Vanderbilt University ALARA Policy – Dosimetry Badge Monitoring Program

**Purpose:** This Policy establishes criteria for monitoring, assessing, and responding to occupational radiation dosimetry badge results in support of efforts to keep occupational radiation exposure as low as reasonably achievable (ALARA).

**Scope:** This policy is limited to occupational dosimetry results and does not apply to monitoring for other purposes.

**Policy:** VEHS will conduct a quarterly review of dosimetry results and compile a summary report based on the investigational level framework below. The RSO will investigate doses exceeding Level III, and unexpected doses exceeding Level II. The RSC will review quarterly a summary of radiation dose records (ALARA report) as specified by the Radiation Safety Manual Section (1.A.4).

**Investigational Levels:**

**Level I** (10% of Occupational Dose Limit): occupational dose for which regulations require personnel monitoring; the number of workers exceeding level 1 indicates roughly the number of people Vanderbilt is required to monitor.

**Level II** (25% of Occupational Dose Limit): occupational dose for which scientific consensus guidance requires personnel monitoring; also, NRC guidance recommends applying correction factors to doses of those workers whose only exposure is from diagnostic X-ray machines, and who wear leaded personal protective equipment (Pb PPE). Measured doses exceeding Level II should be corrected to account for Pb PPE in such cases.

**Level III** (80% of Occupational Dose Limit): occupational dose for which the worker may potentially exceed a regulatory dose limit if exposure patterns are allowed to persist; such cases will be investigated by the RSO when feasible.

### Occupational Exposure Categories:

<table>
<thead>
<tr>
<th></th>
<th>DDE (mSv [mrem])</th>
<th>LDE (mSv [mrem])</th>
<th>SDE-WB&amp;ME (mSv [mrem])</th>
<th>DDE (mSv [mrem])</th>
<th>LDE (mSv [mrem])</th>
<th>SDE-WB&amp;ME (mSv [mrem])</th>
<th>DPW/fetal (mSv [mrem])</th>
<th>Term (mSv [mrem])</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>5 (500)</td>
<td>15 (1,500)</td>
<td>50 (5,000)</td>
<td>1.25 (125)</td>
<td>3.75 (375)</td>
<td>12.5 (1,250)</td>
<td>0.15 (15)</td>
<td>0.5 (50)</td>
</tr>
<tr>
<td>II</td>
<td>12.5 (1,250)</td>
<td>37.5 (3,750)</td>
<td>125 (12,500)</td>
<td>3.12 (312)</td>
<td>9.37 (937)</td>
<td>31.2 (3120)</td>
<td>0.4 (40)</td>
<td>1.25 (125)</td>
</tr>
<tr>
<td>III</td>
<td>40 (4,000)</td>
<td>120 (12,000)</td>
<td>400 (40,000)</td>
<td>10 (1,000)</td>
<td>30 (3,000)</td>
<td>100 (10,000)</td>
<td>1.2 (120)</td>
<td>4 (400)</td>
</tr>
<tr>
<td>Reg. Limit</td>
<td>50 (5,000)</td>
<td>150 (15,000)</td>
<td>500 (50,000)</td>
<td>12.5 (1,250)</td>
<td>37.5 (3,751)</td>
<td>125 (12,500)</td>
<td>~1.5 (~150)</td>
<td>5 (500)</td>
</tr>
</tbody>
</table>

*Note:** Occupational Dose Limits are defined only as annual values, i.e. exceeding one fourth of the annual limit within a calendar quarter does not by itself constitute noncompliance.

**Modification of Measured Dose to Account for Leaded (Pb) Personal Protective Equipment (PPE)**

For radiation workers whose only occupational exposure comes from diagnostic X-ray devices, and who wear Pb PPE during the X-ray procedures, dosimetry badges worn outside the Pb PPE provide a significant overestimation of occupational dose. Several recognized methods exist for correcting these measured DDE doses to more accurately reflect the worker’s actual occupation dose, but the two recognized by the NRC are:

- Single Badge (worn outside Pb PPE at collar): \(D_{\text{reported}} = 0.3 \times D_{\text{measured}}\)
- Double Badge (one worn outside Pb PPE at collar, one under PPE at waist): \(D_{\text{reported}} = 0.04 \times D_{\text{collar}} + 1.5 \times D_{\text{waist}}\)

The State has approved Vanderbilt’s use of a LDE correction factor for such radiation workers who also wear leaded eye protection:

- LDE \(D_{\text{reported}} = 0.5 \times D_{\text{measured(collar)}}\)

Radiation workers whose exposures meet this criteria should have these correction factors applied if their dose exceeds 25% of the regulatory limit for a monitoring period.

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1. TN: 0400-02-05-71; NRC: 10cfr20.1502
4. See e.g. Table 1 of Jarvinen et al (2008), NCRP Report 122 (1995)