authority

You, _____, have been appointed radiation safety officer and are responsible for ensuring the safe and secure use of radiation. You are responsible for managing the Radiation Protection Program, identifying radiation protection problems, initiating, recommending, or providing corrective actions, verifying implementation of corrective actions, stopping unsafe activities, and ensuring compliance with regulations. You are hereby delegated the authority necessary to meet those responsibilities, including prohibiting the use of byproduct material by employees who do not meet the necessary requirements and shutting down operations, when justified, to maintain radiation safety. You are required to notify management if staff does not cooperate and does not address radiation safety issues. In addition, you are free to raise issues with the U.S. Nuclear Regulatory Commission at any time. It is estimated that you will spend _____ hours per week conducting radiation protection activities.

Signature of Management Representative
I accept the above responsibilities,

Date

Signature of Radiation Safety Officer

Date

cc: Affected department heads

APPENDIX P

**CHECKLIST FOR REQUESTS TO WITHHOLD PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE (UNDER 10 CFR 2.390)**

Checklist for Requests to Withhold Proprietary Information From Public Disclosure (Under 10 CFR 2.390)

In order to request that the U.S. Nuclear Regulatory Commission (NRC) withhold information from public disclosure, the applicant or licensee must submit the information, including an affidavit, in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390, "Public Inspections, Exemptions, Requests for Withholding." The applicant should submit all of the following:

<input type="checkbox"/>	A proprietary copy of the information. Brackets should be placed around the material considered to be proprietary. This copy should be marked as proprietary.
<input type="checkbox"/>	A non-proprietary copy of the information. Applicants should white out or black out the proprietary portions (i.e., those in the brackets), leaving the non-proprietary portions intact. This copy should not be marked as proprietary.
<input type="checkbox"/>	An affidavit that:
<input type="checkbox"/>	Is notarized.
<input type="checkbox"/>	Clearly identifies (such as by name or title and date) the document to be withheld.
<input type="checkbox"/>	Clearly identifies the position of the person executing the affidavit. This person must be an officer or upper-level management official who has been delegated the function of reviewing the information the organization is seeking to withhold and is authorized to apply for withholding on behalf of the organization.
<input type="checkbox"/>	States that the organization submitting the information is the owner of the information or is required, by agreement with the owner of the information, to treat the information as proprietary.
<input type="checkbox"/>	Provides a rational basis for holding the information in confidence.
<input type="checkbox"/>	Fully addresses the following issues:
<input type="checkbox"/>	Is the information submitted to, and received by, the NRC in confidence? Provide details.
<input type="checkbox"/>	To the best of the applicant's knowledge, is the information currently available in public sources?
<input type="checkbox"/>	Does the applicant customarily treat this information, or this type of information, as confidential? Explain why.
<input type="checkbox"/>	Would public disclosure of the information be likely to cause substantial harm to the competitive position of the applicant? If so, explain why in detail. The explanation should include the value of the information to your organization, the amount of effort or money expended in developing the information, and the ease or difficulty for others to acquire the information.

APPENDIX Q
SAFETY CULTURE POLICY STATEMENT

Safety Culture

The safety culture policy statement was published in the *Federal Register* (76 FR 34773) on June 14, 2011, and can be found at <http://www.gpo.gov/fdsys/pkg/FR-2011-06-14/pdf/2011-14656.pdf>. It is also posted in NRC's Agencywide Documents Access and Management System (ADAMS) Accession Number ML11146A047.

Safety Culture Policy Statement

The purpose of this Statement of Policy is to set forth the Commission's expectation that individuals and organizations establish and maintain a positive safety culture, commensurate with the safety and security significance of their activities and the nature and complexity of their organizations and functions. This includes all licensees; certificate holders; permit holders; authorization holders; holders of quality assurance program approvals; vendors and suppliers of safety-related components; and applicants for a license, certificate, permit, authorization, or quality assurance program approval, subject to NRC authority. The Commission encourages the Agreement States, Agreement State licensees, and other organizations interested in nuclear safety to support the development and maintenance of a positive safety culture, as articulated in this Statement of Policy.

Nuclear Safety Culture is defined as *the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment*. Individuals and organizations performing regulated activities bear the primary responsibility for safety and security. The performance of individuals and organizations can be monitored and trended and, therefore, may be used to determine compliance with requirements and commitments and may serve as an indicator of possible problem areas in an organization's safety culture. The NRC will not monitor or trend values. These will be the organization's responsibility as part of its safety-culture program.

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

Experience has shown that certain personal and organizational traits are present in a positive safety culture. A trait, in this case, is a pattern of thinking, feeling, and behaving that emphasizes safety, particularly in goal-conflict situations (e.g., production, schedule, and the cost of the effort versus safety). It should be noted that although the term "security" is not expressly included in the following traits, safety and security are the primary pillars of the NRC's regulatory mission. Consequently, consideration of both safety and security issues, commensurate with their significance, is an underlying principle of this Statement of Policy.

The following are traits of a positive safety culture:

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

There may be traits not included in this Statement of Policy that are also important in a positive safety culture. It should be noted that these traits were not developed to be used for inspection purposes.

It is the Commission's expectation that all individuals and organizations, performing or overseeing regulated activities involving nuclear materials, should take the necessary steps to promote a positive safety culture by fostering these traits as they apply to their organizational environments. The Commission recognizes the diversity of these organizations and acknowledges that some organizations have already spent significant time and resources in the development of a positive safety culture. The Commission will take this into consideration as the regulated community addresses the Statement of Policy.

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

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