



NORTH DAKOTA
DEPARTMENT OF HEALTH

Division of Air Quality

RADIOACTIVE MATERIAL
LICENSING GUIDE

Use of Radioactive Tracers in
Well Logging Operations
(Except Field Flooding Tracer Studies)

Revised February 2, 2006

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I. INTRODUCTION

This guide outlines the type of information needed to evaluate an application for a license to conduct radioactive tracer studies in oil, gas, water, etc. well logging operations. This guide is not intended for use in the preparation of applications for the utilization of multicurie tracers in secondary recovery operations. The radioactive materials typically used are radionuclides such as Cobalt-60, Iridium-192, or Iodine-131. The North Dakota Radiological Health Rules listed below apply to radioactive material licensees and should be used in conjunction with this guide. The applicant should carefully read the rules. This guide does not substitute for an understanding of the rules.

- A. Chapter 33-10-03, "Licensing of Radioactive Material."
- B. Chapter 33-10-04.1, "Standards for Protection Against Radiation."
- C. Chapter 33-10-10, "Notices, Instructions, and Reports to Workers- Inspections."
- D. Chapter 33-10-11, "Fees for Issuance of License and Registration Certificates and Inspections."
- E. Chapter 33-10-12, "Radiation Safety Requirements for Wireline Service Operations and Subsurface Tracer Studies."
- F. Chapter 33-10-13, "Transportation of Radioactive Material."

All information submitted as part of this application will be subject to North Dakota's Open Record Statute, Section 44-04-18, "Access to Public Records - Penalty" of the North Dakota Century Code. The information will be available to the public unless confidentiality is granted by the Department. Requests for confidentiality must be submitted in accordance with Section 23-20.1-09.1, "Confidentiality requests will be considered in accordance with the above mentioned statutes.

II. FILING AN APPLICATION

Information submitted should pertain to the specific activities for which authorization is sought and should be as complete and detailed as possible. Submission of incomplete information will result in delays because of correspondence necessary to obtain supplemental information. The information must be sufficient to allow the Department to determine that the proposed equipment, facilities, procedures and controls are adequate to protect health and minimize danger to life and property. The original copy of the application should be mailed to:

North Dakota Department of Health
Division of Air Quality
918 East Divide Avenue, 2nd Floor
Bismarck, ND 58501-1947
Phone: 701-328-5188
Fax: 701-328-5185

Since licensees are required to comply with Department rules, license conditions, and the content of submitted applications, at least one copy of all information submitted to the Department should be kept by the applicant for reference.

A radioactive material licensing guide for the "Use of Sealed Sources in Well Logging Operations" is available for activities involving radioactive material as sealed sources. The use of radioactive tracers and sealed sources may be combined in a single radioactive material application.

III. RADIOACTIVE MATERIAL LICENSE APPLICATION SFN 8414

The application (SFN 8414) should be completed following the instructions provided with the form. The signed original copy should be filed with the Department and one copy kept by the applicant. Since the space provided on the form is limited, additional sheets should be appended as necessary. Supplemental information should be labeled to identify the applicant and should reference the item for which information is being given. The following comments deal with the indicated items:

Item 1: Applicant and Locations of Use: The applicant corporation or other legal entity should be specified by name and mailing address in Item 1(a). Individuals should be designated as the applicant only if they are acting in a private capacity and the use of radioactive material is not connected with their employment with a corporation or other legal entity.

The actual sites of use should be given in 1(b). Permanent facilities such as laboratory or storage areas should be identified in 1(b) by street address, city, and state. A licensee is required to maintain a permanent in-state facility. In addition, field locations of wells should be indicated as "temporary job sites." Attach additional properly keyed sheets if more space is needed.

Item 4: Personnel: Each person who will use radioactive material must be named and his qualifications provided. A named individual must be present and directly supervise use at any temporary job site.

Item 5: Radiation Safety Officer: The individual designated as radiation safety officer (RSO) must be identified and a detailed description of his duties and training and experience must be provided. The RSO is the individual who will coordinate and have overall responsibility for the radiation safety program. Typical duties of the RSO might be:

- A. Verification of all purchases of radioactive materials for compliance with possession limits of the license.
- B. Periodic review of records such as personnel exposure records, logs of tracer usage, quarterly inventories, survey records, survey instrument calibration records and waste disposal records to assure management that the terms and conditions of the license and applicable rules are being met.
- C. Supervision of leak testing of sealed sources used in instrument calibrations.
- D. Supervision of all users to ensure that personnel monitoring equipment is being worn.
- E. Development of operating and emergency procedures and assistance in personnel training and orientation.
- F. Supervision to ensure that licensed material is properly secured against unauthorized removal at all times.
- G. Providing advice and help for accidents and emergencies.
- H. Maintenance of supplies such as radiation survey instruments, radiation signs, labels, warning tape, forms, and dosimeters.
- I. Conducting internal radiation safety audits of licensed activities annually to assure compliance with the rules and license conditions.

The RSO's qualifications should typically include 1) familiarity with Department rules as well as company requirements and procedures, 2) training in radionuclide handling techniques and safety practices, and 3) on-the-job experience actually handling comparable materials. Descriptions of on-the-job experience should include aspects such as: 1) degree of independent use of materials, 2) the types and quantities of materials handled, 3) the types of surveys and other radiation safety duties performed, 4) the name and address of the company or other employer where the experience was gained, and 5) the length of time over which the experience was obtained.

Item 6: Materials: For tracer materials, each isotope, chemical and/or physical form (e.g., iodine 131 as iodide in solution), and total activity in microcuries or millicuries for each isotope should be specified. The possession limit requested for each radionuclide should be sufficient to include radioactive materials in storage, including wastes.

Item 7: Use: The applicant should describe the proposed use for each radionuclide listed in Item 6 and indicate typical amounts of each radionuclide which will be handled at individual job sites. In particular, the applicant should indicate the type of wells in which the material will be used (e.g., gas, oil, mineral).

Items 8 & 9: Qualifications of Personnel Names in Item 4: A resume of the training and experience of each person who will directly supervise the use of material or will have radiological safety responsibilities should be submitted.

User qualifications should include 1) instructions in radiation safety practices appropriate for activities to be performed and in company requirements, manuals, and standard operating procedures and Department rules and 2) on-the-job experience actually handling comparable materials. Descriptions of on-the-job training should typically include: A) degree of independent use, B) the types and quantities of materials handled, C) the company or other employer where the experience was gained, D) the licensee's name and license number under which the experience was gained, and E) the length of time over which the training occurred.

Items 10 & 11: Radiation Detection Instruments: The survey and assay instruments that will be available at each site should be specified.

At least one low range beta-gamma (0-50 mr/hr) survey instrument shall be available at each temporary job site and shall accompany each vehicle carrying tracer material, unless only soft beta emitters (e.g., hydrogen-3) are to be used. [Survey instruments acquired before March 1, 1992, that measure 0-20 mr/hr satisfied this requirement until March 1, 1997.]

Instrument calibration provisions should be described. Checking electronic and battery function by use of check sources which are built into many survey instruments shall be supplemented with calibration on all ranges of survey instruments. Calibration at intervals not exceeding six months and calibration after repairs other than simple battery replacement shall be performed for survey instruments.

Any service company performing instrument repairs and calibrations for the applicant should be identified by name and address.

If the applicant proposes to perform in-house calibration of radiation detection instruments, the following information should be submitted:

- A. The type (i.e., radionuclide, manufacturers name and model number) and activity of each calibration source to be used.

- B. The specific step-by-step procedures to be used for instrument calibration, including radiation safety procedures to be followed during use of the calibration source, and
- C. The name and pertinent experience of each person who will perform instrument calibration.

Item 12: Personnel Monitoring: The type of personnel monitoring equipment (film badge, TLD, dosimeters) should be specified including the name and address of the commercial supplier of the service, the type of radiation (gamma and/or beta) monitored, the frequency of evaluation, and the type of services to be obtained from a commercial supplier. The specification of equipment should include whether the monitoring device is designed to evaluate whole body or extremity exposure. If pocket chambers or pocket dosimeters are to be used, the type, range, frequency of reading, and maintenance and calibration provisions should be specified.

Film badges or TLD personnel monitoring devices are required for well logging operations. The acceptable exchange frequencies are monthly for film badges and quarterly for TLD's. If levels of activity greater than 100 millicuries of gamma emitters are handled on a regular basis, the use of self-reading dosimeters may become necessary to check on exposures during periods of use and at the end of the day.

Bioassays (thyroid checks, urinalysis, whole body counting, etc.) may be required when individuals work with multimillicurie quantities of hydrogen-3, iodine-125 or iodine-131 depending on the type of work, equipment used, and procedures followed. For example, if an individual handles 50 millicuries of iodine-131 per week in noncontained form, thyroid checks should be made. If 100 millicuries of hydrogen-3 in noncontained form is handled at a single time or 100 millicuries/week on a continuing basis, urinalysis should be performed. The criteria to be used in determining the need for bioassays and the type of bioassays that will be performed, should be described. If a commercial bioassay service is to be used, the name and address of the firm should be provided.

Item 13: Facilities and Equipment: The facilities and equipment to be used to ensure security and safe use and storage of materials should be described. In describing available equipment and facilities, the following information should be included:

- A. Storage provisions: The description of storage facilities should include drawings or sketches of the rooms, buildings, pits, vehicles, etc. showing shielding materials (concrete, steel, lead, earth, etc.), and means for securing materials from unauthorized removal. Storage facilities should be designed and materials positioned so that radiation levels do not normally exceed 2 mR/hr at 18" from the exterior surface of the storage facility.
- B. General safety equipment: A description of protective clothing (such as rubber gloves or coveralls), auxiliary shielding, absorbent materials, injection equipment, secondary containers, plastic bags for storing contaminated clothing, tissue, handling tools, etc. that will be available at well sites should be submitted.
- C. Facilities and equipment for sample preparation: If tracer samples are not to be purchased in ready to use form, laboratory or field office facilities that are to be maintained as restricted areas for sample preparation should be described. Sketches are helpful. Hoods, sinks, trays with absorbent materials, remote handling tools, rubber gloves, etc. which will be available at these laboratory sites should also be described.

Item 14: Radiation Protection Program: Procedures should be established to ensure compliance with the provisions of Chapters 33-10-03, "Licensing of Radioactive Material," 33-10-04.1, "Standards for Protection Against Radiation," 33-10-10, "Notices, Instructions, and Reports to Workers- Inspections," 33-10-11, "Fees for Issuance of License and Registration Certificates and Inspections," 33-10-12, "Radiation Safety Requirements for Wireline Service Operations and Subsurface Tracer Studies", and

33-10-13, "Transportation of Radioactive Material". The procedures should be specific and adequate to provide protection against potential external and internal radiation hazards associated with well logging activities.

Depending upon the types and quantities of materials and scope of planned use, the following information should be submitted:

- A. Records and Materials Management: Provisions for keeping and reviewing utilization logs and records of surveys, inventories, inspection and maintenance, personnel exposures, leak tests, receipt, use, and disposal of materials and employee training should be described. The documents and records to be maintained at field stations and at temporary job sites should be identified. Subsections 33-10-12-08.2 and 3 of the rules address the records requirements. Two copies of job log sheets or other standard forms for keeping records on field operations should be submitted.

Procedures for ordering materials, for receipt of materials, for notification of responsible persons upon receipt, and for safely opening packages should be established and described. Subsection 33-10-04.1-13.6 of the rules contains a number of specific requirements for such activities.

Management control of operations with tracers should include procedures to avoid injection into fresh water zones and to evaluate expected concentrations of radioactivity in water, oil, gas, or air released for unrestricted areas.

- B. Methods for Establishing, Posting, and Controlling Access to Restricted Areas: The applicant should establish and describe procedures for posting and controlling access to all work areas including laboratory type areas and field sites. When radiation levels are created which exceed 2 mR/hr the applicant should establish and describe methods for controlling access to all operational areas. All unnecessary personnel should be restricted from the areas and the areas should be posted. For example, when radiation levels will exceed 5 mR/hr for an hour or more, "Caution-Radiation Area" signs must be posted, and when radiation levels will exceed 100 mR/hr for an hour or more "Caution - High Radiation Area" signs must be posted.

- C. Procedures for Transporting Radioactive Materials: The transport of radioactive materials over public roads by licensees is subject to the regulations of the Department of Transportation. Chapter 33-10-13 of the rules requires that DOT regulations be followed for transport of radioactive materials. The DOT regulations cover, among other things, radiation levels at package surfaces (not to exceed 10 mR/hr at 3 feet from any surface and 200 mR/hr at the surface of containers); contents, construction, and labeling of packages; placarding of vehicles; and accident reporting.

Procedures should be established to assure safe transport and should include at least the following: 1) methods for securing radioactive materials in vehicles to prevent shifting or unauthorized removal during transport, 2) a survey program including determination that radiation levels in the passenger compartment do not exceed 2 mR/hr, and 3) placarding vehicles on all four sides with "Radioactive" when required because Radioactive Yellow - III labeled packages are being transported.

When vehicles are used for storage, the requirements in Chapter 33-10-04.1 are applicable. Security from unauthorized removal, posting with "Caution - Radioactive Material," and radiation levels (verified by surveys) not exceeding 2 mR/hr are acceptable practices.

- D. Survey Program: A survey means an evaluation of the radiation hazards incident to the use, release, disposal, or presence of radioactive materials. When appropriate, such evaluation

includes a physical survey of the location of radiation or concentrations of radioactive materials present. The types, methods, and frequency of surveys should be specified.

For operations involving tracer materials, a survey program should include monitoring, with an appropriate survey meter, personnel (hands, feet, clothing) and all tools, equipment, and facilities at job sites for contamination and effectiveness of clean-up. Reasonable efforts should be made to remove all residual contamination.

Acceptable levels of residual contamination should be established. For example, when gamma survey meter readings are less than 0.2 mR/hr or three times background at an inch from the surfaces, equipment and facilities may be released for unrestricted use at job sites.

Short half-life wastes which are stored to allow physical decay to background levels should be surveyed with an appropriate instrument before discarding with normal trash. Any radioactive labeling should be defaced or destroyed before such disposal.

As discussed in previous sections, operations with tracers may require surveys to evaluate the adequacy of storage facility shielding to determine that packages comply with DOT requirements, and to determine if restricted areas must be established and posted.

- E. Operating and Emergency Procedures: Written standard operating and emergency procedures for operating personnel should be developed for the specific operations which will be performed and should be submitted with the application. The procedures may be incorporated into check off type sheets or other forms used on-site to keep records. Copies should be supplied to all employees who are responsible for job site use of materials and should be submitted as part of the application. Management review to be conducted to assure that the established radiation safety program is followed should be briefly described.

Instruction covering tracer operations should include at least the following:

1. Procedures for handling samples, including sample preparation, and injection methods. The instructions should also include methods for establishing, posting, and controlling access to the area; prevention of contamination of site, equipment, and personnel; tools and protective clothes and equipment to be used in performing the tracer study; and maintenance of records generated by logging personnel at temporary jobsites.
2. Procedures to be used for picking up, receiving, and opening packages containing radioactive material.
3. Survey programs. The required frequency and methods of surveys, instruments to be used, records to be kept, and contamination limits to be observed should be specified.
4. Decontamination procedures. These should cover cleaning up spills, use of protection clothing and equipment, and decontamination of personnel and equipment including acceptable contamination limits.
5. Waste disposal procedures. The disposal methods to be used, surveys to be made, and records to be kept should be specified.
6. Emergency procedures. Procedures to follow in case of vehicle accidents, fire or explosion, personnel contamination or overexposures, or similar emergency situations should be explained. These instructions should describe immediate action

to be taken in order to prevent contamination of work areas and personnel, the need for restriction and/or evacuation of the area, and indicate procedures for containment of spills. The instructions should specifically state the names and telephone numbers of responsible persons (owners, management, Department of Health) to be notified in case of an emergency. Subsection 33-10-04.1-16 of the rules contains a number of specific requirements for the occasions and methods for reporting incidents.

7. Inventory. A physical inventory of all radioactive material be performed at least as frequently as once per quarter.
8. Inspection and maintenance. Injection tools and storage containers shall be inspected for routine maintenance at least every six months.

Item 15: Waste Disposal: Wastes from tracer operations such as unused materials, contaminated tissues, gloves, tools, clothing, containers, etc. should be disposed of in accordance with Section 33-10-04.1-14 of the rules. The specific disposal methods to be used should be indicated.

Short half-life materials may be stored to allow decay to background radiation levels. Containment and security during storage should be provided and described.

A commonly used method of disposal is transfer to a commercial firm licensed to accept such wastes. In dealing with such firms, prior contact is recommended to determine the specific services that will be provided.

If other methods of disposal not specified above or in Section 33-10-04.1-14 are requested, the information specified in Subsection 33-10-04.1-14.2 should be submitted. The type of information should include quantities and kinds of materials, levels of radioactivity, a description of the manner and conditions of disposal, an evaluation of environmental considerations, and control procedures.

IV. AMENDMENT AND RENEWAL OF LICENSES

Applications for amendment of existing licenses should be filed in the same manner as initial applications or may be filed in letter form. The application should clearly identify the license which is to be amended by license number. The exact nature of the requested changes should be specified and additional supporting information, as necessary, should be provided.

Licenses are normally issued for a period of five years. An application for license renewal filed thirty days or more before expiration assures that the existing license will not expire until the new application has been finally acted upon by the Department.

Renewal applications should be filed using Form SFN 8418 and should contain complete and up-to-date information concerning the applicant's current program. References to previously submitted documents should be clear and specific and specify the document by date and indicate pertinent information by page and paragraph. There is no fee associated with license renewal.

Upon submitting an application, the appropriate fee should accompany the application as directed in Chapter 33-10-11. For an amendment to an existing license the fee is \$200. The annual fee for a well-logging license is \$2500 (or \$1200 if a Small Entity), and must be paid by January 1 each year the license is active. Fee payments shall be made by check, draft, or money order made payable to the North Dakota Department of Health.