DOCUMENT 2

Supplemental Guidance for NUREG-1556, Volume 6, Revision 1, Consolidated Guidance About Materials Licenses: Program-Specific Guidance About 10 CFR Part 36 Irradiator Licenses

8.10.4 Occupational Dosimetry

Regulations: 10 CFR 19.13, 10 CFR 20.1201, 10 CFR 20.1207, 10 CFR 20.1208, 10 CFR 20.1501(c), 10 CFR 20.1502, 10 CFR 36.55

Criteria: The requirements for occupational dosimetry are shown in Table 8-5.

Discussion: The regulations in 10 CFR 36.55(a) require that irradiator operators shall wear a personnel dosimeter ~~that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor~~ while operating a panoramic irradiator or while in the area around the pool of an underwater irradiator. ~~The National Institute of Standards and Technology maintains a directory of laboratories that are NVLAP-accredited at http://ts.nist.gov/standards/scopes/dosim.html.~~ Regulations in 10 CFR 36.55(b) require, in part, that other individuals who enter the radiation room of a panoramic irradiator shall wear a dosimeter, which may be a pocket dosimeter.

The requirements for most individuals are described in Table 8-5. 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].

Other individuals who perform certain nonroutine operations (e.g., source loading, unloading, and repositioning, troubleshooting the control console, clearing stuck source racks, investigating and remediating removable contamination and leaking sources, (re)installing source cables, and any other activity during which personnel could receive radiation doses exceeding NRC limits) are likely to exceed 10 percent of the limits shown in Figure 8-7 (see Appendix G, “Information Needed to Support Applicant’s Request to Perform Nonroutine Operations”). Applicants also will be required to provide dosimetry (whole body and perhaps extremity monitors) to individuals performing such services.

When personnel monitoring is needed, most licensees use film badges, thermoluminescent dosimeters (TLDs), or optically stimulated luminescence dosimeters (OSLDs) that are supplied by a National Voluntary Laboratory Accreditation Program (NVLAP)-accredited processor. The exchange frequency for film badges is at least monthly because of technical concerns about film fading. The exchange frequency for TLDs and OSLDs is at least quarterly. Personnel dosimeters that do not require processing must be evaluated at least quarterly.

For personnel dosimeters that require processing, applicants should verify that the processor is NVLAP accredited. Consult the NVLAP accredited processor for its recommendations for exchange frequency and proper use. The National Institute of Standards and Technology maintains a directory of laboratories that are NVLAP-accredited at http://ts.nist.gov/standards/scopes/dosim.html.

Some workers (e.g., package handlers, shipping personnel, and custodial personnel) may work near the irradiator but are not likely to exceed 10 percent of the limits. Refer to Appendix K of this NUREG for guidance for demonstrating that an unmonitored individual will not exceed 10 percent of the limits.

Table 8-5. Requirements for Occupational Dosimetry			
Type of Irradiator	**Category of Personnel**	**Type of Dosimetry**	**When Dosimetry Must Be Worn**
Panoramic	Irradiator operators	~~Film, TLD, or OSLD~~ Personnel dosimeter	When operating irradiator
Underwater	Irradiator operators	~~Film, TLD, or OSLD~~ Personnel dosimeter	When in area around pool
Panoramic	Other individuals, including visitors (for groups of visitors, it is sufficient for two to be monitored)	Pocket dosimeter~~, film, TLD, or OSLD~~ or Personnel dosimeter	When entering or in radiation room
All	Anyone who could receive, in a year, a radiation dose in excess of 10% of the allowable limits, as shown in Figure 8-8.*	Pocket dosimeter~~, film, TLD, or OSLD~~ or Personnel dosimeter	As directed by the RSO, based on 10 CFR 20.1502
*The licensee must maintain, for inspection by the NRC, documentation demonstrating that unmonitored individuals are not likely to receive, in a year, a radiation dose in excess of 10 percent of the allowable limits, as shown in Figure 8-8.			

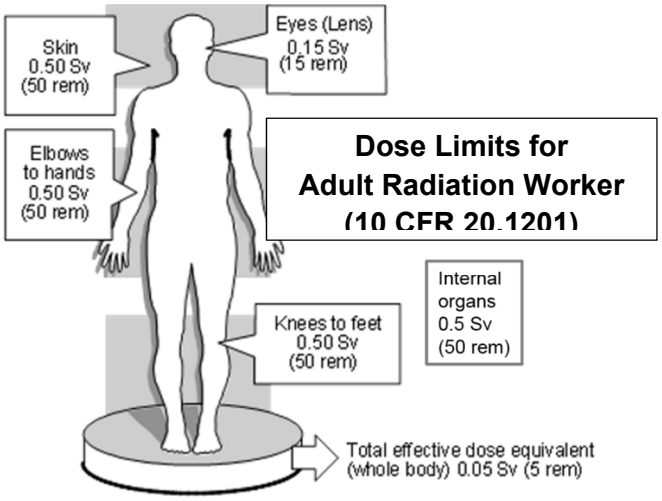

Figure 8-7. Annual Dose Limits for Adult Radiation Workers

Total effective dose equivalent (TEDE) equals the effective dose equivalent (for external exposures) plus the committed effective dose equivalent (for internal exposures).

Response from Applicant: Provide the following:

- ~~A statement that: "Film, TLD, or other dosimetry devices are processed and evaluated by an NVLAP-accredited processor."~~

- A statement that: "~~Film, TLD, or other personnel~~Personnel dosimetry devices that require processing will be ~~exchanged~~replaced and evaluated at the required frequency ~~and~~. Personnel dosimetry devices that do not require processing will be evaluated at the required frequency. Personnel dosimetry devices will be assigned to and worn by irradiator personnel.

- A statement that: Other individuals, including visitors, entering a radiation room will be provided dosimetry in accordance with regulatory requirements.

Suggested Format for Providing Information Requested in Items 5 through 11 of U.S. Nuclear Regulatory Commission Form 313			
Item No	**Title and Criteria**	**Yes**	**Description Attached**
10	**RADIATION SAFETY PROGRAM (CONTINUED)** **Survey Instruments** • Submit alternative calibration procedures for NRC review. **Radiation Monitors** • Describe the type of monitors used to meet the requirements of 10 CFR 36.23(c); 10 CFR 36.29, and 10 CFR 36.59(b). **Material Receipt and Accountability** • Submit a description of procedure(s) for ensuring material accountability. **OR** A statement that: "We will develop, implement, and maintain procedures for ensuring accountability of licensed materials at all times." **AND** A statement declaring that: "We will comply with the NSTS reporting requirements as described in 10 CFR 22.2207." **Occupational Dosimetry** Provide the following: • ~~A statement that: "Film, TLD, or other dosimetry devices are processed and evaluated by an NVLAP-accredited processor."~~ • A statement that: "~~"Film, TLD, or other personnel~~Personnel dosimetry devices that require processing will be replaced and evaluated at the required frequency ~~and~~. Personnel dosimetry devices that do not require processing will be evaluated at the required frequency. Personnel dosimetry devices will be assigned to and worn by irradiator personnel." • A statement that: "Other individuals, including visitors, entering a radiation room will be provided dosimetry in accordance with regulatory requirements."	[ ] [ ] [ ] [ ] [ ]	[ ] [ ]

The red-line addition noted above is on Page C-10 in Appendix C of NUREG-1556, Volume 6, Revision 1

The red-line, strike-out noted below is on Page I-4 in Appendix I of NUREG-1556, Volume 6, Revision 1

Personnel Radiation Protection

A. Are as-low-as-is-reasonably-achievable (ALARA) considerations incorporated into the radiation protection program? [10 CFR 20.1101(b)]

B. Is documentation kept showing that unmonitored individuals receive ≤10 percent of the limit? [10 CFR 20.1502(a)]

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 provided to individuals, as required by 10 CFR 36.55, "Personnel Monitoring," and to individuals likely to receive >10 percent of the limit, including minors? Note that, in accordance with 10 CFR 20.1207, the annual occupational dose limit for minors is also 10 percent of the annual dose limits specified for adult workers.

1. ~~Irradiator operators: Is the dosimetry supplier National Voluntary Laboratory Accreditation Program," approved? [10 CFR 20.1501(c)]~~ Are the dosimeters ~~exchanged~~replaced monthly for film badges and quarterly for thermoluminescent dosimeters (TLDs) and optically stimulated luminescent dosimeters (OSLDs)? Note: The RSO may specify more frequent dosimeter evaluation and dosimeter replacement~~Dosimeter change-out frequency should be specified by the RSO~~ based on exposure history of the facility.

2. Are dosimeters evaluated at least quarterly for personnel dosimeters that do not require processing?

3. Are dosimetry reports reviewed by the RSO upon receipt?

4. Are dosimeters provided to persons who enter the radiation room of a panoramic irradiator? [10 CFR 36.55(b)]

5. Are annual checks of accuracy of pocket dosimeters performed? [10 CFR 36.55(b)]

6. Are the records NRC forms or the equivalent? [10 CFR 20.2104(d), 10 CFR 20.2106(c)]

   a. NRC Form 4 "Cumulative Occupational Exposure History" completed?

The strike-out noted below is on Page K-1 in Appendix K of NUREG-1556, Volume 6, Revision 1

Guidance for Demonstrating that Unmonitored Individuals Are Not Likely to Exceed 10 Percent of the Allowable Occupational Dose Limits

Dosimetry is required for individuals likely to receive in a year, from sources external to the body, a 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, irradiator operators are required by 10 CFR 36.55(a) to wear a personnel dosimeter ~~that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program processor~~ while operating a panoramic irradiator or while in the area around the pool of an underwater irradiator. ~~As discussed in Item 8.10.4, these personnel dosimeters may be film badges, thermoluminescent dosimeters (TLDs) or optically stimulated luminescence dosimeters.~~ Also, other individuals who enter the radiation room of a panoramic irradiator must wear a dosimeter, which may be a pocket dosimeter. When groups of visitors enter the radiation room, at least two people must wear dosimeters. In those instances where pocket ~~chambers~~dosimeters are used instead of ~~film badges or TLDs~~personnel dosimeters, a check of the response of the dosimeters to radiation must be made at least annually. Acceptable dosimeters must read within plus or minus 30 percent of the true radiation dose. To demonstrate that dosimetry is not required for other workers, a licensee needs to have available, for inspection, an evaluation to demonstrate that its workers are not likely to exceed 10 percent of the applicable annual limits.

The most common way that individuals might exceed 10 percent of the applicable limits is by performing work near the irradiator shield or areas of cable or equipment penetration of the shield of the irradiator. However, for most irradiators, even these activities result in the individual receiving minimal doses. A licensee will need to evaluate the doses that its workers might receive in performing these tasks to assess whether dosimetry is required. The evaluation may be completed by carefully measuring the dose rates when the source is in the irradiate position, using techniques similar to those described in Appendix L of this NUREG. An evaluation of the actual time workers spend in the area can provide the information needed to estimate the annual dose of the workers.

The applicable total effective dose equivalent (whole body) limit is 50 millisievert (mSv) [5 rems] per year, and 10 percent of that value is 5 mSv [500 millirems] per year.

Example: A careful measurement of the highest dose rate at the face of the shield of a panoramic irradiator is found to be 0.015 mSv/hr (millisievert per hour) [1.5 mrem/hr]. An individual is expected to spend no more than 3 hours per week in the area near the shield. Based on the dose rate, assuming the source is continuously in the irradiate position while the work is being performed, the annual dose is expected to be less than 2.34 mSv [234 mrem] (i.e., 3 hr/wk × 1.5 mrem/hr × 52 wk/yr). Based on the above specific information, no dosimetry is required if the individual performs work in the area less than 6.4 hours per week.