DOCUMENT 3

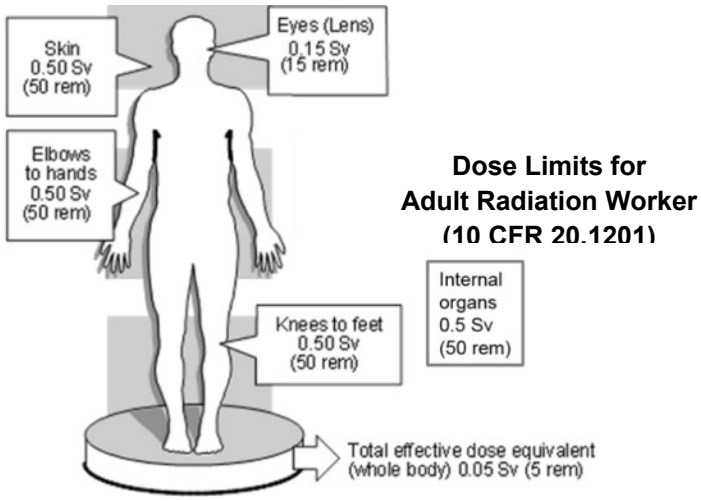
Supplemental Guidance for NUREG-1556, Volume 14, Revision 1, Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Well Logging, Tracer, and Field Flood Study Licenses

8.10.5 Occupational Dose

Regulations: 10 CFR 19.13, 10 CFR 20.1201, 10 CFR 20.1202, 10 CFR 20.1203, 10 CFR 20.1204, 10 CFR 20.1207, 10 CFR 20.1208, 10 CFR 20.1501, 10 CFR 20.1502, 10 CFR 20.2104, 10 CFR 20.2106, 10 CFR Part 20 Appendix B, 10 CFR 39.65

Criteria: According to 10 CFR 39.65, "Personnel monitoring," logging supervisors and logging assistants must wear personnel dosimeters ~~[processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor]~~ during the handling or use of licensed radioactive material. This requirement applies to personnel using dosimeters for whole body measurements. Appendix I of this NUREG provides guidance for determining if individuals other than the RSO, logging supervisors, or logging assistants require dosimetry.

- Bioassay services required in a license must be provided to individuals using tracer materials in subsurface studies if required by the license.



TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE) = THE EFFECTIVE DOSE EQUIVALENT (FOR EXTERNAL EXPOSURES) + THE COMMITTED EFFECTIVE DOSE EQUIVALENT (FOR INTERNAL EXPOSURES)

Figure 8-8. Annual Dose Limits for Adult Radiation Workers

Discussion: The annual dose limits for adult radiation workers are shown in Figure 8-8. Note that in accordance with 10 CFR 20.1207, the annual occupational dose limits for minors are 10 percent of the annual dose limits specified for adult workers. Also, 10 CFR 20.1208 requires the licensee to ensure that the dose equivalent to the embryo/fetus during the entire pregnancy, due to the occupational exposure of a declared pregnant woman, does not exceed 0.5 rem [5 mSv].

The use of individual monitoring devices for external dose is required, pursuant to 10 CFR 20.1502(a), for:

- adults who are likely to receive an annual dose from sources external to the body in excess of any of the following (each evaluated separately):

  — 5 mSv [0.5 rem] deep-dose equivalent
  — 15 mSv [1.5 rems] eye dose equivalent
  — 50 mSv [5 rems] shallow-dose equivalent to the skin
  — 50 mSv [5 rems] shallow-dose equivalent to any extremity

- minors who are likely to receive an annual dose from sources external to the body in excess of any of the following (each evaluated separately):

  — 1.0 mSv [0.1 rem] deep-dose equivalent
  — 1.5 mSv [0.15 rem] eye dose equivalent
  — 5 mSv [0.5 rem] shallow-dose equivalent to the skin
  — 5 mSv [0.5 rem] shallow-dose equivalent to any extremity

- declared pregnant women who are likely to receive a dose from radiation sources external to the body during the entire pregnancy in excess of 1.0 mSv [0.1 rem] deep-dose equivalent

- individuals entering a high or very high radiation area

If an adult radiation worker is likely to receive in a year a dose greater than 10 percent of any applicable limit, monitoring for occupational exposure is required. Monitoring is required for minors and declared pregnant women as shown in the criteria section. The licensee should perform an evaluation of the dose the individual is likely to receive prior to allowing the individual to receive the dose. This evaluation need not be made for every individual; evaluations can be made for employees with similar job functions or work areas.

Licensees should also perform prospective evaluations of the doses that may be received by occupationally exposed minors and declared pregnant women. As with individual adult workers, licensees must supply and require the use of individual monitoring devices to monitor external exposures and monitor the occupational intake of radioactive material when the results of prospective dose evaluations exceed the doses specified in 10 CFR 20.1502.

If this prospective evaluation shows that an adult individual's dose is not likely to exceed 10 percent of any applicable limit, there are no recordkeeping or reporting requirements in regard to the individual's exposure. For individuals who have received doses at other facilities in the current year, the previous dose need not be considered in this prospective evaluation. Only dose that could be received at the facility performing the evaluation need be considered when determining the need for monitoring, and associate recordkeeping and reporting. If it was determined that monitoring was not required and a subsequent evaluation shows that the 10 percent threshold has or will be exceeded, the dose received when monitoring was not provided should be estimated, recorded, and reported. These estimates can be based on any combination of work location radiation monitoring or survey results, monitoring results of

individuals in similar work situations, or other estimates to produce a “best estimate” of the actual dose received.

Licensees should use NRC Form 4, “Cumulative Occupational Dose History,” and NRC Form 5, “Occupational Dose Record for a Monitoring Period,” to record individual dose. If monitoring is not required to demonstrate compliance with all limits but is required relative to one or more specific limits, the licensee should enter “N/A” for “not applicable” in the blocks on NRC Form 4, “Cumulative Occupational Dose History,” and NRC Form 5, “Occupational Dose Record for a Monitoring Period,” to indicate the areas for which monitoring was not required (e.g., extremity or skin doses). Where monitoring was provided but not measurable, the licensee should enter “ND” for “not detectable.”

If the prospective evaluation shows that the individual adult is likely to exceed 10 percent of an applicable limit, then monitoring is required —regardless of the actual dose received. If air sampling or bioassay is required, discussion of air sampling or bioassay should provide enough detail so that the NRC staff is assured that appropriate steps will be taken to manage and monitor such exposure. Licensees must provide individual radiation exposure data to each worker as required by 10 CFR 19.13.

Individuals who perform nonroutine operations, such as installation, initial radiation survey, repair, maintenance of components, and disposal of sealed sources are more likely than workers who only engage in routine activities to exceed the limits in 10 CFR 20.1502(a). Applicants must provide dosimetry (whole body and perhaps extremity monitors) to individuals who perform nonroutine operations or must perform a prospective evaluation demonstrating that unmonitored individuals who perform nonroutine operations are not likely to receive radiation doses in excess of the limits in 10 CFR 20.1502(a).

The licensee may not permit any individual to act as a logging supervisor or logging assistant unless, at all times during the handling of licensed radioactive material, each individual wears on the trunk of the body a personnel dosimeter that ~~is processed and evaluated by an NVLAP-accredited processor and~~ is sensitive to the types of radiation to which the individual is exposed. If neutron sources or neutron producing equipment are to be used, a commitment to provide neutron-sensitive dosimetry devices is required. If film badges are used, they should be replaced at least monthly, and other personnel dosimeters that require processing [e.g., thermoluminescent dosimeters (TLDs) or optically stimulated luminescence dosimeters (OSLs)] should be replaced at least quarterly. Personnel dosimeters that require processing must be promptly processed after replacement. Personnel dosimeters that do not require processing must have the dosimeters evaluated at least quarterly. Reference: The National Institute of Standards and Technology (NIST) maintains a directory of laboratories that are National Voluntary Laboratory Accreditation Program (NVLAP) accredited at http://ts.nist.gov/standards/scopes/dosim.htm.

For purposes of internal dosimetry, the licensee may be required to provide bioassay services when individuals work with unsealed radioactive material. Bioassays or air sampling are

required if working with quantities, chemical and physical forms, and activities that make it likely that the radionuclide will be ingested, inhaled, or absorbed, resulting in an intake in excess of 10 percent of the applicable annual limit on intakes (ALIs) in Table 1, Columns 1 and 2, of Appendix B to 10 CFR Part 20. One ALI results in a committed effective dose equivalent (CEDE) of 5 rems or a committed dose equivalent (CDE) of 50 rems.

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

Bioassay services are available and provided by local hospitals, universities, or other vendors specifically approved by an NRC or Agreement State license to provide such services.
For additional guidance about methodologies for determination of internal occupational dose and summation of occupational dose, refer to Table 8-6.

Table 8-6. Guidance on Personnel Monitoring and Bioassay

Regulatory Guide 8.7, Revision 4	Instructions for Recording and Reporting Occupational Radiation Exposure Data
Regulatory Guide 8.9, Revision 1	Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program
Regulatory Guide 8.20, Revision 2	Applications of Bioassay for Radioiodine
Regulatory Guide 8.25, Revision 1	Air Sampling in the Workplace
Regulatory Guide 8.32	Criteria for Establishing a Tritium Bioassay Program
Regulatory Guide 8.34	Monitoring Criteria and Methods to Calculate Occupational Radiation Doses
Regulatory Guide 8.35, Revision 1	Planned Special Exposures
Regulatory Guide 8.36	Radiation Dose to the Embryo/Fetus
ANSI N13.30-2011	Performance Criteria for Radiobioassay
Information Notice 2000-10	Recent Events Resulting in Extremity Exposures Exceeding Regulatory Limits

Additional Reference for Further Reading:
U.S. Department of Energy G 441.1-1C, Change 1, "Radiation Protection Programs Guide," July 8, 2011.

Response from Applicant:

Provide the following:

- Provide a statement that: "If we are using personnel dosimeters that require processing, ~~The~~ required personnel dosimeters ~~(e.g., film badge, TLD, OSL)~~ will be processed and evaluated by an NVLAP-accredited entity, will be ~~exchanged~~replaced at the required frequency, and will be assigned to and worn by well logging supervisors and logging assistants. If we are using required personnel dosimeters that do not require processing, personnel dosimetry will be assigned to and worn by well logging supervisors and logging assistants and the dosimeters will be evaluated at least quarterly."

AND

- Provide a statement that: "We will develop, maintain, and implement a bioassay program when using unsealed radioactive tracer materials as recommended in NRC Regulatory Guide 8.20, "Applications of Bioassay for Radioiodine," 8.32, "Criteria for Establishing a Tritium Bioassay Program," or other appropriate NRC Regulatory Guide."

OR

- In lieu of developing a bioassay program, provide a commitment that the applicant will contract with a vendor for bioassay services, and confirm that the vendor is licensed or otherwise authorized by the NRC or an Agreement State to provide required bioassay services.

OR

- In lieu of developing a bioassay program, provide a commitment that the applicant will not allow any individual to use more than (i) 1.85 GBq [50 mCI] of iodine-131 at any one time or in any 5-day period at field stations or at temporary job sites, (ii) or more than 3.7 GBq [0.1 Ci] of H-3, or (iii) more than 3700 GBq [100 Ci] of gaseous H-3.

Notes:

- Alternative responses will be evaluated using the guidance in this section.

- Some licensees choose to provide personnel dosimetry to their workers for reasons other than compliance with NRC requirements (e.g., to respond to worker requests or to maintain records of personal exposure).

The red-line, strike-out noted below is on Page B-11 in Appendix B of NUREG-1556, Volume 14, Revision 1

Item No.	Title and Criteria	Yes	N/A	Description Attached
10.	**RADIATION SAFETY PROGRAM (Continued)**			
10.5	**Occupational Dosimetry**			
	• A statement that: "If we are using personnel dosimeters that require processing, ~~required~~ personnel dosimeters ~~(e.g., film badge, TLD, OSL)~~ will be processed and evaluated by an NVLAP-accredited entity, will be ~~exchanged~~replaced at the required frequency, and will be assigned to and worn by well logging supervisors and logging assistants. If we are using required personnel dosimeters that do not require processing, personnel dosimetry will be assigned to and worn by well logging supervisors and logging assistants and the dosimeters will be evaluated at least quarterly."	[ ]		
	AND			
	• Provide a statement that "We will develop, maintain, and implement a bioassay program when using unsealed radioactive tracer materials as recommended in NRC Regulatory Guide 8.20, "Applications of Bioassay for Radioiodine," 8.32, "Criteria for Establishing a Tritium Bioassay Program," or other appropriate NRC Regulatory Guide."	[ ]	[ ]	
	OR			
	• In lieu of developing a bioassay program, provide a commitment that the applicant will contract with a vendor for bioassay services, and confirm that the vendor is licensed or otherwise authorized by the NRC or an Agreement State to provide required bioassay services.	[ ]	[ ]	
	OR			
	• In lieu of developing a bioassay program, provide a commitment that the applicant will not allow any individual to use more than (i) 1.85 GBq [50 mCi] of iodine-131 at any one time or in any 5-day period at field stations or at temporary job sites, (ii) or more than 3.7 GBq [0.1 curie] of H-3 or (iii) more than 3700 GBq [100 Ci] of gaseous H-3.	[ ]	[ ]	

The red-line additions noted below are on Page C-11 in Appendix C of NUREG-1556, Volume 14, Revision 1

ITEM 8.10.5 OCCUPATIONAL DOSE [10 CFR 39.65(a)]

( ) TLD

( ) Film

( ) OSL ~~***Note: Exemption should be requested***~~

( ) Other

( ) Neutron capability

( ) NVLAP-Accredited, if personnel dosimetry is processed

( ) ~~Exchange~~Replacement frequency, if replacement is required

< > Monthly

< > Quarterly

( ) Dosimetery evaluated at least quarterly and promptly after replacement, if replacement is required

BIOASSAYS [10 CFR 39.65(b)]

[ ] Procedures in RG 8.20 adopted for conducting bioassays

[ ] Commitment not to expose any individual to 50 mCi of I-131 at a time or in any 5 days

[ ] Commercial Service:

( ) Name: _____

( ) License No.: _____

ITEM 8.10.6 PUBLIC DOSE

[ ] No response required

[ ] Appendix J of NUREG–1556, Volume 14, Revision 1 reviewed

The red-line, strike-out noted below is on Page E-9 in Appendix E of NUREG-1556, Volume 14, Revision 1

J. RADIATION PROTECTION

1. Dosimetry

   a. Are ALARA considerations incorporated into the Radiation Protection Program? [10 CFR 20.1101(b)]

   b. Were prospective evaluations performed showing that unmonitored individuals receive less than the limits in 10 CFR 20.1502(a)? Did these evaluations consider doses to minors [10 CFR 20.1502(a)(2)] and declared pregnant women [10 CFR 20.1502(a)(3)]?

   c. Did unmonitored individuals' activities change during the year that could put them over 10 percent of the limit?

   d. If yes to "c." above, was a new evaluation performed?

   e. Is external dosimetry required (individuals likely to receive greater than 10 percent of the limit)? And is dosimetry provided to these individuals?

      ~~(1) Is the dosimetry supplier NVLAP-accredited? [10 CFR 20.1501(d), 10 CFR 39.65]~~

      (2) Are the personnel dosimeters ~~exchanged~~replaced and/or evaluated at appropriate frequency?

      (3) Are dosimetry reports reviewed by the RSO when they are received?

      (4) Are the records on NRC Forms or equivalent? [10 CFR 20.2104(d), 10 CFR 20.2106(c)]

         A. NRC-Form 4 "Cumulative Occupational Exposure History" completed?

         B. NRC-Form 5 "Occupational Exposure Record for a Monitoring Period" completed?

      (5) Declared pregnant worker/embryo/fetus [20.1502(a)]

         A. If a worker declared her pregnancy, did licensee comply with [10 CFR 20.1208]?

         B. Were records kept of embryo/fetus dose per [10 CFR 20.2106(e)]?

      (6) Are workers whose exposures exceed 1 mSv [100 mrem] notified annually of their exposures?

      (7) Are records of exposures, radiation surveys, monitoring, and evaluations maintained? [10 CFR 20.2102, 10 CFR 20.2103, 10 CFR 20.2106]

The red-line, strike-out noted below is on page I-1 in appendix I of NUREG-1556, Volume 14, Revision 1

Guidance for Demonstrating That Unmonitored Individuals Are Not Likely To Exceed 10 Percent of the Allowable Limits

Dosimetry is required for individual adults likely to receive, in a year from sources external to the body, an occupational dose in excess of 10 percent of the applicable regulatory limits in Title 10 of the *Code of Federal Regulations* (10 CFR) 20.1201, "Occupational dose limits for adults." However, logging supervisors or logging assistants are required by 10 CFR 39.65(a) to wear a personnel dosimeter ~~that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program processor~~ at all times during the handling of licensed radioactive materials such as licensed tracer materials or sealed sources. ~~Personnel dosimeters may be a film badge, a thermoluminescent dosimeter (TLD), or an optically stimulated luminescence (OSL) dosimeter.~~ In instances where pocket ion chamber dosimeters are used instead of personnel ~~of film badges, TLDs, or OSL~~ dosimeters to assess radiation dosage of personnel who are not logging supervisors or logging assistants, a check of the response of the dosimeters to radiation should be made every 12 months. Acceptable pocket dosimeters should read within plus or minus 20 percent of the true radiation dose. To demonstrate to the NRC that dosimetry is *not* required for nonlogging personnel, a licensee may need to perform a prospective evaluation in accordance with 10 CFR 20.1502 to demonstrate that the unmonitored adult workers are not likely to exceed 10 percent of the applicable limits.

The applicable total effective dose equivalent (TEDE) (whole body) limit is 50 mSv [5 rems] per year, and 10% of that value is 5 mSv [500 millirems] per year for an adult radiation worker.

Three common ways that individuals may exceed 10 percent of the applicable limits are mishandling tracer radionuclides, logging tools, or any devices containing sealed sources. However, most routine well logging or tracer activities result in minimal doses to well logging and tracer personnel. A licensee will need to conduct an evaluation of doses occupationally exposed adult workers could receive in performing tasks involving the handling of radioactive materials to assess the need for dosimetry.

***Example**:* A careful radiation measurement using a survey meter of the location producing the highest dose rate at the rear of the logging truck where radioactive material is stored in its transport compartment and where mechanics routinely work, is found to be 0.015 mSv/h [1.5 mrem/h]. Mechanics are not expected to spend any more than a total of 3 h per week at the location near the storage containers where the sealed sources are housed at the rear of the truck. Based on this measured dose rate, the annual dose is expected to be less than 2.34 mSv [234 mrem]. Specifically, 3 h/wk × 1.5 mrem/h × 52 wk/yr = 234 mrem. Based on the above, if any mechanic works in the area less than 6.4 h per week, no dosimetry is required.

***Note**:* The measurement 6.4 h is the total amount of hours it would take for an individual to meet the 5 mSv [500 millirems] per year limit.