International Isotopes Fluorine Products

International Isotopes Fluorine Products, Inc. (IIFP)
A Wholly Owned Subsidiary of
International Isotopes, Inc. (INIS)

Fluorine Extraction Process & Depleted Uranium De-conversion (FEP/DUP) Plant

License Application

Chapter 4
Radiation Protection

Revision B
October 31, 2011

TABLE OF CONTENTS

LIST OF FIGURES 4-iv
LIST OF TABLES 4-iv
ACRONYMS and ABBREVIATIONS (Provided In License Application Chapter 1 Revision B)

4 RADIATION PROTECTION 4-1

4.1 COMMITMENT TO RADIATION PROTECTION PROGRAM IMPLEMENTATION 4-1
4.1.1 Responsibilities of Key Program Personnel 4-1
4.1.1.1 IIFP Chief Operations Officer 4-2
4.1.1.2 IIFP Environmental, Safety and Health Manager 4-2
4.1.1.3 Radiation Protection Manager 4-2
4.1.1.4 Radiation Protection Staff 4-2
4.1.1.5 Facility Personnel 4-3
4.1.2 Independence of the Radiation Protection Program 4-3
4.1.3 Annual Review of the Radiation Protection Program 4-3

4.2 ALARA PROGRAM 4-3
4.2.1 ALARA Policies and Procedures 4-4
4.2.2 ALARA Goals 4-4
4.2.3 ALARA Committee 4-5

4.3 ORGANIZATION AND PERSONNEL QUALIFICATIONS 4-6

4.4 COMMITMENT TO WRITTEN PROCEDURES 4-7

4.5 TRAINING COMMITMENTS 4-8
4.5.1 Training of Personnel and Visitors 4-8
4.5.2 Level of Training 4-9
4.5.3 Radiation Protection Training Program 4-9
4.5.4 Review of Radiation Protection Training Program 4-10

4.6 VENTILATION AND RESPIRATORY PROTECTION PROGRAMS 4-10
4.6.1 Ventilation Program 4-11
4.6.1.1 Description of Building Ventilation and Process Vents 4-11
4.6.1.2 Management Measures for Ventilation Systems 4-14
4.6.1.3 Design Criteria for Ventilation Systems 4-14
4.6.1.4 Testing of Ventilation Systems 4-16
4.6.2 Respiratory Protection Program 4-17
4.6.2.1 Respiratory Protection Requirements; 10 CFR 20, Subpart H 4-17
4.6.2.2 Procedures for Using Respiratory Protection Equipment 4-17

4.7 RADIATION SURVEYS AND MONITORING PROGRAMS 4-19
4.7.1 Radiation Surveys and Monitoring Programs Meeting Requirements ....
of 10 CFR 20, Subpart F 4-19
4.7.2 Approved Procedures for Radiation Surveys and Monitoring Programs 4-20
4.7.3 External Occupational Radiation Exposures 4-20
4.7.4 Internal Occupational Radiation Exposures 4-20
4.7.4.1 Urinalysis Program 4-21

TABLE OF CONTENTS (Continued)

4.7.4.2 In Vivo Lung Counting Program 4-21
4.7.5 Summation of External and Internal Occupational Radiation Exposures 4-21
4.7.6 Air Sampling Program....4-22
4.7.7 Control of Airborne Radioactive Material 4-22
4.7.8 Minimization of Contamination 4-22
4.7.9 Contamination Survey Program 4-23
4.7.10 Corrective Action Program for Personnel Contamination 4-23
4.7.11 Corrective Action Program for Airborne Occupational Exposure 4-24
4.7.12 Equipment and Instrumentation Sensitivity 4-24
4.7.13 Policies for Removal of Equipment and Materials from Radiological Controlled Areas 4-24
4.7.14 Sealed Sources....4-25
4.7.15 Access Control 4-25
4.7.16 Radiation Reporting Program....4-26

4.8 ADDITIONAL PROGRAM COMMITMENTS 4-27
4.8.1 Records....4-27
4.8.2 Event Reporting....4-27
4.8.3 Annual Dose Monitoring Report....4-27
4.8.4 Corrective Action Reporting 4-27

REFERENCES....4-28

LIST OF FIGURES

Figure 4-1 IIFP Plant Operation Organization 4-7

LIST OF TABLES

Table 4-1 Design Criteria for Vent Off-gas Treatment Equipment 4-15

4 RADIATION PROTECTION

International Isotopes Fluorine Products, Inc. (IIFP), a wholly owned subsidiary of International Isotopes, Inc. (INIS), will build and operate a depleted uranium processing facility near Hobbs in Lea County, New Mexico. The IIFP Facility (also referred to as the FEP/DUP Plant) is being licensed under Title 10 Code of Federal Regulations (CFR) Part 40. A description of the planned facility is provided in the IIFP License Application (LA), Revision B Chapter 1 "General Information."

Chapter 4 addresses the IIFP commitment to radiation protection and the policies and procedures to maintain doses to the workers, the public and the environment as low as reasonably achievable (ALARA).

4.1 COMMITMENT TO RADIATION PROTECTION PROGRAM IMPLEMENTATION

This section describes the facility Radiation Protection Program (RPP). The RPP provides the foundation necessary to protect the radiological health and safety of the workers, the environment and the public and complies with the regulatory requirements of 10 CFR 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," (CFR, 2008a); 10 CFR 20, "Standards for Protection Against Radiation," (CFR, 2008b) and 10 CFR 40, "Domestic Licensing of Source Material", (CFR, 2008c).

Specifically, the RPP meets the requirements of 10 CFR 20 Subpart B, "Radiation Protection Programs," (CFR, 2008d), and is consistent with the guidance provided in Regulatory Guide 8.2, "Guide for Administrative Practices in Radiation Monitoring," U.S. Nuclear Regulatory Commission (NRC) (NRC, 1973). In accordance with 10 CFR 20.1101 (CFR, 2008e), the RPP uses approved written procedures and engineering controls based on sound radiation protection principles to achieve occupational and public doses below the NRC established limits and to maintain exposure to radiation ALARA. Occupational exposures are maintained ALARA through the following:

- Exposure monitoring is consistent with guidance in 10 CFR 20.1501, "General" (CFR, 2008f) and 10 CFR 20.1502, "Conditions Requiring Individual Monitoring of External and Internal Occupational Dose," (CFR, 2008g)
- Frequent interactions between the Radiation Safety Committee and Operations personnel
- Annual RPP assessments with senior management

Occupationally exposed personnel annual exposure goals will be established to ensure that personnel doses received are below the limits specified in 10 CFR 20.1201 (CFR, 2008h). The RPP content and implementation are reviewed annually, at a minimum, as required by 10 CFR 20.1101(c) (CFR, 2008e). In addition, controls are established such that no member of the public is expected to receive a total effective dose equivalent (TEDE) in excess of 0.25 millisieverts per year (mSv/yr) or 25 millirems per year (mrem/yr).

4.1.1 Responsibilities of Key Program Personnel

The key program personnel play an important role in the protection of workers and the environment as well as the implementation of the ALARA Program. Revision B Chapter 2 "Organization and Administration" of the IIFP LA describes the facility, organization and administration in further detail. Staffing is consistent with guidance provided in Regulatory Guide 8.2 (NRC, 1973) and Regulatory Guide 8.10, "Operating Philosophy for Maintaining Occupation Radiation Exposures As Low As Is Reasonably Achievable," (NRC, 1977).

4.1.1.1 IIFP Chief Operations Officer

The Chief Operations Officer (COO) has the overall responsibility of ensuring that facility operations are conducted in a manner that protects the employee, the environment and the public from radiological, chemical and industrial hazards and that operations are carried out in accordance with all applicable regulations, licenses and permits. The duties of the COO are performed in accordance with written policies and procedures. The COO provides for safety and control of operations and protection of the environment by delegating and assigning responsibility to qualified plant and line supervisors. These qualifications are detailed in Revision B Chapter 2 of the IIFP LA.

4.1.1.2 IIFP Environmental, Safety and Health Manager

The Environmental, Safety and Health (ESH) Manager reports to the COO, but also has an interacting relationship with all IIFP managers on matters of ESH policies, regulatory requirements, plant safety and environmental compliance. The ESH Manager has responsibility for directing the activities to ensure the facility complies with appropriate rules, regulations and codes. This includes ESH activities associated with radiation protection, chemical safety, environmental protection, industrial safety/industrial hygiene, emergency preparedness/security, regulatory affairs and licensing. The ESH Manager works with other managers and supervisors of the plant for ensuring consistent interpretations of the requirements, performing independent reviews and supporting facility and operations change control reviews. The ESH organization provides independent oversight of plant operations relative to ESH compliance, specific descriptions of responsibilities and authority. Qualifications for the ESH Manager position are provided in the IIFP LA, Revision B Chapter 2.

4.1.1.3 Radiation Protection Manager

The Radiation Protection Manager (RPM) reports to the ESH Manager and is responsible for implementing the RPP. In matters involving radiation protection unresolved concerns, the RPM has direct access to the COO. The Radiation Protection staff, including engineers, technicians, administrative support personnel and contractors specifically assigned to the Radiation Protection Program report to the Radiation Protection Manager. The RPM ensures that the facility is staffed with suitably trained radiation protection personnel and that sufficient resources are provided to implement an effective program. Specific descriptions of the RPM responsibilities, authority and qualifications are provided in Revision B Chapter 2 of the IIFP LA.

4.1.1.4 Radiation Protection Staff

The Radiation Protection Manager and his/her staff are responsible for:

- Establishing and maintaining the RPP
- Developing and maintaining procedures necessary to implement the RPP
- Establishing and maintaining an ALARA Program
- Reviewing and auditing the efficacy of the RPP in complying with applicable federal and state regulations and NRC license conditions
- Adequately staffing the Radiation Protection organization to implement the RPP
- Establishing and maintaining a Respiratory Protection Program
- Developing and maintaining an internal and external dosimetry program
- Calibration and quality assurance of radiological instrumentation, including verification of required Lower Limits of Detection or alarm levels

- Establishing and maintaining a Radiation Safety Training Program
- Establishing and maintaining the Radiological Environmental Monitoring Program (REMP)
- Ensuring Restricted and Radiological Controlled Areas (RCAs) are posted in accordance with regulations and license conditions and developing occupancy guidelines as needed.

4.1.1.5 Facility Personnel

Facility personnel are required to work safely and to follow the rules, regulations and procedures that have been established for their protection and the protection of the public and environment. Personnel whose duties require working with radioactive material, entering radiation areas, controlling facility operations that could affect effluent releases or directing the activities of others are trained such that they understand and effectively carry out their responsibilities relative to the RPP.

4.1.2 Independence of the Radiation Protection Program

The RPP remains independent of the routine production operations of the facility. The management of the RPP is conducted through the ESH Manager and the RPM.

4.1.3 Annual Review of the Radiation Protection Program

In accordance with 10 CFR 20.1101(c) (CFR, 2008e), the RPP is reviewed annually by the ALARA Committee. The review considers facility changes, new technologies and other process enhancements that could improve overall program effectiveness. Further detail regarding the review is provided in Section 4.2.

4.2 ALARA PROGRAM

This section describes the IIFP commitment to an ALARA Program. The ALARA Program functions as a subset of the RPP. The objective of the Program is to make every reasonable effort to maintain facility exposures to radiation as far below the dose limits of 10 CFR 20.1201 (CFR, 2008h) as is reasonably achievable and to maintain radiation exposures to members of the public such that they are not expected to receive the dose limits of 10 CFR 20.1101(d) (CFR, 2008e). The design and implementation of the ALARA Program is consistent with guidance provided in Regulatory Guide 8.2 (NRC, 1973), Regulatory Guide 8.13 “Instruction Concerning Prenatal Radiation Exposure,” (NRC, 1999a), Regulatory Guide 8.29, “Instruction Concerning Risks from Occupation Radiation Exposure,” (NRC, 1996) and Regulatory Guide 8.37 “ALARA Levels for Effluents from Materials Facilities,” (NRC, 1993).

Features of the ALARA Program include:

- Management commitment demonstrated through a written policy statement, procedures, other directives and periodic management reviews

- Formal program audits conducted on at least an annual basis

- Well-supervised and defined radiation protection capability including appropriately qualified and trained supervisors and technicians. All personnel on site have the authority to stop work as needed to ensure appropriate safety precautions are observed.

- Training for the workforce including training consistent with the requirements of 10 CFR 19.12 (CFR, 2008i) and incorporating appropriate portions of the guidance provided in Regulatory Guides 8.13 (NRC, 1999a) and 8.29 (NRC, 1996)

- Appropriate authority vested in radiation protection personnel including stop work authority

- Consideration of the need for plant modifications as warranted for reducing exposures and doses to personnel

Documented RPP policies are implemented to ensure that ALARA goals are met. Procedures incorporate the ALARA philosophy into routine operations and ensure exposures are maintained below 10 CFR 20.1101 limits (CFR, 2008e). As discussed in Section 4.7, "Radiation Surveys and Monitoring Program Commitments," RCAs will be established within the facility. These areas are identified by the use of signs, ropes, gates, fences or other visible means. Each zone will have specific entry requirements, survey requirements and dosimetry requirements. The establishment of these areas supports the ALARA commitment to minimize the spread of contamination and reduce unnecessary exposure of personnel to radiation.

4.2.1 ALARA Policies and Procedures

To ensure occupational doses are maintained, ALARA work activity restrictions are imposed when an individual's exposure exceeds 80% of the applicable 10 CFR 20.1201 limit (CFR, 2008h).

Doses to declared pregnant workers are maintained below the regulatory limit specified in 10 CFR 20.1208, "Dose Equivalent to an Embryo/Fetus," (CFR, 2008j) and are maintained ALARA. Female employees are advised of the RPP policy for declared pregnant workers during basic radiation safety training. The policy for occupational exposures to declared pregnant workers is consistent with the guidance in Regulatory Guide 8.13 (NRC, 1999a).

Approved written procedures dictate that atmospheric releases are to be monitored and measured. Doses to the public are calculated to ensure compliance with the requirements of 10 CFR 20.1101(d) (CFR, 2008e). Numerous controls exist to ensure public exposure resulting from operations remains below limits specified in 10 CFR 20.1301, "Radiation Dose Limits for Individual Members of the Public," (CFR, 2008k). See the IIFP LA, Revision B Chapter 9 "Environmental Protection" for further information regarding implemented measures to keep public doses ALARA.

4.2.2 ALARA Goals

In accordance with 10 CFR 20.1101 (CFR, 2008e), the RPP is designed to achieve occupational and public doses that are ALARA. The Radiation Protection Manager is responsible for the implementation of the ALARA Program. The ALARA Committee provides oversight of the RPP as described in Section 4.2.3 "ALARA Committee." In order to keep exposures ALARA, the following principles guide the RPP:

- Radiation exposures and the release of radioactive effluents shall be monitored.
- Individual exposures shall be controlled to less than applicable regulatory limits.

Specific goals of the ALARA Program include maintaining occupational exposures, as well as environmental releases, as far below regulatory limits as is reasonably achievable. With respect to environmental effluents, ALARA Goals will be initially set at 20% in accordance with Appendix B, 10

CFR Part 20 values (CFR, 2007). The ALARA concept is also incorporated into the design and operation of the facility. The size and number of areas with higher dose rates are minimal. Per approved written procedures, the time spent in these areas is controlled and projects are evaluated to ensure workers receive the minimum exposure. Areas where personnel spend significant amounts of time are designed to maintain the lowest dose rates reasonably achievable.

The RPM is responsible for implementing the ALARA Program and ensuring that adequate resources are committed to make the program effective. The RPM ensures that an annual ALARA Program evaluation report is prepared and submitted to the COO and the ALARA Committee. The report reviews the following:

- Radiological exposure and effluent release data for trends
- Audits and inspections
- Use, maintenance and surveillance of equipment used for controlling exposures and effluents
- Other issues, as appropriate, that may influence the effectiveness of the RPP and ALARA Program

4.2.3 ALARA Committee

The IIFP ALARA Committee supports the Facility Safety Review Committee (FSRC) and is represented in the Figure 4-1 Plant Operation Organization "FSRC" box that reports to the COO. The ALARA Committee consists of key members of facility management, supervision and the workforce and will meet periodically on a frequency established in the IIFP Facility ALARA Program. The ALARA Committee uses the guidance provided in Regulatory Guides 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning," (NRC, 2008), 8.10 (NRC, 1977) and 8.37 (NRC, 1993) to formulate facility operating philosophy in reducing exposures. Membership of the ALARA Committee includes:

- The Chief Operations Officer
- The Radiation Protection Manager
- Selected department managers
- The Environmental, Safety and Health Manager
- Selected supervisors and hourly personnel

The ALARA Program facilitates interaction between radiation protection and operations personnel. The ALARA Committee is utilized in achieving this goal.

The ALARA Committee's activities include at a minimum an annual review of the following:

- Reviewing site radiological operating performance including trends in airborne concentrations, personnel exposures and environmental monitoring results
- Reviewing operations and exposure records to determine where exposures may be reduced
- Reviewing employee training and methods for utilizing information on-the-job to keep exposure ALARA Reviewing potential modifications of procedures and equipment when changes will reduce exposure at reasonable cost

In addition, the ALARA Committee reviews major changes in authorized activities affecting radiation protection practices and evaluates contamination minimization and/or removal activities.

The proceedings, findings and recommendations of the ALARA Committee are reported in writing to the COO and appropriate line management and area managers responsible for those operations reviewed by the Committee. Such reports are retained for a minimum of three (3) years. Based upon expected improvement, updated performance data, economics and consideration of other site priorities, management decides which of the ALARA Committee recommendations will be pursued. If a specific recommendation is pursued, a task owner is assigned and the action is tracked to completion.

4.3 ORGANIZATION AND PERSONNEL QUALIFICATIONS

The Radiation Protection staff is assigned responsibility for implementation of the Radiation Protection Program functions. Only suitably trained radiation protection personnel are employed at the facility. Staffing is consistent with the guidance provided in Regulatory Guides 8.2 (NRC, 1973) and 8.10 (NRC, 1977). The qualifications of the RPM are described in Revision B Chapter 2 of the IIFP LA. Qualifications of the staff Health Physicists and Radiation Control Technicians are described below.

The RPM reports directly to the ESH Manager and has the responsibility for establishing and implementing the RPP. These duties include the training of personnel in use of equipment, control of radiation exposure of personnel, continuing evaluation and determination of the radiological status of the facility and conducting the REMP. The facility organization chart establishes clear organizational relationships among the radiation protection staff and the other facility line managers. The facility organization is shown in Figure 4-1.

In matters involving radiological protection, the Radiation Protection Manager has responsibility and authority to elevate any unresolved radiation safety or environmental issue to the COO. The RPM is skilled in the interpretation of radiation protection data and regulations and is familiar with the operation of the facility and radiation protection concerns relevant to the facility. The Radiation Protection Manager is a resource for radiation safety management decisions.

Radiation Protection technicians, engineers and supervisors perform the functions of assisting and guiding workers in radiological aspects of the job. These individuals have the responsibility and authority to stop work or mitigate the effect of an activity if it is suspected that the initiation of or continued performance of a job, evaluation or test will result in the violation of approved radiation protection requirements.

Staff Health Physicists shall have as a minimum a bachelor’s degree in engineering or a scientific field and experience commensurate with health physics and radiation protection duties.

Staff Radiation Control Technicians shall have a high school diploma and experience commensurate with radiation control duties.

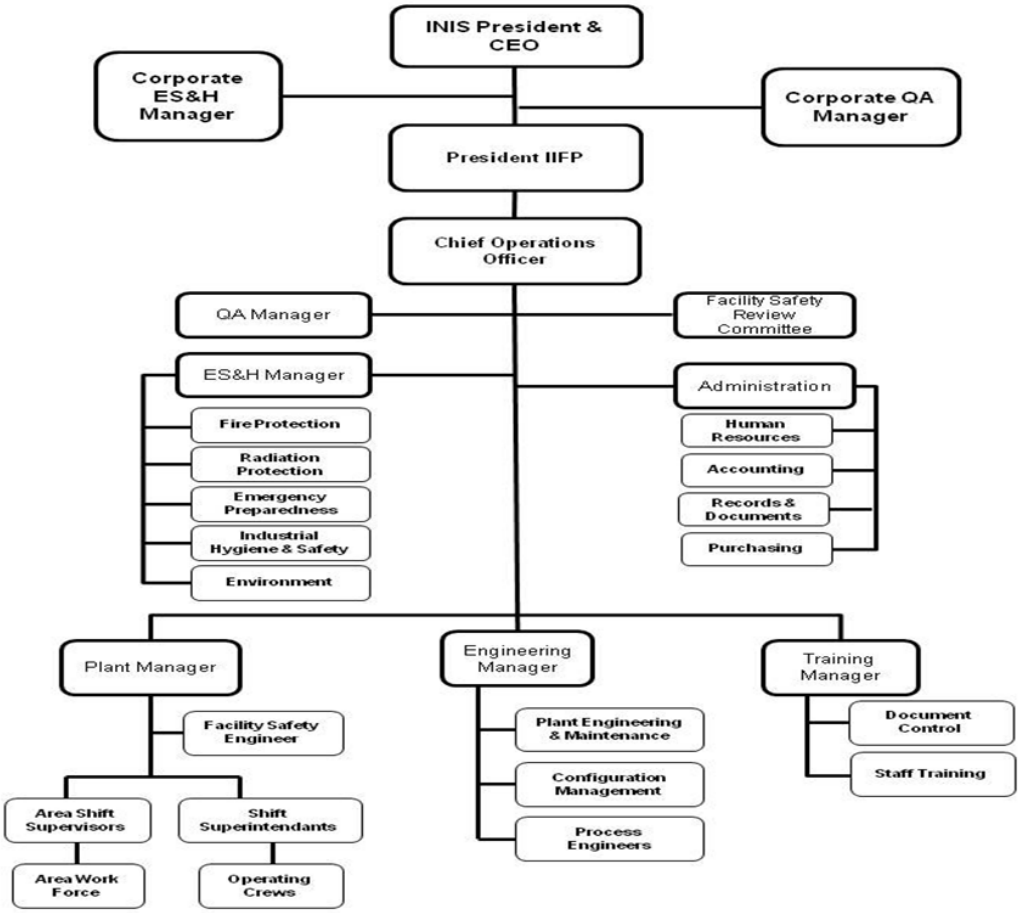

Figure 4-1 IIFP Plant Operation Organization

4.4 COMMITMENT TO WRITTEN PROCEDURES

Operations at the IIFP Facility involving licensed materials are conducted through the use of approved written procedures. Radiation protection procedures are prepared, reviewed and approved to carry out activities related to the RPP. Approved written procedures are used to control radiation protection activities in order to ensure that the activities are implemented in a safe, effective and consistent manner. Radiation protection procedures are reviewed and revised, as necessary, to incorporate facility or operational changes or changes to the IIFP Integrated Safety Analysis (ISA) Summary.

The radiation protection staff prepares draft procedures that are reviewed by affected personnel to ensure the procedures are appropriate and reasonable to implement. The Radiation Protection Manager, or Designee, reviews and approves final radiation protection procedures as well as proposed revisions to radiation protection procedures. Revision B Chapter 11 “Management Measures” of the IIFP LA provides additional information on IIFP procedures.

Routine work involving licensed materials is administered by the use of approved procedures. IIFP uses a structured procedure development, review and control systems approach to ensure safety and health requirements are appropriately incorporated into working procedures, i.e., use of cross-discipline reviews in the development or change of procedures. The IIFP process for developing and controlling procedures is described in the IIFP License Application Revision B Chapter 11 Sections 11.4.2, 11.4.3, 11.4.4 and 11.4.5. Non-routine activities, particularly those performed by non-IIFP employees generally not covered by approved written procedures, are administered by the Radiation Work Permit (RWP) system. The RWP provides a description of the work to be performed defining the authorized activities. The RWP specifies the necessary radiation safety controls, as appropriate, to include personnel monitoring devices, attendance of radiation protection staff, protective clothing, respiratory protective equipment, special air sampling and additional precautionary measures to be taken. The RWP also contains a description of the radiological conditions in the immediate work area covered by the RWP. The RWP requires approval by the Radiation Protection Manager or his/her Designee. The Designee must meet the qualification requirements of Radiation Protection Manager. RWPs have a predetermined period of validity with a specified expiration or termination time. Standing RWPs may be issued for routinely performed activities such as tours of the IIFP Facility.

Prior to commencing work that requires a Radiation Work Permit, employees performing the job must review the RWP and document their review. Work is monitored, as required, by a radiation protection technician. RWPs are available to workers for re-review at any time and include expiration dates. A radiation protection technician or the RPM, or Designee, reviews the status of issued RWPs on a periodic basis. RWPs are closed when the applicable work activity for which it is written is complete and terminated. A copy of RWPs and any associated records are kept for the life of the facility.

4.5 TRAINING COMMITMENTS

The design and implementation of the Radiation Protection Training Program complies with the requirements of 10 CFR 19.12 (CFR, 2008i). Records are maintained in accordance with 10 CFR 20.2110 (CFR, 2008l). The development and implementation of the Radiation Protection Training Program is consistent with the applicable guidance provided in the following regulatory guidance documents:

- Regulatory Guide 8.10, “Operation Philosophy for Maintaining Occupational Radiation Exposures As Low As is Reasonably Achievable,” (NRC, 1977)
- Regulatory Guide 8.13, “Instructions Concerning Prenatal Radiation Exposure,” (NRC, 1999)
- Regulatory Guide 8.29, “Instructions Concerning Risks from Occupational Radiation Exposure,” (NRC, 1996)
- ASTM C986-89, “Developing Training Programs in the Nuclear Fuel Cycle,” (ASTM, ASTM C986-89, 1989)
- ASTM E1168-95, “Radiological Protection Training for Nuclear Facility Workers,” (ASTM, 1995)

4.5.1 Training of Personnel and Visitors

Training programs are established for various job functions commensurate with radiation protection responsibilities. Visitors to restricted areas are either trained in the formal Radiation Protection Training Program or are given a general training session regarding radioactive materials in the workplace and are escorted by trained personnel.

The periodicity of refresher training required by a worker is dependent on the worker's responsibilities, however, the basic refresher training occurs annually (not to exceed 15 months) and includes an exam. Training requirements are documented and tracked for employees. Training records are managed and stored in accordance with 10 CFR 20.2110 (CFR, 2008l).

4.5.2 Level of Training

The level of radiation protection training is based on the potential radiological health risks associated with an employee's work responsibilities and incorporates the provisions of 10 CFR 19.12 (CFR, 2008i). In accordance with 10 CFR 19.12(a) (CFR, 2008i) any individual working at the facility likely to receive, in one (1) year, an occupational dose in excess of 1 mSv (100 mrem) is:

- Informed of the storage, transfer or use of radioactive material
- Instructed in health protection issues associated with exposure to radiation and radioactive material, precautions or procedures to minimize exposure and the purposes and functions of protective devices employed
- Required to observe, to the extent within the worker's control, the applicable provisions of the NRC regulations and licenses for protection of personnel from exposure to radiation and radioactive material
- Instructed of their responsibility to promptly report to management any condition that may lead to or cause a violation of NRC regulations and licenses or result in unnecessary exposure to radiation and radioactive material
- Instructed on the appropriate response to warnings made in the event of any unusual occurrence or malfunction that may involve exposure to radiation and radioactive material
- Advised of the various notifications and reports that a worker may request pursuant to 10 CFR 19.13 (CFR, 2008m), "Notifications and Reports to Individuals"

In accordance with 10 CFR 19.12(b) (CFR, 2008i), management considers the worker's assigned activities during normal and abnormal situations when determining if a worker is likely to receive a dose of 1 mSv (100 mrem). The instructions provided to the worker as described above are commensurate with potential radiological conditions present in the workplace.

The RPM is responsible for establishing and maintaining the radiation protection training for all personnel including contractor personnel who may be working at the facility. Records are maintained for each employee documenting the training date, scope of training, identity of the trainer, any test results and other associated information.

4.5.3 Radiation Protection Training Program

The Radiation Protection Training Program complies with 10 CFR 19.12 (CFR, 2008i) and 10 CFR 20.2110 (CFR, 2008l) requirements and takes into consideration a worker's normally assigned work activities. The following topics are covered during basic radiation protection training:

- Radiation safety principles, policies and procedures
- Radiation hazards and health risks

- Correct handling of radioactive materials
- Location of and adherence to RPP procedures
- Minimization of exposures to radiation and radioactive materials
- Contamination control
- Access and egress controls
- Monitoring for internal and external exposures
- ALARA and exposure limits
- Exposure monitoring methods and instrumentation
- Personal and area dosimetry
- Donning and doffing of personal protective equipment (PPE)
- Emergency response

The radiation protection staff shall be trained in the following radiation protection areas:

- Radiological Fundamentals
- Biological Effects
- Radiation Limits
- ALARA Program
- Personnel Monitoring Programs
- Radiological Access and Control Postings
- Radiological Emergencies
- Practical Factors (e.g., RWPs, dosimeters, contamination control, emergency response, protective clothing)

In addition, radiation protection staff will be trained on all applicable RPP procedures and policies and receive appropriate on-the-job training (OJT) based on their job requirements. Training materials as well as those qualified to provide the training will be approved by the RPM.

4.5.4 Review of Radiation Protection Training Program

The contents of the Radiation Protection Training Program are reviewed bi-annually by the RPM. The review addresses changes in policies, procedures and requirements and changes to the ISA Summary.

As described in the IIFP LA, Revision B Chapter 11 Section 11.3.8, the Radiation Protection Training Program is systematically evaluated to measure the program's effectiveness in producing competent employees. The RPM will review the evaluation information and implement changes in the training program as necessary.

4.6 VENTILATION AND RESPIRATORY PROTECTION PROGRAMS

In accordance with the regulations in 10 CFR 20, Subpart H, “Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas,” (CFR, 2008n), control of the release of radiation or radioactive materials is a fundamental requirement for facility and equipment design for areas in which uranium and other sources of radiation are handled or used in processes. The following section describes the design and management measures taken to ensure that the installed ventilation and containment systems operate effectively. The section also describes the worker Respiratory Protection Program.

4.6.1 Ventilation Program

The confinement of uranium is a design requirement for the facility. The internal radiation exposure of workers is controlled primarily by the containment of uranium materials within the respective process equipment.

Areas where uranium is processed that have potential of producing dusts, mists or fumes containing uranium and other areas where toxic chemicals are processed or produced are provided with dust collection and/or scrubber systems to protect employees and the environment at exposure levels that are ALARA.

4.6.1.1 Description of Building Ventilation and Process Vents

Building ventilation systems control the temperature and the humidity of the indoor air. General ventilation systems are used in areas where uranium is processed or handled and consist of fresh-air intakes and roof exhaust fans. Roof-exhaust fans and other gaseous effluent emission sources in buildings where uranium is processed or handled will be equipped with exhaust monitoring. The Effluent Monitoring Program is described in the IIFP Environmental Report (ER), Revision B Chapter 6 Section 6.1.1; more specifically in Section 6.1.1.1 and Table 6-1, "Gaseous Effluent Sampling Program."

During the detailed design of the IIFP process buildings, the ventilation requirements and design specifications will be determined for each specific building and process area where applicable. The methodology will include calculation of the free volumes of buildings including partitioned areas and floor levels once the equipment locations, layout and equipment volumes are designed, scaled and finalized. Ventilation air turn-over rates will be determined based on code and comfort requirements and specifications. Intakes and exhausts for ventilated areas will be specifically located to satisfy the defined specifications for turn-over, air distribution and mixing. The consequence calculations for the accident sequences involving the worker and the public will then be updated based on the actual detailed design air dispersion volumes, dilutions and mixing. For the public consequence evaluation, the detailed design will provide specific ventilation exhaust locations, velocities, potential release points and flow rates to allow verification of assumptions and conservatism made in the current analysis that has been based on conceptual design of the IIFP Facility and to revise those if needed.

Area Process Control Rooms that are routinely occupied by workers have environments maintained for comfort and safety. All Control Rooms located in process areas where uranium or hazardous chemicals are processed, stored or handled and have separate heating, ventilation and air conditioning (HVAC) systems. The Control Rooms are maintained at a slight positive pressure with dual fresh air intakes located at safe distances from process vent stacks, exhaust fans and equipment containing hazardous chemicals.

In the production of depleted uranium tetrafluoride (DUF_4), a feed supply of depleted uranium hexafluoride (DUF_6) is reacted with gaseous hydrogen in a reaction vessel to produce DUF_4 and gaseous anhydrous hydrofluoric acid (AHF). The DUF_6 feed cylinder autoclaves provide secondary containment in event of leakage of a heated DUF_6 cylinder or connection. The autoclave area is separated from the other processes by a fire barrier wall and has its own separate building ventilation intakes and roof exhaust fans. Fluoride and radiation detection monitors and alarms are strategically located within the Autoclave and DUF_4 Buildings.

The solid particulate DUF_4 exits the bottom of the reaction vessel and is sent to temporary storage vessels for later use in the production of fluoride gas products. The off-gas from the reaction vessel primarily

contains: 1) AHF with some small quantities of un-reacted gaseous hydrogen, 2) small quantities of particulate DUF_4 entrained in the gas stream and 3) potential traces of un-reacted DUF_6. The off-gas stream passes through a set of filters to remove entrained particles of DUF_4 from the gas stream. The filtered gas stream then flows through a series of carbon-filled bed filters designed to remove traces of DUF_6 and any carryover of DUF_4. The off-gas flow exits the carbon-bed filter system and in the next step the gaseous AHF by-product is removed by a two-stage condensing process. The collected liquid AHF is drained to temporary storage tanks located within a containment-type building where the AHF later can be loaded into approved truck trailers and shipped to customers. The residual off-gas stream exits the AHF condensing system and is passed through a gas-fired burner system to combust excess hydrogen. The gas stream then flows through a three-stage Plant KOH (potassium hydroxide) Scrubbing System for final treatment.

In the Plant KOH Scrubbing System, the final off- gas stream is contacted with KOH solution in a series of steps where essentially all of the remaining fluoride-bearing components are removed prior to venting to the atmosphere through a stack. The Plant KOH Scrubbing System is utilized to treat final off-gas streams from both the DUF_4 production process (DUF_6 to DUF_4) and the fluoride gas products (fluorine extraction process, FEP). The three-stage Plant KOH Scrubbing System is designed for removing fluoride bearing components in the gas streams at efficiencies of greater than 80%, 95% and 99% for the first, second and third stages, respectively. The overall system removal efficiency for normal operations is designed at greater than 99.9 %. The Plant KOH Scrubbing System stack is continuously sampled and routinely analyzed to measure for traces of fluorides and uranium in the vent gas.

The Plant KOH Scrubbing System solution is recycled within each of the scrubbers until the concentration of KOH needs replenishment. The KOH solution concentration is maintained at a safe margin to ensure it effectively reacts (scrubs) with fluoride components in the gas stream. The spent scrubbing solution containing potassium fluoride (KF), water and some excess KOH is pumped to the Environmental Protection Process (EPP) where the solution is treated with lime ($CaOH_2$) to form solid particulate calcium fluoride (CaF_2) and regenerated KOH. The resulting products are filtered and the CaF_2 is dried and prepared for shipment to customers or to a licensed Resource Conservation and Recovery Act (RCRA) disposal facility if the CaF_2 is determined to be a RCRA waste. Representative samples of dried CaF_2 ready for shipment are analyzed for uranium prior to leaving the plant. The KOH liquor is regenerated at a concentration suitable for pumping back to the Plant KOH Scrubbing System for reuse.

In areas where uranium particulate solids are handled or processed, equipment and systems are provided for dust capture and collection. The two-stage dust collection systems are filter-type dust collectors that are used to remove the uranium-bearing particulates prior to discharging the air flow through a vent stack to the atmosphere. Equipment where uranium bearing powders are handled or stored, such as storage hoppers and enclosed drum packaging stations, are connected to the dust collection intake header ducts. Uranium particulates (powders) captured by the dust collection systems are either recycled back into the respective process operations or packaged and sent to a licensed off-site disposal facility.

Sampling and analysis are routinely conducted for uranium between each of the dust collector units. If an unacceptable level of uranium carryover is detected on any given filter unit, the unit is removed from on-stream service and investigated and corrective action is taken. Additionally, each dust collector is continuously monitored for differential pressure across the filter sections to ensure filter integrity is maintained. Descriptions of the dust collector shutdown features are provided in the IIFP ISA Summary, Revision B Section 3.1.2.5, subsection “Dust Collectors in the DUF_4 Building” and Section 3.1.3.2, subsection “Dust Collector and Hood Vent Equipment.”

The fluoride products operations (FEP) are located in a building separate from the DUF_4 production process. DUF_4 powder is conveyed through contained piping to the FEP Building where it is pre-mixed and reacted with either silicon dioxide (SiO_2) or boron oxide (B_2O_3) to produce the silicon tetrafluoride (SiF_4) or boron trifluoride (BF_3) gas products, respectively.

In the SiF_4 process, the DUF_4 and SiO_2 are mixed in the desired ratios and fed directly to a rotary calciner. Two flow streams exit the rotary calciner and are described as follows:

1) One flow stream is the product off-gas that contains some vapors of hydrogen fluoride (HF) and fluorosilic acid and potential traces of entrained particulate uranium oxides or fluorides. This off-gas stream flows through porous metal filters to remove uranium bearing particles. Subsequently, the relatively small quantities of HF and fluorosilic acid vapors are removed from the off-gas flow by cooling in a pre-condenser system. The collected HF is sent to the Plant KOH Scrubbing System where it is treated as described above. After removal of the HF and fluorosilic acid impurities using the pre-condenser system, the residual fluoride product gas stream passes through a set of cold trap heat exchanger vessels operating at cryogenic temperatures. The gaseous fluoride product solidifies in the cold trap. When loaded, the cold trap is warmed for unloading and packaging the product into Department of Transportation (DOT) containers. The final off-gas stream exiting the cold trap and containing non-condensable gases and trace quantities of fluoride gases then flows to the Plant KOH Scrubbing System where it also is treated as described above.

2) The second flow stream exiting the rotary calciner is the resulting waste uranium oxide particulate solids that discharge from rotary calciner. This waste stream is conveyed via the enclosed cooling screw equipment to a temporary storage hopper (bin) to be later packaged and shipped to an off-site licensed disposal facility.

For the BF_3 process, an additional step is used. The DUF_4 and B_2O_3 mixture is pre-heated before it is fed to the rotary calciner where it reacts to produce the BF_3 gas. In the pre-heating step, the mixture passes through a pre-heater vessel that is maintained at a temperature to cause moisture in the mixed powder to react with small amounts of the DUF_4 resulting in HF vapors and uranium oxide solid particles being produced. The pre-heater vessel off-gas contains some nitrogen purge gas, HF vapors and traces of particulate DUF_4 or uranium oxides that may have become entrained in the off-gas stream. The stream passes through a set of filters to remove the uranium component particulates. It then flows to the Plant KOH Scrubbing System for final treatment as described above. The resulting pre-heated solid particle materials discharge directly from the pre-heater vessel to the inlet of the BF_3 production rotary calciner where the remainder of the process materials and components flows through equipment and is processed as described similarly in the SiF_4 process. Final treatment of the BF_3 process off-gases is accomplished in the Plant KOH Scrubbing System by the same method as the SiF_4 process.

The equipment that handles or stores solid particulate uranium materials within the FEP Building for both the SiF_4 and BF_3 processes is connected to a two-stage dust collector system that removes uranium prior to venting to the atmosphere.

The AHF, SiF_4 and BF_3 final products are chemically separated from licensed materials and physically located separate from licensed materials. (Refer to LA, Revision B Chapter 1 and the IIFP ISA Summary, Revision B Section 3.1 for more detailed description of the AHF storage and the AHF, SiF_4 and BF_3 trailer loading systems). Ventilation intakes and exhausts of the AHF Staging Containment Building and the Fluoride Products Trailer Loading Building storage have fluoride detectors, a water spray deluge system and engineered controls which close the ventilation and activate a gas knock-down spray of water

in event of fluoride-detector activation in the affected area. The two containment-type buildings are not totally leak tight, but are designed to inhibit and suppress releases to the environment in event of a leak or spill.

The plant laboratory hoods that are used in handling of uranium-bearing materials are checked at least monthly and adjusted as needed to assure the adequate face velocity in accordance with manufacturer's recommendations.

Non-uranium process buildings where hazardous materials are handled, stored or packaged have separate ventilation systems with their own fresh-air intakes and roof-exhaust fans. Enclosed hoods are located in the SiF_4 and BF_3 small cylinder packaging area to capture the gases in event of a leak. Additionally, area fluoride detectors and engineered controls are located in the fluoride gas packaging areas. The controls provide for closing the area ventilation systems and evacuating leaks or releases of hazardous gases to an emergency KOH scrubbing system. The treated gas exiting the emergency scrubber then flows to the SiF_4 venturi scrubber and enters the Plant KOH Scrubbing System where the gas stream undergoes further treatment. In the event of activation, the spent KOH scrubbing liquors resulting from scrubbing of hood ventilation are sent to the EPP for treatment as described above for the Plant KOH Scrubbing System.

4.6.1.2 Management Measures for Ventilation Systems

The Ventilation Program, radiation detectors/alarms, process vents and associated containment systems are checked routinely as part of the operating process controls and Preventive Maintenance Program. Operations and maintenance relative to the Ventilation Program including calibrations, change management, measurements and analysis are performed using approved written procedures. The procedure system is described in the IIFP LA, Chapter 11. Management measures that pertain to preventive and corrective maintenance are described in the IIFP LA, Revision B Chapter 11 Section 11.2 "Maintenance."

4.6.1.3 Design Criteria for Ventilation Systems

Engineered controls and redundancy are integrated into the design of ventilation systems. Normal operation of the facility does not result in a discharge of radioactive materials that exceeds regulatory limits. Ventilation systems for areas that do not have the potential for contamination are not monitored for radioactivity because radioactive materials are not handled or processed in those areas.

Design requirements for the Plant KOH Scrubbing System provide for a safety margin between normal and abnormal operation. The margin is provided so that in event of abnormally higher concentrations or mass flows of the off-gas, the scrubbing system can effectively handle the operational deviations until such time that engineered controls can either correct or shut down the abnormal operation.

The dust collection systems for the DUF_4 and FEP processes are designed with a primary dust collector followed by a secondary dust collector. Sampling and analysis are routinely performed between the primary and secondary dust collectors and in the vent stack after the secondary dust collector discharge. Pressure differential across each dust collector is measured and monitored with alarm notification in the Control Room if the differential pressure deviates outside the set administrative control limits. If differential pressures indicate open filters simultaneously on both of the two-stage dust collectors, the dust collectors and equipment served by the respective dust collectors are shut down until investigated and corrected, if needed.

The design efficiency of dust collectors is greater than 99% for each collector. At least two (2) equipment units are used in series to ensure an overall system efficiency of greater than 99.5% in the collection and removal of particulate uranium from the vented process gas.

Design- rated efficiency criteria for uranium particulate dust collection components and process vent off-gas scrubbers are provided in Table 4-1.

Table 4-1 Design Criteria for Vent Off-gas Treatment Equipment

Component	Design Efficiency	Comments
DUF_4 dust collectors	>99.5% particulates	Applies to all primary, secondary and redundant units
FEP uranium oxide dust collectors	>99.5% particulates	Applies to all primary, secondary and redundant units
DUF_4 vacuum cleaner cyclone	>80% particulates	Cyclone discharges to DUF_4 vacuum cleaner dust collector
FEP uranium oxide vacuum cleaner cyclone	>80% particulates	Cyclone discharges to oxide vacuum cleaner dust collector
DUF_4 vacuum cleaner dust collector	>99.5% particulates	Discharges to inlet of DUF_4 secondary dust collector
FEP uranium oxide vacuum cleaner dust collector	>99.5% particulates	Discharges to inlet of FEP uranium oxide secondary dust collector
DUF_4 primary metal filter	>95% particulates	Removes entrained particulates from the DUF_4 to DUF_6 reaction vessel off-gas
DUF_4 secondary metal filter	>95% particulates	Removes entrained particulates that may pass through the DUF_4 primary filter
SiF_4 primary metal filter	>95% particulates	Removes entrained particulates from the SiF_4 rotary calciner off-gas
SiF_4 secondary metal filter	>95% particulates	Removes entrained particulates that may pass through the SiF_4 primary filter
BF_3 pre-heater primary metal filter	>95% particulates	Removes entrained particles from the BF_3 pre-heater vessel off-gas
BF_3 pre-heater secondary metal filter	>95% particulates	Removes entrained particles that may pass through the BF_3 pre-heater primary filter
BF_3 primary metal filter	>95% particulates	Removes entrained particles from the BF_3 rotary calciner off-gas
BF_3 secondary metal filter	>95% particulates	Removes entrained particles that may pass through the BF_3 primary filter
KOH venturi scrubber	>80% gaseous and particulates	Receives vent gas from DUF_4 and FEP process off-gas system. Exit gas of venturi discharges to packed tower scrubber
KOH packed tower scrubber	>95% gaseous	Second stage system. Exit gas discharges to coke box system
KOH coke box scrubber	>99% gaseous	Discharges to atmosphere through Plant KOH Scrubbing System vent stack
DUF_4 off-gas primary carbon bed trap	>95% gaseous and particulate uranium	Absorbs DUF_6 gas and traces of DUF_4. Discharges to secondary carbon-bed trap
DUF_4 off-gas secondary carbon bed trap	>95% gaseous uranium	Absorbs DUF_6 trace gas that may pass through primary carbon-bed trap. Discharges to tertiary carbon-bed trap
DUF_4 off-gas tertiary carbon-bed trap	>95% gaseous uranium	Absorbs final traces of DUF_6 that may pass through the secondary carbon-bed trap and provides added margin of safety in removing

Table 4-1 Design Criteria for Vent Off-gas Treatment Equipment

Component	Design Efficiency	Comments
		gaseous uranium
DUF_4 Hydrogen burner	>99% hydrogen burned	Gas-fired burner to destroy excess hydrogen from DUF_6 to DUF_4 reaction vessel off-gas
FEP hood vent system emergency KOH scrubber	>95% gaseous fluoride	Treated gas from emergency scrubber exits to SiF_4 venturi scrubber in the Plant KOH Scrubbing System for further and final treatment
Calcium Fluoride Dust Collector	>99.5% particulates	Removes air particulates in the CaF_2 storage area and process
DUF_4 Transfer Dust Collector	>99.5% particulates	Allows for the transfer of particulate DUF_4 from the DUF_6-to-DUF_4 process to FEP consumers
B_2O_3 Unloading Dust Collector	>99.5% particulates	Removes particulates in the B_2O_3 unloading process
Hydrated Lime Unloading Dust Collector	>99.5% particulates	Removes particulates in the Hydrated Lime unloading process

Design of building ventilation systems in process areas and Control Rooms are sized with adequate flows and pressure differentials for comfort and to ensure potential airborne concentrations of radioactivity do not exceed the derived air concentration (DAC) values specified by the International Commission on Radiological Protection (ICRP)-68 (ICRP, 1995). The ventilation system is designed so that air flow will be from areas of low contamination potential towards areas of higher contamination potential to minimize the spread of contamination.

4.6.1.4 Testing of Ventilation Systems

Several measures are in place to ensure effective operation of the ventilation control systems. Differential pressure is monitored and alarmed for High Efficiency Particulate Air (HEPA) filters used for Control Rooms where uranium is processed. Operating procedures specify limits and set points on differential pressure consistent with manufacturer's recommendations. Filters are changed if they fail to function properly or if the differential pressure exceeds the manufacturer's ratings.

Dust collector units in the DUF_4 and FEP processes are monitored and alarmed for differential pressure. Operating procedures specify limits and set points for acceptable differential pressures and uranium sample results. Operating procedures also specify that at least two (2) dust collector units shall be operated in series. If this is not possible, the process system being serviced by the dust collectors must be placed in a shutdown or standby mode.

Filter and dust collector inspection, testing, maintenance and change-out criteria are specified in written procedures approved by the Plant Engineering and Maintenance Manager and the RPM or designated alternates. Change-out frequency is based on considerations of filter loading, operating experience, differential pressure data and any monitoring data that exceeds set administrative control limits.

Pressures are continuously monitored and controlled for the Plant KOH Scrubbing System and across the process system that is being vented to the scrubbing system. Limits are set to ensure an adequate safety margin of pressure controls for the scrubbing system. Operating procedures and operator aids also provide for corrective response when alarms are received relative to the system pressure controls. Testing to ensure established set point pressure drops across scrubber equipment is specified in written procedures that are approved by the Plant Engineering and Maintenance organization.

Air flow rates at exhausted enclosures and close-capture points related to uranium processing and handling areas are adequate to preclude escape of airborne uranium and minimize potential for intake by workers. Air flow rates are checked routinely when in use and after modification of any hood, exhausted enclosure, close-capture point equipment or ventilation system serving these barriers.

4.6.2 Respiratory Protection Program

The Respiratory Protection Program is a subset of the RPP and is conducted in accordance with 10 CFR 20, Subpart H (CFR, 2008n). In accordance with 10 CFR 20.1703(c)(1-2), "Use of Individual Respiratory Protection Equipment," (CFR, 2008o), the Respiratory Protection Program includes air sampling to identify potential hazards, permit proper equipment selection and estimate occupational doses. Surveys and bioassays are also performed, as necessary, to evaluate potential or actual intakes. The Respiratory Protection Program is consistent with the guidance in Regulatory Guide 8.15,"Acceptable Programs for Respiratory Protection," (NRC, 1999b).

4.6.2.1 Respiratory Protection Requirements; 10 CFR 20, Subpart H

In accordance with 10 CFR 20.1701 (CFR, 2008p), the IIFP Facility is designed and operated to use, to the maximum extent practical, process and engineering controls to minimize the concentration of radioactive material in air. In accordance with 10 CFR 20.1702(a), "Use of Other Controls," (CFR, 2008q), when it is not practical to apply process or other engineering controls, ALARA principles to include access control to the affected area, limitations on exposure times and use of respiratory protection equipment are applied. In accordance with 10 CFR 20.1703(a) (CFR, 2008o), respiratory protection equipment specifically tested and certified by the National Institute for Occupational Safety and Health (NIOSH) is used.

4.6.2.2 Procedures for Using Respiratory Protection Equipment

In accordance with 10 CFR 20.1703(c) (4) (CFR, 2008o), approved written procedures dictate the following:

- Monitoring including air sampling and bioassays
- Supervision and training of respirator users
- Fit testing of respirators
- Respirator selection
- Breathing air quality
- Inventory and control of respirators
- Cleaning of respirators
- Storage, issuance, maintenance, repair, testing and quality assurance of respiratory protection equipment
- Recordkeeping
- Limitations on respirator use and relief from respirator use

<u>Selection of Respiratory Protection Equipment</u>

In accordance with 10 CFR 20.1702(b) (CFR, 2008q) when performing ALARA analysis to determine if respiratory equipment should be used, other safety factors are considered including the impact of respiratory protection equipment use on industrial safety and health.

In accordance with 10 CFR 20.1703(e) (CFR, 2008o), consideration is given to the limitations appropriate to the type and mode of respiratory device use. Provisions are made for vision correction, adequate communication, low/high temperature work environments and the concurrent use of other safety or radiation protection equipment. Per approved written procedure(s), radiation protection personnel select the appropriate type of respiratory device to be used for activities involving potential exposure to airborne radioactivity.

Fitting of Respiratory Protection Equipment

Approved written procedures describe the proper techniques for performing fit tests. An adequate fit is determined for face sealing respirators using either a quantitative fit test method or a qualitative method. In accordance with 10 CFR 20.1703(c) (6) (CFR, 2008o), qualitative fit testing is acceptable if it is capable of verifying a fit factor of 10 times the assigned protection factor (APF) for face pieces operated in a negative pressure mode or it is capable of verifying a fit factor of 500 for face pieces operated in a positive pressure mode. Mask fits are reevaluated least annually. Also, in accordance with 10 CFR 20.1703(h) (CFR, 2008o) no objects, materials or substances such as facial hair or any conditions that interfere with the face piece seal or valve function and that are under the control of the respirator wearer are permitted between the skin of the wearer's face and the sealing surface of a tight fitting respirator face piece.

Issuance of Respiratory Protection Equipment

Approved written procedures prescribe the actions to be taken when issuing respiratory protection equipment. In accordance with 10 CFR 20.1703(c) (5) (CFR, 2008o), individuals designated to use respiratory protection equipment are evaluated by a physician to determine if the individual is medically fit to use respiratory protection devices. Individuals are medically evaluated periodically thereafter in accordance with 29 CFR 1910.134(e) (CFR, 2008r).

Maintenance of Respiratory Protection Equipment

Respiratory protection equipment is cleaned, serviced, tested and inspected in accordance with the instructions specified by the manufacturer per NIOSH for each respiratory protection device. The IIFP Facility is equipped with a suitable location for cleaning and storage of respirators and other reusable PPE. Contaminated items must remain inside the RCAs where the items are cleaned until they are successfully decontaminated. Respiratory protection equipment is then taken to the respirator cleaning and refurbishing area for hygienic cleaning and servicing as described above prior to its return to service. Cleaned PPE such as face shields and respirators that come into contact with the wearer's face must be inspected after cleaning before reuse. Approved written procedures prescribe the actions to be taken for maintenance of respiratory protection equipment. The liquid waste resulting from cleaning respirators and other reusable PPE is sent to the plant Decontamination Building liquid treatment process for removal of uranium that may be in the cleaning waste liquid.

Testing of Respiratory Protection Equipment

In accordance with 10 CFR 20.1703(c) (3) (CFR, 2008o), respirators are tested for operability (user seal check for face sealing devices and functional check for others) immediately prior to each use per the instructions in approved written procedures.

Training on the Use of Respiratory Protection Equipment

If there are no medical restrictions precluding respirator use, the individual is provided respiratory training and fitting by a qualified instructor. Additional training on the use and limitations of self-contained breathing devices is provided to designated individuals per approved written procedures.

In accordance with 10 CFR 20.1703(d) (CFR, 2008o), each respirator user is advised that he/she may leave the area at any time for relief from respirator use in the event of equipment malfunction, physical or psychological distress, procedural or communication failure, significant deterioration of operating conditions or any other condition that may require such relief.

Monitoring Areas Requiring Respiratory Protection

In accordance with approved written procedures, an area requiring respiratory protection is monitored by the radiation protection staff for airborne radioactivity in order to estimate the dose to the individual wearing respiratory protection. This monitoring could include air sampling, bioassay and/or other method(s) deemed appropriate by radiation protection personnel.

Recordkeeping for the Use of Respiratory Protection Equipment

Records regarding the use of respiratory protection equipment are maintained in accordance with approved written procedures and comply with 10 CFR 20, Subpart L "Records." (CFR, 2008s). The Records Management Program is described in the IIFP LA, Revision B Chapter 11.

Revision of Respiratory Protection Procedures

In accordance with the LA, Revision B Chapter 11, respiratory protection procedures are revised as needed.

Respiratory Protection Program Records

Records of the RPP (including training for respiratory use and maintenance) are maintained in accordance with the Records Management Program as described in LA, Revision B Chapter 11.

4.7 RADIATION SURVEYS AND MONITORING PROGRAMS

Routine radiological surveys and monitoring are conducted at a regular frequency to ensure occupational exposures are ALARA. This includes airborne and surface contamination surveys and personnel dosimetry. The survey and monitoring programs are consistent with the guidance in Regulatory Guide 8.2 (NRC, 1973), Regulatory Guide 8.7, "Instructions for Recording and Reporting Occupational Radiation Exposure Data," (NRC, 2005) and Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations and Assumptions for a Bioassay Program," (NRC, 1993c).

4.7.1 Radiation Surveys and Monitoring Programs Meeting Requirements of 10 CFR 20, Subpart F

In accordance with 10 CFR 20.1501(a) and (b) (CFR, 2008f), IIFP conducts radiation surveys and radiation area monitoring with instrumentation or area dosimetry that: 1) satisfy applicable regulations, 2) are adequate to evaluate the magnitude and extent of radiation levels, concentrations or quantities of

radioactive material and 3) can identify potential radiological hazards or the accumulation of radioactivity. Section 4.7.6, “Air Sampling Program,” discusses air sampling and Section 4.7.8, “Minimization of Contamination,” discusses the Contamination Survey Program.

In accordance with 10 CFR 20.1501(b) (CFR, 2008f), instruments and equipment are calibrated periodically. Section 4.7.12, “Equipment and Instrumentation Sensitivity,” discusses equipment calibrations.

In accordance with 10 CFR 20.1501(c) (CFR, 2008f), personnel dosimeters are processed by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited vendor. Section 4.7.3, “External Occupational Radiation Exposures,” discusses external dose and personnel dosimetry.

In accordance with 10 CFR 20.1502 (CFR, 2008g), IIFP monitors exposure to radiation and radioactive material to demonstrate compliance with occupational dose limits. Sections 4.7.3 and 4.7.4 discuss monitoring for external and internal dose, respectively.

4.7.2 Approved Procedures for Radiation Surveys and Monitoring Programs

The approved written procedures include survey and monitoring objectives, sampling procedures and data analysis methods, types of equipment and instrumentation to be used, frequency of measurements, recordkeeping and reporting requirements and actions to be taken in case measurements exceed administrative or regulatory limits.

4.7.3 External Occupational Radiation Exposures

External occupational dose is measured in accordance with 10 CFR 20.1501(a) (CFR, 2008f). Deep-dose equivalent and shallow-dose equivalent from external sources of radiation are determined by individually assigned dosimeters. Per approved written procedures, personnel dosimeters are distributed to individuals based on their job functions commensurate with the amount of time an individual spends working with or near radioactive materials. Personnel dosimeters are processed by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited vendor. The capability exists to process dosimeters expeditiously if there is an indication of an exposure in excess of established action guides. Action guides for external exposures are established in approved written procedures. Work activity restrictions are imposed when an individual’s exposure exceeds 80 percent of the applicable 10 CFR 20.1201 (CFR, 2008h) limit.

Any time an administrative limit is exceeded, the RPM is notified. He/she then determines the need for investigation and/or corrective action. When the results of individual monitoring are unavailable or are invalidated by unusual exposure conditions, external exposures may be calculated by the radiation protection staff on the basis of data obtained by investigation.

4.7.4 Internal Occupational Radiation Exposures

The Personnel Monitoring Program is designed and implemented for internal occupational radiation exposures based on the requirements of 10 CFR 20.1201 (CFR, 2008h), 10 CFR 20.1204, “Determination of Internal Exposure,” (CFR, 2008t) 10 CFR 20.1502(b), (CFR, 2008g) and 10 CFR 20.1704(i), “Further Restrictions on the Use of Respiratory Protection Equipment,” (CFR, 2008u). Intakes are assigned to individuals based upon one or more types of measurements as follows: air sampling, in vitro bioassay (i.e. urinalysis or fecal) and/or in vivo bioassay (i.e. lung counting). The type and frequency of measurements for an individual are determined by their job function and properties of the licensed material associated

with a known or suspected intake. The measurements are commensurate with the amount of time an individual spends working with or near radioactive material. Intakes are converted to committed dose equivalent (CDE) and committed effective dose equivalent (CEDE) for the purposes of limiting and recording occupational doses. Action levels are established in approved written procedures to prevent an individual from exceeding the occupational exposure limits specified in 10 CFR 20.1201 (CFR, 2008h). Work activity restrictions are imposed when an individual's exposure exceeds 80 percent of the 10 CFR 20.1201 (CFR, 2008h) limit. Control actions include temporarily restricting the individual from working in an area containing airborne radioactivity and actions are taken as necessary to prevent recurrence.

4.7.4.1 Urinalysis Program

The In Vitro (urinalysis and/or fecal) Bioassay Program is conducted primarily to evaluate the intake of soluble uranium to assure the 10 CFR 20.1201(e) (CFR, 2008h) intake limit of 10 milligram (mg) per week is not exceeded. Personnel assigned to work in areas where soluble airborne uranium compounds are present in concentrations likely to result in intakes in excess of 10 percent of the applicable limits in 10 CFR 20.1201 (CFR, 2008h) are monitored by urinalysis and/or fecal bioassay methods. The minimum sampling frequency for these individuals is specified in approved written procedures. In vitro monitoring may also be used to monitor individuals involved in non-routine operations, perturbations or incidents.

In vitro sampling frequencies and action levels are established in approved written procedures based on the appropriate bio-kinetic models for the uranium compounds present. Results above the applicable action level are investigated. Work activity restrictions are imposed when an individual's exposure (Total Effective Dose Equivalent) exceeds 80 percent of the occupational dose limit in 10 CFR 20.1201(a) (CFR, 2008h). Exceeding an action level will result in a temporary work restriction for the individual to prevent additional exposure and allow a more accurate assessment of the intake.

An off-site laboratory that meets the performance standards specified in ANSI/HPS N13.22 and ANSI/HPS N13.30 will be utilized to process and analyze in vitro bioassay samples.

4.7.4.2 In Vivo Lung Counting Program

In vivo lung counting will be conducted as necessary to supplement or verify in vitro bioassay results.

Actions are taken based on in vivo lung counting results to ensure the Annual Limit on Intake (ALI) is not exceeded. If the individual's lung count indicates an intake and burden greater than the established action level, the individual is restricted from working in areas containing potential airborne uranium until such time that investigation and re-counting finds the intake to be below the established limits. Work activity restrictions are imposed if an individual exposure were to exceed 80 percent of the occupational dose limit in 10 CFR 20.1201(d) (CFR, 2008h).

In vivo lung counting will be performed by qualified contractors in accordance with ANSI/HPS N13.35 performance standards.

4.7.5 Summation of External and Internal Occupational Radiation Exposures

Per approved written procedures, the summation of external and internal occupational radiation exposure is reported as a TEDE and is calculated in accordance with 10 CFR 20.1202(a)-(d), "Compliance with Requirements for Summation of External and Internal Doses," (CFR, 2008v). The calculation is

consistent with the guidance in Regulatory Guide 8.34, “Monitoring Criteria and Methods to Calculate Occupational Radiation Doses,” (NRC, 1992a).

4.7.6 Air Sampling Program

An Air Sampling Program is designed and implemented in areas of the IIFP Facility that are identified as Airborne Radioactivity Areas. This Program includes procedures to conduct air surveys and to calibrate and maintain radiation protection airborne sampling equipment in accordance with the manufacturers’ recommendations.

4.7.7 Control of Airborne Radioactive Material

Air samples are continuously taken from each main process area where airborne concentrations potentially could exceed 0.3 derived air concentrations (DAC) when averaged over 40 hours to assess the concentrations of uranium in the air. Per approved written procedure(s), the air samples are collected in such a way that the concentrations of uranium measured are representative of the air which workers breathe. Air sampling results and individual personnel exposure assignments are monitored by the radiation protection function to evaluate the effectiveness of personnel exposure controls.

Evaluations of air sampling effectiveness are performed in accordance with the methods and acceptance criteria in Regulatory Guide 8.25, “Air Sampling in the Workplace,” (NRC, 1992b). Filters from air samplers are changed each shift during normal operating periods or at more frequent intervals following the detection of an event that may have released airborne uranium based upon knowledge of the particular circumstances. Filters are not changed as frequently during periods when no work is in progress. The filters are processed to determine the uranium concentration in the air for each area.

Grab samples are obtained during maintenance activities that are known to or have the potential to generate airborne radioactivity levels in excess of 1.0 DAC.

Each air sampler is equipped with a flow meter to indicate flow rate of air sampled. These flow meters are calibrated or replaced every 18 months, at a minimum. Air sampling, resulting in excess of 2.5 DAC (eight hour sample) and not resulting from specific known causes, are investigated to determine the probable cause. Operations or equipment will be shut down and immediate corrective action will be taken at locations where an air sample exceeds 10 DAC without a specific known cause.

In addition to the activities described above, exposure to airborne radioactive material is controlled through limiting access to areas, limiting exposure time and use of respiratory equipment.

4.7.8 Minimization of Contamination

The IIFP Facility is designed and operated in accordance with 10 CFR 20.1406 “Minimization of Contamination,” (CFR, 2008w) to minimize contamination, facilitate eventual decommissioning and minimize, to the extent practicable, the generation of radioactive waste. In addition, minimization of contamination is accomplished through compliance with labeling and packaging requirements in 10 CFR 20.1904, “Labeling Containers,” (CFR, 2008x), 10 CFR 20.1905, “Exemptions to Labeling Requirements,” (CFR, 2008y), 10 CFR 20.1906, “Procedures for Receiving and Opening Packages,” (CFR, 2008z), 10 CFR 20, Subpart K “Waste Disposal,” (CFR, 2008aa). The following are examples of methods for minimizing contamination:

- Containment of radioactive material throughout the facility

- Monitoring for equipment leaks
- Training on proper techniques for handling radioactive material
- Airflow from areas of low radioactivity to higher radioactivity

4.7.9 Contamination Survey Program

Routine surveys are performed in areas that are most likely to be contaminated or where contamination from licensed processes, licensed material decay products or other radionuclide contaminates may concentrate. The radiation protection staff determines survey frequencies, compares the survey results to action guide values as specified in approved written procedures and ensures the appropriate responses are taken. If the results exceed the action guide values, the Radiation Protection Manager, or Designee, is informed and he/she determines if an investigation and/or corrective actions are necessary.

Protective clothing is provided to persons who are required to enter the RCAs where the potential for personnel contamination exists as determined by the radiation protection staff. The amount and type of protective clothing required for a specific area or operation is determined by operational experience and the potential for contamination. Available clothing includes caps, hoods, laboratory coats, coveralls, safety glasses, boots, overshoes, shoe covers, rubber and cloth gloves and safety shoes. The protective clothing is removed in the change rooms upon exit. In the Laboratory area, where uranium is handled, the minimum protective clothing requirement for entry is a laboratory coat and safety glasses. PPE and anti-contamination clothing is segregated and disposed of in accordance with the following:

Labeled radioactive material bags are provided for placement of disposable PPE. Used disposable PPE, respirator cartridges and other disposable items are containerized and taken to the Radiological Waste Area.

Radiation protection technicians perform routine contamination surveys in the change rooms, plant exit walkways and the Laboratory area.

4.7.10 Corrective Action Program for Personnel Contamination

Personnel contamination surveys are required for external contamination on clothing and the body by personnel exiting the change rooms. If contamination is found in excess of background levels, the individual attempts self-decontamination (except for facial contamination) at the facilities provided in the change rooms. If decontamination attempts are not successful, or if facial contamination is detected, decontamination assistance is provided by the radiation protection function (typically a radiation protection technician). If skin or personal clothing is still contaminated above background levels, the individual is not permitted to leave the area without the prior approval (per approved written procedure) of the RPM.

Personnel contamination events that exceed a facility Administrative Control Level will be recorded, tracked and managed through the Corrective Action Program described in the IIFP License Application, Revision B Chapter 11 Section 6 “Incident Investigations and Corrective Action Program.” The corrective action process will require investigation of the contamination event and implementation of corrective actions to rectify any deficiencies. Contamination events that are managed through the Corrective Action Program will be reported to the ALARA Committee and reviewed as described in Section 4.2.3, “ALARA Committee.” Tracking and trending will be performed in accordance with the ALARA Program as stated in Section 4.2.2 “ALARA Goals.”

4.7.11 Corrective Action Program for Airborne Occupational Exposure

Corrective actions are implemented and documented based on the frequency and magnitude of events causing releases of airborne uranium that exceed administrative limits. Routine air sampling is supplemented by portable air sample surveys as required to evaluate non routine activities or breaches in containment. Radiation protection and operations staff will investigate the cause of the release and implements recommended actions to prevent future releases.

4.7.12 Equipment and Instrumentation Sensitivity

Appropriate radiation detection instruments are available in sufficient number to ensure adequate radiation surveillance can be accomplished. Selection criteria for portable and laboratory counting equipment are based on the types of radiation detected, maintenance requirements, ruggedness, interchangeability and upper and lower limits of detection capabilities.

Portable instrumentation is calibrated in accordance with manufacturing recommendations before initial use, after major maintenance and on a routine basis following the last calibration. Calibration consists of a performance check on each range scale of the instrument with a radioactive source of known activity traceable to a recognized standard such as the National Institute of Standards and Technology (NIST). Prior to each use, operability checks are performed on monitoring and laboratory counting instruments. The background and efficiency of laboratory counting instruments are determined on a daily basis when in use.

4.7.13 Policies for Removal of Equipment and Materials from Radiological Controlled Areas

When removing equipment and materials from RCAs, with the exception of hazardous chemicals produced from licensed operations, the guidance contained in NRC Branch Technical Position, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-product, Source or Special Nuclear Material," April 1993 (NRC, 1993b), will be followed. Volumetrically contaminated materials will be released if the uranium concentration of the material does not exceed 30 pCi/g, or the dose to a member of the public, taking into consideration the subsequent use of the material, does not exceed 1 mrem per year. The radiation protection staff must approve the release of equipment and/or materials from RCAs. The equipment and material screening and evaluation process will be governed by approved written procedures.

Hazardous chemicals produced from licensed materials, as defined in 10 CFR 70.4, will be considered "separated from licensed materials" by meeting the exemptions described in 10 CFR 40.13(a) for "unimportant quantities of source material." The term "Unimportant quantities of source material" is defined as "… source material in any chemical mixture, compound, solution, or alloy in which the source material is by weight less than one-twentieth of 1 percent (0.05 percent) of the mixture, compound, solution or alloy."

Environmental, safety and health controls and regulations associated with the storage, handling, transportation and disposal of these hazardous chemicals result in more restrictive controls than those necessary to protect the worker, public and environment from the radiological hazard associated with source material at a concentration of one-twentieth of 1 percent (0.05 percent or 500 ppm) in the hazardous chemical. For example, uranium at a concentration of 500 ppm in anhydrous hydrogen fluoride (AHF) would result in a dose of 0.09 mrem to an individual exposed to AHF at the ACGIH TLV-STEL of 2 ppm for 15 minutes. In the more extreme case, the lowest lethal concentration of HF, considered to range between 50 and 250 ppm for 5 minutes, would result in a dose between 0.75 and 3.8 mrem,

respectively. Generally at IIFP, the hazardous chemicals produced from licensed materials and then separated from licensed materials are products that are sold. The customers of these products will typically require rigorous routine sampling and analysis of the products to meet any required specifications. IIFP will establish a statistically confident sampling and analysis written procedure including approved analytical methods to demonstrate that customer product purity and impurity limit requirements are met.

IIFP will also include a statistically confident sampling and analysis written procedure for source material (uranium) determination in the materials being considered as "separated from licensed materials" as an assurance that exemptions described in 10 CFR 40.13(a) remain applicable for the subject materials. The measurement methods applied to determine the concentration of source material in hazardous chemicals will be governed by approved written procedures. The written procedure for uranium determination in the "separated from licensed materials" will include the sampling plan, acceptable quality levels, the approved analytical methods and steps, calibration standard requirements and procedures for calibration where applicable. The sampling plan will be based on valid technical and statistical principles including estimates of variance and established confidence limits associated with the sampling method. The qualified measurement methods, including the analytical accuracy, variance and confidence limits will be demonstrated to an acceptable performance before being approved as an implementing procedure.

4.7.14 Sealed Sources

When not in use, sources shall be stored in a closed container adequately designed and constructed to contain radioactive material that may otherwise be released during storage. The sources shall be tested for leakage using the Dry Wipe test method described in ISO 9978:1992, "Radiation Protection-Sealed Radioactive Sources-Leakage Test Methods," (ISO, 1992).

Sealed sources will be leak checked at six (6) month intervals not to exceed that specified on the sealed source and device registration certificate using a quantitative analysis requiring that instrumentation used to analyze the sample be capable of detecting 185 Becquerel (Bq) (0.005 microcuries) of radioactivity.

Leak tests will not be required if:

- Sources contain only H-3.
- Sources contain only licensed material with a half-life of less than 30 days.
- Sources contain only a radioactive gas.
- Sources contain 3.7 MBq (100 microcuries) or less of beta-emitting or gamma-emitting material or 370 kBq (10 microcuries) or less of alpha-emitting material.
- Sources are stored and are not being used (must be leak tested before use or transfer).

Sources that exhibit removable contamination in excess of 185 Bq (0.005 microcuries) will be removed from service and disposed of in accordance with regulations.

4.7.15 Access Control

Access control is accomplished through compliance with the requirements in 10 CFR 20.1601(a)-(c), "Control of Access to High Radiation Areas," (CFR, 2008bb) and 10 CFR 20.1602, "Control of Access to Very High Radiation Areas," (CFR, 2008cc). For most RCAs, routine access points are established through change rooms. Each change room includes a step off area provided between the contamination Controlled and Non-Controlled Areas. Instructions controlling entry and exit from RCAs are posted at the entry points. Survey meters are provided in the step off area of each change room for use by personnel

leaving the RCA. Posted instructions address the use of the survey meters, donning and doffing protective clothing and appropriate decontamination methods. Alternate access points to RCAs are established for specific activities not accommodated by the change rooms. Such access is governed by approved written procedures or RWPs which establish controls to prevent the spread of contamination to Non-Controlled Areas.

RCA that may pose a risk to employees are identified and posted in compliance with the requirements in 10 CFR 20.1901, "Caution Signs," (CFR, 2008dd), 10 CFR 20.1902, "Posting Requirements," (CFR, 2008ee), and 10 CFR 20.1903, "Exceptions to Posting Requirements," (CFR, 2008ff). Access to these areas is controlled so that only appropriately trained individuals are allowed entry. Signs are regularly inspected for conformance. The following areas are identified and posted if applicable in accordance with definitions provided in 10 CFR 20.1003 (CFR, 2008gg). Definitions of Access Control Areas are given in the IIFP LA, Revision B Chapter 1 Section 1.1.2 "Facility Description."

- Radiation Area
- High Radiation Area (unlikely to have but a sealed calibration source may require)
- Airborne Radioactivity Area
- Radioactive Material Area

In addition, contamination areas are posted in accordance with approved written procedures. Signs are posted at the entry points of areas requiring protective clothing. Radiation safety training and approved written procedures instruct employees on requirements for entering and working in posted areas.

4.7.16 Radiation Reporting Program

A Radiation Reporting Program will be established to maintain records of the RPP, radiation survey results, corrective action program referrals, RWPs and planned special exposures. The Radiation Reporting Program is consistent with the guidance in Regulatory Guide 8.7 (NRC, 2005).

The Radiation Reporting Program commits to report to the NRC any event resulting in an occupational exposure to radiation exceeding the dose limits in 10 CFR 20.1201 (CFR, 2008h), within the time specified in 10 CFR 20.2202, "Notification of Incidents," (CFR, 2008hh), 10 CFR 30.50, "Reporting Requirements," (CFR, 2008ii), 10 CFR 40.60, "Reporting Requirements," (CFR, 2008jj), and 10 CFR 70.74, "Additional Reporting Requirements," (CFR, 2008kk). The Radiation Reporting Program also commits to prepare and submit to the NRC an annual report of individual monitoring results, as required by 10 CFR 20.2206(b), "Reports of Individual Monitoring," (CFR, 2008ll).

Radiation exposure data for an individual and the results of any measurements, analyses and calculations of radioactive material deposited or retained in the body of an individual shall be reported to the individual as specified in 10 CFR 19.13 (CFR, 2008m). Individuals are advised of their right to request radiation exposure data in Basic Radiation Safety Training. In accordance with 10 CFR 19.11, "Posting of Notices to Workers," (CFR, 2008mm), IIFP management posts current copies or locations where they may be reviewed of the following documents:

- The regulations in 10 CFR 19 (CFR, 2008a) and 10 CFR 20 (CFR, 2008b)
- The license, license conditions or documents incorporated into the license by reference and amendments thereto
- The operating procedures applicable to licensing activities

4.8 ADDITIONAL PROGRAM COMMITMENTS

The following sections provide commitments to achieve compliance with the regulations in 10 CFR 20, Subpart L (CFR, 2008s), 10 CFR 20, Subpart M "Reports," (CFR, 2008nn) and 10 CFR 70.74 (CFR, 2008kk).

4.8.1 Records

In accordance with 10 CFR 20, Subpart L (CFR, 2008s), IIFP maintains records of the RPP (including program provisions, audits and reviews of the Program context and implementation), radiation survey results (air sampling, bioassays, external exposure data from monitoring individuals, internal intakes of radioactive material) and results of Corrective Action Program referrals, RWPs and planned special exposures. Recordkeeping is further described in LA, Revision B Chapter 11.

4.8.2 Event Reporting

Approved written procedures dictate that IIFP will report to the NRC, within the time specified by 10 CFR 20, Subpart M (CFR, 2008nn) and 10 CFR 70.74 (CFR, 2008kk), any event resulting in an occupational exposure to radiation exceeding the dose limits in 10 CFR 20 (CFR, 2008b). Approved written procedures contain instructions for when and how to report events to the NRC and other regulatory agencies.

4.8.3 Annual Dose Monitoring Report

IIFP prepares and submits an annual report of the results of individual monitoring as required by 10 CFR 20.2206(b) (CFR, 2008ll) to the NRC.

4.8.4 Corrective Action Reporting

Any radiation incident resulting in an occupational exposure that exceeds the dose limits in 10 CFR 20.1201 (CFR, 2008h), or is required to be reported per 10 CFR 20, Subpart M (CFR, 2008nn), 10 CFR 30.50 (CFR, 2008ii), 10 CFR 40.60 (CFR, 2008jj) and 10 CFR 70.74 (CFR, 2008kk) will be evaluated within the IIFP Corrective Action Program. The corrective actions taken (or planned) to protect against a recurrence and the proposed schedule to achieve compliance are reported to the NRC.

REFERENCES

ASTM, 1989 — ASTM C986-89. "Developing Training Programs in the Nuclear Fuel Cycle," American Society for Testing and Materials, 1989.

ASTM, 1995 — ASTM E1168-95. "Radiological Protection Training for Nuclear Facility Workers," American Society for Testing and Materials, 1995.

CFR, 2007 — 10 CFR 20 Appendix B. "Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage," U.S. Nuclear Regulatory Commission, 2007.

CFR, 2008a — 10 CFR 19. "Notices, Instructions and Reports to Workers:Inspection and Investigations," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008b — 10 CFR 20. "Standards for Protection Against Radiaton," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008c — 10 CFR 40. "Domestic Licensing of Source Material," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008d — 10 CFR 20 Subpart B. "Radiation Protection Programs," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008e — 10 CFR 20.1101. "Radiation Protection Programs, " U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008f — 10 CFR 20.1501." General, " U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008g — 10 CFR 20.1502. "Conditions Requiring Individual Monitoring of External and Internal Occupational Dose, " U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008h — 10 CFR 20.1201. "Occupational Dose Limits for Adults," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008i — 10 CFR 19.12. "Instructions to Workers," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008j — 10 CFR 20.1208. "Dose Equivalent to an Embryo/Fetus," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008k — 10 CFR 20.1301. "Radiation Dose Limits for Individual Members of the Public," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008l — 10 CFR 20.2110. "Form of Records," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008m — 10 CFR 19.13. "Notifications and Reports to Individuals," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008n 10 CFR 20 Subpart H. "Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008o 10 CFR 20.1703." Use of Individual Respiratory Protection Equipment," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008p 10 CFR 20.1701. "Use of Process or Other Engineering Controls," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008q 10 CFR 20.1702. "Use of Other Controls," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008r 29 CFR 1910. "Occupational Safety and Health Standards," Occupational Safety and Health Administration, 2008.

CFR, 2008s 10 CFR 20 Subpart L. "Records," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008t 10 CFR 20.1204. "Determination of Internal Exposure," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008u 10 CFR 20.1704. "Further Restrictions on the Use of Respiratory Protection Equipment," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008v 10 CFR 20.1202. "Compliance with Requirements for Summation of External and Internal Doses," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008w 10 CFR 20.1406. "Minimization of Contamination." U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008x 10 CFR 20.1904. "Labeling Containers," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008y 10 CFR 20.1905. "Exemptions to Labeling Requirements," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008z 10 CFR 20.1906. "Procedures for Receiving and Opening Packages," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008aa 10 CFR 20 Subpart K. "Waste Disposal," U.S. Nuclear Regulatory Commission 2008.

CFR, 2008bb 10 CFR 20.1601. "Control of Access to High Radiation Areas," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008cc 10 CFR 20.1602. "Control of Access to Very High Radiation Areas," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008dd 10 CFR 20.1901. "Caution Signs," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008ee 10 CFR 20.1902. "Posting Requirements," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008ff 10 CFR 20.1903. "Exceptions to Posting Requirements," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008gg 10 CFR 20.1003. "Definitions," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008hh 10 CFR 20.2202. "Notification of Incidents," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008ii 10 CFR 30.50. "Reporting Requirements," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008jj 10 CFR 40.60. "Reporting Requirements," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008kk 10 CFR 70.74. "Additional Reporting Requirements," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008ll 10 CFR 20.2206." Reports of Individual Monitoring," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008mm 10 CFR 19.11. "Posting of Notices to Workers," U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008nn 10 CFR 20 Subpart M. "Reports," U.S. Nuclear Regulatory Commission, 2008.

ICRP,1995 ICRP-68. "Dose Coefficients for Intakes of Radionuclides by Workers," International Commission on Radiological Protection, 1995.

ISO, 1992 ISO 2919:1999. "Radiation Protection-Sealed Radioactive Sources-Leakage Test Methods," International Organization for Standardization, 1992.

NRC, 1973 Regulatory Guide 8.2."Guide for Administrative Practices in Radiation Monitoring," U.S. Nuclear Regulatory Commission, 1973.

NRC, 1977 Regulatory Guide 8.10."Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable," U.S. Nuclear Regulatory Commission, 1977.

NRC, 1992a Regulatory Guide 8.34. "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses," U.S. Nuclear Regulatory Commission, 1992.

NRC, 1992b Regulatory Guide 8.25." Air Sampling in the Workplace," U.S. Nuclear Regulatory Commission, 1992.

NRC, 1993a Regulatory Guide 8.37. "ALARA Levels for Effluents from Materials Facilities," U.S. Nuclear Regulatory Commission, 1993.

NRC, 1993b Branch Technical Position."Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct Source or Special Nuclear Material," U.S. Nuclear Regulatory Commission, 1993.

NRC, 1993c Regulatory Guide 8.9. "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program," U.S. Nuclear Regulatory Commission, 1993.

NRC, 1996 Regulatory Guide 8.29. "Instruction Concerning Risks from Occupational Radiation Exposure," U.S. Nuclear Regulatory Commission, 1996.

NRC, 1999a Regulatory Guide 8.13. "Instruction Concerning Prenatal Radiation Exposure," U.S. Nuclear Regulatory Commission, 1999.

NRC, 1999b Regulatory Guide 8.15. "Acceptable Programs for Respiratory Protection," U.S. Nuclear Regulatory Commission, 1999.

NRC, 2005 Regulatory Guide 8.7. "Instructions for Recording and Reporting Occupational Radiation Exposure Data," U.S. Nuclear Regulatory Commission, 2005.

NRC, 2008 Regulatory Guide 4.21. “Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning,” U.S. Nuclear Regulatory Commission, 2008.