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NOTE: This Section's Sign-off Record is maintained in the Training & Records Management Office, 151 TASF.

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REVISION / REVIEW LOG

SECTION 7 – RADIOLOGICAL PROTECTION PROGRAM

Review Number:	Effective Date:	Contact Person:	Pages Affected:	Description of Revision:
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2	8/01/2011	Mike McGuigan	5	G:\ESHA\Document Control\Revision Descriptions\ESH&A Manual\ Manual 10200.002 Section 7 revdesc.doc

SIGN-OFF RECORD

The Environment, Safety Health and Assurance Program Manual has been reviewed and approved as documented below:

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Note: Original Sign-off Record with signatures is on file with ESH&A.

7.0 RADIOLOGICAL PROTECTION PROGRAM

This section deals only with IONIZING radiation. Non-ionizing radiation is managed by the Industrial Hygiene Program and information concerning non-ionizing radiation is found in section 4 of this manual.

7.1 RADIOACTIVE MATERIALS

***Applicability Statement**: This section applies to groups/departments that use, handle or store radioactive materials in a laboratory environment. This section also applies to employees who transfer, ship or receive radioactive materials.*

7.1.1 REFERENCES

DOE Order 5400.5, Chg. 2 Radiation Protection of the Public and the Environment
DOE Order 231.1B, Environmental, Safety and Health Reporting
DOE Order 474.2, Nuclear Material Control and Accountability
DOE Order 435.1, Radioactive Waste Management
Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection,
Form 10200.004, Readiness Review Activity Approval Form
Plan 10202.004, Radiation Protection Program (RPP)
Manual 10202.001, Radiation Safety Manual
Manual 10200.003, Waste Management Program Manual
Manual 58304.001, Transportation Safety Manual
Form 10202.016, Radiological Work Permit Guidance and Checklist Form

7.1.2 REGULATIONS

The Federal Regulation governing the use of radioactive materials at Ames Laboratory is 10 CFR 835. To implement this regulation, the Ames Laboratory Radiological Protection Program (RPP) has been written to state how each of the safety requirements will be accomplished at the Laboratory. The Radiation Safety Manual presents the information and procedures that must be understood and practiced in order to ensure that all uses of ionizing radiation at Ames Laboratory are in compliance with existing regulatory requirements. Any resultant radiation exposures must be maintained As Low As Reasonably Achievable (ALARA).

7.1.3 BACKGROUND

Use, handling, storage, receipt, shipping, transferring, and disposal of radioactive materials are important aspects to many of the Laboratory's research programs. The hazards associated with radioactive materials can be significant and demand an effective management program. This section describes the health physics protection mechanisms designed to ensure worker and environmental protection from radioactive materials.

7.1.4 PROGRAM INFORMATION

General

The activities of radioactive material commonly used in research at the Laboratory today are typically quite small (microcurie or millicurie amounts) and the doses recorded on personnel dosimetry are far less than 100 millirem in a year. However, radiological conditions are continually monitored by Health Physics in order to promptly detect, and correct, if necessary, potentially unsafe conditions. New projects or modifications to existing projects involving the use of sources of radioactive materials must be approved through the Readiness Review approval process before beginning operations. Special projects, such as

mitigation of contaminated equipment or areas, are performed under guidance of a Radiological Work Permit issued by ESH&A.

Ames Laboratory follows the requirements listed in the Radiation Protection Program (RPP). The RPP, Radiation Safety Manual, along with the information contained in this section of the Ames Laboratory ESH&A Program Manual and Institutional Training modules constitute the Laboratory's written program.

It is the policy of Ames Laboratory to both allow and facilitate the use of radioactive materials and radiation-producing devices for purposes of research and teaching. At the same time, Ames Laboratory is committed to ensuring that all uses of these materials and devices are in compliance with regulatory requirements and that resultant radiation exposures are kept As Low As Reasonably Achievable (ALARA). Toward this end, the Ames Laboratory has established specific administrative entities with responsibilities for controlling the use of radioactive materials and radiation-producing devices at Ames Laboratory.

ALARA Committee

In accordance with the specific requirements of Ames Laboratory's RPP, an ALARA Committee has been established. The Committee consists of members of Ames Laboratory's staff and faculty appointed by the Director for terms of three years. The principal function of the Committee is to oversee the implementation of Laboratory policies and procedures for the safe use of radioactive materials and radiation-producing devices. In addition, the ALARA Committee reviews all requests for use of radioactive materials and radiation-producing devices, reviews records of personnel dosimetry, and decides whether or not authorization for use is to be granted. The ALARA Committee must specifically authorize each activity, which involves the use of radioactive material. See Section 4.0 of the Radiation Safety Manual for detailed explanation of these requirements.

NOTE: <u>Use Authorizations</u> that have been approved by the ALARA Committee are required to be submitted to the ESH&A Office for Activity Readiness Reviews.

Radiation Safety Officer (RSO)

The Radiation Safety Officer is the individual who has the responsibility for the day-to-day administration and operation of Ames Laboratory's Radiological Protection Program. This individual is also a permanent member of the ALARA Committee. At Ames Laboratory, the RSO is assisted by Radiological Control Technicians (RCTs) to ensure the safe use of radioactive materials and radiation-producing devices.

Environment, Safety, Health and Assurance Office (ESH&A)

At Ames Laboratory, the health physics program is administered through the Health Physics Group (HPG) of the ESH&A Office. The ESH&A has the responsibility for managing all Ames Laboratory health and safety programs including radiation, chemical, industrial hygiene and biological safety. The radiation safety program includes accountability of radioactive materials and radiation producing devices, personnel training, laboratory surveys and inspections, waste handling, and personnel dosimetry.

Detailed programmatic information is provided via the training modules listed in Section 7.1.5.

General Laboratory Rules for Radiation Safety

In general, both internal and external exposures to ionizing radiation can be maintained ALARA through the adherence by radioactive material users to a number of standard procedures, practices, and rules. Each person using radioactive materials in an activity shall observe the following:

1. Smoking, eating or drinking shall not be permitted in radionuclide laboratories.
2. Food, beverages and their containers shall not be permitted in the laboratory.
3. Pipetting by mouth shall not be permitted in radionuclide laboratories.
4 Microwave ovens in radionuclide laboratories shall not be used for heating food or beverages for personal use.
5. Individuals who have not been approved for radionuclide use shall not work with or handle radioactive materials.
6. Radionuclide work areas shall be clearly designated and should, to the extent possible, be isolated from the rest of the laboratory. The work area shall be within a hood if the radioactive material to be used is in a volatile form.
7. All work surfaces shall be covered with absorbent paper that should be changed regularly to prevent the build-up of contamination.
8. Work involving relatively large volumes or activities of liquid radioactive material should be performed in a spill tray lined with absorbent paper.
9. Procedures involving radioactive materials should be well planned and, whenever possible, practiced in advance using non-radioactive materials.
10. Protective clothing appropriate for the work conditions shall be worn when working with radioactive materials. This includes laboratory coats, gloves, and safety glasses. Appropriate footwear must always be worn (sandals cannot be worn when working with radioactive materials).
11. When assigned a dosimeter it shall be worn when working with radionuclides.
12. All containers of radioactive materials and items, suspected or known to be contaminated, shall be properly labeled (i.e. with tape or tag bearing the radiation warning trefoil logo and the words "Caution, Radioactive Material or Danger, Radioactive Material").
13. All contaminated waste items shall be placed in a container specifically designated for radioactive waste. Sharp items such as needles or razor blades shall be placed in a cardboard box, glass bottle or "sharps" container.
14. A radiation survey shall be performed by the radionuclide worker at the end of each procedure involving radioactive materials (the survey may be conducted using a portable survey instrument, wipes, or both depending on the radionuclides used). All items found to be contaminated shall be placed either in the radioactive waste container or an appropriately designated area. Any surfaces found to be contaminated shall be labeled and decontaminated as soon as possible. The survey should always include a check of personnel for possible contamination. The ESH&A Office must be notified immediately if extensive contamination is found within the laboratory or if any personnel are found to be contaminated.
15. Record of the types and quantities of radionuclides possessed by each activity supervisor at a given time shall be maintained.
16. Radioactive materials shall be protected from unauthorized removal or access at all times.

7.1.5 TRAINING

GENERAL EMPLOYEE RADIOLOGICAL TRAINING (GERT)	**AL-074**
Module Description:	●*Provides methods for maintaining exposures to radiation and radioactive materials As Low as Reasonably Achievable (ALARA).*
Target Audience:	●*Plant Protection, Custodial and other personnel who have not completed Radiological Worker II but who may enter a Controlled Area and encounter radiological barriers, postings, or radioactive materials.*
Module Format:	*Classroom instruction with quiz. Estimated completion time: 1.0 hour.*
Associated Retrain Period & Format:	*Two-year retrain. Retrain module consists of attending a classroom session or a CBT session.*

RADIOLOGICAL WORKER II (RADIOACTIVE MATERIALS)	**AL-077**
Module Description:	●*Covers radioactive materials fundamentals, hazards, and safety practices & controls.*
Target Audience:	●*Required for all workers whose job assignment involves entry into Radiological Buffer Areas, Radiation Areas, and Radioactive Materials Areas.*
Module Format:	*Module is self-study. Module consists of video, study guide, challenge exam and a practical factors evaluation. Estimated completion time: 1.5 hours/exam and 1 hour/PFE.*
Associated Retrain Period & Format:	*Two-year retrain. Retrain module consists of study guide training and challenge exam.*

RADIOLOGICAL WORKER I (For Support Staff)	**AL-162**
Module Description:	●*Covers radioactive materials fundamentals, hazards, and safety practices & controls.*
Target Audience:	●*Required for all workers whose job assignment involves entry into Radiological Buffer Areas, Radiation Areas, and Radioactive Materials Areas.*
Module Format:	*Module is self-study. Module consists of video, challenge exam and a practical factors evaluation. Estimated completion time: 1.5 hours/exam and 1 hour/PFE.*
Associated Retrain Period & Format:	*Two-year retrain. Retrain module consists of study guide training and challenge exam.*

RADIOLOGICAL INSTRUMENT TRAINING	**AL-157, 207**
Module Description:	●*Covers radioactive materials fundamentals, hazards, and safety practices & controls.*
Target Audience:	●*Required for all workers whose job assignment involves entry into Radiological Buffer Areas, Radiation Areas, and Radioactive Materials Areas.*
Module Format:	*Module is self-study. Module consists of video, study guide, challenge exam and a practical factors evaluation. Estimated completion time: 1.5 hours/exam and 1 hour/PFE.*
Associated Retrain Period & Format:	*Two-year retrain. Retrain module consists of study guide training and challenge exam.*

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of radiological hazards, contamination control, and other safety information. In addition, the group/activity training shall review emergency response measures and any other procedural information. This training shall be documented by the Group Leader / Department Manager.

7.1.6 PERFORMANCE CHECKLISTS

Group Leader / Department Manager shall:

- ❑ Assure Hazard Inventory/Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- ❑ Complete required institutional radiological worker training listed in section 7.1.4. above.
- ❑ Complete "Hazardous Waste Generator Training", (AL-073), if working with chemicals, radiological or other hazardous materials.
- ❑ Follow the procedures in the Ames Laboratory Radiation Safety Manual, and when necessary, the Ames Laboratory Waste Management Manual if working with chemicals, radiological or other hazardous materials.
- ❑ Conduct and document group/activity-specific hazard communication training for each employee prior to work that includes a discussion of radioisotopes used, hazard mitigation, contamination control and emergency procedures.
- ❑ Assure that group Standard Operating Procedures (SOPs) are current and that work is performed within established guidelines.
- ❑ Assure that work is performed in accordance with Ames Laboratory Radiation Safety Manual and associated regulations.
- ❑ Assure that inventory sheets and necessary survey records for all radioactive sources are present and accessible.
- ❑ Submit radiological inventories to ESH&A annually.
- ❑ Assure that radiological package or container marking and labeling is complete and in accordance with guidelines given in the Ames Laboratory RPP.
- ❑ Ensure all employees working with radioactive materials or working in areas where radioactive materials are handled or stored have the appropriate training.
- ❑ Notify ESH&A for new or significantly modified activities.

Employees shall**:**

- ❑ Complete required institutional radiological worker training listed in section 7.1.5. above.
- ❑ Complete "Hazardous Waste Generator Training", (AL-073), if working with chemicals, radiological or other hazardous materials.
- ❑ Follow the procedures in the Ames Laboratory Radiation Safety Manual, and when necessary, the Ames Laboratory Waste Management Manual if working with chemicals, radiological or other hazardous materials.
- ❑ Complete mandatory training requirements per Employee Training Profile in a timely manor.
- ❑ Receive activity/experiment-specific training prior to working with radioactive materials.
- ❑ Perform work in accordance with group Standard Operating Procedures (SOPs).
- ❑ Performed work in accordance with Ames Laboratory Radiation Safety Manual and associated regulations.

7.2 RADIATION PRODUCING DEVICES (X-ray Systems)

Applicability Statement: *This section applies to groups/departments that use radiation producing devices, analytical x-ray systems.*

7.2.1 REFERENCES

ANSI N43.2 Radiation Safety for X-ray Diffraction and Fluorescence Analysis Equipment
ANSI N43.3 Installations Using Non-Medical X-Ray and Sealed Gamma Sources
Manual 10202.001, Radiation Safety Manual
Title 10, Code of Federal Regulations, Part 835 Occupational Radiation Protection

7.2.2 BACKGROUND

Use of analytical x-ray systems is an important part of several of the Laboratory's research programs. The hazards associated with analytical x-ray systems are significant and demand an effective management program. This section describes the health physics protection mechanisms designed to ensure worker protection from analytical x-ray systems.

7.2.3 PROGRAM INFORMATION

Ames Laboratory follows the requirements listed in ANSI N43.2, ANSI N43.3, Radiation Protection Program (RPP) and the Radiation Safety Manual. These documents, along with the information contained in this section of the Ames Laboratory Program Manual and the training module "Radiological Worker II – "Radiation Producing Devices", (AL-076), constitutes the Laboratory's written program.

The basic elements of the Laboratory's program are: ESH&A Radiation Safety Training Program, ESH&A periodic inspection of analytical x-ray laboratories, the ESH&A personnel dosimetry program, Readiness Review procedure, Activity Status Review procedure, and the Group-specific safety training for analytical x-ray users.

Detailed programmatic information is provided via the training modules listed in Section 7.2.4.

It is the policy of Ames Laboratory to both allow and facilitate the use of radioactive materials and radiation-producing devices for purposes of research and teaching. At the same time, Ames Laboratory is committed to ensuring that all uses of these materials and devices are in compliance with regulatory requirements and that resultant radiation exposures are kept As Low As Reasonably Achievable (ALARA). Toward this end, the Ames Laboratory has established specific administrative entities with responsibilities for controlling the use of radioactive materials and radiation-producing devices at Ames Laboratory. These entities are, the ALARA Committee, Radiation Safety Officer and the health physics program administered through the Health Physics Group (HPG) of the ESH&A Office.

The ALARA Committee must specifically authorize each activity, which involves the use of a radiation-producing device, (e.g., analytical x-ray system). See Section 4.0 of Ames Laboratory Radiation Safety Manual for detailed explanation of these requirements.

NOTE: **<u>Use Authorizations</u> that have been approved by the ALARA Committee are required to be submitted to the ESH&A Office for Activity Readiness Reviews.**

7.2.4 TRAINING

RADIOLOGICAL WORKER II (RADIATION PRODUCING DEVICES) AL-076	
Module Description:	*Covers X-ray fundamentals, hazards, and safety practices & controls.*
Target Audience:	*Required for all workers using Radiation Producing Devices (Analytical X-ray Systems) or performing general maintenance on the X-ray system.*
Module Format:	*Module is self-study. Module consists of video, 50 question closed book challenge exam and a Radiation Instrument Survey Session. Estimated completion time: 1.5 hours/exam and 15 minutes for the Radiation Instrument Survey session.*
Associated Retrain Period & Format:	*Two-year retrain. Retrain module consists of study guide preparation and challenge quiz.*

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of analytical x-ray hazards and other safety information. In addition, the group/activity training shall review emergency response measures and any other procedural information. This training shall be documented by the Group Leader / Department Manager.

7.2.5 PERFORMANCE CHECKLISTS

Group Leader / Department Manager shall:

- ❑ Complete Ames Laboratory "Radiological Worker II Training for Radiation Producing Devices", (AL-076).
- ❑ Assure Hazard Inventory/Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- ❑ Conduct and document group/activity-specific hazard communication training for each employee prior to work that includes a discussion of x-ray hazards and emergency procedures.
- ❑ Assure that group Standard Operating Procedures (SOPs) are current and that work is performed within established guidelines.
- ❑ Assure that work is performed in accordance with Ames Laboratory Radiation Safety Manual and associated regulations.
- ❑ Assure that maintenance data and user logs are present and accessible.
- ❑ Assure that the x-ray room and barriers are properly marked and labeled in accordance with guidelines given in the Ames Laboratory RPP.
- ❑ Ensure all employees working with X-ray systems or working in areas where an X-ray system is located have the appropriate training.

Employees shall**:**

- ❑ Complete Ames Laboratory "Radiological Worker II Training for Radiation Producing Devices", (AL-076) and Radiological Instrumentation Training, (AL-157 or AL-207).
- ❑ Receive activity/experiment-specific training prior to working with radioactive materials.
- ❑ Perform work in accordance with group Standard Operating Procedures (SOPs).
- ❑ Perform work in accordance with Ames Laboratory Radiation Safety Manual and associated regulations.
- ❑ Complete mandatory training requirements per Employee Training Profile in a timely manor.
- ❑ Complete user logbook. All records shall be current to the present day of operation and be kept near the system.