PERSONAL EXPOSURE INVESTIGATIONS AND REPORTING

PURPOSE
This procedure specifies the requirements and responsibilities for conducting, documenting and reporting investigations of actual or suspected radiation exposures to individuals that exceed specific investigation levels, and for timely reporting of any doses that exceed regulatory limits.

RULES AND REGULATIONS
The University is committed to maintaining all radiation doses to levels that are as low as reasonably achievable (ALARA). One method for accomplishing the ALARA goal is to investigate situations and incidents that lead to unusual exposures, even if no regulatory limit is exceeded. To assure that unexpected radiation exposures are evaluated, investigation levels are established well below the dose limits.

For all exposures, there are two investigation levels (ILs). The levels are based on the expected (normal) exposure for a category or specific group of radiation users. A higher level or Level II is established as an ALARA limit that requires a formal documented investigation. Values of the IL for doses to the body or to the extremities for the various groups are listed in the table on page 3.

For internal exposures, Level I IL is set to 0.025 ALI per single intake or per calendar quarter. Specific ILs may be dictated by CSU’s broad-scope license conditions, or detection sensitivity for a given radionuclide. In those instances, different ILs will be assigned. Level II ILs are typically set at 0.05 the ALI unless otherwise noted. Annual intakes exceeding 0.1 the ALI for all nuclides combined shall be included in the calculation of total effective dose equivalent for purposes of determining compliance with annual dose limits and reporting requirements.

Potential intakes due to personal contamination or injury involving radioactive materials shall be investigated regardless of the actual radiation dose.

Any radiation dose to an individual that exceeds the annual dose limit shall be investigated and reported to the regulatory agency. If the dose is received as the result of a single event, it shall be reported either immediately or within 24 hours, depending on the magnitude of the dose. The RSO directs the investigation, evaluates the results and submits the report to the regulatory agency. The exposed individual shall provide information regarding the circumstances of the exposure.
The principal user must be informed of the exposure and of any subsequent restrictions that may need to be imposed on the individual.

PROCEDURES

The RCO shall ensure that the monthly dosimetry reports are reviewed to determine whether any reported doses exceed an investigation level. The RCO shall also ensure that any reported overexposure is investigated promptly and reported, if necessary.

For doses below the reportable level (Level I), no action is necessary. Doses that exceed the reportable Level 1 limit require the RCO to contact the individual by phone or email and make that person aware of the dose report. The phone call or email is to be considered for informational purposes only and no investigation is required. For doses above the reportable level (Level II) the RCO must obtain the relevant information by a face-to-face interview. Investigations of external exposures exceeding the LEVEL II value shall be recorded on the "EXTERNAL EXPOSURE (ALARA) INVESTIGATION REPORT" (RF-46A). The questionnaire on the back of RF-46A must be used as a guide for Level II investigations to ensure that all necessary information is obtained. Investigations of internal exposures shall be recorded on the "INTERNAL EXPOSURE (ALARA) INVESTIGATION REPORT" (RF-46B).

For each overexposure requiring a report to the regulatory agency, a signed, written statement shall be submitted by the exposed individual describing the circumstances that led to the exposure and the measures that will be taken to prevent recurrence. An accurate and complete response is important, since all or part of this statement may be sent to the regulatory agency.

Dosimeter readings shall be accepted as valid and shall not be changed on the permanent record unless there is a complete, written description of the circumstances that produced an invalid dosimeter exposure, and the report is signed by the exposed individual, the principal user and the RSO.

The original Investigation Report and all attachments shall be filed in the personal dosimetry record for the individual. A copy of the report shall be provided to the exposed individual.

All ALARA investigations are required to be reported to the Radiation Safety Committee.

The loss of a radiation dosimetry badge should be investigated and the RF-46C form is required to be completed. The loss of the badge requires an estimation of dose by the Radiation Control Office that must be documented. A charge for the loss may be
incurred by the participant as outlined in the University’s Radiation Control Manual.

<table>
<thead>
<tr>
<th>REPORTING LEVELS and DEADLINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Effective dose equivalent in rem)</td>
</tr>
<tr>
<td>Regulatory Limit Reporting Requirements for the University to the State of Colorado</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Immediately</th>
<th>24 Hours</th>
<th>30 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Body:</td>
<td>25 rem/event</td>
<td>5 rem/event</td>
<td>5 rem/year</td>
</tr>
<tr>
<td>Eye:</td>
<td>75 rem/event</td>
<td>15 rem/event</td>
<td>15 rem/year</td>
</tr>
<tr>
<td>Skin or Extremities:</td>
<td>250 rem/event</td>
<td>50 rem/event</td>
<td>50 rem/year</td>
</tr>
<tr>
<td>Any Other Single Organ:</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>50 rem/year</td>
</tr>
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<table>
<thead>
<tr>
<th>ALARA INVESTIGATION LEVELS – (Level I)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Effective dose equivalent in mrem/month)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>External Dose to Body (Body Badges)</th>
<th>External Dose to Extremities (Ring Badges)</th>
<th>Intake by Any Route (Bioassay)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Catheterization:</td>
<td>150</td>
<td>1500</td>
<td>N/A</td>
</tr>
<tr>
<td>Other Special Procedures:</td>
<td>150</td>
<td>1500</td>
<td>N/A</td>
</tr>
<tr>
<td>Diagnostic Radiology:</td>
<td>150</td>
<td>500</td>
<td>N/A</td>
</tr>
<tr>
<td>Nuclear Medicine:</td>
<td>150</td>
<td>750</td>
<td>7.5E-4 ALI (\textsuperscript{125}I)</td>
</tr>
<tr>
<td>(Radio Iodines)</td>
<td></td>
<td></td>
<td>2.5E-5 ALI (\textsuperscript{131}I)</td>
</tr>
<tr>
<td>All Others:</td>
<td>150</td>
<td>500</td>
<td>0.025 ALI (\textsuperscript{123}I)</td>
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</table>

<table>
<thead>
<tr>
<th>ALARA INVESTIGATION LEVELS – (Level II)</th>
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</thead>
<tbody>
<tr>
<td>10% of ALI (Effective dose equivalent in mrem/month)</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>External Dose to Body (Body Badges)</th>
<th>External Dose to Extremities (Ring Badges)</th>
<th>Intake by Any Route (Bioassay)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Catheterization:</td>
<td>500</td>
<td>5000</td>
<td>N/A</td>
</tr>
<tr>
<td>Other Special Procedures:</td>
<td>500</td>
<td>5000</td>
<td>N/A</td>
</tr>
<tr>
<td>Diagnostic Radiology:</td>
<td>500</td>
<td>5000</td>
<td>N/A</td>
</tr>
<tr>
<td>Nuclear Medicine:</td>
<td>500</td>
<td>5000</td>
<td>0.05 ALI (\textsuperscript{125}I)</td>
</tr>
<tr>
<td>(Radio Iodines)</td>
<td></td>
<td></td>
<td>0.05 ALI (\textsuperscript{131}I)</td>
</tr>
<tr>
<td>All Others:</td>
<td>500</td>
<td>5000</td>
<td>0.05 ALI/event</td>
</tr>
</tbody>
</table>
Name: ____________________________  CSU ID No.: __________________

Work Location: ____________________________  Phone: _____________

Principal User: ____________________________  Department: _____________

**REASON FOR INVESTIGATION:** ____________________  □ Dosimeter reading for the period: ____________________

Badge #: _______  Series: _______  Collar Badge  Body Badge  Finger (Ring)

   Reported dose - Shallow: __________ mrem  __________ mrem  __________ mrem

   Reported dose - Deep: C: __________ mrem  B: __________ mrem

   Effective dose (if leaded apron was worn) = 0.04C + 1.5B = __________ mrem

Report received by: ____________________________  Date: __________  Time: __________

Additional information dated _________________  □ attached

**NOTIFY CDPHE-RCD (and NRC if Reactor involved); check category:**

□ IMMEDIATE NOTIFICATION IF REPORTED OR POTENTIAL DOSE EXCEEDS 5 x ANNUAL LIMIT

□ NOTIFICATION WITHIN 24 HOURS IF REPORTED OR POTENTIAL DOSE EXCEEDS ANNUAL LIMIT

Initial Notification by: ____________________________  Date: __________  Time: __________

□ WRITTEN REPORT REQUIRED WITHIN 30 DAYS FOR ANY DOSE THAT EXCEEDS ANY LIMIT.

**RESULTS OF INVESTIGATION:** (see Questionnaire on next page)

Employee interviewed by: ____________________________  Date: __________

Employee statement attached?  □ Yes  □ No  Date: _________________

Invalid dosimeter reading(s) verified by: ____________________________  Date: _________________

Valid dosimeter reading(s) verified by: ____________________________  Date: _________________

   Additional information dated ____________________________  □ attached

**RECOMMENDATIONS TO PREVENT RECURRENCE:**

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

Additional information dated _________________  □ attached

Reported by: ____________________________  Date: _________________
EXTERNAL EXPOSURE INVESTIGATION QUESTIONNAIRE
(Level II)

For all investigations of external exposures:

1. Where did you work during the exposure period? Building, room, hood/bench, etc., or any other information which would help to determine the source of exposure, and whether it is valid.

2. What type and number of procedures did you perform during the monitoring period? How much time was spent on these procedures?

3. Where is your dosimeter kept when not being worn? Was it ever taken out of the lab area by you or anyone else? Could anyone else have used it or exposed it to a radiation source? For Dispersible Users: was the badge surveyed for contamination upon completion of the procedure?

4. Incident Specific Questions

   Question #1

   Question #2

For Nuclear Medicine:

5. What is the specific caseload for the monitoring period (animal species, etc.)

For radioisotope users:

6. Did you use shielding? Which type? Could another individual have caused the exposure, e.g. someone working near you, a sample placed near you or in a drawer?

For Cardiologists:

7. What position were you located at during the fluoroscopy procedure? (diagram 46.1)

8. Do you use the X-ray equipment in such a way that the angle of the primary beam is not perpendicular to the patient? If so how do you ensure that your distance from the primary beam is maintained?
RF-46B. INTERNAL EXPOSURE INVESTIGATION REPORT

Name: ________________________________ CSU ID No.: ____________

Work Location: ________________________ Phone: ____________

Principal User: ________________________ Department: ____________

REASON FOR INVESTIGATION:

☐ Personal contamination or injury    Date: ____________

☐ Abnormal Urinalysis    ☐ Abnormal Thyroid Count    Date: ____________

Additional information dated ____________    ☐ attached

Investigation initiated by: ________________________ Date: ____________    Time: ______

NOTIFY CDPHE-RCD (and NRC if Reactor involved); check category:

☐ IMMEDIATE NOTIFICATION IF REPORTED OR POTENTIAL DOSE EXCEEDS 5 x ANNUAL LIMIT

☐ NOTIFICATION WITHIN 24 HOURS IF REPORTED OR POTENTIAL DOSE EXCEEDS ANNUAL LIMIT

Initial notification by: ________________________ Date: ____________    Time: ______

☐ WRITTEN REPORT REQUIRED WITHIN 30 DAYS FOR ANY DOSE THAT EXCEEDS ANY LIMIT

RESULTS OF INVESTIGATION: (description of event, cause, etc.)

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Employee interviewed by: ________________________ Date: ____________

Employee statement attached?    ☐ Yes    ☐ No    Date: ____________

Intake of radioactive material - Estimated: ____________ ALI;    Verified: ____________ ALI

Intake verified by: ________________________ Date: ____________

Additional information dated ____________    ☐ attached

RECOMMENDATIONS TO PREVENT RECURRANCE: ______________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Additional information dated ____________    ☐ attached

WRITTEN REPORT, if required, within 30 days:

Reported by: ________________________ Date: ____________
1. Where did you work during the contamination event? Building, room, hood/bench, etc., or any other information which would help to determine the source of exposure, and whether it is valid.

2. What type of procedures did you perform during the exposure event? What is the estimated activity that was taken internally (The details of the procedures are not so important as a reliable estimate of your potential intake.)

3. What is the likely cause of the internal exposure?

4. What type of personal protective apparel did you wear, i.e. lab coat, lead apron, thyroid collar, goggles, gloves?

5. Who else may have been exposed to the contamination?

RF-46C. LOSS OF RADIATION BADGE
INVESTIGATION REPORT

Name: _______________________________  CSU ID No.: ________________

Work Location: ________________________  Dept.: ____________________

Principal User: ________________________  Phone: _________________

Month/Year of Loss: ________________  Badge Wear Date: ________________

Notified RCO on (date): ______________  Interview Conducted By: ______________________

Interview Date: ____________  Over the Phone: ☐  Face to Face: ☐  e-mail ☐

1. Where did you work during the exposure period? (Building, Rm, and Dept.)

________________________________________________________________________

2. What type of procedures/research did you perform during the monitoring period?

________________________________________________________________________

3. Are these procedures routine procedures that you have performed in previous months?

________________________________________________________________________

4. Where on your person is your badge worn? i.e. waist, collar etc.

________________________________________________________________________

5. Explain how you might have lost your badge?

________________________________________________________________________

6. Notes:

________________________________________________________________________

Estimated Dose Equivalent by RCO: ____________ for (month/yr or quarter/yr): ______________

Estimates taken from prior Dose reports dated (m/y) _______ to _______

Means of dose estimate (Calculation, P.U. estimate): ______________________

________________________________________________________________________

Reported By (RCO): __________________________ Date: ____________

Radiation Worker (signature): __________________________ Date: ____________

RCO USE ONLY:

Location: ______________  Wearer #: __________  Badge Type: ______________

Contact Dosimetry Vendor  Yes ☐  No ☐  Initials: __________  Date: __________

Attach Dose History from Vendor ☐  Spare badge assigned ☐  Yes ☐  No ☐

Entered into Access data base ☐  Spare Badge #_______, Series #_______
46.1 Fluoroscopy Procedure Positioning