

**PART W****RADIATION SAFETY REQUIREMENTS FOR WELL LOGGING OPERATIONS AND  
SUBSURFACE TRACER STUDIES**Sec. W.1 - Purpose.

The regulations in this Part prescribe requirements for the issuance of a license authorizing the use of licensed materials including sealed sources, radioactive tracers, radioactive markers, and uranium sinker bars in well logging in a single well. This Part also prescribes radiation safety requirements for persons using licensed materials in these operations. The provisions and requirements of this Part are in addition to, and not in substitution for, the requirements of Parts A, B, C, D, J, T and V of these regulations.

Sec. W.2 - Scope. The regulations in this Part apply to all licensees or registrants who use sources of radiation for well logging operations including mineral-logging, radioactive markers, or subsurface tracer studies.

Sec. W.3 - Definitions. As used in this Part, the following definitions apply:

"Energy compensation source (ECS)" means a sealed source, with an activity not exceeding 3.7 MBq (100  $\mu$ Ci), 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.

"Fresh water aquifer," for the purpose of the Part, means a geologic formation that is capable of yielding fresh water to a well or spring.

"Global Positioning System (GPS)" means a system of orbiting satellites that transmit precise signals enabling GPS receivers to determine their current location (latitude and longitude coordinates), the time, and their velocity.

"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 in a well and has either: (a) detached from a wireline logging tool or (b) is contained within any other well logging tool (for example a LWD tool) over which control has been lost 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 or who performs surveys required by W.401.

"Logging supervisor" means the individual who uses sources of radiation or provides personal supervision of the utilization of sources of radiation.

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

"Logging while drilling (LWD) ", along with measurement while drilling (MWD), means a technique of acquiring geologic formation properties, directional surveys and other information in real-time while drilling a well.

"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 observing the performance of the operation in such proximity that contact can be maintained and immediate assistance given as required.

"Radioactive marker" means radioactive material used for 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. The review may include, as appropriate, the results of internal inspections, new procedures or equipment, accidents or errors that have been observed, and opportunities for employees to ask safety questions.

"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 unsealed radioactive material or a substance labeled with radioactive material released into a well for the purpose of tracing the movement or position of the material or substance in the well 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 operations 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 may be performed. As used in the 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 contain sources of radiation or are used to detect sources of radiation 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 containing one or more electrical conductors which is used to lower and raise logging tools in the well.

### **Agreement with Well Owner or Operator**

#### Sec. W.4 - Conditions of Agreement.

- a. No licensee shall perform well logging operations with a sealed source(s) or subsurface tracer(s) unless, prior to commencement of the operation, the licensee has a written agreement with the well operator, well owner, drilling contractor, or land owner that:
  - i. In the event a sealed source is lodged downhole, a reasonable effort at recovery will be made;
  - ii. A person may not attempt to recover a sealed source in a manner which, in the licensee's opinion, could result in its rupture;
  - iii. In the event a decision is made to abandon the sealed source downhole, the requirements of Paragraph W.501c. [and the name of any other State Agency having applicable regulations] shall be met;
  - iv. The radiation monitoring required in W.402.a will be performed;
  - v. If the environment, any equipment, or personnel are contaminated with the licensed material they must be decontaminated before release from the site or release for unrestricted use, the agreement must identify the party or parties that are responsible for decontamination; and
  - vi. Identifies the individual who will initiate the emergency procedures required by W.202; and
  - vii. If the sealed source is classified as irretrievable after reasonable efforts at recovery have been expended, the following requirements must be implemented within 30 days:
    - (1) Each irretrievable well logging source must be immobilized and sealed in place with a cement plug.

- (2) A means to prevent inadvertent intrusion on the source, unless the source is not accessible to any subsequent drilling operations; and
- (3) A permanent identification plaque, constructed of long lasting material such as stainless steel, brass, bronze, or monel, must be mounted at the surface of the well, unless the mounting of the plaque is not practical. The size of the plaque must be at least 17 cm [7 inches] square and 3 mm [<sup>1</sup>/<sub>8</sub>-inch] thick. The plaque must contain:
  - a) The word "CAUTION";
  - b) The radiation symbol (the color requirement in D.1901.a. need not be met);
  - c) The date the source was abandoned;
  - d) The name of the well owner or well operator, as appropriate;
  - e) The well name and well identification number(s) or other designation;
  - f) An identification of the sealed source(s) by radionuclide and quantity;
  - g) The depth of the source and depth to the top of the plug; and
  - h) An appropriate warning, such as, "DO NOT RE-ENTER THIS WELL."
- b. The licensee shall retain a copy of the written agreement for three years after the completion of the well logging operation.
- c. A licensee may apply, on a case-by-case basis, proposed procedures to abandon an irretrievable well logging source in a manner not otherwise authorized in W.4.a.vii.
- d. A written agreement between the licensee and the well owner or operator is not required if the licensee and the well owner or operator are part of the same corporate structure or otherwise similarly affiliated. However, the licensee shall still otherwise meet the requirements in W.4.a.i. through a.vii.

### **Specific Licensing Requirements**

Sec. W.11 - Application for a Specific License. A person, as defined in Part A of these regulations, shall file an application for a specific license authorizing the use of licensed material in well logging. Each application for a license, other than a license exempted from Part A of these regulations, must be

accompanied by the fee prescribed in [insert fee schedule address here] of these regulations.

Sec. W.13 - Specific Licenses for Well Logging. The Agency will approve an application for a specific license for the use of radioactive material in well logging if the applicant meets the following requirements:

- a. The applicant shall satisfy the general requirements specified in C.25, and any special requirements contained in this Part.
- b. The applicant shall develop a program for training logging supervisors and logging assistants and submit to the Agency a description of this program which specifies the:
  - i. Initial training;
  - ii. On-the-job training;
  - iii. Annual safety reviews provided by the licensee;
  - iv. Means the applicant will use to demonstrate the logging supervisor's knowledge and understanding of and ability to comply with the Agency's regulations and licensing requirements and the applicant's operating and emergency procedures; and
  - v. 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.
- c. The applicant shall submit to the Agency written operating and emergency procedures as described in this Part that includes the important radiation safety aspects of the procedures.
- d. The applicant shall establish and submit to the Agency its program for annual audit of the job performance of each logging supervisor to ensure that the Agency's regulations, license requirements, and the applicant's operating and emergency procedures are followed. Inspection records must be retained for three years after each annual internal audit.
- e. 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.
- f. 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 Agency. The description must include the:
  - i. Instruments to be used;

- ii. Methods of performing the analysis; and
- iii. Pertinent experience of the person who will analyze the wipe samples.

Sec. W.47 - Radioactive Markers. 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 C, Appendix B of these regulations. The use of markers is subject only to the requirements of W.106.

Sec. W.49 - Uranium Sinker Bars. The licensee may use a uranium sinker bar in well logging applications only if it is legibly impressed with the words "CAUTION--RADIOACTIVE--DEPLETED URANIUM" and "NOTIFY CIVIL AUTHORITIES (or COMPANY NAME) IF FOUND."

Sec. W.51 - Use of a Sealed Source in a Well Without a Surface Casing. The licensee may use a sealed source in a well without a surface casing for protecting fresh water aquifers only if the licensee follows a procedure for reducing the probability of the source becoming lodged in the well. The procedure must be approved by the Agency pursuant to W.13c. or by the U.S. Nuclear Regulatory Commission or an Agreement State.

Sec. W.53 - Energy Compensation Source. 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].

- a. For well logging applications with a surface casing for protecting fresh water aquifers, use of the ECS is only subject to the requirements of W.105, W.106 and W.107.
- b. For well logging applications without a surface casing for protecting fresh water aquifers, use of the ECS is only subject to the requirements of W.4, W.105, W.106, W.107, W.51 and W.501.

Sec. W.55 - Tritium Neutron Generator Target Source.

- a. 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 this Part except W.4, W.108 and W.501.
- b. 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 this Part except W.108.

## **Equipment Control**

Sec. W.101 - Limits on Levels of Radiation. Sources of radiation shall be used, stored, and transported in such a manner that the transportation requirements of Part T and the dose limitation requirements of

Part D of these regulations are met.

Sec. W.102 - Storage Precautions. The licensee shall store each source containing licensed material in a storage container or transportation package. The container or package must be locked and physically secured to prevent tampering or removal of licensed material from storage by unauthorized personnel. The licensee shall store licensed material in a manner which will minimize danger from explosion or fire.

Sec. W.103 - Transport Precautions. The licensee shall lock and physically secure the transport package containing licensed material in the transporting vehicle to prevent accidental loss, tampering, or unauthorized removal of the licensed material from the vehicle.

Sec. W.104 - Radiation Survey Instruments.

- a. The licensee 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 D 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 0.01 sievert (1 rem) per hour. (changed to match ind. radiography)
- b. The licensee shall keep appropriate [calibrated and] operable radiation detection instruments sensitive enough to detect:
  - i. The radiation and contamination levels that could be encountered if a sealed source ruptured or contamination from tracer material; and
  - ii. If neutron emitting sources are used, neutrons where the neutron source may contribute more than five percent (5%) of a relevant dose limit.
- c. Each radiation survey instrument shall be calibrated in accordance with procedures outlined in ANSI N323A-1997:
  - i. At intervals not to exceed six months and after each instrument servicing;
  - ii. 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
  - iii. So that accuracy within 20 percent of the true radiation level can be demonstrated on each scale.

- d. Calibration records shall be maintained for a period of three years for inspection by the Agency.

Sec. W.105 - Leak Testing of Sealed Sources.

- a. Exemptions. The following sources are exempted from the periodic leak test requirements of Paragraphs W.105b. through e.:
- i. Hydrogen-3 sources;
  - ii. Sources of radioactive material with a half-life of 30 days or less;
  - iii. Sealed sources of radioactive material in gaseous form;
  - iv. Sources of beta- or gamma-emitting radioactive material with an activity of 3.7 MBq (100  $\mu$ Ci) or less; and
  - v. Sources of alpha-emitting radioactive material with an activity of 0.370 MBq (10  $\mu$ Ci) or less.
- b. Requirements. Each licensee using sealed sources of radioactive material not exempted by W.105a., shall have the sources tested for leakage. Records of leak test results shall be kept in units of Bq ( $\mu$ Ci).
- i. Energy compensated source (ECS) leak test records shall be maintained for inspection by the Agency for three years after the next required leak test is performed or until transfer or disposal of the ECS;
  - ii. All other sealed source leak test records shall be maintained for inspection by the Agency for at least three years after the next required leak test is performed or until transfer or disposal of the sealed source.
- c. Method of Testing. Measurement of activity of the tests for leakage shall be performed only by persons specifically authorized to perform such tests by the Agency, the U.S. Nuclear Regulatory Commission (NRC), or an Agreement State. The test sample shall be taken from the surface of the source, source holder, or from the surface of the device in which the source is stored or mounted and on which one might expect contamination to accumulate. The test sample shall be analyzed for radioactive contamination, and the analysis shall be capable of detecting the presence of 185 Bq (0.005  $\mu$ Ci) of radioactive material on the test sample.
- d. Interval of Testing.
- i. Each sealed source of radioactive material shall be tested at intervals not to exceed six months. In the absence of a certificate from a transferor indicating that a test has been made prior to the transfer, the sealed source shall not be put into use until tested. 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.

- ii. Each ECS that is not exempt from testing in accordance with W.105a. must be tested at intervals not to exceed three years. In the absence of a certificate from a transferor that a test has been made within the three years before the transfer, the ECS may not be used until tested.
- e. Removal of Leaking Sources from Service. If the test conducted pursuant to W.105b. and c. reveals the presence of 185 Bq [0.005 microcuries] or more of removable radioactive material, the licensee shall remove the sealed source from service immediately and have it repaired or disposed of by an Agreement State or NRC licensee that is authorized to perform these functions. The licensee shall check the equipment associated with the leaking source for radioactive contamination and, if contaminated, have it decontaminated or disposed of by an Agreement State or NRC licensee that is authorized to perform these functions. A report of leaking sources shall be filed in accordance with W.501a.

Sec. W.106 - Quarterly Inventory. Each licensee or registrant shall conduct a quarterly physical inventory to account for all sources of radiation. Records of inventories shall be maintained for three years from the date of the inventory for inspection by the Agency and shall include the quantities and kinds of sources of radiation, the location where sources of radiation are assigned, the date of the inventory, the name of the individual conducting the inventory, the manufacturer, the model number, and the serial number.

Sec. W.107 - Utilization Records. Each licensee or registrant shall maintain current records, which shall be kept available for inspection by the Agency for three years from the date of the recorded event, showing the following information for each source of radiation:

- a. Make, model number, and a serial number or a description of each source of radiation used;
- b. The identity of the well-logging supervisor or field unit to whom assigned;
- c. Locations where used and dates of use; and
- d. In the case of tracer materials and radioactive markers, the utilization record shall indicate the radionuclide and activity used in a particular well and disposition of any unused tracer material.

Sec. W.108 - Design, Performance, and Certification Criteria for Sealed Sources Used in Downhole Operations.

- a. A licensee may use a sealed source for use in well logging applications if:
  - i. The sealed source is doubly encapsulated;

- ii. The sealed source contains licensed material whose chemical and physical forms are as insoluble and nondispersible as practical; and
  - iii. Meets the requirements of paragraph (b), (c), or (d) of this section
- b. 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 US ANSI N5.10-1968, "Classification of Sealed Radioactive Sources," or the requirements in paragraph (c) or (d) of this section.
- c. 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 ANSI/HPS N43.6-1997, "Sealed Radioactive Sources-Classification."
- d. For a sealed source manufactured after July 14, 1989, a licensee may use the sealed source, for use in well logging applications, if:
- i. The sealed source's prototype has been tested and found to maintain its integrity after each of the following tests:
    - (1) *Temperature.* The test source must be held at  $-40^{\circ}$  C for 20 minutes,  $600^{\circ}$  C for 1 hour, and then be subject to a thermal shock test with a temperature drop from  $600^{\circ}$  C to  $20^{\circ}$  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  $1.695 \times 10^7$  pascals [24,600 pounds per square inch absolute].
- e. The requirements in paragraph (a), (b), (c), and (d) of this section do not apply to sealed sources that contain licensed material in gaseous form.
- f. The requirements in paragraphs (a), (b), (c), and (d) of this section do not apply to energy compensation sources (ECS). ECSs must be licensed or registered with the Agency, an Agreement State, or with the NRC under 10 CFR 32.210.

Sec. W.109 - Labeling.

- a. Each source, source holder, or logging tool containing radioactive material shall bear a durable, legible, and clearly visible marking or label, which has, as a minimum, the standard radiation caution symbol, without the conventional color requirement, and the following wording:

DANGER<sup>1/</sup>  
RADIOACTIVE

This labeling shall be on the smallest component transported as a separate piece of equipment.

- b. Each transport container shall have permanently attached to it a durable, legible, and clearly visible label which has, as a minimum, the standard radiation caution symbol and the following wording:

DANGER<sup>1/</sup>  
RADIOACTIVE  
NOTIFY CIVIL AUTHORITIES [OR NAME OF COMPANY]

Sec. W.110 - Inspection and Maintenance.

- a. 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. If defects are found, the equipment must be removed from service until repaired, and a record must be made listing:
  - i. The date of check;
  - ii. The name of inspector;
  - iii. The equipment involved;
  - iv. The defects found; and
  - v. The repairs made.

These records must be retained for three years after the defect is found.

- b. Each licensee or registrant shall conduct, at intervals not to exceed six months, a program of inspection and maintenance of source holders, logging tools, source handling tools, storage containers, transport containers, uranium sinker bars, and injection tools to assure proper labeling and physical condition. If defects are found, the equipment must be removed from service until repaired, and a record must be made listing:

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<sup>1/</sup> or CAUTION

- i. Date;
- ii. Equipment involved;
- iii. Inspection and maintenance operations performed;
- iv. Any defects found; and
- v. Any actions taken to correct the defects.

Records of inspection and maintenance shall be maintained for a period of three years for inspection by the Agency.

- c. If any inspection conducted pursuant to W.110.b. reveals damage to labeling or components critical to radiation safety, the device shall be removed from service until repairs have been made.
- d. 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 the Agency, an Agreement State, or the NRC to perform this operation.
- e. The repair, opening, or modification of any sealed source shall be performed only by persons specifically authorized to do so by the Agency, the NRC, or an Agreement State.

### **Requirements for Personnel Safety**

#### Sec. W.201 - Training Requirements.

- a. No licensee or registrant shall permit any individual to act as a logging supervisor as defined in this Part until such individual has:
  - i. Completed training in the subjects outlined in Appendix A of this Part and demonstrated an understanding thereof;
  - ii. Received copies, read and received instruction in the regulations contained in this Part and the applicable Sections of Parts A, D, and J of these regulations or their equivalent, conditions of appropriate license or certificate of registration, and the licensee's or registrant's operating and emergency procedures, and demonstrated an understanding thereof; and
  - iii. Completed on-the-job training and demonstrated competence in the use of licensed materials, remote handling tools, and radiation survey instruments by a field evaluation;

and

- iv. Has demonstrated understanding of the requirements of W.201a.i. through W.201a.ii. by successfully completing a written test.
- b. No licensee or registrant may permit an individual to act as a logging assistant until that person--
- i. Has received instruction in applicable sections of Parts A, D and J of these regulations;
  - ii. Has received copies of, and instruction in, the licensee's operating and emergency procedures required by W.202;
  - iii. Has demonstrated understanding of the materials listed in W.201b.i and W.201b.ii. by successfully completing a written or oral test; and
  - iv. Has received instruction and demonstrated competence in the use of licensed materials, remote handling tools, and radiation survey instruments, as appropriate for the logging assistant's intended job responsibilities.
- c. The licensee shall maintain employee training records for inspection by the Agency for three years following termination of the individual's employment.
- d. The licensee shall provide safety reviews for logging supervisors and logging assistants at least once during each calendar year.
- e. The licensee or registrant shall maintain a record of each logging supervisor's and logging assistant's training and annual safety review. The training records must include copies of written tests and dates of oral tests. The training records must be retained until three years following the termination of employment. Records of annual safety reviews must list the topics discussed and be retained for three years.

Sec. W.202 - Operating and Emergency Procedures. The licensee's or registrant's operating and emergency procedures shall include instructions in at least the following:

- a. Handling and use of sources of radiation including but not limited to sealed sources and tracers, to be employed so that no individual is likely to be exposed to radiation doses in excess of the standards established in Part D of these regulations;
- b. Methods and occasions for conducting radiation surveys, including surveys for detecting contamination, as required by W.401;
- c. Methods and occasions for locking and securing sources of radiation;
- d. Personnel monitoring and the use of personnel monitoring equipment;

- e. 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;
- f. Minimizing exposure of individuals including exposures from inhalation and ingestion of tracer materials;
- g. Procedure for notifying proper personnel (e.g., RSO, well operator/owner, landowner, regulatory agency) in the event of an accident;
- h. Procedure to be followed in the event a sealed source is lodged downhole;
- i. Procedures to be used for picking up, receiving, and opening packages containing radioactive material;
- j. For the use of tracers, decontamination of the environment, equipment, and personnel;
- k. Maintenance of records generated by logging personnel at temporary jobsites;
- l. 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 Section W.104.
- m. The inspection and maintenance of sealed sources, source holders, logging tools, injection tools, source handling tools, storage containers, transport containers, and uranium sinker bars as required by W.110; and
- n. Identifying and reporting to the Agency defects and noncompliance; and
- o. 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 W.202 has been approved by the Agency pursuant to W.13, the U.S. Nuclear Regulatory Commission (NRC), or an Agreement State.

Sec. W.203 - Personnel Monitoring. [Individual Monitoring]. The licensee shall provide personnel monitoring [individual monitoring], as required by Part D of these regulations.

- a. The licensee or registrant may not permit an individual to act as a logging supervisor or logging assistant unless that person wears a personnel dosimeter at all times during the handling of licensed radioactive materials. Each personnel dosimeter must be assigned to and worn by only one individual. Film badges must be replaced at least monthly and all other personnel dosimeters

that require replacement must be replaced at least quarterly. All personnel dosimeters must be evaluated at least quarterly or promptly after replacement, whichever is more frequent.

- b. The licensee shall provide bioassay services to individuals using licensed materials in subsurface tracer studies if required by the license.
- c. The licensee shall retain records of personnel dosimeters required by W.203a. and bioassay results for inspection until the Agency authorizes disposition of the records.

### **Precautionary Procedures in Logging and Subsurface Tracer Studies**

#### Sec. W.301 - Security.

- a. 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.
- b. Should a source become lodged in a well, and if the logging supervisor is the only licensee's employee onsite, the logging supervisor may leave the jobsite to obtain assistance, provided that:
  - i. The supervisor has established a controlled area;
  - ii. Barriers are in place to prevent unauthorized entry into the controlled area; and
  - iii. No further action has been taken until the supervisor has arrived back on the jobsite.
- c. During each logging or tracer application, the logging supervisor or other designated employee shall maintain direct surveillance of the operation to protect against unauthorized or unnecessary entry into a restricted area, as defined in Part A of these regulations.

Sec. W.302 - 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.

#### Sec. W.303 - Subsurface Tracer Studies.

- a. Protective gloves and other appropriate protective clothing and equipment shall be used by all personnel handling radioactive tracer material. Precautions shall be taken to avoid ingestion or inhalation of radioactive material and to avoid contamination of field stations and temporary jobsites.
- b. No licensee shall cause the injection of radioactive material into potable aquifers without prior written authorization from the Agency [and any other appropriate State Agency].

Sec. W.304 - Particle Accelerators. No licensee or registrant shall permit above-ground testing of

particle accelerators, designed for use in well-logging, which results in the production of radiation, except in areas or facilities so controlled or shielded that the requirements of Part D.1201 and D.1301 of these regulations, as applicable, are met.

### **Radiation Surveys and Records**

#### Sec. W.401 - Radiation Surveys.

- a. An appropriate survey meter shall be used to make radiation surveys to insure that radiation hazards are evaluated as required by W.401b. through W.401g. where radioactive materials are used and stored.
- b. Radiation surveys shall be made and recorded for the radiation levels in occupied positions and on the exterior of each vehicle used to transport radioactive material. Such surveys shall include each source of radiation or combination of sources to be transported in the vehicle.
- c. If the sealed source assembly is removed from the logging tool before departing the jobsite, the logging tool detector shall be energized, or a survey meter used, to assure that the logging tool is free of contamination. If the tool contained a neutron source, the measurement is to be taken after the decay of any activation of the tool and its components to differentiate between the activation products and any potential contamination.
- d. Immediately following the transfer of the source from the logging tool to the transport container, and prior to leaving the temporary jobsite, the licensee shall perform a radiation survey of the transport/source storage container to confirm that the source is in the shielded position.
- e. Radiation surveys shall be made and recorded at the jobsite or well-head for each tracer operation. These surveys shall include measurements of radiation levels before and after the operation.
- f. Surveys of the storage area shall be performed with the maximum number of radiation sources possessed present.
- g. 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.
- h. Records required pursuant to Paragraphs W.401 a. through g. shall include the dates, the identification of individual(s) making the survey, the identification of survey instrument(s) used, and an exact description of the location of the survey. Records of these surveys shall be maintained for inspection by the Agency for three years after completion of the survey.

#### Sec. W.402 - Radioactive Contamination Control.



- a. If the licensee detects evidence that a sealed source has ruptured or licensed materials have caused contamination, the licensee shall initiate immediately the emergency procedures required by W.202 and notify the Agency as required by W.501.
- b. If contamination results from the use of licensed material in well logging, the licensee shall decontaminate all work areas, equipment, and unrestricted areas in accordance with the emergency procedures required by W.202.
- c. 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.

Sec. W.403 - Documents and Records Required at Field Stations. Each licensee or registrant shall maintain, for inspection by the Agency, the following documents and records for the specific devices and sources used at the field station:

- a. Appropriate license, certificate of registration, or equivalent document(s);
- b. Operating and emergency procedures;
- c. Applicable regulations;
- d. Records of the latest survey instrument calibrations pursuant to Section W.104;
- e. Records of the latest leak test results pursuant to Section W.105;
- f. Records of quarterly inventories required pursuant to Section W.106;
- g. Utilization records required pursuant to Section W.107;
- h. Records of inspection and maintenance required pursuant to Section W.110;
- i. Survey records required pursuant to Section W.401; and
- j. Training records required pursuant to Section W.201.

Sec. W.404 - Documents and Records Required at Temporary Jobsites. Each licensee or registrant conducting operations at a temporary jobsite shall have the following documents and records available at that site for inspection by the Agency:

- a. Operating and emergency procedures;

- b. Survey records required pursuant to Section W.401 for the period of operation at the site;
- c. Evidence of current calibration for the radiation survey instruments in use at the site;
- d. When operating in the state under reciprocity, a copy of the appropriate license, certificate of registration, or equivalent document(s); and
- e. Shipping papers for the transportation of radioactive material.

### **Notification**

#### Sec. W.501 - Notification of Incidents, Abandonment, and Lost Sources.

- a. Any sealed source determined to be leaking, in accordance with W.105, must be reported immediately to the Agency. The immediate report can be by telephone, fax or email. The licensee shall submit a report to the Agency within five days of receiving the test results. The report must describe the equipment associated with the leaking source, the test results, any contamination which resulted from the leaking source, and the corrective actions taken up to the time the report was submitted.
- b. Notification of incidents and sources lost in other than downhole logging operations shall be made in accordance with appropriate provisions of Part D of these regulations.
- c. Notify the Agency 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 planned or being taken to mitigate these consequences.
- d. If a sealed source becomes lodged in a well and when it becomes apparent that efforts to recover the radioactive sealed source will not be successful, the licensee shall:
  - i. Advise the well-operator of [insert the regulations of the appropriate state agency regarding abandonment and] an appropriate method of abandonment, 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 Paragraph W.501e.;
  - ii. Notify the Agency by telephone, giving the circumstances of the loss, and request approval of the proposed abandonment procedures. [Should there be an immediate threat to public health and safety the licensee may implement abandonment procedures prior to receiving Agency approval.]; and
  - iii. File a written report with the Agency within 30 days of the abandonment. The licensee shall send a copy of the report to [insert appropriate State and Federal Agency] that issued permits or otherwise approved of the drilling operation. The report shall contain the following information:
    - (1) Date of occurrence;
    - (2) A description of the well logging source involved, including the radionuclide and its quantity, chemical, and physical form;
    - (3) Surface location and identification of the well;
    - (4) Results of efforts to immobilize and seal the source in place;
    - (5) A brief description of the attempted recovery effort;
    - (6) Depth of the source;
    - (7) Depth of the top of the cement plug;
    - (8) Depth of the well;
    - (9) GPS coordinates of the abandoned source or sources;
    - (10) Any other information, such as a warning statement, contained on the permanent identification plaque; and
    - (11) The names of state and federal agencies receiving a copy of this report.
    - (12) The immediate threat to public health and safety justification of implementing abandonment if prior Agency approval was not obtained in accordance with W.501d.ii.
- e. Whenever a sealed source containing radioactive material is abandoned downhole, the licensee

shall provide a permanent plaque<sup>2/</sup> for posting the well. This plaque shall:

- i. Be constructed of long-lasting material, such as stainless steel or monel; and
- ii. Contain the following information engraved on its face:
  - (1) The word "CAUTION";
  - (2) The radiation symbol without the conventional color requirement;
  - (3) The date of abandonment;
  - (4) The name of the well-operator or well-owner;
  - (5) The well name and well identification number(s) or other designation;
  - (6) The sealed source(s) by radionuclide and activity;
  - (7) The source depth, the true depth to the top of the plug and GPS coordinates for the location of the source; and
  - (8) An appropriate warning, depending on the specific circumstances of each abandonment.<sup>3/</sup>
- f. The licensee shall notify the Agency immediately by telephone and subsequently by confirming letter if the licensee knows or has reason to believe that licensed 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.
- g. 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.

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<sup>2/</sup> An example of a suggested plaque is shown in Appendix B of this Part.

<sup>3/</sup> 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 [insert the name of the radiation control Agency]".

**Part W****APPENDIX A****SUBJECTS TO BE INCLUDED IN TRAINING COURSES  
FOR LOGGING SUPERVISORS**

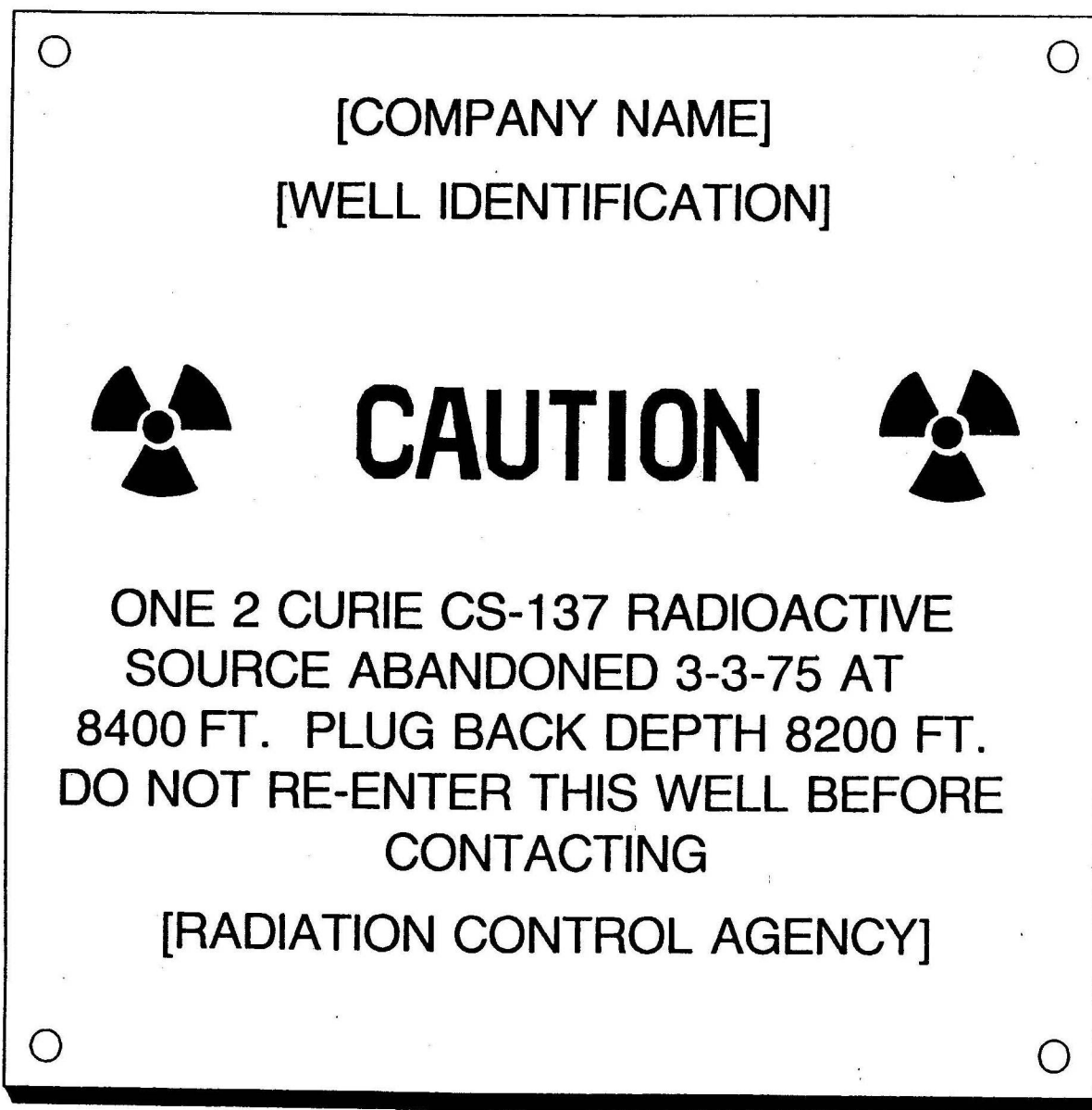
- I. Fundamentals of Radiation Safety
  - A. Characteristics of radiation
  - B. Units of radiation dose and quantity of radioactivity
  - C. Significance of radiation dose
    - 1. Radiation protection standards
    - 2. Biological effects of radiation dose
  - D. Levels of radiation from sources of radiation
  - E. Methods of minimizing radiation dose
    - 1. Working time
    - 2. Working distances
    - 3. Shielding
  - F. Radiation safety practices including prevention of contamination and methods of decontamination
  
- II. Radiation Detection Instrumentation to be Used
  - A. Use of radiation survey instruments
    - 1. Operation
    - 2. Calibration
    - 3. Limitations
  - B. Survey techniques
  - C. Use of personnel monitoring equipment
  
- III. Equipment to be used including:
  - A. Operation of equipment, including source handling equipment and remote handling tools;
  - B. Storage, control, and disposal of licensed material; and
  - C. Maintenance of equipment.
  
- IV. The Requirements of pertinent state and federal Regulations
  
- V. The Licensee's or Registrant's Written Operating and Emergency Procedures

VI. Case histories of accidents in well logging

Part W

APPENDIX B

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



The size of the plaque should be convenient for use on active or inactive wells, e.g., a 7-inch square, 1/8<sup>th</sup> inch thick. Letter size of the word "CAUTION" should be approximately twice the letter size of the rest of the information, e.g., 1/2-inch and 1/4-inch letter size, respectively.