

GUIDANCE DOCUMENT ON FINANCIAL ASSURANCE

**Revision 2
January 2007**



**ILLINOIS EMERGENCY MANAGEMENT AGENCY
Bureau of Environmental Safety
1035 Outer Park Drive
Springfield, Illinois 62704**

Table of Contents

PURPOSE.....	1
KEY DEFINITIONS	1
FINANCIAL ASSURANCE REGULATIONS.....	2
EXEMPTIONS.....	4
Licensee Exemptions.....	4
Material Exemptions	4
MAJOR POSSESSOR DETERMINATION	5
REQUIREMENT TO PROVIDE FINANCIAL ASSURANCE	6
Requirements for a Specified Amount of \$25,000 Financial Assurance.....	6
Requirement To Develop a Reclamation Plan and Cost Estimate.....	7
FINANCIAL ASSURANCE ARRANGEMENTS.....	7
REVIEW PROCESS FOR THE FINANCIAL ASSURANCE DOCUMENTS	8
RECLAMATION PLAN AND COST ESTIMATE.....	9
The Reclamation Plan.....	10
The Cost Estimate.....	10
Factors To Be Considered In Estimating Reclamation Costs	12
Soil and Facilities	12
Groundwater.....	13
CONTACT	13
REFERENCES.....	15
APPENDIX A – 32 IAC Part 326 Appendix A Quantities of Material for Major Possessor Determination	A-1
APPENDIX B – Guidance for Reclamation Plan and Cost Estimate	B-1

List of Tables

Table 1 – Financial Assurance Categories	3
--	---

GUIDANCE DOCUMENT ON FINANCIAL ASSURANCE

PURPOSE

The purpose of this document is to inform applicants and licensees of the requirements for providing financial assurance to the Illinois Emergency Management Agency (Agency) and the data required to substantiate the financial assurance amount. Please note that the term “applicant” as used in this document refers to persons applying for a new license, and current licensees applying for renewal or amendment of existing licenses. It is also the purpose of this document to inform applicants of the various financial assurance arrangements allowed. The format of these arrangements is presented in the regulations and briefly discussed in this document.

The reason for requiring financial assurance is to ensure the health and safety of the general public and to protect the environment in the event of abandonment, default or other inability of the licensee to meet the requirements for license termination. Regulations require the licensee to restore the facility to conditions acceptable for release for unrestricted use. In addition, the Agency has a responsibility to protect the State from the unnecessary burden of costs related to decontamination and disposal.

This guidance document is issued to explain acceptable methods of implementing the financial assurance requirements of the regulations. This document is not a regulation and strict compliance with the methodology described herein is not required. Methods and solutions different from those described in this guide are acceptable if they provide a basis for the Agency to make the necessary determinations required by regulation before issuance, renewal or amendment of a radioactive materials license.

KEY DEFINITIONS

Definitions are provided in the regulations (32 IAC 326). Certain key definitions are included below to aid the applicant.

Cost Estimate means a licensee’s evaluation of the costs associated with reclamation of a facility or site. Cost estimates are subject to Agency review and approval.

Financial Assurance Arrangement means a method of guaranteeing that reclamation costs will be paid. A financial assurance arrangement consists of a surety bond, an irrevocable letter of credit, a certificate of deposit, a self-guarantee, a parent-company guarantee, a combination of such arrangements or other financial arrangements approved in writing by the Agency.

Major Possessor means a person who is licensed to use, possess or store radioactive material with half-lives greater than 275 days, as either sealed or unsealed sources in quantities exceeding the quantities specified in 32 IAC 326 Appendix A.

Reclamation means decontamination of facilities and sites and disposal of radioactive material such that the property is returned to a state that no longer presents a radiological health or safety hazard to persons or threat to the environment.

Reclamation Plan is a document describing the decontamination activities of facilities and sites and disposal of radioactive material and provides the basis for preparing a cost estimate to determine sufficient financial assurance.

FINANCIAL ASSURANCE REGULATIONS

Financial assurance requirements applicable to radioactive materials applicants and licensees are codified in 32 IAC 326. There are separate financial assurance requirements for Source Material Milling Facilities that are codified in 32 IAC 332.

The regulations require general and specific licensees provide assurance to the Agency that the licensee will have the financial ability to restore the licensed facility to a releasable condition. The regulations provide exemptions to the financial assurance requirements for certain licensees and radioactive materials. The regulations require some licensees to provide financial assurance in a specified amount while others must prepare a reclamation plan and cost estimate for approval by the Agency to demonstrate the level of financial assurance required. Table 1 provides a brief summary of the financial assurance categories.

Table 1 – Financial Assurance Categories ⁽¹⁾

Exemptions ⁽²⁾

Exempt Licensees

- State, local and other government entities
- Educational institutions
- Reciprocity licensees
- Licensees not authorized to possess or use radioactive material in Illinois
- Licensees with no permanent storage or use facilities in Illinois

Exempt Material

- GCs, benchtop analyzers, XRF's, static elimination devices, exit signs
- Sealed sources for exchange into devices
- Radioactive noble gases
- Depleted uranium used as shielding
- Radioactive material with half-life ≤ 30 days
- Radioactive material other than gases or sealed sources, with half-lives >30 but ≤ 275 days, in quantities not to exceed 1 Ci per nuclide
- Sealed sources with atomic no. ≤ 82 and quantities ≤ 1 mCi per source, not to exceed 5nCi total
- Sealed sources with atomic no. ≥ 83 and quantities ≤ 50 μ Ci per source, not to exceed 1mCi total
- Sealed sources with half-lives ≥ 30 but ≤ 275 days
- Sealed sources ≤ 1 Ci per source, with half-lives > 275 days but total $<$ Appendix A

Specified Financial Assurance Amount of \$25,000

Licensees (specific or general) with sealed sources greater than 1 Ci per source and total activity less than Appendix A value.

Financial Assurance based on Reclamation Plan and Cost Estimate

- Waste handling facilities
- Major possessors (material in any form with half lives > 275 days and activity total $>$ Appendix A
- Source material mill tailings/sludges
- Particle accelerators to manufacture for distribution
- Category III or IV irradiators
- Radioactive material other than noble gases or sealed sources, with half-lives ≥ 30 but ≤ 275 days, in quantities > 1 Ci per nuclide
- DOE facilities, if subject to regulatory control of the Agency

(1) This is only a guideline and is not to be used as a substitute to the regulations.

(2) Some exemptions do not apply to all facilities. This guidance document discusses which apply.

EXEMPTIONS

The regulations that apply to most applicants can be found in 32 IAC Part 326. The general provisions of the regulations require each general and specific licensee to provide financial assurance arrangements unless specifically exempted. The regulations further provide for exemptions for different categories of licensees as well as exemptions according to the material the licensee may possess.

Licensee Exemptions

The rules in Part 326 provide exemptions to the financial assurance requirements for the following licensee categories:

- State, local or other government entities;
- Educational institutions;
- Licensees not authorized to possess or use radioactive material in Illinois;
- Licensees with no permanent storage or use facilities in Illinois; and
- Reciprocity licensees.

Material Exemptions

Radioactive materials in the following forms are exempted from the requirements of financial assurance:

- Gas chromatographs, benchtop analytical laboratory instruments, x-ray fluorescence analyzers, static elimination devices and self-luminous exit signs except for radionuclides with atomic numbers greater than 82 in quantities greater than 3.7 GBq (100 mCi);
- Sealed sources for exchange into a device, provided that the sources do not concurrently remain in the licensee's possession for more than 30 days;
- Radioactive noble gases such as krypton-85;
- Depleted uranium prefabricated as shielding;
- Radioactive material with half-lives of 30 days or less;

- Radioactive material with atomic numbers less than or equal to 82 *in the form of sealed sources*, in quantities less than or equal to 37 MBq (1 mCi) per source, not to exceed 185 MBq (5 mCi) total;
- Radioactive material with atomic numbers greater than or equal to 83 *in the form of sealed sources*, in quantities less than or equal to 185 kBq (50 µCi) per source, not to exceed 37 MBq (1 mCi) total;
- Except for low-level radioactive waste (LLRW) licensees (such as waste treatment facilities, centralized waste storage licenses, waste disposal facilities, etc.), radioactive material with half-lives greater than 30 days, but less than or equal to 275 days in the following forms:
 - Radioactive material in forms *other than noble gases or sealed sources*, in quantities not to exceed 37 GBq (1 Ci) per nuclide (this could include such material as Iodine-125, Sulfur-35, etc.); and
 - Radioactive material *in the form of a sealed source* (such as Cobalt-57 with a half-life of about 271 days).
- Unless you are a major possessor, ore processor, source mill tailings/sludge, Category III or IV (pool) irradiator, particle accelerators for manufacture/distribution, U.S. Department of Energy (DOE) (if subject to regulatory control of the Agency), or LLRW licensee, an exemption is provided for specific or general licensees that possess or use radioactive material *as sealed sources* with half-lives greater than 275 days in quantities less than or equal to 37 GBq (1Ci) per source, but not exceeding the quantities specified in Appendix A of Part 326.

MAJOR POSSESSOR DETERMINATION

The definition for a major possessor exempts licensees that only possess small quantities of radioactive material. *The definition indicates that licensees with loose material and/or sealed sources in quantities less than the limits specified in Appendix A of 32 IAC 326 are exempt from providing financial assurance.* (Section 326 Appendix A is included as Appendix A of this guidance document.) Licensees who are authorized to possess several isotopes must use the sum-of-the ratios to determine if they meet this requirement. For example, a licensee authorized to possess 800 mCi of carbon-14 would not be required to submit a cost estimate or provide financial assurance because the quantity is less than Appendix A limit of 1000 mCi. This would also be true if this licensee also possesses various quantities of sulfur-35 and/or phosphorous-32, since these two isotopes are exempt because of their half-life. However, if this licensee is authorized

to possess 600 mCi of carbon-14 and 500 mCi of hydrogen-3 (tritium) as loose material (regardless if the licensee is authorized to possess sulfur or phosphorous), the sum of the ratios is greater than 1 ($^{14}\text{C}:600/1000 + ^3\text{H}:500/1000 = 1.1$). Therefore a reclamation plan and cost estimate would be required followed by an appropriate financial assurance arrangement. If the licensee is authorized to possess 800 mCi of carbon-14 as loose material but 5 Ci of cobalt-60 as sealed sources, financial assurance is not required ($^{14}\text{C}:800/1000 + ^{60}\text{Co}:5000/1000000 = 0.805$).

REQUIREMENT TO PROVIDE FINANCIAL ASSURANCE

There are many authorized uses of radioactive material. The conditions of use, physical form of the radioactive material and its exposure potential to humans and the environment vary among licensees. These variances dictate the extent of financial assurance requirements, are included in the regulations and are described in this document.

For general or specific licensees that must provide a financial assurance arrangement, either a specified amount of \$25,000 is required for certain quantities of sealed sources, or submittal of a Reclamation Plan and Cost Estimate for approval by the Agency is required to determine the amount of financial assurance. Once the Agency approves the Reclamation Plan and Cost Estimate, the applicant must secure a financial assurance arrangement for at least the amount specified on the approved cost estimate. After the facility is properly decommissioned, the Agency may conduct confirmatory surveys to verify decontamination has been achieved. After license termination is granted, upon written request, the financial assurance arrangement will be returned.

Requirements for a Specified Amount of \$25,000 Financial Assurance

The regulations, to minimize the expenses of preparing a reclamation plan and cost estimate for many general and specific licensees, provide a set amount of financial assurance for a category of licensees with sealed sources. These licensees are required to post a financial assurance arrangement in the amount of \$25,000. These are:

- Licensees with sealed sources that are greater than 37GBq (1 Ci) per source but not exceeding the quantities in Appendix A of Part 326.

A licensee may choose to prepare a reclamation plan and cost estimate (described below) to demonstrate that the cost to decontaminate the licensed facility is less than the prescribed posting amount of \$25,000.

Requirement To Develop a Reclamation Plan and Cost Estimate

Licensees who do not qualify for complete exemption from financial assurance or for the pre-set \$25,000 amount may be required to prepare a Reclamation Plan and Cost Estimate to determine the amount of financial assurance required by the Agency. Licensees required to prepare these documents are generally those who possess large sealed sources or loose material that is not exempt. These licensees are:

- Major Possessors;
- Those who possess radioactive material in forms other than noble gases or sealed sources with half-lives greater than 30 days, but less than or equal to 275 days, in quantities exceeding 37 GBq (1 Ci) per nuclide;
- Those who possess source material tailings or sludge;
- Category III or IV irradiators (pool irradiators);
- Particle accelerators to manufacture radionuclides for distribution to other licensees or customers; and
- Facilities owned or operated by the U.S. Department of Energy (DOE) or its contractors or subcontractors, if subject to the regulatory control of the Illinois Emergency Management Agency.

These licensees do not need to include material exempted by Part 326.50 (b), listed as exempted material above, in their Reclamation Plan and Cost Estimate.

FINANCIAL ASSURANCE ARRANGEMENTS

A listing of the types of financial assurance arrangements is provided below. References to more detailed descriptions and the content required in the arrangement are provided. The licensee must choose from the financial assurance arrangements specified. These are:

- Surety Bond – identified in Part 326.100 with required wording specified in Part 326 Appendix B;
- Letter of Credit – identified in Part 326.110 with required wording specified in Part 326 Appendix C;

- Certificate of Deposit –identified in Part 326.120 with required wording specified in Part 326 Appendix D;
- Self-Guarantee – identified in Part 326.130 with financial tests identified in Part 326.140 and required wording specified in Part 326 Appendix E; or
- Parent Company Guarantee – identified in Part 326.150 with financial tests identified in Part 326.160 and required wording specified in Part 326 Appendix F.

If a licensee chooses to use more than one financial assurance arrangement per facility, the combination of arrangements must equal the amount of financial assurance approved by the Agency.

If a licensee chooses to use a financial assurance arrangement for more than one license, or more than one facility in Illinois, the amount of the arrangement must be equal to the sum of the arrangements that would be available if a separate financial assurance arrangement had been filed and maintained for each license or facility. A listing indicating, for each facility, the license number(s), name(s), address(es) and amount(s) of funds provided should be included in the submittal.

When choosing an institution to supply the financial assurance arrangement, the licensee should ensure that the institution is, for a surety bond, on the *U.S. Department of the Treasury's Listing of Approved Sureties (Department Circular 570)* most recent edition or, for a letter of credit, a regulated institution authorized to issue letters of credit. The wording of the arrangements must comply with the regulations.

If a licensee chooses to comply with the requirements of a certificate of deposit, the licensee should assure that the interest is not capitalized but transferred to another account.

REVIEW PROCESS FOR THE FINANCIAL ASSURANCE DOCUMENTS

A licensee required to file a financial assurance arrangement must submit a draft arrangement for review. If a Reclamation Plan and a Cost Estimate are also required, a financial assurance arrangement will not be accepted until the Agency approves the Reclamation Plan and Cost Estimate. Review of the Reclamation Plan and Cost Estimate is performed concurrent with the review of the license application or amendment request. The licensee must provide sufficient information in the Reclamation Plan and Cost Estimate to cover all aspects of the operation and probable extent of contamination.

Once the draft arrangement has been approved, the licensee will be asked, in writing, to submit the final arrangement within 30 days. If the requirement for posting

the necessary financial assurance is for a new license or is the result of a requested amendment by the licensee, the amendment or the new license will not be issued until the Agency has received the final financial assurance arrangement. The licensee is required to review the Reclamation Plan periodically to determine if changes are necessary and determine if costs need to be revised. If an increase in financial assurance becomes necessary, the licensee must submit an updated financial assurance arrangement.

The Reclamation Plan and the Cost Estimate are considered companion documents. The Reclamation Plan provides the description of the decommissioning process and the Cost Estimate presents the costs attributed to the process. This guide describes each document separately to assist in distinguishing how the required information should be addressed.

RECLAMATION PLAN AND COST ESTIMATE

The Reclamation Plan and the Cost Estimate provide a basis for determining the amount of financial assurance necessary for decommissioning the licensed facility/site. The amount defined in the facility-specific cost estimate becomes the minimum level of financial assurance coverage. Methods and solutions different from those set out in this guidance document for the Reclamation Plan and Cost Estimate will be acceptable if they provide a valid basis for the Agency to make determinations for approving the cost estimate. Section 326.80 codifies the information the Agency will consider in approving the Plan and Cost Estimate. These include, but are not limited to:

- 1) The probable extent of contamination throughout the facility and/or site;
- 2) The cost of removal of contamination to the level for unrestricted release conforming to 32 IAC 340 Appendix A, or as described in 32 IAC 330.325(b)(1)(B)(ii);
- 3) A description of the probable contaminating events associated with the licensee's methods or modes of operation;
- 4) An inventory of the potentially contaminating materials including:
 - a) the quantities
 - b) half-lives and
 - c) chemical and physical forms of the radioactive materials
- 5) A description of the radiation hazards and toxicities of the radioactive materials;

- 6) The extent and location of actual or possible off-site contamination with licensed materials;
- 7) The means of removal and disposal of contaminated materials and radioactive sources which are or would be generated, stored, processed, or otherwise present at the licensed facility or site; and
- 8) The means for reclaiming the property on which the facility or site is located and all other properties contaminated by radioactive material authorized under the license.

The Reclamation Plan

The Reclamation Plan must provide a level of detail for the Agency to determine the completeness and accuracy of the cost estimate. The Reclamation Plan should include, but not be limited to, the following:

- Detailed description of the facility and site (acreage, water and utilities, etc.);
- Site maps and facility drawings with dimensions;
- Quantities and types of material authorized by the licensee;
- Discussion on processes used and where these materials are used in operations;
- Description of facility components and equipment (fume hoods, labs, production lines, etc.);
- Description of probable extent of contamination; and
- Decontamination techniques to be used.

The Cost Estimate

The Cost Estimate, or the probable cost to terminate the license, provides the logic and support for the financial assurance amount. The Cost Estimate should be itemized in sufficient detail to allow independent evaluation by the Agency. Methods and solutions different from those presented in this guidance document are acceptable provided a clear basis is presented to allow the Agency to make a determination for approving the Cost Estimate.

Cost Estimates, at a minimum, should:

- Identify the year costs are based;
- Be site specific;
- Be based on the assumption that independent contractors perform all decontamination, reclamation, storage, and disposal including engineering services, chemical tests, and radiological surveys or analyses, as applicable;
- Be based on abandonment at the height of operations with the maximum possession of materials in inventory as authorized on the license;
- Ensure units designating dimensions and/or volume are consistent throughout the cost estimate, either English or metric units, but not both;
- Include costs due to inflation for those activities that take several years to complete; and
- Do not include credits for resale and/or salvage of used equipment, facilities, or other similar items or services.

Cost factors to include are:

- Staff training needs, management oversight;
- Planning and preparation of all supporting documents (Work Plans, Health and Safety Plans, Final Status Surveys);
- Labor costs (direct and indirect costs);
- Non-labor costs such as:
 - Packaging materials
 - Shipping costs (may be included as labor costs for some facilities)
 - Disposal costs including transportation and any surcharges
 - Other equipment and supplies (e.g., personal protective equipment, cleaning materials)
 - License fees, permits, insurance, taxes, etc.
- If decay-in storage is a viable option, cost of space rental and periodic radiation monitoring and security;

- Restoration of facilities, contaminated areas and grounds (unrestricted release);
- Final radiation survey;
- Site stabilization; and
- Allowance for contingencies.

Assumptions used in the preparation of the cost estimate should be identified and justified and submitted as part of the Cost Estimate. To aid the applicant, presented in Appendix B are several listings of items to be included in the Cost Estimate depending on the material possessed. Examples of technical factors to be considered in estimating reclamation costs are included later in this document. These factors are not intended to be all-inclusive but to provide a basis for the applicant to provide complete site-specific cost estimates.

The Agency acknowledges that some licensees (e.g., pool irradiators, licenses with several large sealed sources, etc.) may not require extensive reclamation plans and cost estimates to substantiate their proposed financial assurance amounts. However, information submitted should be supported by verifiable data and logic based on the description of actual operations and realistic potential contamination conditions. For example, if decay-in-storage of radioactive material at the facility is part of normal operations, the licensee must factor in time to decay its inventory, the cost for storage space rental, and security and monitoring over the decay period.

Agency experience has identified that reclamation plans tend to under estimate cleanup work because of unknown areas of potential contamination. Also, with the uncertainty in waste disposal costs and other costs associated with decommissioning, the cost estimate should apply a contingency factor of 25 percent to the sum of all estimated decommissioning costs. The Agency may consider adjustments to the contingency (up or down) depending upon the comprehensive nature of the estimate, the type of work being performed, the radionuclides being used, and the basis of the cost estimate.

Factors To Be Considered In Estimating Reclamation Costs

Soil and Facilities

Items to be included, as applicable, in the Cost Estimate:

1. Removal and disposal of all contamination in or on structures or removal and disposal of the contaminated structures, including concrete pads, process plants, offices, laboratories, and other associated buildings.

2. Dismantling, removing and disposing of pipe, wellheads, surge tanks, plant satellite equipment and other equipment.
3. When considering radioactive facility components, be sure to consider the number of glove boxes, fume hoods, ventilation ductwork, hot cells, sinks and drains, and floor and wall surfaces.
4. Removal and disposal of contaminated soil related to site operations including soil from under facilities.
5. Removal of uncontaminated roads, parking lot, etc., if required to get to contaminated areas.
6. Soil preparation, leveling or contouring and revegetation.
7. Removal and disposal of fluid and/or sediments, liners, contaminated soil below the liners, and associated equipment, e.g., pumps and pipes.
8. Backfilling with uncontaminated material, including a layer of topsoil to support the growth of vegetation.

Groundwater

Items to be included when groundwater must be remediated to meet the requirements of 32 IAC Part 340, as applicable, in the cost estimate:

1. Restoration of contaminated groundwater quality at least to levels prescribed in the regulations.
2. Decontamination and/or disposal of restoration associated surface equipment.
3. Proper disposal of restoration generated waste materials.

CONTACT

For any questions regarding the process, the licensee or his representative may contact the Manager of LLRW and Site Decommissioning, Bureau of Environmental Safety at (217) 782-1329 or the Manager of Radioactive Materials, Bureau of Radiation

Safety at (217) 785-9947. Correspondence may be addressed to either representative at 1035 Outer Park Drive, Springfield, Illinois 62704.

Comments and suggestions for improving this guide are encouraged. The guide will be revised, as appropriate, to accommodate comments and to reflect new information or experience. Comments should be sent to:

Manager, LLRW and Site Decommissioning
Bureau of Environmental Safety
Illinois Emergency Management Agency
1035 Outer Park Drive
Springfield, Illinois 62704

#

REFERENCES

Illinois Administrative Code / Title 32 / Chapter II: Illinois Emergency Management Agency.

Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Nureg-1575 and EPA 402-R-97-016; August 2000.

U.S. Nuclear Regulatory Commission (NRC), NUREG-1757, Volume 3, Consolidated NMSS Decommissioning Guidance: Financial Assurance, Recordkeeping, and Timeliness, September 2003

APPENDIX A

**32 IAC Part 326 Appendix A –
Quantities of Material for Major Possessor Determination**

**32 IAC Part 326 Appendix A –
Quantities of Material for Major Possessor Determination**

Radionuclide	Abbrev.	UNSEALED FORMS		SEALED SOURCES	
		MBq	mCi	GBq	Ci
Actinium-227	Ac-227	0.037	0.001	370	10
Aluminum-26	Al-26	370	10	37000	1000
Americium-241	Am-241	0.037	0.001	370	10
Americium-242m	Am-242m	0.037	0.001	370	10
Americium-243	Am-243	0.037	0.001	370	10
Antimony-125	Sb-125	3700	100	37000	1000
Barium-133	Ba-133	3700	100	37000	1000
Berkelium-247	Bk-247	0.037	0.001	370	10
Berkelium-249	Bk-249	3.7	0.1	37000	1000
Beryllium-10	Be-10	37	1	37000	1000
Bismuth-207	Bi-207	370	10	37000	1000
Bismuth-210m	Bi-210m	3.7	0.1	37000	1000
Cadmium-109	Cd-109	37	1	37000	1000
Cadmium-113	Cd-113	3700	100	37000	1000
Cadmium-113m	Cd-113m	3.7	0.1	37000	1000
Calcium-41	Ca-41	3700	100	37000	1000
Californium-248	Cf-248	0.37	0.01	3700	100
Californium-249	Cf-249	0.037	0.001	370	10
Californium-250	Cf-250	0.037	0.001	370	10
Californium-251	Cf-251	0.037	0.001	370	10
Californium-252	Cf-252	0.037	0.001	370	10
Carbon-14	C-14	37000	1000	37000	1000
Cerium-144	Ce-144	37	1	37000	1000
Cesium-134	Cs-134	370	10	37000	1000
Cesium-135	Cs-135	3700	100	37000	1000
Cesium-137	Cs-137	370	10	37000	1000
Chlorine-36	Cl-36	370	10	37000	1000
Cobalt-60	Co-60	37	1	37000	1000
Curium-243	Cm-243	0.037	0.001	370	10
Curium-244	Cm-244	0.037	0.001	370	10
Curium-245	Cm-245	0.037	0.001	370	10
Curium-246	Cm-246	0.037	0.001	370	10
Curium-247	Cm-247	0.037	0.001	370	10
Curium-248	Cm-248	0.037	0.001	370	10
Einsteinium-254 (276 days)	Es-254	0.37	0.01	3700	100
Europium-150 (34.2y)	Eu-150	37	1	37000	1000
Europium-152	Eu-152	37	1	37000	1000
Europium-154	Eu-154	37	1	37000	1000
Europium-155	Eu-155	370	10	37000	1000
Gadolinium-148	Gd-148	0.037	0.001	370	10

Radionuclide	Abbrev.	UNSEALED FORMS		SEALED SOURCES	
		MBq	mCi	GBq	Ci
Gadolinium-152	Gd-152	3700	100	37000	1000
Germanium-68	Ge-68	370	10	37000	1000
Hafnium-172	Hf-172	37	1	37000	1000
Hafnium-182	Hf-182	3.7	0.1	37000	1000
Holmium-166m	Ho-166m	37	1	37000	1000
Hydrogen-3	H-3	37000	1000	37000	1000
Indium-115	In-115	3700	100	37000	1000
Iodine-129	I-129	37	1	37000	1000
Iron-55	Fe-55	3700	100	37000	1000
Iron-60	Fe-60	37	1	37000	1000
Lanthanum-137	La-137	370	10	37000	1000
Lanthanum-138	La-138	3700	100	37000	1000
Lead-202	Pb-202	370	10	37000	1000
Lead-205	Pb-205	3700	100	37000	1000
Lead-210	Pb-210	0.37	0.01	3700	100
Lutetium-173	Lu-173	370	10	37000	1000
Lutetium-174	Lu-174	370	10	37000	1000
Lutetium-176	Lu-176	3700	100	37000	1000
Manganese-53	Mn-53	37000	1000	37000	1000
Manganese-54	Mn-54	3700	100	37000	1000
Mercury-194	Hg-194	37	1	37000	1000
Molybdenum-93	Mo-93	370	10	37000	1000
Neptunium-235	Np-235	3700	100	37000	1000
Neptunium-236 (1.15x10 ⁵ y)	Np-236	0.037	0.001	370	10
Neptunium-237	Np-237	0.037	0.001	370	10
Nickel-59	Ni-59	3700	100	37000	1000
Nickel-63	Ni-63	3700	100	37000	1000
Niobium-93m	Nb-93m	370	10	37000	1000
Niobium-94	Nb-94	37	1	37000	1000
Osmium-194	Os-194	37	1	37000	1000
Palladium-107	Pd-107	370	10	37000	1000
Platinum-193	Pt-193	37000	1000	37000	1000
Plutonium-236	Pu-236	0.037	0.001	370	10
Plutonium-238	Pu-238	0.037	0.001	370	10
Plutonium-239	Pu-239	0.037	0.001	370	10
Plutonium-240	Pu-240	0.037	0.001	370	10
Plutonium-241	Pu-241	0.37	0.01	3700	100
Plutonium-242	Pu-242	0.037	0.001	370	10
Plutonium-244	Pu-244	0.037	0.001	370	10
Potassium-40	K-40	3700	100	37000	1000
Promethium-144	Pm-144	370	10	37000	1000
Promethium-145	Pm-145	370	10	37000	1000
Promethium-146	Pm-146	37	1	37000	1000
Promethium-147	Pm-147	370	10	37000	1000
Protactinium-231	Pa-231	0.037	0.001	370	10

Radionuclide	Abbrev.	UNSEALED FORMS		SEALED SOURCES	
		MBq	mCi	GBq	Ci
Radium-226	Ra-226	3.7	0.1	37000	1000
Radium-228	Ra-228	3.7	0.1	37000	1000
Rhenium-186m	Re-186m	370	10	37000	1000
Rhenium-187	Re-187	37000	1000	37000	1000
Rhodium-101	Rh-101	370	10	37000	1000
Rhodium-102	Rh-102	370	10	37000	1000
Rubidium-87	Rb-87	3700	100	37000	1000
Ruthenium-106	Ru-106	37	1	37000	1000
Samarium-145	Sm-145	3700	100	37000	1000
Samarium-146	Sm-146	37	1	37000	1000
Samarium-147	Sm-147	3700	100	37000	1000
Samarium-151	Sm-151	370	10	37000	1000
Selenium-79	Se-79	3700	100	37000	1000
Silicon-32	Si-32	37	1	37000	1000
Sodium-22	Na-22	370	10	37000	1000
Strontium-90	Sr-90	3.7	0.1	37000	1000
Tantalum-179	Ta-179	3700	100	37000	1000
Tantalum-180m	Ta-180m	37000	1000	37000	1000
Techneium-97	Tc-97	37000	1000	37000	1000
Techneium-98	Tc-98	370	10	37000	1000
Techneium-99	Tc-99	3700	100	37000	1000
Tellurium-123	Te-123	3700	100	37000	1000
Terbium-157	Tb-157	370	10	37000	1000
Terbium-158	Tb-158	37	1	37000	1000
Thallium-204	Tl-204	3700	100	37000	1000
Thorium-228	Th-228	0.037	0.001	370	10
Thorium-229	Th-229	0.037	0.001	370	10
Thorium-230	Th-230	0.037	0.001	370	10
Thorium-232	Th-232	3700	100	37000	1000
Thulium-171	Tm-171	370	10	37000	1000
Tin-119m	Sn-119m	3700	100	37000	1000
Tin-121	Sn-121	37000	1000	37000	1000
Tin-126	Sn-126	370	10	37000	1000
Titanium-44	Ti-44	37	1	37000	1000
Uranium-232	U-232	0.037	0.001	370	10
Uranium-233	U-233	0.037	0.001	370	10
Uranium-234	U-234	0.037	0.001	370	10
Uranium-235	U-235	0.037	0.001	370	10
Uranium-236	U-236	0.037	0.001	370	10
Uranium-238	U-238	3700	100	37000	1000
Vanadium-49	V-49	37000	1000	37000	1000
Zirconium-93	Zr-93	37	1	37000	1000
Thorium-natural		3700	100	37000	1000
Uranium-natural		3700	100	37000	1000

When a combination of nuclides is involved, the limit for the combination shall be derived as follows: For each nuclide, determine the ratio between the quantity authorized on the license and the quantity established in this Appendix A for the form of the material (sealed source or unsealed material). If the sum of the ratios for all nuclides is greater than one, then the licensee shall post financial assurance arrangements.

AGENCY NOTE: Possession of special nuclear material (Plutonium, Uranium-233 and Uranium-235) is limited to quantities not sufficient to form a critical mass as defined in 32 IAC 310.20.

APPENDIX B

GUIDANCE FOR RECLAMATION PLAN AND COST ESTIMATE

APPENDIX B

Guidance for Reclamation Plan and Cost Estimate

The Reclamation Plan and Cost Estimate will vary depending on the material and use. As a minimum all Reclamation Plans and Cost Estimates should include:

- Detailed description of the facility and site where material has been and/or is planned to be used,
- Quantities and types of material authorized by the license,
- Techniques to be used in removing the material and contamination, and
- Shipping and disposal costs and/or costs for returning material to the supplier.

To aid the applicant, the Agency has prepared several lists shown below of what should be included for some of the different types of licensees required to provide Plans. In all cases the items specified above should be included even if they are not included in the lists below.

Sealed Sources

- Removal from the facility
- Wipe tests
- Packaging
- Shipping costs
- Disposal costs or cost to return to supplier (if applicable).

Small Irradiators

Typically, suppliers will provide an estimate to oversee the removal, packaging and shipping of irradiators. This estimate must be included in the cost estimate. Any additional rigging expenses must be included as well.

Large Irradiators

For large irradiators, the licensee must follow the procedures identified in Nureg/CR-6280, *Technology, Safety, and Costs of Decommissioning a Reference Large Irradiator and Reference Sealed Sources*. Costs must be in present day U.S. dollars and include up to date disposal costs or supplier return fees.

Licensees with Loose Material

The list presented below is intended to be comprehensive but not all-inclusive. Plans and estimates may be more comprehensive or less comprehensive depending on the work being performed, extent of potential contamination, amount of material licensed, etc.

- Description of facility and site including facility components and equipment,
- Quantities and types of radioactive material (including sealed sources),
- Processes used and locations of use at the facility,
- Probable extent of contamination,
- Decontamination techniques to be used,
- Cost estimate (different formats are acceptable as long as the items below are included and can be differentiated),
 - Planning, including detailed characterization for complex cases, and preparation,
 - Worker training (Occupational Safety and Health Training, radiation protection, etc.),
 - Worker rates (i.e. Health physicists, HP technicians, clerical, supervisors, laborers, welders, electricians, etc.),
 - Sealed source disposal (wipe test, packaging, etc.),
 - Decontamination,

- Inventory disposal,
- Cost for material needs such as gloves, tools, coveralls, respirators, waste and shipping drums, etc.,
- Waste description,
- Waste packaging and shipping,
- Final Status Survey,
- Verification by the Agency, and
- Allowance for contingencies (25%).

The Agency expects all Reclamation Plans and Cost Estimates to be as complete as necessary for the Agency to determine its adequacy. It should be noted that for any termination (full license or part of a facility) the Agency charges for review of planning documents, performance of oversight surveillance (as necessary) and final verification. The hourly rate is cited in 32 IAC 331.200.