



OCCUPATIONAL EXPOSURE AND PERSONNEL MONITORING PROGRAM

1. ADULT OCCUPATIONAL LIMITS AND MONITORING EXTERNAL EXPOSURE

1.1. The Annual Occupational Dose Limits for Adults are as follows:

Table 1, Annual Occupational Exposure Limits for Adults

	ANNUAL LIMIT	QUARTERLY LIMIT FOR X-RAY
Whole Body	5 rem (0.05 Sv)	1 ¼ rem/qtr (3 rem/qtr allowed if 5 rem/year not exceeded)
Lens of Eye	15 rem (0.15 Sv)	1 ¼ rem/qtr (3 rem/qtr allowed if 5 rem/year not exceeded)
Skin or any extremity	50 rem (0.50 Sv)	7 ½ rem/qtr
Fetal exposure	0.5 rem (5.0 mSv) during entire pregnancy	n/a

1.2. Required Dosimetry for Occupationally Exposed Personnel

Dosimeters (radiation badges) are required by regulation to be issued to those likely to receive ten percent of the above limits. By review of the results of monitoring, those persons who have exceeded ten percent of any limit or guidance in the table above will be identified and designated; monitored as required by regulation. For those monitored as required by regulation, all required records will be obtained, exposure reports provided as required by regulation. Records must be kept according to [Record Retention for Radiation Safety Office](#). For additional guidance on dosimeter selection see the section, “Guidelines For Assigning Radiation Detection Dosimetry” in this Appendix.

1.3. Elective Dosimetry for Occupationally Exposed Personnel

Additional dosimeters are supplied upon request to any person frequenting a controlled area, but who is not likely to exceed ten percent of any regulatory limit or quarterly fraction. These persons are designated as administratively monitored. Records, exposure reports and retention requirements may be subject to Emory Policy but are not subject to regulation.

1.4. Review of Monitoring Program

Continuous evaluation of the results of both administrative and regulatory monitoring will identify any individual that achieves regulatory trigger levels, who will then be designated henceforth as monitored as required by regulation. All required records will be obtained, exposure reports provided as required by regulation. Records must be kept according to [Record Retention for Radiation Safety Office](#).

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1.5. Dosimeter Use

Administratively monitored personnel who elect to maintain their dosimeters will be encouraged to use them properly and return them in a timely manner. Administratively monitored staff may discontinue their dosimeters in consultation with Radiation Safety staff.

2. SUMMATION OF EXTERNAL AND INTERNAL DOSE

The total dose to the individual is a summation of external and internal exposure. The most likely route of internal exposure is the inhalation of volatile radionuclides. When airborne radionuclides are present, the Radiation Safety Officer will evaluate the protocol to determine if the use of a fume hood or a respirator is required. Radioactive material can also enter the body via oral ingestion, intake through wounds and absorption through the skin.

3. INTERNAL EXPOSURE

Internal exposures are determined through bioassays.

3.1. Urine Bioassays

Urine bioassays will be run on personnel who use more than 8 mCi of volatile tritium on an annual basis. Prior bioassays of persons using stable tritium compounds did not yield any positive results.

3.2. Thyroid bioassays

Thyroid bioassays are required of personnel who perform iodinations with more than 1 mCi of free iodine or who administer liquid therapeutic doses of I-131.

3.3. Emergency Bioassay

Bioassays must also be done following spills that result in significant personnel contamination and/or airborne radioactive material.

4. EMORY UNIVERSITY ALARA PROGRAM

The ALARA program of Emory University expresses the commitments made at all levels of the University to maintain individual and collective radiation doses as low as reasonably achievable.

4.1. Management Commitment

4.1.1. ALARA Commitment

The management of Emory University is committed to a program for keeping both individual and collective radiation doses as low as reasonably achievable.

4.1.2. Annual Program Review

A formal annual review of the Radiation Safety Program will be conducted with special focus on ALARA considerations. This evaluation will include a review of Council and Committee activities, exposure records, operating procedures and audits and consultation with members of the Radiation Safety Office staff. Modification of procedures and to equipment and facilities will be made where expenditures appear in the judgment of University Management and the Radiation Safety Officer to be justified by the resulting radiation exposure reductions.

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4.2. Radiation Control Council Commitment

4.2.1. Review of Applications

All committees are charged by the Council to review applications with respect to user qualifications, types and quantities of materials requested, and uses of materials requested. Applications will require the description of personnel monitoring, protective clothing, shielding and survey procedures designed to properly evaluate exposures and maintain them ALARA.

4.2.2. Delegation of Authority

The Radiation Control Council delegates authority to the Radiation Safety Office for enforcement of the ALARA concept and supports the Radiation Safety Office in instances where authority must be asserted. If the Radiation Safety Officer is overruled, the Council will record the basis for its action in the minutes of the Council's quarterly meeting.

4.2.3. Review of Occupational Exposure

The Radiation Control Council will review quarterly the institutions' occupational radiation exposure level with emphasis upon those exceeding action limits.

Trends in exposure serve as an index of ALARA program quality and alert Radiation Safety to areas where investigation or assistance is warranted.

4.3. The Radiation Safety Office (RSO) Commitment

4.3.1. Monthly Review of External Exposures

The RSO will review electronic or printed reports on a monthly basis for the external radiation exposures of monitored staff to determine that they are ALARA in accordance with established action limits. Internal exposure records will be merged with external exposures to obtain total dose upon completion of bioassay tests.

4.3.2. Annual Review of Radiation Safety Program

The RSO will perform an annual review of the Radiation Safety Program for adherence to ALARA concepts and seek to remedy any deficiencies noted.

4.3.3. Quarterly ALARA Reviews

The RSO will also review quarterly radiation levels in restricted areas and adjacent non-restricted areas as indicated on staff surveys.

4.3.4. Formal ALARA Training

The basic concept of the ALARA program will be presented in all orientation training and refresher training for authorized users, radiation workers and ancillary personnel.

4.3.5. Informal ALARA Instruction

Frequent contact between radiation workers and RSO personnel in the workplace fosters cooperative development of ALARA procedures in which the workers can participate in the formation of procedures which they will be required to follow.

4.4. Radiation Permit Holder's Commitment

4.4.1. Evaluation of Procedures

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Principal Investigator will evaluate all approved procedures before using radioactive materials to ensure that exposures will be kept ALARA. This may be enhanced through the applications of trial runs.

4.4.2. Commitment to ALARA

Authorized users will express their commitment to maintaining exposures ALARA to all laboratory personnel, both users of radioactive material and those who do not use radioactive material in their laboratory protocols. They will ensure that laboratory personnel using radioactive material under their supervision are trained and educated in good radiation safety practices which contribute to maintaining exposures ALARA.

4.5. Radiation Workers Commitment

4.5.1. Personnel Monitoring

Proper monitor use includes requiring personnel to wear all personnel monitoring badges issued, place them in a safe place away from radiation at the end of the shift and return them promptly after the wear period.

4.5.2. Protective Clothing

Proper protective clothing (see [EHSO PPE Guideline](#)) will be used at all times and proper shielding will be used when indicated. Both instrument surveys and wipe tests will be performed on a timely basis to prevent unnecessary exposure and spread of radioactive contamination.

4.6. Investigational Levels for Occupational External Radiation Exposure

Emory University has established the following investigational levels for occupational external radiation exposure which will initiate review of investigation by the RSO.

Table 2, Emory Investigational Levels

BODY EXPOSURE:	LEVEL 1 – MREM (mSv)	LEVEL 2 MREM (mSv)
Radioactive material workers: Whole body; head; trunk including male gonads; arms above elbows, and legs above knee. Assigned exposure/chest badge of x-ray workers	125 /qtr. (1.25) 500 /yr.(5)	375 /qtr. (3.75) 1500 /yr. (15)
Skin of whole body (shallow)	1250 /qtr (12.5) 5000 /yr. (50)	3750 /qtr (37.5) 15,000 /yr. (150)
Lens of the eye	375 /qtr.(3.75) 1500 /yr. (15)	1125 /qtr. (11.25) 4500 /yr. (45)
Extremity Exposure: Hands; elbows; arms below elbow; knee; legs below knees	1250 /qtr. (12.5) 5000 /yr. (50)	3750 /qtr. (37.5) 15,000 /yr. (150)

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4.7. Monthly Dosimetry Report Reviews

The RSO will review electronic or printed reports monthly for the external radiation exposures of monitored staff to determine that they are ALARA in accordance with established action limits. When any body or collar badge exposure exceeds 400 mR (4 mSv) for one month, the employee will be notified and efforts made to examine ways to reduce exposure to acceptable limits, and to determine types of protective equipment used (thyroid collar, leaded glasses, etc.).

4.8. Quarterly ALARA Reports

In regards to Quarterly ALARA reports, the following action will be taken:

- 4.8.1. Quarterly exposure of individual to less than Investigation Level 1: No further action
- 4.8.2. Quarterly exposures of individual is equal to or greater than Investigation Level I but less than Investigational Level 2:
 - 4.8.2.1. Exposure will be reported to the Radiation Control Council. No action related specifically to the exposure is necessary unless deemed appropriate by the Council. The Council will consider each exposure in comparison with those of others performing similar tasks as an index of ALARA program quality and will record the review in the Council minutes. Employee will be advised and sufficient data collected to meet regulatory reporting requirements. These persons will remain monitored for regulatory compliance purposes as long as their job function involves radiation exposure.
- 4.8.3. Exposures equal to or greater than Investigational Level 2:
 - 4.8.3.1. The RSO will investigate in a timely manner the cause(s) of all personnel exposures; and, if warranted, will take action. A report of the investigation, actions taken, if any, and a copy of the individual's cumulative annual and permanent exposure will be presented to the Radiation Control Council. A copy of these reports will be included in the Council minutes. Employee will be advised and sufficient data collected to meet regulatory reporting requirements. These persons will remain monitored for regulatory compliance purposes until they change or are assigned different job duties.

5. EXPOSURE LIMITS FOR MINORS

Occupational exposure limits for minors are 10% of the annual occupational exposure limits specified for adult workers.

6. EXPOSURE LIMITS FOR EMBRYO/FETUS

6.1. Exposure to Embryo/Fetus During Entire Pregnancy

The licensee shall ensure that the dose equivalent to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv). A declared pregnant woman who receives an exposure which exceeds 50 mrem (0.5 mSv) will be contacted by the radiation safety physicist serving the area.

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6.2. Confidential Counseling

Radiation Safety personnel will provide private and confidential counseling upon request from any radiation worker who is contemplating pregnancy.

7. DOSE LIMIT FOR THE PUBLIC

The total effective dose equivalent to members of the general public from licensed operations must not exceed 0.1 rem (1 mSv), exclusive of background, medical procedures, or sewer disposal. The dose in any unrestricted area from external sources with the exception of released patients must not exceed 0.002 rem (0.02 mSv) in any one hour. The total effective dose equivalent to individual members of the general public from infrequent exposure from radiation producing machines must not exceed 0.5 rem (5 mSv).

8. GUIDELINES FOR ASSIGNING RADIATION DOSIMETRY

The Georgia Department of Natural Resources, Radioactive Materials Program, Rules and Regulations for Radioactive Materials, Chapter 391-3-17, require that any person who is occupationally exposed to radiation at a level which is likely to exceed ten percent of any regulatory limit (corresponding to an ALARA level 1), must be issued an individual monitoring device. Similar regulations exist for x-ray users by the Georgia Department of Human Resources.

Archived and current dosimetry data review determines dosimeter assignment; those who have received exposures requiring monitoring will be considered Regulatory (see Monitoring Categories section below), and all required records will be obtained, exposure reports provided as required by regulation. Records must be kept according to [Record Retention for Radiation Safety Office](#). All other dosimeters will be issued for administrative purposes. Records will be reviewed and available electronically. A person who receives an exposure exceeding any ALARA level will be advised, listed as a person monitored for regulatory purposes and all required records will be obtained, exposure reports provided as required by regulation. Records must be kept according to [Record Retention for Radiation Safety Office](#). Those monitored for administrative purposes will be identified by name, work area and employee identification or dosimeter assignment number. Records will be kept for administrative purposes only in electronic form.

Personnel working with large quantities of beta emitters will be issued extremity monitoring (ring badge), but issued for administrative purposes (see Monitoring Categories section below) unless screening review shows an ALARA level has been received.

A declared pregnant radiation worker will be issued a monthly dosimeter to be worn at waist level, in addition to her regular dosimeter.

Persons working with any type of x-ray equipment or patient doses will be issued a whole body dosimeter, collar and body dosimeters or extremity exposures as conditions warrant, but issued for administrative purposes (see Monitoring Categories section below) unless screening review shows an ALARA level has been received.

Personnel who do not fall into any of these categories may be issued a dosimetry badge for administrative purposes if, after speaking with Radiation Safety personnel, they are still concerned about their radiation exposure.

9. MONITORING CATEGORIES

Exposure monitoring has been divided into three categories: Monthly Regulatory Monitoring, Quarterly Regulatory monitoring, and Administrative Monitoring.

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9.1. Monthly Regulatory Monitoring

9.1.1. Monthly Regulatory Monitoring includes personnel working in clinical areas who are likely to receive or have ever received exposures in excess of any ALARA level.

9.2. Quarterly Regulatory Monitoring

9.2.1. Quarterly Regulatory Monitoring includes healthcare staff who care for patients receiving treatment with radioactive materials on an irregular basis or researchers who are likely to receive or have ever received exposures in excess of any ALARA level.

9.3. Administrative Monitoring

9.3.1. Administrative Monitoring includes researchers, healthcare and ancillary personnel who, from a historical perspective of the potential exposure of the group, and from an evaluation of the exposure of the individuals do not require monitoring according to applicable regulations.