Licensing Guidance for Well Logging

This supplement is intended for use by applicants desiring to obtain licensure, amendments, or renewal for authorization to possess radioactive sealed sources and unsealed radioactive material for use in well-logging operations. See NUREG-1556 Vol. 14 Rev. 1 for additional guidance.

NOTE: Please submit all hard copy correspondence in duplicate.

I. NEW and RENEWAL Applications for a Radioactive Material License

Include the following information with a letter requesting a new or renewed radioactive materials license:

A. Include a fully completed "Application for Radioactive Material License", form (RH 2050), executed by an individual with financial and legal responsibility for the company accompanied by appropriate fees.

If more space is required, the information specified on form RH 2050 may be provided on attachments thereto. Further guidance is provided in the appendices that follow.

Form RH2050 may be obtained online from the department's website at: https://www.cdph.ca.gov/CDPH%20Document%20Library/ControlledForms/rh2050.pdf

B. All information requested in Appendices A-I of this guidance, as applicable.

II. AMENDMENT Applications to a Radioactive Material License

For amendment requests, please provide a letter from the Radiation Safety Officer or an individual with financial and legal responsibility for the company requesting the required changes. Also include the information requested in the appropriate appendices of this checklist.

Amendments to a Radioactive Material License may include, but are not limited to, changes to any of the items listed below:

1. Company Ownership
2. Mailing / Billing Address
3. Radioactive Material Authorization
4. Personnel
5. Permanent Storage location(s)
6. Radiation Safety Program

7. Termination of Radioactive Materials License

Appendix A: Entity Information

1. **Entity**
    a. Name of the company, business entity, or individual (if self-employed) as you would have it appear on the license.
    b. Articles of Incorporation,
    c. Current Business License at the location of use.
    d. Company tax identification number (EIN **and** State Tax ID number) or Social Security Number (if self-employed).
    e. Physical address (cannot be a P.O. Box).
    f. Mailing address (may be a P.O. Box), and
    g. Company Phone and fax numbers and email address.
2. **Billing and Annual Fees**
    a. Provide the name, title, mailing address, phone, and email address of the person responsible for accounts payable, and
    b. Provide a check payable to the Radiologic Health Branch for the required annual fees. A fee calculation worksheet is provide on the department's website at: https://www.cdph.ca.gov/Programs/CEH/DRSEM/CDPH%20Document%20Library/RHB/RML/RAMfeeWorksheet.pdf

    NOTE: Temporary job site authorization counts as one use location and must be accounted for in billing.
3. **Temporary Jobsites**
    a. Indicate whether temporary jobsites are required.
4. **Change of Ownership**
    a. For Change of Ownership amendment requests, please also provide the change of ownership form signed by representatives with financial and legal authority for both, the buyer and the seller, in addition to the items listed above.

    A sample ownership change form may be obtained online at: https://www.cdph.ca.gov/Programs/CEH/DRSEM/CDPH%20Document%20Library/RHB/RML/RHB-OwnershipChange.docx
    b. Provide an Organizational Chart (RSO and above) with names, titles, and contact information of individuals.

Appendix B: Radioactive Material Authorization

1. Nuclide

a. Name the nuclide(s) (e.g., Iodine-131, Krypton-85, Cesium-137, etc.)

b. State *maximum* activity of each nuclide, and *maximum* individual source activity for sealed sources (e.g., “Not to exceed 100 millicuries” or “2 sealed sources not to exceed 50 millicuries each”).

c. Specify the *form* of the radioactive material (e.g., sealed source, liquid, gas, labeled frac sand, etc.)

d. For *sealed sources,* specify the following:

   i. Manufacturer(s) and

   ii. Model number(s) (Sealed source (ABC Corp. Model DEF)),

   iii. Specify the number of sources to be possessed under the license.

2. Proposed Use

a. Clearly state the intended use of each radionuclide (e.g., “To be used as tracers in oil, gas, and geothermal wells” or “To be used as a component of tools for well logging”).

b. To provide flexibility, well-logging licenses do not list the various devices in which sealed sources are used, with the exception of the Mount Sopris Instrument Company Model HLP-2375 gamma probe.

   Note that this type of license does not permit manufacturing and distribution.

3. Changes in Possession Limit

a. To change Possession Limit, provide a letter requesting the change.

b. To add a new radionuclide, provide the same information as in sections 1 and 2 of this Appendix, as appropriate.

c. For a decrease in possession limit for sealed sources, provide the following:

   i. Receipt(s) for transfer of sources signed by both the licensee and the party accepting the sources,

   ii. Radioactive Material License Number of the recipient if a California licensee, or a copy of the Radioactive Material License if an NRC or another agreement state licensee,

   iii. Leak tests of all sources transferred, and

   iv. Disposition documents (e.g., use logs, disposal records, etc.).

Appendix C: Radiation Safety Officer and Authorized Users

1. Radiation Safety Officer (RSO) and Alternate Radiation Safety Officer (ARSO)

a. Provide a letter from the person with legal and financial responsibility for the company, naming the RSO and ARSO.

b. Provide the phone, fax, cell phone (24-hr contact phone), and email address for the RSO and ARSO.

c. Provide the completed Statement of Training and Experience (form RH2050A) for the RSO and ARSO. Form RH2050A may be downloaded from the department's website at:

https://www.cdph.ca.gov/CDPH%20Document%20Library/ControlledForms/rh2050a.pdf

d. Confirm that the RSO and ARSO have received training that meets the requirements of 17 CCR 30348.1(a) and provide copies of their training certificates.

e. Provide copies of the 40-hour Radiation Safety Officer training certificates for both the RSO and ARSO.

f. For RSO – provide the executed Duties and Responsibilities and Delegation of Authority, which may be obtained from the department website at:

https://www.cdph.ca.gov/CDPH%20Document%20Library/ControlledForms/cdph8243IR1.pdf

https://www.cdph.ca.gov/CDPH%20Document%20Library/ControlledForms/cdph8243IR6.pdf

g. For ARSO – provide the executed Duties and Responsibilities and Delegation of Authority, which may be obtained from the department website at:

https://www.cdph.ca.gov/CDPH%20Document%20Library/ControlledForms/cdph8243IA1.pdf

https://www.cdph.ca.gov/CDPH%20Document%20Library/ControlledForms/cdph8243IA6.pdf

h. Provide an Organizational Chart (RSO and above) with names, titles, and contact information of individuals.

i. An updated Emergency Call-down list that includes the names and phone numbers (day and 24-hour numbers) of:

1. RSO,
2. ARSO (if applicable),
3. Source manufacturer(s),
4. Numbers listed below for local inspection agency and RHB:

24 Hour Radiation Emergency Assistance	**1-800-852-7550**
RHB Sacramento	**1-916-327-5106**

RHB Richmond	**1-510-620-3416**
RHB Brea	**1-714-524-1409**

2. Reviewing Officials

Licensees who possess Category 1 or Category 2 quantities of radioactive materials are required by 10 CFR 37.23 to appoint one or more Reviewing Officials. Reviewing Officials are the only individuals who may make trustworthiness and reliability (T&R) determinations that allow individuals to have unescorted access to Category 1 or Category 2 quantities of radioactive materials possessed by the licensee.

To appoint an individual as a Reviewing Official the licensee must submit a certification that meets the following requirements:

a. The certification must be signed by an individual who has signature authority for the company (e.g., President, CEO, etc.)

b. The certification is provided under oath or affirmation using a notary public to authenticate oaths or affirmations and to certify that the information provided is correct and true; or the certification is provided using an unsworn declaration with the specific statement that “I declare [or certify, verify, state] under penalty of perjury that the foregoing is true and correct. Executed on [date] [signature].”

c. The T&R determination date of the proposed Reviewing Official is provided. T&R determinations are only valid for 10 years.

Note: a Reviewing Official may not appoint other Reviewing Officials.

3. Authorized Users: Well-Logging Supervisors and Assistants

a. Provide a list of Well-Logging Supervisors for inclusion on the license.

    i. Confirm that all logging supervisors have received training that meets the requirements of 17 CCR 30348.1(a).

    ii. Provide copies of training certificates.

b. Lists of Well-Logging Assistants do not need to be submitted for approval for inclusion on the license. The licensee is to keep their qualifications on file, available for inspection. The training of Well-Logging Assistants must meet the requirements of 17 CCR 30348.1(b).

Appendix D: Radiation Detection and Personnel Monitoring

1. Radiation Detection

Per 17 CCR 30346.2 and 10 CFR 39.33, licensees must possess operable and calibrated radiation detection/measurement instruments to perform package, vehicle, and tracer material radiation contamination surveys of equipment, vehicles, personnel, and sites, prescreening of sealed source leak tests, and unrestricted area dose rate measurements. Instruments must meet the following requirements:

a. Instruments must be calibrated at least every six months.

b. Instruments must be capable of measuring beta and gamma radiation at intensities ranging from 0.1 mR/hour through at least 50 mR/hour.

c. Instruments must be appropriate for the type of radiation to be measured and the type of measurement to be taken (e.g., count rate, dose rate, etc.).

d. The number of instruments must be commensurate with the scope and size of licensed operations.

Confirm that you will meet the above requirement and provide information on the number, type, make/model, and intended use of instruments you will possess. State whether you will have the instruments calibrated by an outside vendor or you will calibrate them in-house. If calibrated in-house, confirm following the procedures in Appendix H of this guidance.

2. Personnel Monitoring and Bioassay

a. During the handling of licensed radioactive material, logging supervisors, logging assistants, and other personnel performing non-routine operations must wear on the trunk of the body a personnel dosimeter that is processed and evaluated by an NVLAP-accredited processor and is sensitive to the types of radiation to which the individual is exposed. If film badges are used, they should be replaced at least monthly, and other personnel dosimeters [e.g., thermoluminescent dosimeters (TLDs) or optically stimulated luminescence dosimeters (OSLs)] should be replaced at least quarterly.

   Confirm that the required personnel dosimeters will be processed and evaluated by an NVLAP-accredited entity, will be exchanged at the required frequency, will be assigned to and worn by well logging supervisors and logging assistants, and specify the dosimetry provider, the type of dosimeter used, and the frequency of exchange.

b. Bioassay services may be required when individuals work with unsealed radioactive material. Bioassays or air sampling are required if working with quantities, chemical and physical forms, and activities that make it likely that the radionuclide will be ingested, inhaled, or absorbed, resulting in an intake in excess of 10 percent of the applicable annual limit on intakes (ALIs) in Table 1, Columns 1 and 2, of Appendix B to 10 CFR Part 20. One ALI results

in a committed effective dose equivalent (CEDE) of 5 rems or a committed dose equivalent (CDE) of 50 rems.

i. Confirm that you will develop, maintain, and implement a bioassay program when using unsealed radioactive tracer materials (see Appendix G of this guidance); or

ii. Confirm that in lieu of developing a bioassay program, you will contract with a vendor for bioassay services, and confirm that the vendor is licensed or otherwise authorized by the NRC or an Agreement State to provide required bioassay services; or

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

Appendix E: Facilities and Equipment

1. Adding a permanent storage location

a. Describe the permanent storage location(s).

b. Provide a street address where the sources will be stored,

   i. Residential storage is prohibited,

   ii. NOTE: Different licensees shall not share the same storage area.

   iii. Commit to post the following at each storage location:

      1. "Caution, Radioactive Material" sign with the international radiation symbol,

      2. "Notice to Employees" (Form RH-2364, provided by the Department), and

      3. Current copy of

         a) The radioactive material license,

         b) The state and federal regulations (Title 17, California Code of Regulations, and Title 10, Code of Federal Regulations, Part 20), and

         c) The operating and emergency procedures.

         d) Or commit to post a notice that describes these three documents and states where they are kept available for review.

c. Submit an 8-1/2” x 11” diagram of the storage location(s),

   i. Specify the location of the sources within the room,

   ii. Describe all adjacent areas and their use (e.g., office, storage, parking lot, neighboring suite), and

   iii. Indicate on the diagram the location of the nearest full-time workstation,

   NOTE: No full-time workstation can be located within 10 feet of the source storage area. Consider neighboring suites as well.

d. Provide a copy of the building agreement or disharmony letter with the building owner, if applicable.

e. Commit to maintain radiation levels below 2mR/hr for all unrestricted areas.

f. Describe the storage box/cabinet/room (i.e., construction material and approximate dimensions).

g. Indicate the maximum number of sources/devices that the storage box/cabinet/room can hold.

h. Describe (or indicate on the diagram) the security used to prevent unauthorized access to sources. Confirm meeting the security requirements of 10 CFR Part 37 if required.

i. Confirm restricting access to radioactive material to Authorized Users, and state who has access. Only individuals determined to be trustworthy and reliable by the Reviewing Official (RO) shall have unescorted access to Category 1 and Category 2 quantities of radioactive material – see section 2 of Appendix C of this Guidance. In the absence of a valid RO certified per 10 CFR 37.23, licensees shall not permit individuals not deemed trustworthy and reliable within the last ten years unescorted access to Category 1 or Category 2 quantities of radioactive materials

j. Provide the land use zoning of the storage location (e.g., industrial, commercial).

k. If sources are stored at temporary jobsites, confirm that exposure rates to the public, security, and signage/postings will be the same as those used at the permanent storage facility.

2. Decommissioning a Storage/Use Location or Terminating a Radioactive Materials License

For decommissioning a location, or terminating the radioactive materials license, use the following guidelines:

1. For sealed sources, please follow *Guidance for Termination or Decommissioning for Licensees Using Radioactive Material in Sealed Sources*.
2. For unsealed radioactive material of short half-life (≤ 120 days), please follow *Guidance for Termination or Decommissioning for Licensees Using Short Half-life (≤ 120 days) Radioactive Material.*
3. For unsealed radioactive material of long half-life (≥ 120 days), please follow *Guidance for Termination or Decommissioning for Licensees Using Long Half-Life (≥ 120 days) Radioactive Material.*

Appendix F: Radiation Safety Program

1. Radiation Safety Program

Submit your Radiation Safety Program (RSP). Include the following list of items in your RSP. For additional information on radiation safety requirements for well logging, see 17 CCR 30345.1 through 17 CCR 30353 and USNRC publication NUREG-1556 Vol. 14 Rev. 1.

a. RSO Duties and Responsibilities.
b. Operating and Emergency procedures with an Emergency Call-down list.
c. Procedures for handling sealed sources and devices.
d. Procedures for handling unsealed radioactive material.
e. Confirm that, prior to performing well-logging operations with a sealed source, you will obtain a written agreement with the well operator, well owner, drilling contractor, or landowner that meets the requirements of 17 CCR 30346.
f. Leak testing of well-logging sealed sources is required by 17 CCR 30346.3 and 17 CCR 30275. Provide the following:
    i. Confirm performing leak tests for sealed sources at intervals not to exceed 6 months,
    ii. Identify the individual or company who collects your leak test samples,

        NOTE: Only the RSO or individuals designated in writing by the RSO may collect leak test samples,
    iii. Commit to follow the manufacturer's instructions for collecting leak test samples,
    iv. Identify the vendor that provides your leak test kit, and
    v. Identify the vendor that performs your sample analysis.
g. Confirm that your transportation procedures meet the requirements of 17 CCR 30346.1 and 17 CCR 30373, and provide the following:
    i. Describe the type of vehicle used in transporting material.
    ii. Describe the package used.
    iii. Confirm use of blocking and bracing.
    iv. Marking/labeling of packages.
    v. Posting/placarding of vehicle.
    vi. Vehicle security.
    vii. Overnight stops.
    viii. Surveys of vehicles – external radiation level not to exceed 2 mR/hour.

ix. Submit a copy of the shipping paper. Please ensure it is using the correct shipping names and UN numbers. Also ensure that someone other than the driver is listed as the emergency contact list on the shipping paper. The emergency contact should be knowledgeable about the materials being shipping and their handling during emergencies.

x. Confirm that the following documents are carried in the vehicle:

1. The shipping paper (must be within arm's reach of the driver during transit.)
2. Copy of your license.
3. Authorized user list, signed by the RSO, and
4. Operating and emergency procedures with an emergency call down list.

xi. Special Form certificates.

xii. Change placards to signs if vehicle is used as temporary storage at a jobsite.

xiii. Accident reporting procedures.

xiv. Confirm that US DOT Hazmat training and refresher training are provided.

h. Provide your package receipt procedures and ensure that they meet the requirements of 10 CFR 20.1906.

i. Confirm that you will notify the Department as soon as practicable, but within 24 hours, of theft, loss, or damage to a source or device.

j. Confirm meeting the following record-keeping requirements:

i. Maintain records of receipt and transfer of sealed sources for three years.

ii. Maintain records of radiation survey instruments for three years.

iii. Maintain records of leak testing of sealed sources and devices containing depleted uranium for three years.

iv. Maintain records of quarterly inventory, to include:

1. Date of inventory.
2. Person conducting the inventory.
3. Radionuclide.
4. Activity in curies (for sealed sources) or mass (for devices using DU).
5. Location of sealed source or device.

6. Manufacturer, model, and serial number for each sealed source or device.

v. Maintain a utilization log, and submit a copy of the log, that includes:

1. Manufacturer, model and serial number of the device or container in which the sealed source is located.
2. Name and signature of the well logger to whom it is assigned.
3. Location where it is used.
4. Dates of use.
5. Maintain records for three years.

vi. Maintain records of inspection and maintenance of devices, transport and storage containers, associated equipment, and survey instruments.

vii. Maintain records of training and certification.

viii. Maintain copies of operating and emergency procedures.

ix. Maintain records of personnel monitoring procedures.

x. Maintain records of radiation surveys.

k. Confirm that National Source Tracking System (NSTS) reporting requirements as described in 10 CFR 20.2207 will be followed, if required.

l. Confirm performing an annual audit of the Radiation Safety Program. The audit should include compliance with regulations, license conditions, and operating and emergency procedures, record maintenance, and steps taken to correct deficiencies in the program.

m. Confirm providing annual radiation safety refresher training internally (e.g., by the RSO) or externally (e.g., by the manufacturer) to all users.

NOTE: All training records must be maintained for inspection.

n. Waste Disposal

i. Confirm that you will return sources to the manufacturer or to transfer them to another specific licensee of the U. S. Nuclear Regulatory Commission or an Agreement State.

NOTE: Receipt records must be provided at termination of this license.

ii. If using the decay-in-storage method of waste disposal, confirm following Appendix I.

o. Decontamination and Decommissioning

a. To decommission a use location:

i. Confirm that you will provide the Department with a 30-day written notification of your intent to vacate a use location.

ii. Provide a decommissioning survey with proposed release criteria.

iii. Provide current copies of leak tests results for all sealed sources stored at the location being vacated.

iv. Confirm that the location(s) will not be released for unrestricted use until an amendment releasing the location is issued by the Department.

b. For licenses with large quantities of radioactive material, a Decommissioning Funding Plan (DFP) and/or financial surety will be required. Refer to 10 CFR 30.35 and NUREG-1727 Volume 3 for more information.

Appendix G: Requirements for a Bioassay Program

This checklist serves to identify information to be submitted for authorization to either be a bioassay service provider or perform bioassays for your own employees.

Rather than provide bioassay services in-house, you may contract with an outside vendor to provide them. Bioassay services are available and provided by local hospitals, universities, or other vendors specifically approved by an NRC or Agreement State license to provide such services.

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

Thyroid Bioassay Program:

Submit the following:

1. Specify isotopes to be considered (e.g. I-125, I-123, I-131).
2. Submit a description and diagram of the measurement system, including the instruments, neck phantom, and the room it will be performed in.
3. Provide the manufacturer and model number of the instruments used to do the counting.
4. Describe the neck phantom (ANSI standard N44.3-1973) and the NIST traceable standard (rod) source (exempt) used for calibration (Regulatory Guide 8.20).
5. Provide the procedures used to calibrate the system, specify the frequency of calibrating the system, and demonstrate an adequate minimum detectable activity (MDA) for the system (15 nanocuries or less).
6. Provide the procedures for making the actual measurements and conversion of CPM to micro curies in the thyroid.
7. Describe how the microcurie results are converted to dose and ensure that the CEDE is determined for employees.
8. Confirm the action levels or investigational level using the thyroid burden results (no more than 10% of ALI) and how the results will be recorded and maintained for each employee.

9. Confirm performing a baseline measurement for new workers prior to working with the material and if the employee is leaving the position, perform a final measurement and dose summation.
10. Specify routine frequency of monitoring and performing a special bioassay on an as-needed basis in case of a possible uptake during a spill or accident.

If radioiodine is detected in the thyroids of personnel, it is recommended that air samples in the room should be checked to determine if there is a problem with ventilation. Action levels for I-125 can be set for 10 % of the Derived Air Concentration (DAC) in air (approximately 3×10^{-8} microcuries/ml of air). If the action level counted in the charcoal filter exceeds this amount, the ventilation system should be checked and iodination procedures reviewed.

Bioassays for H-3, C-14, P-32, or other isotopes:

Please provide the information listed above, as applicable to the isotope being measured, such as the equipment, procedures, method of counting, action or investigational levels, MDA, frequency of monitoring, and method of converting the result to a dose.

Personnel Monitoring Requirements for Internal Exposure

The licensee shall monitor occupational intakes of radioactive material by, and assess the committed effective dose equivalent to, individuals who may have exceeded or are likely to exceed, the limits specified in 10 CFR 20.1502(b). Suitable and timely measurements used for determination of such internal exposures shall be performed as specified by Section 20.1204.

References

Regulatory Guide 8.9 “Acceptable Concepts, Model, Equations and Assumptions for a Bioassay Program”.

Regulatory Guide 8.20 “Application of Bioassay for I-125 and I-131.”

Regulatory Guide 8.32, “Criteria for Establishing a Tritium Bioassay Program.”

ANSI HPS N13.14-1994, “Internal Dosimetry Programs for Tritium Exposure - Minimum Requirements”.

US NRC, Code of Federal Regulations, 10 CFR 20.1204.

NUREG/CR 4884/BNL-NUREG-52063 “Interpretation of Bioassay Measurements”, Appendix B (Page B-711)is a table for retention and excretion for H-3, (page B-484) for P-32, (Page B-587) for I-131.

ICRP 30, Part 1, Limits for Intakes of Radionuclides by Workers, “Metabolic Data for Phosphorous”.

Appendix H: Instrument Calibration Procedures Checklist

This checklist identifies items which need to be included to obtain authorization for calibration of instruments for in-house use or as a customer service. Additional information may be found in ANSI N323-1997 and NUREG-1556, Volume 14, Revision 1, Appendix H.

Exposure Rate Meters:

1. A facility diagram showing the location of the calibration device and range. Include expected or measured radiation levels in adjacent uncontrolled areas.
2. Describe security and posting of the area when the unit is in use.
3. Provide the manufacturer and model number of the calibration device and sealed source(s) contained within the device, as well as the isotope and activity of the source(s).
4. Confirm following ANSI N323A-1997 or provide the following information:
   (a) Assure NIST traceability to within 5 percent of the true activity of the calibration source or output (using thimble ion chambers). A 100 mCi source is considered adequate for calibration of ranges up to 1 R/hr. Smaller sources may be used for calibrating limited ranges (specify, if applicable).
   (b) Provide step-by-step operating procedures which include radiation safety precautions and personnel dosimetry. A minimum of 2 points per scale, separated by 50 percent full scale shall be included for each scale certified as calibrated to ± 10 percent (or to ± 20 percent with chart or graph attached to the instrument).
   (c) Attach a sample reporting form given to the customer or used to keep records for inspection.
   (d) Confirm performing an annual recharacterization of your working standard.

Contamination Survey Meters:

1. Contamination survey meters with a known cpm or mR/hr conversion may be calibrated as above, or:
   (a) Provide procedures which include the use of a pulse generator and a NIST-traceable source of sufficient strength to determine the efficiency of the probe.
   (b) Submit sealed source handling precautions and dosimetry as needed.
   (c) Refer to Items 4(b) and 4(c) above regarding calibration points, certification, and reporting forms.
2. If the user requires gamma and/or beta efficiency, address the following:
   (a) Confirm obtaining NIST traceable sources of similar radiations and energies to the types the end user would encounter.

(b) Submit the MDA equations that you will use, along with references. Alternatively, confirm that you will use the following Minimal Detectable Activity equation (or derivations) based on NUREG 1400:

(i) For scalers: MDA (dpm / 100 cm^2) = $4.65\sqrt{\frac{R_b}{E(\frac{A}{100})}}$

(ii) For ratemeters: MDA (dpm / 100 cm^2) = $4.65\sqrt{\frac{R_b/2T}{E(\frac{A}{100})}}$

(c) Refer to Items 4(b) and 4(c) above regarding calibration points, certification, and reporting forms.

Pocket Dosimeters:

Refer to ANSI N13.5-1972 (available from the Department).

Appendix I: Checklist for the Decay-in-Storage Method of Waste Disposal

1. Confirm that only radionuclides (sealed and unsealed) with half-lives less than or equal to 120 days will be considered for DIS.
2. Submit a description and a diagram of the area where the waste will be held in storage. Describe the shielding and security. Confirm that postings will meet the requirements of 10 CFR 20.1902.
3. Provide the frequency of surveys of adjacent areas and the DIS area along with the survey map and form in which survey results will be recorded.
4. Confirm that dose rates in adjacent unrestricted areas will not exceed 0.05 mrem/hr above background radiation levels or propose and justify higher limits that comply with 10 CFR 20.1301 and 10 CFR 20.1302.
5. Provide survey procedures including the following:
    a. Confirm that the inventory control system used to track individual bags, boxes, or other containers will include isotopes, activities, and date sealed and placed in storage.
    b. Confirm that waste will be held for a minimum of ten (10) half-lives prior to release from DIS.
    c. Confirm that waste will be surveyed and determined to be indistinguishable from background prior to disposal. The surveys are to be performed in low background areas that are not impacted by licensed radioactive materials.
    d. Identify instrumentation (see Table 1, below) used to perform surveys in the low background area. Surveys should include all outer surfaces of each container to be released (i.e., scan within 1 inch of the surface at a scan rate not greater than 1 inch per second).
    e. Confirm that waste will be segregated by half-life groups and type of emitted radiation.

Table 1

Type of Instrument (Recommended)	Pure Beta (P-32, S-35, Y-90)	Gamma or X-Ray (low energy) (I-125, Pd-103)	Gamma or X-Ray (moderate energy) (Tc-99m, Ga-67, Tl-201, Cr-51, Co-57, In-111, I-123, Ra-223)	Gamma or X-Ray (higher energy) (I-131 and PET Isotopes)
GM Pancake or equivalent (< 2.0 mg/cm^2 window)	X			
Thin crystal NaI (1" x 1mm)		X	X	
Thick crystal NaI (1" x 1")			X	X

6. Recommended instruments are listed in Table 1. If different instrumentation is proposed, submit supporting information, including the manufacturer's technical specifications of the instrument/system, to demonstrate that the instrumentation is appropriate for distinguishing above background radiation levels for the isotopes of concern.
7. Confirm that if new isotopes are added to the DIS program, instruments used for release surveys will be based on Table 1 or submit the new instrument to RHB for approval.
8. Confirm that all labels or similar markings, which indicate the presence of radioactive materials, will be removed or obliterated. This can be done as the waste is placed in containers, leaving only the outer container labels to be removed prior to release. If the waste is destined to be disposed of at a biomedical waste facility, internal labels do not need to be removed.
9. Confirm that the waste/DIS log will include disposal date, type of waste, surveys results, serial number for sealed sources, instrumentation used, and the name of the surveyor and will be maintained for (3) three years or until the next inspection.