DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

Hazardous Materials and Waste Management Division

RADIATION CONTROL - RADIATION SAFETY REQUIREMENTS FOR WELL LOGGING AND SUBSURFACE TRACER STUDIES

6 CCR 1007-1 Part 16

[Editor's Notes follow the text of the rules at the end of this CCR Document.]

Adopted by the Board of Health July 20, 2016

PART 16: RADIATION SAFETY REQUIREMENTS FOR WELL LOGGING AND SUBSURFACE TRACER STUDIES

16.1 Purpose and scope.

16.1.1 Authority.

Rules and regulations set forth herein are adopted pursuant to the provisions of Sections 25-1-108, 25-1.5-101(1)(l), and 25-11-104, CRS.

16.1.2 Basis and Purpose.

A statement of basis and purpose accompanies this part and changes to this part. A copy may be obtained from the Department.

16.1.3 Scope.

The regulations in this part establish radiation safety requirements for use of sources of radiation or licensed materials including sealed sources, radioactive tracers, radioactive markers, and uranium sinker bars in well logging. This part also prescribes radiation safety requirements for persons using sources of radiation or licensed materials in these operations.

16.1.4 Applicability.

The regulations in this part apply to all applicants, licensees or registrants who use sources of radiation for well logging or wireline service operations including mineral-logging, radioactive markers, or subsurface tracer studies. The requirements of this part are in addition to, and not in substitution for, the requirements of Parts 1, 2, 3, 4, 8, 10, 17, and 22 of these regulations.

16.1.5 Published Material Incorporated by Reference.

Published material incorporated in Part 16 by reference is available in accord with Part 1, Section 1.4.

16.2 Definitions.

As used in this part, these terms have the definitions set forth as follows.

"Energy compensation source" (ECS) means a small sealed source, with an activity not exceeding 3.7 MBq (100 microcuries), used within a logging tool, or other tool components, to provide a reference standard to maintain the tool's calibration when in use.

"Field station" means a facility where radioactive sources may be stored or used and from which equipment is dispatched to temporary jobsites.

"Injection tool" means a device used for controlled subsurface injection of radioactive tracer material.

"Irretrievable well-logging source" means any sealed source containing licensed material that is pulled off or not connected to the wireline that suspends the source in the well and for which all reasonable effort at recovery has been expended.

"Logging assistant" means any individual who, under the personal supervision of a logging supervisor, handles sealed sources or tracers that are not in logging tools or shipping containers or who performs surveys required by 16.22.

"Logging supervisor" means an individual who uses sources of radiation or provides personal supervision in the use of sources of radiation at a temporary jobsite and who is responsible to the licensee for assuring compliance with the requirements of the Department's regulations and the conditions of the license.

"Logging tool" means a device used subsurface to perform well-logging.

"Mineral logging" means any logging performed for the purpose of mineral exploration other than oil or gas.

"Personal supervision" means guidance and instruction by the logging supervisor who is physically present at the jobsite and watching the performance of the operation in such proximity that contact can be maintained and immediate assistance given as required.

"Radioactive marker" means radioactive material placed subsurface or on a structure intended for subsurface use for the purpose of depth determination or direction orientation. For purposes of this part, this term includes radioactive collar markers and radioactive iron nails.

"Safety review" means a periodic review provided by the licensee for its employees on radiation safety aspects of well-logging, with opportunities for employees to ask safety questions. The review shall include, as appropriate, the results of internal inspections, new procedures or equipment, and accidents or errors that have been observed.

"Source holder" means a housing or assembly into which a radioactive source is placed for the purpose of facilitating the handling and use of the source in well-logging operations.

"Subsurface tracer study" means the release of a substance tagged with radioactive material for the purpose of tracing the movement or position of the tagged substance in the well-bore or adjacent formation.

"Surface casing for protecting fresh water aquifers" means a pipe or tube used as a lining in a well to isolate fresh water aquifers from the well.

"Temporary jobsite" means a location where radioactive materials are present for the purpose of performing well logging or subsurface tracer studies.

"Tritium neutron generator target source" means a tritium source used within a neutron generator tube to produce neutrons for use in well-logging applications.

"Uranium sinker bar" means a weight containing depleted uranium used to pull a logging tool down toward the bottom of a well.

"Well" means a drilled hole in which well logging and subsurface tracer studies are performed. As used in this part, "well" includes drilled holes for the purpose of oil, gas, mineral, groundwater, or geological exploration.

"Well-logging" means all operations involving the lowering and raising of measuring devices or tools which may contain sources of radiation or are used to detect radioactive materials in wells or cavities for the purpose of obtaining information about the well or adjacent formations which may be used in oil, gas, mineral, groundwater, or geological exploration.

"Wireline" means a cable which may or may not contain electrical conductors which is used to lower and raise logging tools in the well.

"Wireline service operation" means any evaluation or mechanical service which is performed in the well using devices on a wireline.

16.3 Specific licenses for well logging.

16.3.1 The Department will approve an application for a specific license for the use of radioactive material in well logging if the applicant meets the following requirements:

16.3.1.1 The applicant shall satisfy the general requirements specified in Part 3, Sections 3.9, 3.9.1, 3.9.2, 3.9.4 and 3.14.1 for byproduct, source, and special nuclear material, as appropriate, and any special requirements contained in this part.

16.3.1.2 The applicant shall develop a program for training logging supervisors and logging assistants and submit to the Department a description of this program which specifies the:

(1) Initial training;

(2) On-the-job training;

(3) Annual safety reviews (refresher training) provided by the licensee;

(4) Means the applicant will use to demonstrate the logging supervisor's knowledge and understanding of and ability to comply with the Department's regulations and licensing requirements and the applicant's operating and emergency procedures; and

(5) Means the applicant will use to demonstrate the logging assistant's knowledge and understanding of and ability to comply with the applicant's operating and emergency procedures.

16.3.1.3 The applicant shall submit to the Department written operating and emergency procedures as described in 16.16 that includes the important radiation safety aspects of the procedures.

16.3.1.4 The applicant shall establish and submit to the Department its program for annual inspections of the job performance of each logging supervisor and well logging assistant to ensure that the Department's regulations, license requirements, and the applicant's operating and emergency procedures are followed. Inspection records must be retained for 3 years after each annual internal inspection.

16.3.1.5 The applicant shall submit a description of its overall organizational structure as it applies to the radiation safety responsibilities in well logging, including specified delegations of authority and responsibility.

16.3.1.6 If an applicant wants to perform leak testing of sealed sources, the applicant shall identify the manufacturers and the model numbers of the leak test kits to be used. If the applicant wants to analyze its own wipe samples, the applicant shall establish procedures to be followed and submit a description of these procedures to the Department. The description must include the:

(1) Instruments to be used;

(2) Methods of performing the analysis; and

(3) Pertinent experience of the person who will analyze the wipe samples.

16.4 Agreement with well owner or operator.

16.4.1 A licensee may perform well logging with a sealed source only after the licensee has a written agreement with the employing well owner or operator. This written agreement must identify who will meet the following requirements:

16.4.1.1 In the event a sealed source is lodged downhole, a reasonable effort will be made to recover it.

16.4.1.2 A person may not attempt to recover a sealed source in a manner which, in the licensee’s opinion, could result in its rupture.

16.4.1.3 The radiation monitoring required in 16.22.7 will be performed.

16.4.1.4 If the environment, any equipment, or personnel are contaminated with radioactive material, they must be decontaminated before release from the site or release for unrestricted use; and

16.4.1.5 If the sealed source is classified as irretrievable after reasonable efforts at recovery have been expended, the requirements of 16.25.4.2(1), 16.25.4.2(2), 16.25.4.2(3) and 16.25.6 must be implemented within 30 days.

16.4.2 The licensee shall retain a copy of the written agreement for 3 years after the completion of the well logging operation.

16.4.3 A licensee may apply, pursuant to Part 1, Section 1.5.1, for Department approval, on a case-by-case basis, of proposed procedures to abandon an irretrievable well logging source in a manner not otherwise authorized in 16.4.1.5.

16.4.4 A written agreement between the licensee and the well owner or operator is not required if the licensee and the well owner or operator is part of the same corporate structure or otherwise similarly affiliated. However, the licensee shall still otherwise meet the requirements in 16.4.1.1 through 16.4.1.5.

EQUIPMENT CONTROL

16.5 Limits on levels of radiation.

Sources of radiation shall be used, stored, and transported in such a manner that the transportation requirements of Part 17 and the dose limitation requirements of Part 4 of these regulations are met.

16.6 Storage precautions.

16.6.1 The licensee shall store each source of radiation, except an accelerator, in a storage container or transportation package.

16.6.1.1 The container or package must be locked and physically secured to prevent tampering or removal of radiation sources from storage by unauthorized personnel.

16.6.1.2 Sources of radiation shall be stored in a manner which will minimize danger from explosion or fire.

16.7 Transport precautions.

16.7.1 The licensee shall lock and physically secure the transport package containing radioactive material in the transporting vehicle to prevent accidental loss, tampering, or unauthorized removal of the radioactive material from the vehicle.

16.8 Radiation survey instruments.

16.8.1 The licensee or registrant shall keep a calibrated and operable radiation survey instrument capable of detecting beta and gamma radiation at each field station and temporary jobsite to make the radiation surveys required by this part and by Part 4 of these regulations. To satisfy this requirement, the radiation survey instrument must be capable of measuring 0.001 mSv (0.1 mrem) per hour through at least 0.5 mSv (50 mrem) per hour.

16.8.2 The licensee shall have available additional calibrated and operable radiation detection instruments sensitive enough to detect the low radiation and contamination levels that could be encountered if a sealed source is ruptured. The licensee may own the instruments or may have a procedure to obtain them quickly from a second party.

16.8.3 Each radiation survey instrument shall be calibrated:

16.8.3.1 At intervals not to exceed 6 months and after each instrument servicing;

16.8.3.2 For linear scale instruments, at two points located approximately 1/3 and 2/3 of full-scale on each scale; for logarithmic scale instruments, at midrange of each decade, and at two points of at least one decade; and for digital instruments, at appropriate points; and

16.8.3.3 So that accuracy within 20 percent of the true radiation level can be demonstrated on each scale.

16.8.4 Calibration records shall be maintained for a period of 3 years after the date of calibration for inspection by the Department.

16.9 Leak testing of sealed sources.

16.9.1 Requirements.

Each licensee who uses a sealed source shall have the source tested for leakage periodically. The licensee shall keep a record of leak test results in units of becquerel (Bq) or microcuries (uCi) and retain the record for inspection by the Department for 3 years after the leak test is performed.

16.9.2 Method of Testing.

16.9.2.1 Tests for leakage shall be performed using a leak test kit or method approved by the Department, the NRC, or an Agreement State.

16.9.2.2 The wipe test sample shall be taken from the nearest accessible point to the surface of the sealed source where contamination is likely to accumulate.

16.9.2.3 The wipe test sample shall be analyzed for radioactive contamination.

16.9.2.4 The analysis shall be capable of detecting the presence of 185 Bq (0.005 microcuries) of radioactive material on the wipe test sample and must be performed by a person specifically approved by the Department, the NRC, or an Agreement State to perform the analysis.

16.9.3 Test Frequency.

16.9.3.1 Each sealed source of radioactive material (except an energy compensation source (ECS)) shall be tested at intervals not to exceed 6 months. In the absence of a certificate from a transferor indicating that a test has been made within 6 months prior to the transfer, the sealed source shall not be used until tested.

16.9.3.2 Each ECS that is not exempt from testing in accordance with 16.9.5 must be tested at intervals not to exceed 3 years. In the absence of a certificate from a transferor indicating that a test has been made within the 3 years prior to the transfer, the ECS shall not be used until tested.

16.9.4 Leaking or Contaminated Sources.

If, for any reason, it is suspected that a sealed source may be leaking, it shall be removed from service immediately and tested for leakage as soon as practical.

16.9.4.1 If the wipe test reveals the presence of 185 Bq (0.005 microcuries) or more of removable radioactive material, the licensee shall immediately withdraw the source from use and shall cause it to be decontaminated and repaired, or disposed of, by a licensee authorized by the Department, the NRC, or Agreement State to perform these functions.

16.9.4.2 The licensee shall check the equipment associated with the leaking source for radioactive contamination and, if contaminated, have it decontaminated or disposed of by a licensee authorized by the Department, NRC, or Agreement State to perform these functions.

16.9.4.3 The licensee shall submit a report to the Department within 5 days of receiving the test results. The report must describe the equipment involved in the leak, the test results, any contamination which resulted from the leaking source, and the corrective action taken up to the time the report is made.

16.9.5 Exemptions from testing requirements.

The following sources are exempted from the periodic leak test requirements of 16.9.1 through 16.9.4:

16.9.5.1 Hydrogen-3 (tritium) sources;

16.9.5.2 Sources of radioactive material with a half-life of 30 days or less;

16.9.5.3 Sealed sources of radioactive material in gaseous form;

16.9.5.4 Sources of beta- or gamma-emitting radioactive material with an activity of 3.7 MBq (100 microcuries) or less; and

16.9.5.5 Sources of alpha- or neutron emitting radioactive material with an activity of 0.37 MBq (10 microcuries) or less.

16.10 Physical inventory.

16.10.1 Each licensee or registrant shall conduct a semi-annual physical inventory to account for all sources of radiation received and possessed under the license.

16.10.2 Records of inventories shall be maintained for 3 years from the date of the inventory for inspection by the Department and shall include:

16.10.2.1 The quantities and kinds of sources of radiation;

16.10.2.2 The location where sources of radiation are assigned;

16.10.2.3 The date of the inventory; and

16.10.2.4 The name of the individual conducting the inventory.

16.10.3 Physical inventory records may be combined with leak test records.

16.11 Records of material use.

16.11.1 Each licensee or registrant shall maintain current records for each use of sources of radiation which shall include:

16.11.1.1 The make, model number, and a serial number or a description of each source of radiation used;

16.11.1.2 In the case of unsealed radioactive material used for subsurface tracer studies and radioactive markers, the radionuclide and quantity of activity used in a particular well and the disposition of any unused tracer materials;

16.11.1.3 The identity of the well-logging supervisor who is responsible for the licensed material and the identity of logging assistants present; and

16.11.1.4 The locations and date of use of the sources of radiation.

16.11.2 The licensee shall make the records required by 16.11.1 available for inspection by the Department. The licensee shall retain the records for 3 years from the date of the recorded event.

16.12 Design, performance, and certification criteria for sealed sources used in downhole operations.

16.12.1 A licensee may use a sealed source for use in well logging applications if:

16.12.1.1 The sealed source is doubly encapsulated;

16.12.1.2 The sealed source contains radioactive material whose chemical and physical forms are as insoluble and non-dispersible as practical; and

16.12.1.3 Meets the requirements of 16.12.3.1, 16.12.3.2, or 16.12.3.3, as appropriate.

16.12.2 Reserved

16.12.3 Each sealed source, except energy compensation sources (ECS) and those containing radioactive material in gaseous form, used in downhole operations, shall be certified by the manufacturer, or other testing organization acceptable to the Department, as meeting the sealed source performance requirements for oil well-logging:

16.12.3.1 For a sealed source manufactured on or before July 14, 1989, a licensee may use the sealed source, for use in well logging applications, if it meets the requirements of United States Of America Standards Institute (USASI) N5.10-1968, “Classification of Sealed Radioactive Sources” (1968), or the requirements in 16.12.3.2 or 16.12.3.3.

16.12.3.2 For a sealed source manufactured after July 14, 1989, a licensee may use the sealed source, for use in well logging applications, if it meets the oil well logging requirements of American National Standards Institute / Health Physics Society (ANSI/HPS) N43.6-1997, “Sealed Radioactive Sources Classification” (November 1997).

16.12.3.3 For a sealed source manufactured after July 14, 1989, a licensee may use the sealed source, for use in well logging applications, if the sealed source's prototype has been tested and found to maintain its integrity after each of the following tests:

(1) Temperature test. The test source must be held at minus 40°C for 20 minutes, 600°C for 1 hour, and then be subject to a thermal shock test with a temperature drop from 600°C to 20°C within 15 seconds.

(2) Impact test. A 5-kg steel hammer, 2.5 cm in diameter, must be dropped from a height of 1 m onto the test source.

(3) Vibration test. The test source must be subject to a vibration from 25 Hz to 500 Hz at 5 g amplitude for 30 minutes.

(4) Puncture test. A 1-gram hammer and pin, 0.3 cm pin diameter, must be dropped from a height of 1 m onto the test source.

(5) Pressure test. The test source must be subject to an external pressure of 1.695×10^7 pascal [24,600 pounds per square inch absolute].

16.12.4 Certification documents shall be maintained for inspection by the Department for a period of 3 years after source disposal. If the source is abandoned downhole, the certification documents shall be maintained until the Department authorizes disposition.

16.12.5 The licensee may use an energy compensation source (ECS) which is contained within a logging tool, or other tool components, only if the ECS contains quantities of licensed material not exceeding 3.7 MBq (100 microcuries).

16.12.5.1 For well logging applications with a surface casing for protecting fresh water aquifers, use of the ECS is only subject to the requirements of 16.9, 16.10, and 16.11.

16.12.5.2 For well logging applications without a surface casing for protecting fresh water aquifers, use of the ECS is only subject to the requirements of 16.4, 16.9, 16.10, 16.11, and 16.25.1 through 16.25.5.

16.12.6 The requirements in 16.12.1, 16.12.3.1, 16.12.3.2, and 16.12.3.3 do not apply to sealed sources that contain radioactive material in gaseous form.

16.12.7 The requirements in 16.12.1, 16.12.3.1, 16.12.3.2, and 16.12.3.3 do not apply to Energy Compensation Sources (ECS). ECSs must be registered with the Department under Part 3, Section 3.12.14 or with NRC or an Agreement State.

16.12.8 Use of a tritium neutron generator target source, containing quantities not exceeding 1,110 GBq (30 curies) and in a well with a surface casing to protect fresh water aquifers, is subject to the requirements of Part 16 except Sections 16.4, 16.12.1 through 16.12.7, and 16.25.1 through 16.25.5.

16.12.9 Use of a tritium neutron generator target source, containing quantities exceeding 1,110 GBq (30 curies) or in a well without a surface casing to protect fresh water aquifers, is subject to the requirements of Part 16 except Section 16.12.1 through 16.12.7.

16.13 Labeling.

16.13.1 The licensee may not use a source, source holder, or logging tool containing radioactive material unless the smallest component that is transported as a separate piece of equipment with the radioactive material inside bears a durable, legible, and clearly visible marking or label. The marking or labeling must contain the standard radiation caution symbol specified in Part 4, Section 4.27, without the conventional color requirements, and the following wording:

DANGER* – RADIOACTIVE MATERIAL

*or “CAUTION”

16.13.2 The licensee may not use a container to store radioactive material unless the container has securely attached to it a durable, legible, and clearly visible label. The label must contain the standard radiation caution symbol specified in Part 4, Section 4.27 and the following wording:

DANGER*- RADIOACTIVE MATERIAL

NOTIFY CIVIL AUTHORITIES [OR NAME OF COMPANY]

*or “CAUTION”

16.13.3 The licensee may not transport radioactive material unless the material is packaged, labeled, marked, and accompanied with appropriate shipping papers in accordance with the requirements of Part 17.

16.13.4 The licensee may use a uranium sinker bar in well logging applications only if it is legibly impressed with the following wording:

CAUTION--RADIOACTIVE--DEPLETED URANIUM

and

NOTIFY CIVIL AUTHORITIES [OR COMPANY NAME] IF FOUND

16.14 Inspection and maintenance.

16.14.1 Each licensee shall visually check source holders, logging tools, and source handling tools, for defects before each use to ensure that the equipment is in good working condition and that required labeling is present.

16.14.1.1 If defects are found, the equipment must be removed from service until repaired, and a record must be made listing: the date of check, name of inspector, equipment involved, defects found, and repairs made. These records must be retained for 3 years after the defect is found.

16.14.2 Each licensee shall have a program for semiannual visual inspection and routine maintenance of source holders, logging tools, injection tools, source handling tools, storage containers, transport containers, and uranium sinker bars to ensure that the required labeling is legible and that no physical damage is visible.

16.14.2.1 If defects are found, the equipment must be removed from service until repaired, and a record must be made listing: date, equipment involved, inspection and maintenance operations performed, any defects found, and any actions taken to correct the defects. These records must be retained for 3 years after the defect is found.

16.14.3 Removal of a sealed source from a source holder or logging tool, and maintenance on sealed sources or holders in which sealed sources are contained may not be performed by the licensee unless a written procedure developed pursuant to 16.16 has been approved either by the Department, NRC, or an Agreement State to perform this operation.

16.14.4 If a sealed source is stuck in the source holder, the licensee shall not perform any operation, such as drilling, cutting, or chiseling, on the source holder unless the licensee is specifically approved by the NRC, or an Agreement State to perform this operation.

16.14.5 The repair, opening, or modification of any sealed source shall be performed only by persons specifically authorized to do so by the Department, the NRC, or an Agreement State.

REQUIREMENTS FOR PERSONNEL SAFETY

16.15 Training requirements.

16.15.1 The licensee or registrant may not permit any individual to act as a logging supervisor as defined in this part until such individual:

16.15.1.1 Has completed training in the subjects outlined in Appendix 16A and demonstrated an understanding thereof;

16.15.1.2 Has received copies of and instruction in:

(1) The regulations contained in the applicable sections of Parts 1, 4, 10 and 16 of these regulations or their equivalent;

(2) The license or certificate of registration under which the logging supervisor will perform well logging; and

(3) The licensee's or registrant's operating and emergency procedures required by 16.16;

16.15.1.3 Has completed on-the-job training and demonstrated competence in the use of sources of radiation, remote handling tools, and radiation survey instruments by a field evaluation; and

16.15.1.4 Has demonstrated understanding of the requirements in 16.15.1.1, and 16.15.1.2 by successfully completing a written test.

16.15.2 The licensee may not permit an individual to act as a logging assistant until that person has:

16.15.2.1 Has received instruction in the applicable sections of Parts 1, 4, and 10 of these regulations or their equivalent;

16.15.2.2 Has received copies of, and instruction in, the licensee's or registrant's operating and emergency procedures required by 16.16; and

16.15.2.3 Has demonstrated understanding of the materials listed in 16.15.2.1, and 16.15.2.2 by successfully completing a written or oral test; and

16.15.2.4 Has received instruction in the use of sources of radiation, remote handling tools, and radiation survey instruments, as appropriate for the logging assistant’s intended job responsibilities.

16.15.3 The licensee shall provide safety reviews (refresher training) for logging supervisors and logging assistants at least once during each calendar year.

16.15.4 The licensee shall maintain a record on each logging supervisor’s and logging assistant’s training and annual safety review (refresher training).

16.15.4.1 The training records must include copies of written tests and dates of oral tests given after July 14, 1987.

16.15.4.2 The training records must be retained until 3 years following the termination of employment.

16.15.4.3 Records of annual safety reviews (refresher training) must list the topics discussed and be retained for 3 years.

16.16 Operating and emergency procedures.

Each licensee or registrant shall develop and follow written operating and emergency procedures that cover:

16.16.1 Handling and use of sources of radiation to be employed so that no individual is likely to be exposed to radiation doses in excess of the standards established in Part 4 of these regulations;

16.16.2 Methods and occasions for conducting radiation surveys, including surveys for detecting contamination, as required by 16.22.3 - 16.22.5;

16.16.3 Methods and occasions for locking and securing sources of radiation;

16.16.4 Personnel monitoring and the use of personnel monitoring equipment;

16.16.5 Transportation to temporary jobsites and field stations, including the packaging and placing of sources of radiation in vehicles, placarding of vehicles, and securing sources of radiation during transportation to prevent accidental loss, tampering, or unauthorized removal;

16.16.6 Minimizing personnel exposure including exposures from inhalation and ingestion of licensed tracer materials;

16.16.7 Procedure for notifying proper personnel in the event of an accident;

16.16.8 Maintenance of records;

16.16.9 Use, inspection and maintenance of source holders, logging tools, source handling tools, storage containers, transport containers, and injection tools;

16.16.10 Procedure to be followed in the event a sealed source is lodged downhole;

16.16.11 Procedures to be used for picking up, receiving, and opening packages containing radioactive material;

16.16.12 For the use of tracers, decontamination of the environment, equipment, and personnel;

16.16.13 Maintenance of records generated by logging personnel at temporary jobsites; and

16.16.14 Actions to be taken if a sealed source is ruptured, including actions to prevent the spread of contamination and minimize inhalation and ingestion of radioactive material and actions to obtain suitable radiation survey instruments as required by 16.8.

16.17 Personnel monitoring.

16.17.1 No licensee or registrant shall permit any individual to act as a logging supervisor or to assist in the handling of sources of radiation unless each such individual wears, at all times during the handling of such sources, a personnel dosimeter that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor.

16.17.1.1 Each personnel dosimeter shall be assigned to and worn by only one individual.

16.17.1.2 Film badges must be replaced at least monthly. Other types of personnel dosimeter must be replaced at least quarterly.

16.17.1.3 After replacement, each personnel dosimeter must be promptly processed.

16.17.2 The licensee shall provide bioassay services to individuals using licensed materials in subsurface tracer studies if required by the license.

16.17.3 Personnel monitoring records shall be maintained for inspection until the Department authorizes disposition.

PRECAUTIONARY PROCEDURES IN LOGGING AND SUBSURFACE TRACER OPERATIONS

16.18 Security.

16.18.1 A logging supervisor must be physically present at a temporary jobsite whenever licensed materials are being handled or are not stored and locked in a vehicle or storage place. The logging supervisor may leave the jobsite in order to obtain assistance if a source becomes lodged in a well.

16.18.2 During each logging or tracer application, except when the radiation sources are below ground or in shipping or storage containers, the logging supervisor or other individual designated by the logging supervisor shall maintain direct surveillance of the operation to prevent unauthorized or unnecessary entry into a restricted area, as defined in Part 1 of these regulations.

16.19 Handling tools.

The licensee shall provide and require the use of tools that will assure remote handling of sealed sources other than low-activity calibration sources.

16.20 Subsurface tracer studies and radioactive markers.

16.20.1 The licensee shall require all personnel handling radioactive tracer material to use protective gloves, and if required by the licensee, other appropriate protective clothing and equipment. Precautions shall be taken to avoid ingestion or inhalation of radioactive material and to avoid contamination of field stations and temporary jobsites.

16.20.2 A licensee may not knowingly inject radioactive material into fresh water aquifers unless specifically authorized to do so by the Department and any other appropriate State agency.

16.20.3 The licensee may use radioactive markers in wells only if the individual markers contain quantities of licensed material not exceeding the quantities specified in Part 3, Schedule 3B. The use of markers is subject only to the requirements of 16.10.

16.21 Particle accelerators.

No licensee or registrant shall permit aboveground testing of particle accelerators, designed for use in well-logging, which results in the production of radiation, except in areas or facilities controlled or shielded so that the requirements of Part 4, Sections 4.6 and 4.14 of these regulations, as applicable, are met.

RADIATION SURVEYS CONTAMINATION CONTROL AND SURVEY RECORDS

16.22 Radiation surveys.

16.22.1 The licensee shall make radiation surveys, including but not limited to the surveys required by 16.22.2 through 16.22.5, of each area where licensed materials are used and stored.

16.22.2 Before transporting licensed materials, the licensee shall make a radiation survey of the position occupied by each individual in the vehicle and of the exterior of each vehicle used to transport the licensed materials.

16.22.3 If the sealed source assembly is removed from the logging tool before departure from the temporary jobsite, the licensee shall confirm that the logging tool is free of contamination by energizing the logging tool detector or by using a survey meter.

16.22.4 If the licensee has reason to believe that, as a result of any operation involving a sealed source, the encapsulation of the sealed source could be damaged by the operation, the licensee shall conduct a radiation survey, including a contamination survey, during and after the operation.

16.22.5 The licensee shall make a radiation survey at the temporary jobsite before and after each subsurface tracer study to confirm the absence of contamination.

16.22.6 The results of surveys required pursuant to 16.22.1 through 16.22.5 must be recorded and must include:

16.22.6.1 The date(s) of the survey;

16.22.6.2 The name of the individual(s) making the survey;

16.22.6.3 The identification of the survey;

16.22.6.4 Instrument(s) used; and

16.22.6.5 The location of the survey.

The licensee shall retain records of the surveys for inspection by the Department for 3 years after they are made.

Contamination control.

16.22.7 If the licensee detects evidence that a sealed source has ruptured or radioactive materials have caused contamination, the licensee shall initiate immediately the emergency procedures required by 16.16.

16.22.8 If contamination results from the use of radioactive material in well logging, the licensee shall decontaminate all personnel, work areas, equipment, and unrestricted areas.

16.22.9 During efforts to recover a sealed source lodged in the well, the licensee shall continuously monitor, with an appropriate radiation detection instrument or a logging tool with a radiation detector, the circulating fluids from the well, if any, to check for contamination resulting from damage to the sealed source.

16.23 Documents and records required at field stations.

Each licensee or registrant shall maintain the following documents and records at the field station:

16.23.1 The license, certificate of registration, or equivalent document(s) authorizing the use of sources of radiation;

16.23.2 Operating and emergency procedures required by 16.16;

16.23.3 A copy of Parts 1, 4, 10, and 16 and other applicable regulations;

16.23.4 Records of the latest survey instrument calibrations required by 16.8;

16.23.5 Records of the latest leak test results required by 16.9;

16.23.6 Records of physical inventories required by 16.10;

16.23.7 Utilization records required by 16.11;

16.23.8 Records of inspection and maintenance required by 16.14;

16.23.9 Survey records required by 16.22; and

16.23.10 Training records required by 16.15.4.

16.24 Documents and records required at temporary jobsites.

Each licensee or registrant conducting operations at a temporary jobsite shall maintain the following documents and records at the temporary jobsite until the well logging operation is complete:

16.24.1 Operating and emergency procedures required by 16.16;

16.24.2 Survey records required pursuant to 16.22 for the period of operation at the site;

16.24.3 Evidence of current calibration for the radiation survey instruments in use at the site required by 16.8;

16.24.4 When operating in the State under reciprocity, a copy of the appropriate license, certificate of registration, or equivalent document(s) authorizing use of sources of radiation; and

16.24.5 Shipping papers for the transportation of radioactive material required by Part 17.

NOTIFICATION

16.25 Notification of incidents, abandonment, and lost sources.

16.25.1 The licensee shall notify the Department of the theft or loss of radioactive materials, radiation overexposures, excessive levels and concentrations of radiation, and certain other accidents as required by Part 4, Sections 4.51, 4.52, and 4.53.

16.25.2 Whenever a sealed source or device containing radioactive material is lodged downhole, the licensee shall monitor at the surface for the presence of radioactive contamination with a radiation survey instrument or logging tool during logging tool recovery operations.

16.25.3 Notify the Department immediately by telephone and subsequently within 30 days by confirmatory letter if the licensee knows or has reason to believe that a sealed source has been ruptured. This letter shall identify the well or other location, describe the magnitude and extent of the escape of radioactive material, assess the consequences of the rupture, and explain efforts being planned or taken to mitigate these consequences.

16.25.4 If a sealed source becomes lodged in a well, and when it becomes apparent that efforts to recover the radioactive source will not be successful, the licensee shall:

16.25.4.1 Notify the Department by telephone of the circumstances that resulted in the inability to retrieve the source; and

(1) Obtain Department approval to implement abandonment procedures; or

(2) That the licensee implemented abandonment before receiving Department approval because the licensee believed there was an immediate threat to public health and safety; and

16.25.4.2 Advise the well owner or operator, as appropriate, of the abandonment procedures under 16.4.1 or 16.4.3; which shall include:

(1) The immobilization and sealing in place of the radioactive source with a cement plug;

(2) The setting of a whipstock or other deflection device; and

(3) The mounting of a permanent identification plaque at the surface of the well, containing the appropriate information required by 16.25.6; and

16.25.4.3 Either ensure that abandonment procedures are implemented within 30 days after the sealed source has been classified as irretrievable or request an extension of time if unable to complete the abandonment procedures.

16.25.5 The licensee shall, within 30 days after a sealed source has been classified as irretrievable, make a report in writing to the Department. The licensee shall send a copy of the report to each appropriate State or Federal agency that issued permits or otherwise approved of the drilling operation. The report shall contain the following information:

16.25.5.1 Date of occurrence;

16.25.5.2 A description of the well-logging source involved, including the radionuclide and its quantity, chemical, and physical form;

16.25.5.3 Surface location and identification of the well;

16.25.5.4 Results of efforts to immobilize and seal the source in place;

16.25.5.5 A brief description of the attempted recovery effort;

16.25.5.6 Depth of the source;

16.25.5.7 Depth of the top of the cement plug;

16.25.5.8 Depth of the well;

16.25.5.9 The immediate threat to public health and safety justification for implementing abandonment if prior Department approval was not obtained in accordance with 16.25.4.1(2);

16.25.5.10 Any other information, such as a warning statement, contained on the permanent identification plaque; and

16.25.5.11 State and Federal Agencies receiving a copy of this report.

16.25.6 Whenever a sealed source containing radioactive material is abandoned downhole, the licensee shall provide a means to prevent inadvertent intrusion on the source, unless the source is not accessible to any subsequent drilling operations, and shall provide a permanent plaque[1] for posting the well or well-bore. This plaque shall:

1 An example of a suggested plaque is shown in Appendix 16B.

16.25.6.1 Be constructed of long-lasting material, such as stainless steel, brass, bronze, or monel;

16.25.6.2 Be mounted at the surface of the well, unless the mounting of the plaque is not practical;

16.25.6.3 Be at least 17 cm (7 inches) square and 3 mm (1/8th inch) thick; and

16.25.6.4 Contain the following information engraved on its face:

(1) The word “CAUTION”;

(2) The radiation symbol (the color requirement in Part 4, Section 4.27 need not be met);

(3) The date the source was abandoned;

(4) The name of the well-operator or well-owner, as appropriate;

(5) The well name and well identification number(s) or other designation;

(6) An identification of the sealed source(s) by radionuclide and quantity ;

(7) The depth of the source and the depth to the top of the plug; and

(8) An appropriate warning, depending on the specific circumstances of each abandonment.[2]

2 Appropriate warnings may include: (a) “Do not drill below plug-back depth”; (b) “Do not enlarge casing”; or (c) “Do not re-enter the hole”, followed by the words, “before contacting the Colorado Department of Public Health and Environment, Hazardous Materials And Waste Management Division.”

16.25.7 The licensee shall immediately notify the Department by telephone and subsequently by confirming letter if the licensee knows or has reason to believe that radioactive material has been lost in or to an underground potable aquifer. Such notice shall designate the well location and shall describe the magnitude and extent of loss of radioactive material, assess the consequences of such loss, and explain efforts planned or being taken to mitigate these consequences.

PART 16, APPENDIX 16A:

SUBJECTS TO BE INCLUDED IN TRAINING COURSES FOR LOGGING SUPERVISORS

16A.1 Fundamentals of radiation safety including:

16A.1.1 Characteristics of radiation

16A.1.2 Units of radiation dose and quantity of radioactivity

16A.1.3 Hazards of exposure to radiation

16A.1.4 Levels of radiation from sources of radiation

16A.1.5 Methods of controlling and minimizing radiation dose

(1) Working time

(2) Working distances

(3) Shielding

16A.1.6 Radiation safety practices including prevention of contamination and methods of decontamination

16A.2 Radiation detection instrumentation to be used

16A.2.1 Use of radiation survey instruments to include:

(1) Operation

(2) Calibration

(3) Limitations

16A.2.2 Survey techniques

16A.2.3 Use of personnel monitoring equipment

16A.3 Equipment to be used including:

16A.3.1 Operation of equipment, including source handling equipment and remote handling tools

16A.3.2 Sources of radiation

16A.3.3 Storage, control, and disposal of sources of radiation

16A.3.4 Maintenance of equipment

16A.4 The Requirements of pertinent Federal and State Regulations

16A.5 Case histories of accidents in well logging

PART 16, APPENDIX 16B:

EXAMPLE OF PLAQUE FOR IDENTIFYING WELLS CONTAINING SEALED SOURCES CONTAINING RADIOACTIVE MATERIAL ABANDONED DOWNHOLE

[COMPANY NAME]

[WELL IDENTIFICATION]

ONE 2 CURIE CS-137 RADIOACTIVE SOURCE

ABANDONED 3-3-75 AT 8400 FT. PLUG BACK DEPTH 8200 FT.

DO NOT RE-ENTER THIS WELL BEFORE CONTACTING

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

The size of the plaque should be convenient for use on active or inactive wells, for example, a 7-inch square. Letter size of the word "CAUTION" should be approximately twice the letter size of the rest of the information, for example, 1/2-inch and 1/4-inch letter size, respectively.

EDITOR'S NOTES

6 CCR 1007-1 has been divided into separate parts for ease of use. Versions prior to 04/01/2007 are located in the first section, 6 CCR 1007-1. Prior versions can be accessed from the All Versions list on the rule's current version page. To view versions effective on or after 04/01/2007, select the desired part of the rule, for example 6 CCR 1007-1 Part 01 or 6 CCR 1007-1 Part 10.

History

Entire rule eff. 09/14/2016.