SP-PRO-008 MVF

REVISION 0

RADIATION SAFETY PROGRAM MANUAL

Approved: Travis Snowder / _____ / _____
QTA President/CEO (Print) (Sign) Date

Approved: Michael Albanese / _____ / _____
Radiation Safety Officer (Print) (Sign) Date

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LIST OF EFFECTIVE PAGES

Pages	Revision	Effective Date
1-82	0	Pending NRC Approval

Revision History	Reason for change:
Rev 0	New document

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EXECUTIVE SUMMARY

The Radiation Safety Program Manual (RSPM) provides procedures and guidance for the conduct of operations and processes related to acceptance, receipt, storage, analysis and disposition of of generator waste. The anticipated work by QAL-TEK ASSOCIATES, LLC (QTA) Mayfield Verification Facility (MVF) provides waste disposition activities for other licensees.. Licensed activities by QAL-TEK ASSOCIATES, LLC (QTA) Mayfield Verification Facility (MVF) provides collection and sorting services of sealed sources for disposal or recycling in accordance with OP-PRO-607MVF and associated QTA MVF procedures..

The RSPM will be complied with, to the extent practicable, to implement and maintain proper radiological safety and compliance with NRC regulations related to radiological activities during the course of QTA MVF operations including implementation of an Emergency Plan in the event the CAP88 evaluation is exceeded.

The QTA Radiation Safety Officer (RSO) bears the responsibility of the QTA MVF Radiation Safety Program as described and defined by this Manual. Any changes to this Manual shall be approved by the RSO and NRC as applicable, before they are implemented and used. The signature, below, by the QTA CEO, indicates the review and approval of this Manual.

Qal-Tek Associates, President/Chief Executive Officer

RADIOLOGICAL CONTROL POLICY STATEMENT

QAL-TEK ASSOCIATES is committed to the goal of a quality Radiation Protection Program that will maintain radiological exposures to employees, the public, and the environment within the limitations of 10 CFR 20 by the use of the principles of ”As Low As Reasonably Achievable” (ALARA) and “Best Practices”. Component elements of this Program are outlined in this Manual and shall be followed by QAL-TEK ASSOCIATES employees wherever they conduct operations. Conscientious adherence by all QAL-TEK ASSOC. employees to the component principles described in this Manual will result in the realization of the above-stated goal.

President of QAL-TEK ASSOCIATES, LLC

DEFINITIONS

Activation products (AP)	Byproduct radioactive material that is produced due to exposure to ionizing radiation.
Airborne Radioactivity Area	A room, enclosure, or area in which airborne radioactive materials, composed wholly or partially of licensed material, exist in concentrations that (1) exceed the derived air concentration limits (DAC), or (2) would result in an individual present in the area without respiratory protection exceeding, during those hours an individual is present in a week, 0.6 percent of the annual limit on intake (ALI) or 12 DAC-hours.
Bill of Lading (BOL)	A document used to capture information about the materials publicly transported, commonly used via road transportation (i.e. shipping papers).
Contaminated Area	A room, enclosure, or area in which removable radioactive contamination exceeds 1,000 dpm/100cm^2 beta-gamma or 20 dpm/100cm^2 alpha.
Controlled area	Areas within the USEI property that QTA can positively control with respect to public occupancy irrespective of QTA presence.
Excepted Shipment	A radioactive shipment granted exception from certain packaging marking, labeling and paperwork requirements in 49CFR173 Subpart I.
Fission products (FP)	Any radionuclide or stable nuclide resulting from nuclear fission, including both primary fission fragments and associated radioactive decay products.
Generator	The last beneficial user or end producer of Low Level Radioactive Waste.
In-Situ Object and Counting System (ISOCS)	A commercial hardware and software system that qualitatively and quantitatively analyzes radioactive material samples of various geometries.
Licensed activities	The possession, use, transport, and storage of byproduct, source material and SNM material pursuant to the QTA license.
Low Level Radioactive Waste	Radioactive material that is not high-level radioactive

(LLRW)	waste, spent nuclear fuel, or byproduct material (as defined in section 11e(2) of the Atomic Energy Act of 1954, (42 U.S.C. 2014(e)(2)); and the NRC, consistent with existing law and in accordance with paragraph (a) of 10CFR62.2, classifies as low-level radioactive waste.
Low Specific Activity (LSA)	means radioactive material with limited specific activity which is nonfissile or is excepted under § 71.15 of the 3 types in accordance with 71.4.
Non-Conforming Waste	Waste no longer eligible for the predetermined waste disposal pathway due to discrepancies with waste profile or characterization data.
Radioactive Material (RM)	Radioactive material “material” which is specifically controlled and regulated by the U. S. Nuclear Regulatory Commission under the definition contained in 10 CFR 30.
Radiological incident	Any act, activity, or occurrence which causes an increased potential for, or a real non-compliance to, radiological safety principles and/or requirements.
Resource Conservation and Recovery Act (RCRA)	Enacted in 1976, is the principal federal law in the United States governing the disposal of solid waste and hazardous waste.
Surface Contaminated Object (SCO)	Any object with; fixed contamination, non-fixed contamination, or a combination of fixed and non-fixed contamination meeting the conditions of 10CFR71.4.
Uniform Hazardous Waste Manifest	A federally approved form used to capture hazardous material.
Unrestricted Area	An area that is not controlled by the licensee that allows public access.
Waste Compacts	A self-appointed organization of states in response to the Federal Low Level Radioactive Waste Policy Amendments Act of 1985 designed to meet the national needs of managing low level radioactive waste at the state level in accordance with the US Constitution.
Uniform LLRW Manifest	NRC forms 540/541/542 used to capture radioactive waste information that acts as a chain of custody and shipping papers for disposal.
Waste Profile	Waste characterization document designed to identify information regarding waste materials from a generator in order to determine

disposal site acceptance in accordance with applicable permits, licenses or regulations.

ACRONYMS/ABBREVIATIONS

ACL	Administrative Control Level
ALARA	As Low As Reasonably Achievable
ALI	Annual Limit of Intake
Bq	Becquerel
CEDE	Committed Effective Dose Equivalent
CEO	Chief Executive Officer
CFR	Code of Federal Regulations
Ci	Curie, quantity of radioactivity equal to $3.7x10^{10}$ disintegration per second
cpm	counts per minute
DAC	Derived Air Concentration
dpm	disintegrations per minute
DOE	Department of Energy (Department of U. S. Government)
DOT	Department of Transportation (Department of U. S. Government)
HEPA	High-efficiency Particulate Air (filter)
ICRP	International Commission for Radiological Protection
RM	Radioactive Material, radioactive material governed by NRC or Agreement State license
MEI	Maximally Exposed Individual
MeV	Million electron volts
mR	milli-Roentgen
mrem	milli-radiation equivalent man
mSv	milli-Sievert
MVF	Mayfield Verification Facility
NIST	National Institute of Standards and Technology
NCRP	National Council on Radiation Protection and Measurements
NRC	Nuclear Regulatory Commission (Commission of the U. S. Government)
NVLAP	National Voluntary Laboratory Accreditation Program
OJT	On-the-job training
OM	Operations Manager
PC	Protective clothing
PPE	Personal protective equipment
QEG	Quarterly Exposure Goal

Rad	Radiation absorbed dose
rem	Radiation Equivalent Man
RSO	Radiation Safety Officer
RSP	Radiation Safety Program
RSPM	Radiation Safety Program Manual
SSDA	Site Specific Dose Assessment
TEDE	Total Effective Dose Equivalent
TI	Transportation Index
TLD	Thermoluminescent dosimeter
UL	Underwriters Laboratory
USE	US Ecology Inc.
USEI	US Ecology Idaho

CHAPTER 1 - Operations Commensurate with Disposition of Radioactive Waste and materials

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PART 1 - QAL-TEK ASSOCIATES Radiation Safety Program – Roles and Responsibilities

111 Principle Roles

The fundamental principles underlying the QTA Radiological Protection Program Policy Statement and this Manual are:

That this Manual:

1. Outlines practices for the safe conduct of radiological activities at all QTA sites managing Radioactive Material (RM) and states QTA' positions and views on the best courses of action currently available in the area of radiological controls for the conduct of operations that will protect workers, members of the public, facilities and environment and in so doing satisfy NRC requirements.

2. Is a compilation of work practices, that when adhered to, will ensure QTA, compliance with all relevant statutory and regulatory requirements.

3. **Shall** be reviewed at least annually, and **shall** be revised by the RSO whenever necessary to ensure such consistency with current requirements and industry best practices.

4. Challenges the user to go beyond minimum requirements resulting in achieving and surpassing related statutory or regulatory requirements and to maintain personal exposures as low as reasonably achievable (ALARA).

5. Will be approved and signed by the Company President..

6. Identifies specific procedures written to enable the QTA organization to perform functions within the framework of compliance to appropriate and applicable NRC regulations.

7. **Shall** be approved by the RSO before being implemented in the field, whenever any changes other than minor typographical changes to this manual occur.

That Management:

1. Is firmly committed to, and supports, a Radiation Safety Program (RSP) as defined by this Program Manual. The RSP **shall**[20.1101-b] be based on sound radiation protection principles to achieve personal occupational doses and doses to the public that are as low as reasonably achievable (ALARA).

2. **Shall**[20.1101-c] have the provisions of this Manual reviewed by the RSO on **an annual basis** and upgrade the provisions as appropriate to incorporate "lessons learned" and appropriate suggestions to maintain a Program of Excellence.

3. **Shall**[19.12] provide training for each employee on this manual, and shall ensure that each employee understands the consequences of failure to comply with the provisions of this manual.

4. **Shall** use the provisions of this Manual in the evaluation of the performance of its employees and staff.

5. **Shall** implement this Manual for employee use at each and every site where QTA employees and teaming partner employees work.

6. **Shall** utilize the Radiation Safety Officer (RSO) to evaluate the suggestions and approve, if applicable, upgrades to this Manual before “lessons learned” or suggestions are incorporated into the Program and before they are implemented.

7. **Shall** ensure that QTA subcontractors understand and comply with Manual provisions.

8. **Shall** clearly and unambiguously state the policies, requirements, expectations and objectives that are to be incorporated in the Manual.

9. **Should** revise position descriptions and the QTA organization chart when required to accurately reflect required radiological responsibilities.

10. **Shall** ensure that the Radiation Safety Officer (RSO) understands and fulfills his role in the implementation of the RSP and understands the consequences of non-compliance.

11. **Shall** ensure this Manual is kept current and is entered into the Document Control System.

12. **Should** emphasize the need for high standards for radiological control through direct communication, instruction and inspection of the work space.

13. **Should** solicit feedback from their radiological control professionals, line management and workers on radiological control performance.

14. **Should** adopt and promote a positive attitude toward radiological control that encourages initiatives to identify concerns at an early stage, to prevent problems from deteriorating and to promote doing the right job correctly the first time.

15. **Shall** require and approve radiological improvement goals that are measurable, realistic, auditable, and challenging and cannot be changed without technical justification and management approval.

16. **Shall satisfy** posting requirements as outlined in 10 CFR 20.1902.

That Employees:

1. **Shall**[19.12] be adequately trained, and understand, the principles of biological effects of radiation and radiation protection before any work is performed with radioactive waste.

2. Are expected to demonstrate responsibility and accountability through an informed, disciplined, and cautious attitude toward radiation and the control and handling of radioactive waste.

3. Own the responsibility, to know his/her radiation exposure goal, and actively works to stay below that goal.

4. Participate in job planning, pre-job briefings, if appropriate before accomplishing the task. If the employee is unsure of any aspect of the job, ask questions of the RSO or other employees to gain proper understanding before any job with radioactive waste is performed.

5. Keep the principles of ALARA in mind to maintain his/her, as well as other employees, personnel exposure as low as reasonably achievable.

6. Understand that when a requirement contains the word “**shall**”, **mandatory compliance is required** to maintain adequate control and prevent a possible NRC violation.

7. Understand that when a written statement contains the word "**should**", compliance with the statement is **strongly recommended.**

8. **Shall** wear appropriate dosimetry when they are working with radioactive material.

9. **Shall** have the ability to stop work when they see a condition that could lead to a situation that could endanger themselves or another employee.

10. **Should** understand that cleanliness and good housekeeping are essential for the conduct of a good Radiation Safety Program and that they play a major role in these two aspects of the work place.

11. **Shall** perform and documented hazards analysis of newly proposed projects for Management review and approval..

115 MVF Radiation Safety Officer (RSO) Role and Duties

The Radiation Safety Officer (RSO) reports, and is responsible, to the Qal-Tek Assoc. Corporate RSO and **shall**:

1. Perform routine radiological evaluations (package receipt survevys, inventory, storage, material handling, waste analysis, air sampling, dosimetry and disposition activities) as needed to enable operational functions to proceed safely.

2. **Shall** have the ability to stop work when they see a condition that could lead to a situation that could endanger themselves or another employee.

3. Perform and document, for Management review and approval, hazards analysis for proposed operations.

4. Review and audit the training program to assure the training curriculum is adequate and current for the prospective radioactive waste handling.

5. Have oversight and be cognizant of the waste profiles, manifest, receipt, handling, storage, and shipping of radioactive or mixed waste operations.

6. Have oversight and be cognizant of the radioactive waste disposal program for Qal-Tek.

7. Prepare, or aid in the preparation of, new operational procedures that will require Management approval prior to use.

8. Annually review the Radiation Safety Program elements (source storage, source handling, personnel badge use, etc.) to ensure procedures are being followed and that there is compliance with NRC requirements.

9. Review operational aspects (procedures, modes of operation, etc.) to assure personal exposures are being properly monitored and recorded for the assurance that personnel exposures are below allowed annual dose limits and are being kept ALARA. .

10. The RSO should have supervisory and leadership capabilities to direct the work of Radiological Techs (RT), effectively interact with the Operations Manager (OM), professional staff and Managers and be able to respond and direct others in contingency situations.

11. Perform and document operational audits for the purpose of trending personnel exposures and the potential for a more effective means of performing a given operation.

12. Perform an initial review of the qualifications of each authorized user to ensure the user is qualified, trained, and “comfortable” with the operations he/she is to perform.

13. Investigate all incidents, write reports, and detail remediation activities.

14. Respond and be the cognizant individual in the event of emergencies.

15. Interface with the NRC when required for inspections and inquiries..

16. Routinely monitor, survey, and review all areas where radioactive material is used to ensure:
    a. Control and accountability is maintained
    b. Users use approved procedures for work performed
    c. Users use ALARA principles in maintaining exposures ALARA
    d. Users use good housekeeping in maintaining a clean shop
    e. Users are physically and mentally capable of the job at hand

17. Maintain all records required by NRC regulations:
    a. Personnel dosimetry and exposure records
    b. Area monitoring and surveys
    c. Shipment monitoring and surveys
    d. Waste inventory database
    e. Waste/material receipt/shipping records
    g. Annual Program Audits

18. Interface with the NRC to report events requiring telephone notification and/or written reports in accordance with Appendix 1A.

PART 2 Conduct of Operations

121 QTA MVF

Under a waste processing service license, QTA MVF will perform receiving, waste characterization, sorting, consolidation, repackaging and disposition services.. As a result, QTA MVF will be equipped to address the following radiological hazards;

a) radioactively contaminated waste containers/conveyances
b) waste spills
c) potential for internal and external personnel contamination and dose determination.

Consistent performance is achieved when qualified personnel use approved procedures and management actively monitors the workplace and assesses ongoing activities. Such oversight includes, but is not limited to;

1. Properly and adequately trained personnel including On-The–Job (OJT) training where appropriate
2. Use of adequate and approved procedures
3. Use of proper tools and equipment.
4. Identifying and mitigating radiological conditions that can change unexpectedly during the job.
5. Knowledge of the radiological conditions at the job site
6. Adequate personnel and area dosimetry for the job

7. Use of proper ALARA principles.
8. Critique of abnormal events in a timely manner.
9. Provide feedback for possible procedure rewrite and apply “lessons learned” to future operations of a similar nature.

Constant review and informed interest by senior management **is required** to achieve a quality Radiation Safety Program.

> When required the QTA MVF RSO shall work directly with Management/Supervisors to assure achievement of the "Best Practice" program.
>
> **QAL-TEK ASSOCIATES, LLC Corporate**

Executive management **should** also be familiar with the current radiological performance record. Key principles common in a successful, well-managed Radiation Safety Program.

122 Worker Attitude

Minimizing worker radiation exposure can be achieved only if all persons involved in radiological activities have an understanding of and the proper respect for radiation.

1. Each worker **should** understand that proper radiological control is an integral part of their daily duties.

2. Improving the attitude of the work force **should** be supported by the training program. To achieve this, training personnel need to be knowledgeable about the work environment and those aspects of radiological control that are important to developing a better worker attitude and perspective.

3. The attitude that constant improvement is required in radiological work needs to be developed at all levels of management and in the work force. Cooperation between the work force and the RSO has to be developed and fostered. The workers **should not** look upon radiological controls as hurdles or restrictions to be bypassed.

4. This spirit of cooperation needs to be developed without subverting the radiological control function.

123 Worker Responsibilities

1. Trained personnel **should** recognize that their actions directly affect contamination control, personnel radiation exposure and the overall radiological environment associated with their work. The radiological control rules, provided in Figure 1, are applicable to each person in the workplace.

> NOTE: A poster/signage that displays the worker responsibilities (Figure 1) or similar should be displayed at appropriate access points and work areas within the MVF.

124 Radiation and Risk Communications

Due to the continuing concerns of many people related to low radiation exposure and health impacts, managers **should** be trained to deal with the perceptions of personnel concerning radiation risks.

Managers and first-line supervisors **should** be sensitive to the fact that workers need to understand the fundamentals of radiation, its risks and their role in minimizing exposure. It is not sufficient to rely solely on regulatory limits for establishing or defining acceptable work practices and work environments.

1. Appropriate personnel **should** receive training which is helpful in their dealing with workers who have anxiety about radiation. This training **should** include the following:

    a. Guidance on handling such personnel interactions
    b. Emphasis on being factual
    c. Fundamentals of communicating risks
    d. Importance of keeping management informed

2. Some personnel, such as those who **may** have internal deposition of radionuclides from prior years, are concerned about future exposures. In such cases, the condition may:

    a. Warrant special attention on the part of the manager
    b. Consider that counseling with such personnel **should** be the preferred way to consider relevant factors
    c. Warrant that Special Control Levels **should** be applied

125 Conduct of Radiological Operations

1. Managers at all levels **are expected** to be knowledgeable in the conduct of radiological work.

2. Assurance of adequate radiological safety **should** not be compromised to achieve production, or remediation objectives.

3. Supervisors and Managers **should** be technically knowledgeable and inquisitive and **should** ask questions of the work force concerning radiological work details to assure and demonstrate worker understanding and comprehension.

4. Line managers **should** periodically monitor work areas to observe personnel at work and to identify radiological deficiencies and concerns.

5. Frequent inspections and walk-through, including off-hours and weekends (where appropriate), **are essential** to reinforce management expectations to the work force.

6. Managers, supervisors and workers **should** be involved in the development of accurate, clear, written procedures for performing radiological work.

7. If during the use of procedures a written requirement cannot be responsibly followed, the work **shall** be stopped and guidance obtained.

8. Supervisors and managers **should** encourage the work force to identify radiological control deficiencies and concerns. Prompt action **should** be taken to address and eliminate identified issues and prevent recurrence. Retraining, indoctrination and procedure review are useful in addressing these issues.

9. Managers and supervisors **should** establish working conditions that encourage improved radiological control. This includes temperature, humidity and lighting as well as the more difficult considerations of accessibility.

10. Work conditions **shall** be considered in planning work.

11. Cleanliness and good housekeeping **are essential**. A good Radiation Safety Program cannot exist in a sloppy, dirty workplace.

> QTA MVF policy is that poor housekeeping will not be tolerated.
> **QAL-TEK ASSOCIATES, LLC Corporate**

12. Cleaning up after operations **should** be automatic for each person. It is not reasonable to expect radiological control to be separated from the work environment; they go together.

13. Subcontractors and their employees **should** be treated the same as facility staff in the area of radiological safety compliance, **should** have comparable training, and **shall** meet the same requirements and expectations.

14. Conditions that could cause or promote the spread of contamination, such as a leaking roof or piping, **should** be identified and corrected on a priority basis.

126 Improving Worker Awareness of Radiological Conditions

1. In performing assigned duties within radiological areas, workers **shall** be familiar with the area radiological conditions and be aware of the possibility that changes may occur due to unforeseen reasons.

2. Surveys in addition to required surveys, result in reduced exposures and worker dose being kept ALARA include self-monitoring and the monitoring of tools and equipment for contamination during work in potentially Contaminated Areas.

127 Incident Investigations

It is the Company's desire and expectation, based on concern for the safety and well-being of workers and the general public, that radiological work practices be continually scrutinized and questioned so that opportunities for improvement can be identified, assessed and incorporated into this Manual.

1. An incident investigation will be initiated to capture pertinent facts following an unusual radiological situation or at the satisfactory conclusion of a new or unusual operation involving radiological controls.

2. The investigation **should** be used to quickly establish facts in chronological order in accordance with SP-PRO-145 so that the underlying reasons or causes for the success or failure are well understood. The investigation **should**:
   a. Involve affected individuals in the work force.
   b. **Not** be used to "fix blame" or "shoot the messenger." Investigations are a management tool.
   c. Determine finding(s)
   d. Determine and evaluate root cause analysis
   e. Identify corrective and preventative actions
   f. Implement and monitor corrective and preventative action performance

128 Facility Modifications and Radiological Design Considerations

Radiological control performance is affected by human performance and engineered design features. This Manual primarily addresses the way people operate and use existing facilities and sites.

1. Designs for new facilities and major modifications to existing facilities **should** be based on the following additional radiological control design criteria:
   a. Individual worker deep whole body dose **shall** be less than **500mrem per year** and kept ALARA
   b. Discharges of radioactive liquid to the environment are covered by the provisions of applicable laws and standards and **should** not degrade the groundwater and/or the environment.
   c. Control of contamination **should** be achieved by containment of radioactive material
   d. Efficiency of maintenance, decontamination and operations **should** be maximized
   e. Components **should** be selected to minimize the buildup of radioactive material
   f. Support facilities **should** be provided for donning and doffing of protective clothing and for personnel monitoring, where appropriate.

2. Facilities **should** be evaluated and the above criteria applied where practicable.

129 Radiological Performance Goals

Goals are intended as a measure of and a motivation for improvement and as such are constantly changing, they are not an end in themselves. These performance indicators are not to be viewed narrowly as numerical goals.

1. These indicators **should** be used as tools to assist management in focusing their priorities and attention.

2. The following example of a goal that **may be** appropriate:
   a. minimize daily surface contamination and airborne concentration and number of spills per year based on historical performance

QTA MVF facilities are anticipated to have minimal contamination and in order to maintain this condition the following measures will be assessed for each work activity with an eye toward continual improvement to minimize occurrences of the following;

1. Numbers of Skin and Personal Clothing Contamination Occurrences: Personnel contaminations may indicate a breakdown of controls intended to prevent the spread of contamination.

2. Number of Intakes of Radioactivity: Personnel intakes of radioactivity **should** be minimized and management **should** focus attention on any failure of the controls that results in intakes.

3. Square Feet of Contaminated Area (within buildings): Operating with a smaller contaminated area results in less radioactive waste, fewer personnel contaminations and improved productivity.

130 Program Reviews

Program reviews, as used in this Manual, refers to the process of providing independent feedback to senior line managers to indicate the adequacy of the Radiation Safety Program.

1. Inspections, audits, reviews, investigations and self-assessments are part of the numerous checks and balances needed in a good Radiation Safety Program.
   a. Internal review of the Radiation Safety Program **shall** be conducted in accordance with the guidance contained in of NUREG 1556, Vol. 18 such that over a 1-year period, all functional elements are assessed for program compliance, applicability, content and implementation.
   b. These **should** be performed by the MVF RSO or other designated qualified individuals.

Table 1-1 Suggested Radiological Performance Indicators

Exposure control
a. Collective dose b. Average worker dose c. Maximum gamma dose to a worker d. Number of dose assessments for lost or damaged dosimeters e. Dose to maximally exposed member of public

2. Managers, supervisors, and workers **should** look upon program reviews as helpful. It is desirable to approach reviews with nothing to hide and with the Radiation Safety Program as an open book. Results of reviews **should** be incorporated into the ongoing process of improving radiological safety.

3. Managers **should** encourage the positive view that identifying even minor deficiencies represents an opportunity for further improvement. The number of deficiencies does not in themselves measure the overall quality of the Radiation Safety Program. A prioritization system to implement actions for resolving the deficiencies **should** be implemented by the RSO.

4. In developing corrective action plans for program review activities, managers **should** address basic underlying reasons for the identified deficiencies or concerns, not just the specific symptoms identified by the reviewer.

5. Feedback on findings from program reviews, root-cause analyses, status of corrective actions and adherence to action plan schedules **should** be frequently provided from the RSO to management.

131 Neutron Exposures

1. Neutron exposures will be monitored through appropriate dosimetry and implementation plans.

132 Relationship between RSO (MVF/Corporate) and Workers

1. The RSO and supervisor perform the functions of assisting and guiding workers in the radiological aspects of the job.

2. Workers **should** be sufficiently qualified to recognize the symptoms of deteriorating radiological conditions and seek advice from the RSO and their supervisors before conditions become hazardous to worker safety or regulatory compliance.

3. Workers and their supervisors **shall** have the responsibility and authority to stop work or mitigate the effect of an activity if they suspect that the initiation or continued performance of a job, evolution, or test will result in the violation of radiological control standards or result in imminent danger or unacceptable risk. Any worker through their supervisor also has stop work authority in accordance with Article 342.

4. The actions or presence of the RSO does not absolve the workers of their responsibility for properly conducting radiological aspects of the job. The RSO is not present to compensate for poor management of the work force and **should** not be required to do so.

Figure 1
Rules to Minimize Radiation Exposure and Spread of Contamination

TO MINIMIZE YOUR RADIATION EXPOSURE AND SPREAD OF CONTAMINATION, OBSERVE THE FOLLOWING RULES:

OBEY

- Posted, written and oral radiological control instructions and procedures
- "Evacuate" and "stop work" orders from radiological control personnel promptly.

DO NOT

- Loiter in radiation areas.

BE SURE TO

- Wear assigned personnel monitoring device(s). Immediately report the loss or damage of personnel monitoring devices
- Keep track of your radiation exposure status and avoid exceeding the radiological Quarterly Exposure Goal or the Administrative Control Levels.
- Wear Personal Protective Equipment and clothing properly whenever required by procedure or postings.
- Minimize the spread of potential waste material and promptly notify the appropriate personnel of all spills/releases.
- Avoid contact of skin, clothing and equipment with contaminated material/surfaces.
- Place potentially contaminated tools, equipment and solid waste items on disposable surfaces, such as plastic sheets, when not in use.
- Notify the RSO of alarming or faulty radiological control equipment.

PRIOR TO ENTERING AREA

- Assure that you are mentally alert and in physically sound condition.
- Ensure use of assigned dosimetry
- Have necessary materials and equipment on hand to complete your task.
- Notify your supervisor or the RSO of the presence of open wounds, sores or rashes before entering an area where contamination exists and exit immediately if a wound occurs while in such an area.

Appendix 1A
NRC Event Reporting Requirements

Event	Telephone Notification	Written Report	Regulatory Requirement
Doses in excess of; Occupational dose limits for adults in 20.1201(i) Occupational dose limits for a minor in 20.1207 Limits for an embryo/fetus of a declared pregnant woman in 20.1208 Limits for an individual member of the public in 20.1301 – 1mSv (100mrem)		30 days	20.2203(a)(2)(i-iv)
ALARA constraints for air emissions is exceeded 20.1101(d)		30 days	20.2203(a)(vi)
Levels of radiation or concentrations of radioactive material in; (i) A restricted area in excess of any applicable limit in the license; or (ii) An unrestricted area in excess of 10 times any applicable limit set forth in this part or in the license (whether or not involving exposure of any individual in excess of the limits in § 20.1301)		30 days	20.2203(a)(3)
Removable contamination on package > limits in 10CFR71.87 (173.443 limits)	Immediate Final delivery carrier & Regional NRC		20.1906(d)(1)
Radiation levels on package > limits in 10CFR71.47 (200mrem/hr on contact and T.I.>10)	Immediate Final delivery carrier & Regional NRC		20.1906(d)(2)
Theft or loss of material >1000 x App. C	Immediate	30 days	10 CFR 20.2201(a)(1)(i)
Theft or loss of material >10 x App. C	30 days		10 CFR 20.2201(a)(1)(ii)
Real or Threatened WB TEDE dose > 0.25 Sv (25 rem), LDE >0.75Sv (75 rem) or SDE (WB or ME) >2.5Gy (250 rads)	Immediate	30 days	10 CFR 20.2202(a)(1)
Release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake five times the annual limit on intake	Immediate	30 days	10 CFR 20.2202(a)(2)

Real or Threatened WB TEDE dose > 0.05Sv (5 rem), LDE >0.15Sv (15rem) or SDE (WB or ME) >0.5Sv (50rem) in 24 hr. period	24 hrs.	30 days	10 CFR 20.2202(b)(1)
Release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake in excess of one occupational annual limit on intake	24 hrs.	30 days	10 CFR 20.2202(b)(2)
Dose to individual member of public greater than 1 mSv (100 mrems) or 2 mrem in any one hour	none	30 days	10 CFR 20.2203(a)(2)(iv)
Receipt of any information having significant implication for public health and safety	2 days		30.9(b)
Filing petition for bankruptcy under 11 U.S.C.	none	Immediately after filing petition	10 CFR 30.34(h)
Expiration of license	none	60 days	10 CFR 30.36(d)
Decision to permanently cease licensed activities at entire site	none	60 days	10 CFR 30.36(d)
Decision to permanently cease licensed activities in any separate building or outdoor area that is unsuitable for release for unrestricted use	none	60 days	10 CFR 30.36(d)
No principal activities conducted for 24 months at the entire site	none	60 days	10 CFR 30.36(d)
No principal activities conducted for 24 months in any separate building or outdoor area that is unsuitable for release for unrestricted use	none	60 days	10 CFR 30.36(d)
Event that prevents immediate protective actions necessary to avoid overexposure or releases of radioactive materials that could exceed regulatory limits	Immediate	30 days	10 CFR 30.50(a)
Unplanned fire or explosion that affects the integrity of any licensed material or device, container, or equipment with licensed material	24 hours	30 days	10 CFR 30.50(b)(4)
Note: Telephone notifications shall be made to the NRC Operations Center at (301) 816-5100 or (301) 951-0550.			

CHAPTER 2 - RADIOLOGICAL STANDARDS

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PART 1 - NRC Administrative Control Levels & Dose Limits

211 Radiological Dose Control

1. National and international radiation exposure review committees (NCRP and ICRP) have established radiation exposure limits for radiation workers that are believed to represent acceptable risk. The NRC has adopted their recommended annual limit of 5 Rem per year as the maximum allowed whole-body dose for a radiation worker, which **shall not**[20.1201] be exceeded.

2. QTA's objective is to maintain personnel radiation exposure well below regulatory dose limit. To accomplish this objective, QTA has set challenging Administrative Control Levels (ACLs) at levels below the regulatory limits to administratively control and help reduce individual and collective radiation dose to levels as low as reasonably achievable (ALARA). With issuance of this Manual, the total effective dose equivalent (TEDE) is used to assign dose received by personnel at the QTA facilities and includes the committed effective dose equivalent (CEDE), which is the resulting dose committed to the whole body from internally deposited radionuclides over a 50-year period after intake, as well as the dose acquired from external sources. The NRC limiting doses, which **shall not**[20.1201] be exceeded, and the QTA ACLs are given in Table 2-1.

212 Administrative Control Levels

1. A QTA Administrative Control Level (ACL) of 500mrem per year per person is established for all company activities.

2. A request by the RSO and approval by the Chief Executive Officer, or designee, **shall** be required prior to allowing a person to exceed the ACL of 500mrem per year.

3. The choice of a low ACL for radiation exposure for 1 year **should** not preclude choosing either a higher or lower ACL in a subsequent year.

213 Quarterly Exposure Goal (QEG)

1. An individual quarterly exposure goal (QEG), based upon an evaluation of historical and projected radiation exposures, workload, and mission, **shall** be established by the RSO, submitted to management for review and approval .To help in maintaining the annual ACL below 500mrem, the QEG should be at, or below, 150mrem.

2. The QEG **should** be reevaluated semi-annually.

3. For most cases, a QEG of 150mRem or less **should** be challenging and achievable. A QEG above 150 mrem is in most cases not sufficiently challenging to meet the goals of this Policy.

4. No person **shall** be allowed to go above the QEG without the prior approval of the RSO.

214 Visitor & Members of the Public Dose Limit

1. Visitors & members of the public to the QTA MVF **shall** be limited to an annual radiation dose of less than 100 mRem from the sum of internal and external radiation sources and from receiving 2mRem in any one hour, unless they either meet the requirements of Article 622 or qualify as radiological workers in accordance with Article 632 and/or 633.

215 Embryo/Fetus Dose Limits

1. After a female radiological worker voluntarily notifies her employer in writing that she is pregnant, for the purposes of fetal/embryo dose protection, she is considered a declared pregnant worker.

> QTA MVF Policy is that the dose calculated to the embryo/fetus from internally deposited radionuclides will be calculated directly if possible. If this is not possible, the Committed Effective Dose Equivalent (CEDE) determined for the mother resulting from incidents occurring during the gestation period will also be assigned to the embryo/fetus as a default value to be included in assessing compliance with the limits of this article.
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2. The employer **shall** provide the option of a mutually agreeable assignment of work tasks, without loss of pay or promotional opportunity, such that further occupational radiation exposure is unlikely. For a declared pregnant worker who chooses to continue working as a radiological worker:
   a. The dose for the embryo/fetus from conception to birth (entire gestation period) **shall not exceed**[20.1208] 500mRem.
   b. Efforts **should** be made to avoid any further radiation exposure during the first trimester and to not exceed 40mRem per month during the last two trimesters to the pregnant worker.

3. If the dose to the embryo/fetus is determined to have already exceeded 500mRem when a worker notifies her employer of her pregnancy, the worker **shall** not be assigned to tasks where additional occupational radiation exposure is likely during the remainder of the gestation period.

Table 2-1 Summary of NRC Dose Limits and Administrative Control Levels

Personnel exposures **shall**[20.1201] be below the limits in this table and maintained ALARA.

TYPE OF EXPOSURE	NRC ANNUAL LIMIT	Admin. Control Levels
Radiological Worker: Whole Body (internal + external)	5 Rem	0.5 Rem
Radiological Worker: Lens of Eye	15 Rem	3 Rem
Radiological Worker: Extremity (hands and arms below the elbow; feet and legs below the knees)	50 Rem	10 Rem
Radiological Worker: Any organ or tissue (other than lens of eye) and skin	50 Rem	***
Declared Pregnant Worker: Embryo/Fetus	0.5 Rem Gestation period	<0.5 Rem Gestation period
Minors and Students (under age 18): Whole body (internal + external)	0.5 Rem	0.2 Rem
Visitors* and public: Whole Body (internal + external)	0.1 Rem	0.1 Rem

* Applies to visitors who have not completed training in accordance with Articles 622, 632 and/or 633.

*** Notes:

1. Activities which would result in internal dose to the body due to internal uptake of radioactive material should be avoided to the maximum extent possible. Internal dose to the whole body **shall** be calculated as committed effective dose equivalent (CEDE). The CEDE is the resulting dose committed to the whole body from internally deposited radionuclides over a 50-year period after intake. See Appendix 10A for the weighting factors to be used in converting organ dose equivalent to effective dose equivalent for the whole body dose.
2. Background, therapeutic and diagnostic medical exposures **shall** not be included in either personnel radiation dose records or assessment of dose against the limits in Table 2-1.

PART 2 - Posting

221 Posting Requirements

> QTA MVF Policy is to standardize to the extent practicable radiological postings used at the QTA MVF.
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1. Radiological posting **shall**[20.1902] be used to alert personnel to the presence of radiation and radioactive materials and to aid them in minimizing exposures and preventing the spread of contamination.

2. Signs **shall**[20.1901] contain the standard, three-bladed radiation symbol colored magenta or black on a yellow background and lettering **shall**[20.1901] be either magenta or black. Magenta is the preferred color over black.

3. Radiological postings **should:**
   a. Be displayed only to signify actual or potential radiological conditions.
   b. Be maintained in a legible condition and updated based upon the results of the most recent surveys.
   c. Be designated with rope, tape, chain and similar barriers which are yellow or yellow and magenta in color.
   d. Be placed so that they are clearly visible from all directions and at various elevations.
   e. Not be easily walked over or under, except at identified access points.
   f. Be such that the postings remain visible when doors are open or closed.
   g. Include an area as small as practicable for efficiency.
   h. Include a listing of all radiological conditions that are present in the area, such as “contamination area” and “radiation area” if appropriate.
   i. Include the dose rate or contamination level of the applicable area for areas of ongoing work.
   j. Include entry requirements (dosimetry, PPE, etc.) appropriate for the area.
   k. Include a statement specifying when the radiation is present, such as "CAUTION: RADIATION AREA” when there is a presence of an intermittent radiological condition.

4. Barriers **shall** be set up such that they do not impede the intended use of emergency exits or evacuation routes.

222 Posting Radiation and High Radiation Areas

1. Areas **shall**[20.1902] be posted to alert personnel to the presence of external radiation hazards in accordance with Table 2-2 and Article 221.

2. Dose rate measurements used to determine criteria for Radiation Areas **shall** be made at a distance of 30 centimeters from the radiation source or from any external surface through which the radiation penetrates.

3. Contact readings **should** be used to determine the presence of Hot Spots.

4. The type of personnel dosimeter used by the facility **should** be included on the sign if the personnel dosimeter is <u>not</u> a Thermoluminescent Dosimeter (TLD).

5. Radiation Areas shall be located within Controlled Areas.

Table 2-2 Criteria for Posting Radiation Areas

AREA	DOSE RATE CRITERIA	POSTING
Radiation Area	> 0.005 Rem/hr and ≤ 0.1 Rem/hr (measured at 30cm)	"CAUTION, RADIATION AREA" "TLD Required for Entry"

223 Posting Radioactive Material Areas

1. Facility areas or containers where waste are stored **shall** be posted “Caution – Radioactive Material” with the yellow and magenta/black trefoil symbol”. The posting **shall** meet the requirements in Article 221.

2. Posting for Radioactive Material Areas is not required when the radioactive material is inside a Contamination Area.

3. The requirements for labeling radioactive material are contained in Chapter 4.

CHAPTER 3 - PREPARATION AND CONDUCT OF RADIOLOGICAL WORK

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PART 1 - Planning and Preparation of Radiological Work

311 Requirement Overview

1. All maintenance and modification plans and procedures **shall** be reviewed to identify and incorporate radiological requirements, if any, such as engineering controls and dose considerations. Performance of this review is the responsibility of the line management, with support and concurrence from the MVF RSO. Routine tasks, such as surveillance, tours, and minor non-radiological maintenance can be performed as long personnel are properly trained and wear appropriate personal dosimetry.

2. The design and planning processes of operations that involve, or will be involved with, radioactive material such as the storage, repackaging or shipping **shall** incorporate radiological considerations in the early planning stages and throughout the job. The checklist in Appendix 3B should be used for guidance in maintaining/reducing occupational radiation exposure. Initially, all radiological operations will undergo the same management and RSO review and approval. Following approval of operations, minor changes can be made to these operations with MVF RSO approval

312 Technical Work Documents

1. Technical work documents, such as procedures, **shall** be used to control hands-on work with waste and materials. Work documents are not required for incidental or work activities that involve a low potential of worker exposure.

2. Technical work documents used to control radiological work activities **shall** be reviewed and approved by the RSO.

3. Radiological incidents that trigger the contingency plan **shall** be incorporated into technical work documents for steps that require action by the work manager or RSO to prevent radiation exposures in excess of ACLs. The trigger level considerations **should** include:
   a. Estimated individual or collective dose greater than pre-established values
   a. The possibility of producing airborne radioactivity concentrations
   b. The possibility of creating work area contamination greater than the values in Table 8-1

313 Radiological Aspects for Consideration in Job/Work plans

The following considerations should be implemented in job/work plans:
1. Inclusion of Radiological Control Pause or Stop Work Points in the technical work documents
2. Use of work processes and special tooling to reduce time in the work area
3. Use of engineered controls to prevent the generation or spread of contamination and to prevent the generation of airborne radioactivity
4. Specification of special radiological training or monitoring requirements
5. Walk down or dry-run of the activity using applicable procedures
6. Staging and preparation of necessary materials and special tools
7. Maximization of prefabrication and shop work
8. Review of abnormal and emergency procedures and plans
9. Identification of points where signatures and second party or independent verifications are required
10. Establishment of success or completion criteria, with contingency plans to anticipate difficulties

11. Provisions for waste minimization and disposal.

PART 2 - Work Conduct and Practices

321 Required and Good Work Practices

1. Radiological work activities **shall** be conducted as specified by the controlling technical work document(s).

2. Prerequisite conditions, such as tag-outs and system isolation, **shall** be verified in accordance with the technical work documents before work is initiated.

3. Workers **should** assure they have all the appropriate equipment and dosimetry, including during contingency conditions, before starting a job/task

4. Workers **should** keep the principles of ALARA in mind as they perform a task/job.

5. Radiation levels caused by ongoing work **shall** be monitored and maintained ALARA.

6. Tools and equipment **should** be inspected to verify operability before being brought into Radiation Areas.

7. The identity of components and systems **should** be verified prior to work.

8. Engineering controls, such as containment devices, portable or auxiliary ventilation **should** be installed in accordance with the technical work documents and inspected prior to use.

9. Hoses and cables entering the work area **should** be suspended, sheathed, and secured to prevent the spread of potential contamination or safety hazards.

10. Where practicable, parts and components **should** be removed to areas with low dose rates to perform work.

11. Upon identification of radiological concerns, such as inappropriate work controls or procedural deficiencies, workers **shall** immediately report the concern to line supervision or the RSO.

12. Requirements for area cleanup **should** be included in the technical work documents. Work activities **should** not be considered complete until support material and equipment have been removed and the area has been returned to at least pre-work status.

322 Logs and Communications

1. The Operations Manager and the MVF RSO **shall** maintain logs to document radiological incidents, status of work activities and other relevant information.

2. During continuous or extended daily operations, replacement personnel **should** review logs and receive a turnover briefing including the current status of all equipment that may affect radiological conditions from the personnel they are relieving.

3. Communication systems required by the technical work document **should** be checked for operability before being brought into the work area and periodically during work.

4. Workers **should** keep MVF RSO informed of the status of work activities that affect radiological conditions.

323 Reviews of Work in Progress

1. As part of their normal work review, work supervisors **should** periodically review ongoing jobs to ensure prescribed radiological controls are being implemented.

2. The MVF RSO **shall** conduct periodic tours of the workplace to review the adequacy of radiological work practices, postings, and area controls.

324 Response to Emergency Situations

1. A separate Emergency procedure **should** address the general actions in items 2 and 3 below, modified as necessary to reflect applicable and specific facility conditions.

2. Response of personnel identifying contamination on their person **should** include the following actions:
   a. Remain in the immediate area
   b. Notify the Operations Manager or RSO
   c. Take actions that may be available to minimize cross-contamination, such as putting a glove on a contaminated hand
   d. Take follow-up actions in accordance with Article 818.

3. Response to a release of both wet and dry spills of radioactive material **should** include the following actions:
   a. Stop or secure the operation(s) causing the spill
   b. Warn others in the area, including Manager or RSO
   c. Isolate the spill area if possible
   d. Minimize individual exposure and contamination
   e. Secure unfiltered ventilation

PART 3 - Evaluation of Performance

330 Performance Assessment

1. During the conduct of radiological work and the handling of waste and materials, abnormal events may occur which could indicate a weakness or area of programmatic breakdown of radiological controls.

2. Prompt, consistent gathering of facts related to such events **is required** to satisfy reporting and investigation requirements and to formulate corrective actions to prevent recurrence.

3. In addition, successful performance or completion of unique activities **should** be evaluated to identify and incorporate appropriate lessons learned.

4. Analysis of the facts **should** reveal areas where improvements can be made or identify methods to prevent the recurrence of undesired results.

331 Conduct of Incident Investigations

Investigations are meetings with the personnel knowledgeable about an event to document a chronological listing of the facts. The purpose of the investigation is not to assign blame, but to establish and record the facts in order to identify the root cause of the incident and to implement preventive measures to prevent a reoccurrence.

1. Investigations **should** be conducted for successes and abnormal events where practical.

2. Investigation leaders **should** be trained in the required elements of the incident investigation process and the appropriate methods of conducting and controlling the investigation.

3. Investigation meetings **should** be conducted as soon as practicable after the event or situation is stabilized, or after a successful evolution is completed.

4. Investigations of abnormal events **should** preferably be conducted before involved personnel leave for the day.

5. At a minimum, the general investigation process **should** include the following elements:
   a. Formal meetings, chaired by an investigation leader
   b. Attendance by all who can contribute
   c. Personal statement completed by selected personnel before the meeting
   d. Attendance records
   e. Minutes, recorded and signed by the investigation leader and all contributors
   f. Personal statements, signed and attached to the meeting minutes
   g. A listing of the facts in chronological order
   h. Supporting materials, including documents, records, photographs, parts and logs, maintained by the investigation leader.

6. Evaluation of complex evolutions or events may require multiple investigation efforts and meetings.

332 Lessons Learned

1. Lessons learned are available from incident reports of past radiological events on site. The RSO, in conjunction with line management, **should** evaluate lessons learned, provide prompt distribution, and incorporate, if applicable, the lessons into the Radiation Safety Program, the radiological training program and related operations, ensure retraining of the employees on the change, and captured in the program review to verify the implementation and training.

Part 4 - Radiological Work Controls

It is the policy of QTA MVF to prevent to the maximum extent practicable the creation of a radiological contamination event. Such conditions lead to potential personnel contaminations and internal intakes, contamination control problems, potential airborne releases to the environment, which are often difficult to quantify, and the resulting radiologically contaminated waste that must be disposed of.

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341 Requirements for Receipt ofwaste or materials

1. Packages ofwaste and materials received at the MVF shall be monitored in accordance OP-PRO-607MVF.

2. The MVF RSO, upon confirming the contamination and/or radiation levels above the limits, **shall** notify the final delivery carrier, if not previously notified, and in necessary the NRC Operations Center (301-816-5100).

342 Stop Radiological Work Authority

1. All radiological workers have the authority and responsibility to stop radiological work activities for any of the following reasons:
   a. Inadequate radiological controls.
   b. Radiological controls not being implemented.
   c. Radiological Control Pause Point not being satisfied.
   d. Operations that pose a threat to the well-being of an individual.

2. Stop radiological work authority **shall** be exercised in a justifiable and responsible manner.

3. Once radiological work has been stopped, it **shall** not be resumed until proper radiological control has been reestablished.

4. Resumption of radiological work **requires** the approval of the RSO and Supervisor

5. For unanticipated spills involving toxic chemicals, workers **should** immediately exit the area without attempting to stop or secure the spill. Pre-work planning when necessary, should address contingency issues to prevent the spread of hazardous materials from leaving the operations facility.

6. Workers **should** promptly notify their cognizant manager or MVF RSO, who will then coordinate with the in-house Emergency Coordinator to activate response teams as appropriate. (See Section 3 of EP-PRO-003MVF)

343 Controlling the Spread of Contamination

1. The following measures **should** be used to prevent the spread of contamination:
   a. Use solid barriers to enclose areas wherever practicable
   b. Mark and secure items such as hoses and cords that cross the boundary
   c. Control and direct airflow from areas of lesser to greater removable contamination
   d. Use engineering controls and containment devices such as absorbent pigs and facility grades or trenches to capture any spills.
   e. Do not remove container/conveyance covers without approval.

344 Entry into Radioactive Material Areas

1. Radiological Worker training **shall** be required for unescorted entry into Radioactive Material Areas containing labeled and packaged/unpackaged waste or materials in accordance with Articles 632 or 633.

2. Entry into Radiation Areas where whole body dose rates exceed 5 mR/hr **shall** be in accordance with the requirements of Articles 345.1.

345 Entry into Radiation Area

1. Minimum requirements for unescorted entry into Radiation Areas shall include the following:
   a. Radiological Worker training
   b. Personnel dosimetry
   c. Current annual dose is below the ACL, or will not exceed the ACL .
   d. Survey or dose rate indicating device available at the work area.

2. Facility operations personnel **shall** be notified prior to personnel entry to areas where operational or system changes made by operations personnel could result in significantly increased area dose rates.

346 Visitor Entry Requirements

1. Site procedures and/or postings **shall** identify area entry requirements and access restrictions for visitors.

2. Visitors **shall** be prevented from entering Radiation Areas in accordance with Article 345.2 and **shall** be prohibited access to posted Radioactive Contaminated Areas except as provided in 3.

3. Visitors with a demonstrated need to enter the following areas **may be** allowed access if such access is controlled with a combination of training and the use of escorts trained for the specific area:
   a. Radiation Areas

b. Radioactive Contamination Area

4. Training requirements for unescorted visitors are identified in Article 622.

Part 5 - Miscellaneous

351 Other Workplace Hazards

1. Radiological controls **should** be implemented in a balanced way to ensure that protection from all workplace hazards can be implemented.

2. Other hazards to consider include:
   a. General construction hazards
   b. Confined spaces
   c. Flammable materials
   d. Reactive chemicals
   e. Heat stress
   f. Chemical exposures
   g. Energized electrical equipment
   h. Biological hazards
   i. Pinch or Sheering hazards
   j. Noise and vibration
   k. Use of Heavy Equipment

CHAPTER 4 - RADIOACTIVE MATERIALS

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PART 1 – Waste Handling, Labeling and Storage

For the purposes of this manual, packages or conveyances containing waste could vary from 5 gallon drums to Gondola rail cars.

411 Requirements

1. The RSO **shall** be notified in the event of a loss of any waste or sealed source material **and shall**[20.2201] develop response and notification requirements, including; searches, internal incident investigations, documentation, and reporting in accordance with applicable requirements of 10 CFR Parts 20 and 30.

2. All waste at the MVF and RTF will be under video surveillance.

3. Labels **shall**[20.1901] have a yellow background with a magenta or black standard radiation symbol.

4. Lettering **shall**[20.1901] be magenta or black with Magenta the preferred color.

412 Waste Container/Conveyance, Sealed Source and Area Labeling

1. Waste containers/conveyances and processing facilities **shall**[20.1904] be labeled in accordance with Table 4-1.

Table 4-1 Labeling Requirements for Facility and exempt eligible LLRW/Material

ITEM/MATERIAL	REQUIRED LABELING
Controlled Storage Areas and Processing facilities	"CAUTION, RADIOACTIVE MATERIAL", the standard radiation symbol
All sealed sources	"CAUTION, RADIOACTIVE MATERIAL", the standard radiation symbol
Waste containers with non-conforming waste	"CAUTION, RADIOACTIVE MATERIAL", the standard radiation symbol

2. The following are not subject to labeling requirements:
   b. Shipmentslabeled in accordance with Department of Transportation (DOT) Regulations
   c. Personal Protective Equipment and clothing
   d. Radiological control samples such as air, process and soil samples or swipes that are in the custody of authorized users during the processing of LLRW or material.
   e. Portable tools and equipment with fixed contamination permanently marked with yellow or magenta and maintained in a contaminated tool box.
   f. Installed system components located within an area, the entrance to which is posted in accordance with Table 2-2.

413 Radioactive Material (RM) Packaging

1. Waste or material packages outside a marked Contamination Areas but inside the controlled radiation material work area, and is confirmed or suspected of having removable radioactive contamination levels greater than Table 8-1 values, **shall** be securely wrapped in plastic or placed in a container, which **shall**[20.1904] be labeled in accordance with Article 412.

2. Waste or material packages with sharp edges or projections **should** be taped or additionally protected to ensure package integrity and employee safety.

414 Radioactive Material (RM) Storage

1. Waste storage **shall** be posted with a conspicuous sign or signs bearing the standard radiation symbol and the words “CAUTION, RADIOACTIVE MATERIALS’ and “Radiation Area”, if applicable.

2. The material handler **shall regularly** conduct walkthroughs of waste storage areas to check container integrity and account for waste inventory in storage.

3. Flammable or combustible materials **should** not be stored adjacent to waste/material in storage or during processing.

4. Fire protection measures such as; smoke detectors, water sprinklers and fire extinguishers, **should** be available inside the facility where processing is performed.

PART 2 - Release and Transportation of Low Level Radioactive Waste (LLRW)

421 Item release to Unrestricted Areas

1. Items in Contamination Areas **shall** be surveyed prior to release.

> QTA MVF will interpret "Items" in this article to mean "any material or equipment containing radioactive material."
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2. Items to be released to unrestricted areas **shall** be demonstrated to have contamination levels less than Table 8-1 values.

3. RM to be released to unrestricted areas **shall** be surveyed in accordance with Article 422.

4. RM not immediately released after survey **shall** be controlled to prevent recontamination while awaiting release.

5. Items released to an unrestricted area **should** document; item description, date of last survey, identity of the person who performed the survey, type and identification number of the survey instrument used, and survey results.

422 Container Release to Unrestricted Areas

1. Empty containers **shall** be surveyed [49CFR173.443(c)] prior to release for unrestricted use.

2. Waste containers not immediately released after survey **shall** be controlled to prevent contamination while awaiting release.

3. Labels/Marking/Postings **shall** be removed or defaced prior to release of containers for unrestricted use.

423 Transportation of Radioactive Materials

1. Hazardous material shipments from the MVF will comply with 49 CFR Parts 170 through 180.

2. The 49 CFR Part 173.443 contamination values **shall** be used as controlling limits for all shipments. These limits also apply to transfers of shipments received from, or destined to, locations external to the MVF.

3. Off-site shipments of LLRW or material **shall** be controlled and conducted in accordance with this Manual and applicable Federal, state and local regulations.

4. Transport conveyances **shall** be visually inspected prior to loading to ensure they are acceptable for the intended use.

5. The MVF emergency procedure **should** describe appropriate responses for potential on-site transportation accidents.

PART 3 - Radioactive Source Controls

431 Radioactive Source Controls

The following provisions apply to radioactive materials.

1. Materials **shall** be controlled and maintained in accordance with 10 CFR 20 which specifies requirements for receipt, inventory, storage, transfer, disposal and if applicable, leak testing.

2. Receipt surveys **shall**[20.1906] be performed by an authorized user.

3. The RSO **shall** maintain security [20.1801 and 1802] for all licensed materials.

4. Live time inventory records will be maintained for all licensedmaterials.

5. Radiation Technician(s), material handler(s) and operations manager **shall**[20.2201] notify the MVF RSO of changes in storage, transfer, disposal or loss of radioactive materials. The MVF RSO **shall** notify the NRC in accordance with Appendix 1A.

6. If applicable, sealed source leak testing **shall** be performed at intervals as approved by the NRC or Agreement State or specified by the SS&DR certificate or whenever damage might have occurred.

CHAPTER 5 - RADIOLOGICAL HEALTH SUPPORT OPERATIONS

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PART 1 - External Dosimetry

511 Requirements

1. Personnel dosimetry **shall**[20.1502] be required for personnel who are expected to receive an annual external whole body dose greater than 500 mRem (>50 mRem for declared pregnant women) or an annual dose to the extremities, lens of the eye or skin greater than 10 percent of the corresponding regulatory limits specified in Table 2-1.

2. Neutron dosimetry **shall** be provided when a person is likely to exceed 100 mRem annually from neutrons.

3. Dosimeters **shall** be issued only to personnel formally instructed in their use and **shall** be worn only by those to whom the dosimeters were issued.

4. To minimize the number of personnel in the dosimetry program, the issuance of dosimeters **is discouraged** to other than personnel entering Radioactive Material Areas, Radiation Areas where there is a potential for external exposure.

5. Personnel **shall** return dosimeters for processing as scheduled or upon request, and **should** be restricted by line management from continued radiological work until dosimeters are returned.

6. Personnel **shall** wear their primary dosimeters on the chest area, on or between the waist and the neck, in the manner prescribed by training personnel.

7. Dosimeters **shall** not be worn or taken off-site unless specifically authorized by the MVF RSO.

8. Personnel **shall** wear dosimeters issued by MVF RSO while being monitored by a dosimeter at another licensee's site.

9. Personnel **shall** not expose their dosimeters to security x-ray devices, excessive heat, water immersion or medical sources of radiation.

10. A person whose dosimeter is lost, damaged, or contaminated **should** place work in a safe condition, immediately exit the area and report the occurrence to the MVF RSO.

512 Technical Requirements for External Dosimetry

1. 10 CFR 20 specifies that service providers for dosimetry must meet the requirements for accreditation of personnel external dosimetry monitoring programs by the National Voluntary Laboratory Accreditation Program (NVLAP).

> Service providers who provide & process external dosimeters used at Qal-Tek Assoc. facilities **shall**[20.1501] meet the requirements of NVLAP accreditation.

2. TLDs will be returned for processing to the contracted processor at the prescribed exchange interval not to exceed every 6 months.

3. An administrative dose assessment **shall** be performed for each instance of a lost, damaged or contaminated personnel dosimeter.

513 Area Monitoring Dosimeters

Establishment and maintenance of a comprehensive area monitoring program minimizes the number of personnel dosimeters issued and demonstrates that areas outside Radioactive Material

or Controlled Areas meet public dose limits. Minimizing the number of personnel dosimeters issued saves in the costs of operating the dosimetry program and reduces costs associated with maintaining personnel with enhanced training and qualifications.

1. Area monitoring dosimeters **shall** be used to record and document radiation levels in routinely occupied areas adjacent to areas where radiation or operations with radiation exist.

2. Area monitoring dosimeter results **should** be used to support dosimetry investigations where personnel express concerns about their work environments and exposure to ionizing radiation.

PART 2 - Radiological Monitoring and Surveys

521 Requirements & Surveys

1. Radiological monitoring of radiation exposure and contamination levels and, when applicable, airborne radioactivity, **shall** be conducted to characterize workplace conditions and to identify areas requiring postings or additional PPE

2. Monitoring **shall** be performed only by trained and qualified personnel using properly calibrated instruments.

3. Surveys for radiation, contamination, and potential airborne radioactive materials **shall** be performed as necessary to ensure adequate radiological controls.

4. The RSO **shall** perform a review of the adequacy of sampling and monitoring systems as part of any facility or operational changes affecting radiological control. In the absence of such changes, a review **should** be conducted annually.

5. Instruments used to perform radiation surveys **shall** be response-checked daily when in use or prior to operation.

6. When instruments fail a response checks it **shall** be taken out of service.

7. When response checks are not feasible, such as with instruments used to measure neutrons or tritium, compensatory actions **should** be established to ensure proper instrument performance.

8. Assessment of radiological conditions **should** include a sufficient number of survey points to characterize the radiation present and to verify boundaries.

9. Performance of radiation surveys **should** include dose rate measurements of the general area, dose rates at a distance of 30 centimeters from waste or external surface as applicable, to evaluate potential whole body exposures.

10. Surveys **should** be performed before and at the completion of work that has the potential for causing significant changes in levels of radiation that could exceed the exposure limits defined in Table 2.1.

11. Upon exiting active MVF processing area, frisking **shall** be performed to prevent loss of control of contamination.

12. Survey frequencies **should** be established based on potential radiological conditions, probability of change in conditions and area occupancy factors.

13. Monitoring results **shall** be reviewed by the MVF RSO or his designee, which **should** ensure that all required surveys have been performed and that the documentation is accurate and complete.

14. Results of current general area surveys of radiological work areas **should** be conspicuously posted to inform personnel of the radiological conditions.

15. Monitoring results at the MVF RSO's discretion will be made available to line mangers.

16. Monitoring data in each building or area **should** be compiled and reviewed at least quarterly. Changes or trends **should** be noted and corrective actions assigned at least annually by the MVF RSO.

522 Workplace Air Monitoring

1. Air monitoring will take place during all intrusive waste operations (i.e. Opening of waste containers with potential for loose contamination or transfers of wastes between containers).

PART 3 - Instrumentation and Calibration

531 Inspection, Calibration and Performance Tests

1. Radiological instruments **shall** be used only to measure the radiation type and energy for which their calibrations are valid.

2. Radiological instrumentation used in the MVF operations will be calibrated at a minimum, annually or more frequently, if necessary, due to maintenance, repair, and/or modifications to the instrument.

CHAPTER 6 - TRAINING AND QUALIFICATIONS

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PART 1 - General Requirements

611 Purpose

This chapter establishes the requirements to ensure that personnel have adequate training to work safely in and around radiological areas and to maintain their individual radiation exposure and the radiation exposures of others ALARA. Training requirements in this chapter apply to personnel working with waste and materials at the MVF.

612 Standardization

1. In establishing the local training program, the standardized courses, based on established Radiation Safety programs with emphasis on NRC regulations, **shall** be presented and item-specific (lessons learned) or site-specific information added as appropriate.

2. Standardized course materials **shall** be fully implemented for all personnel (authorized users) that work with waste and materials. Standardized course training material developed and maintained by QTA and MVF RSO, consists of lesson plans, viewgraphs, student handbooks, qualification standards and question banks ensuring competency in accordance with 10CFR19 and Vol. 18 of NUREG-1556.

3. The MVF RSO **shall** be involved with, and concur, with training lesson plans and item- or site-specific radiological training material.

613 Requirements

1. Workers must meet General Employee Training (GET) requirements.

2. Workers must successfully complete Radiological Worker Training per job role training plan and **shall** be able to demonstrate satisfactory comprehension and retention of the classroom training and the requirements for written exams including:
   a. That a minimum passing score of 80%
   b. That true/false or multiple choice questions may be used
   c. That questions may be randomly selected from a question bank
   d. Acknowledgement by signature that the student participated in a post-examination review
   e. That competence in required skills be measured using performance-based examinations
   f. Remedial actions for failure to meet the minimum score
   g. That questions be selected to test what the student is expected to remember months after the training rather than to test short-term memory of theoretical material.

3. Training **shall** address both normal and abnormal situations in radiological control.

4. Changes to the program **shall** be incorporated as they are identified and a decision by the MVF RSO will be made if additional training is needed.

5. Training and refresher training **shall** include changes in requirements and updates of lessons learned from operations and maintenance experience and occurrence reporting, for the site.

6. Specific radiological operations training **shall** be accomplished by On-The-Job training (OJT) by observing the student in the workplace in the performance of applicable operating procedures. This performance shall be documented.
   a. OJT may include observation of practical applications, discussions of the course material, and **may** include written examinations.

b. OJT must be performed by MVF RSO, supervisor, quality assurance personnel, or senior instructors.

7. New employees will be supervised until completion of GET, Radiation Worker training, OJT's, MVF RSO evaluation, and authorized user approval in writing.

8. Training records and course documentation **shall** meet the requirements of QTA AP-PRO-009 and TP-PRO-046.

614 Instructor Training and Qualifications

1. All instructors **shall** be qualified and approved by the QTA RSO and management.

2. Instructors **should** have the technical knowledge, experience and instructional skills required to fulfill their assigned duties.

3. Instructors-in-training **shall** be monitored by a qualified instructor.

4. Subject matter experts without instructor qualification **may** provide training in their areas of expertise. However, these subject matter experts **should** be authorized as instructors when this occurs routinely.

5. Instructor Training and Qualifications, based on criteria as provided in NUREG 1556, Vol. 18 publication or TP-PRO-046, are required for the respective training activity.

PART 2 - General Employee Radiological Training

621 Company Personnel

1. Personnel who may routinely enter Radioactive Material Areas or Radiation Areas and encounter radiological barriers, postings or radioactive waste/materials **shall** receive and successfully complete Radiological Worker Training per job role training plan.

2. General Employee Radiological Training (GET) **shall** include the standardized course training materials. General Employee Radiological Training (GET) **is recommended** for all MVF employees.

3. Additional training (i.e. site or area specific) beyond Radiological Worker Training **is necessary** for unescorted entry into radioactive material areas.

4. Information **may be** communicated by classroom lecture, videotape, or other applicable methods.

622 Radiological Orientation for Visitors

1. Visitors who have a need to have unescorted access to a Radioactive Material Area or a Radiation Area, and who has not received site specific training in the last year, **shall** receive a radiological safety orientation that **should** include the following topics:
   a. Basic radiation protection concepts
   b. Risk of low-level occupational radiation exposure, including cancer & genetic effects
   c. Risk of prenatal radiation exposure
   d. Radiological protection policies and procedures
   e. Visitor and management responsibilities for radiation safety
   f. Adherence to radiological posting and labeling
   g. Applicable emergency procedures
   h. Training for issuance of dosimeters, where applicable.

2. Information **may be** communicated electronically or by handout to personnel entering a site. An examination is not required.

3. Visitors who have previously had the appropriate radiological training shall be provided a briefing that identifies appropriate site- or item-specific information that has changed or potential emergency conditions.

4. Records of the orientation **shall** be maintained and are included on the Visitor sign-in log.

5. The orientation for continuously escorted individuals or groups **should** be commensurate with the areas to be visited.

PART 3 - Training Program per Role

631 Authorized User Requirements

1. Authorized Users are required to complete Radiological Worker Training and On-The-Job (OJT) training on procedures, an MVF RSO evaluation, and obtain an RSO authorized user letter to be able to work independently with waste and materials under the QTA MVF license.

2. All personnel operating the ISOCS® system must be a properly trained and qualified analysts.

3. Workers **may** challenge Radiological Worker Trainingrequirements by passing a comprehensive examination. If unsuccessful in one attempt, the entire standardized Radiological Worker training **shall** be completed. Challenges do not apply to the site-specific portions, where program changes and operational experience are updated.

> QTA MVF training programs shall provide formalized OJT, where applicable with first line management & MVF RSO evaluations to ensure performance meets the required objectives.
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632 Radiological Worker Training

1. Workers whose job assignments require unescorted access to Radioactive Material and Radiation Areas **shall** complete the training requirements in articles 613 and 631.

2. Radiological Worker training **shall** use the QTA standardized course training materials and in addition **shall** emphasize item-specific information involved withwaste and material work activities.

3. **General Employee Training (GET)** is <u>not</u> a prerequisite for Radiological Worker training.

4. Radiological Worker training **shall** encompass at a minimum the following site-specific practical factors:
   a. Entering and exiting simulated Radioactive Material and Radiation Areas
   b. Performance of frisking for personnel contamination, as applicable
   c. Verification of instrument response and source check
   d. Waste hazards and hazardous conditions

Table 6-1 Radiological Worker Entry Training Requirements

AREAS	GET	RADIOLOGICAL WORKER
Entry into Radioactive Material or Radiation Areas	NO	YES
Entry into Contamination Areas	NO ENTRY ALLOWED	YES

633 MVF Radiation Safety Officer (MVF RSO) Training

1. The MVF RSO shall be trained and experienced in radiation protection to include the types and quantities of waste and materials authorized on the license.

2. In addition, the MVF RSO shall have:

   a. A combination of education and experience commensurate with their job responsibilities.
   b. Continuing training based on an assessment of job responsibilities to maintain and enhance proficiency.
   c. Continuing training to remain cognizant of changes to the facility, operating experience, procedures, regulations and quality assurance requirements.
   d. Training on standardized course topics per job role training plan and additional job-specific topics, as applicable.

> It is QTA MVF Policy that all radiation workers and all line management working in controlled areas or around waste and materials is equally responsible for implementation of the ALARA principles and philosophy.
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3,Certification and involvement with professional industry organizations should be encouraged.

634 Operations Manager

1. The Operations Manager **shall** be qualified as an Authorized Use and **should** participate in continuing radiological training programs.

> It is QTA MVF's policy that individuals placed in supervisory roles with no previous supervisory or management experience will be provided supervisory/administrative training/instructional support in addition to continued job-specific and technical training.
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2. The Operations Manager **shall** attend annual radiological refresher training.

3. Additional performance reviews **should** focus on the ability to analyze situations and supervise subordinates.

4. The Operations Managers depth of knowledge **should** exceed that expected of a material handler.

PART 4 - Other Radiological Training

641 Management Training

> It is QTA MVF Policy to provide individual employee training on the Radiation Safety Program Manual to reinforce QTA MVF commitment to good radiological control practices and line management responsibility in radiation protection.
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1. The RSO, and cognizant Managers who manage, supervise or provide oversight of radiological work programs **shall** be trained in the principles of this Manual.

2. Such training **should** be based on QTA MVF standardized course training materials supplemented by site-specific procedures and be completed by new personnel prior to formally assuming line supervision and management responsibilities.

3. Incumbents **should** participate in continuing training.

4. The continuing training **should** emphasize self-assessment and external evaluations including performance indicators, root causes and lessons learned based on operational experience.

642 Emergency Response Personnel

1. Provisions **shall** be in place to accommodate rapid site and radiological area access by on-site and off-site emergency workers such as firefighters, medical personnel, and security personnel.

2. Emergency response personnel, from both on-site and off-site may be required to work in radiological areas and should have for knowledge and adequate training for proper response.

3. MVF emergency response personnel **shall** have at a minimum Radiological Worker Training and **shall** receive special radiological training commensurate with the situations they are likely to encounter.

4. Such training **shall** be based on the Radiological Worker standardized course and site-specific training materials.

5. Training **should** make it clear that lifesaving has priority over radiological controls.

6. Records of this training **shall** be maintained.

CHAPTER 7 - RECORDS

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PART 1 - Requirements

711 Purpose

1. This chapter contains the prescribed practices for preparing and retaining Radiation Safety Program related records. Radiological control records are needed to demonstrate the effectiveness of the overall program. The work force and management **are required** to use records to document radiological safety afforded to personnel on-site. Therefore, QTA MVF RSO **shall**[20.2102] maintain records of the Radiation Safety Program and provisions of this Program in accordance with Table 7.1.

2. Records of radiological safety programs **may be** required to support worker health studies and future disputes or claims.

3. Therefore, these records **should** be high quality, readily retrievable and managed for the prescribed retention period.

4. Consideration **should** be given to cross-referencing related records to aid retrievability.

5. Records **shall** be handled such that personal privacy is protected.

712 Records Management Program

1. A radiological records management program **shall** be established.

> "It is the policy of QTA MVF to have an established radiological records program that recognizes that The Privacy Act of 1974 contains requirements to protect the privacy of individual records. This program will be under the cognizance of the MVF RSO."
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2. This program **shall** ensure that auditable records and reports are controlled through the stages of creation, distribution, use, arrangement, storage, retrieval, media conversion (if applicable) and disposition.

3. Units used in the records **shall**[20.2101] be the curie, rad, Rem, and multiples and subdivisions of these terms. Records required to be in SI equivalents of the given terms shall be maintained.

4. The records management program **shall** include the following:
   a. Radiation Safety Program Manual
   b. Radiological Control Procedures
   c. Each individual's previous and current radiological exposure history
   d. Internal and External Dosimetry Policies and Procedures (including Basis Documents)
   e. Personnel Training (course records and individual records)
   f. ALARA Records
   g. Radiological Surveys
   h. Area Monitoring Dosimetry Results
   i. Radiological Performance Indicators and Assessments
   j. Radiological Program Review Reports
   k. Quality Assurance Records
   l. Radiological Incident and Occurrence Reports
   m. NRC correspondence
   n. NRC license related documents
   o. Records for release of waste and material
   p. Reports of loss of waste and sealed source material.

5. Where radiological services (for example: dosimetry and laboratory analyses) are purchased, there **should** be a clear agreement regarding records responsibility during performance of the service.

6. Records of results **should** reside in the custody of the originating company organization.

713 Recordkeeping Standards

1. Radiological control records **shall** be accurate and legible and **should** include the following:
   a. Identification of the facility, specific location, function and process
   b. Signature or other identifying code of the preparer and date
   c. Legible entries in blue or black ink
   d. Corrections identified by a single line-out, initialed and dated
   e. Supervisory signature to ensure review and proper completion of forms

2. The RSO should maintain a file of names, signatures and initials for future identification of the person who signed or initialed a record.

3. Radiological control records **should** not include:
   a. Opaque substances for corrections
   b. Shorthand or other non-standardized terms.

4. Similar procedural standards **should** be established for computerized records.

PART 2 - Employee Records

721 Employment History

1. Records detailing an employee's pre-employment and employment history related to radiological work activities and the associated radiation dose **shall** be maintained.

2. Where practical, the association between the radiation dose and job function **should** be preserved for trending purposes, future worker health studies and to defend against any legal accusations.

3. The following information **shall** be maintained:
   a. Previous work history detailing radiological work assignments, to the extent practical and yearly doses at other facilities (NRC Form 5 or equivalent)

722 Personnel Radiological Records

1. Personnel dose records fall under the “Privacy Act” as described in Article 712 and **shall** be maintained in a locked file cabinet.

2. Radiation dose records **shall** be maintained for all contractors, subcontractor and other employees, who are part of the personnel dosimetry program.

3. Radiation dose records **shall** contain information sufficient to identify each person, including last four of social security or employee number.

4. Routine and special records related to radiation doses **shall** be retained for each person monitored including:
   a. Records of dose above detectable limits.
   b. Procedures, data and supporting information needed to reconfirm a person's dose at a later date.

5. External dose records **should** include the following:

a. Extremity, skin, eye and whole body dose results measured with personnel dosimeters, including all multiple dosimeter badging results.
b. Evaluations resulting from anomalous dose results such as unexpected high or low doses.
c. Dose reconstructions from lost or damaged dosimeters, or for un-badged workers.

6. Internal dose records **should** include the following as applicable and/or required:
   a. Whole body and lung counting results (including chest wall thickness measurement where applicable)
   b. Urine, fecal and specimen analyses
   c. Dose assessment, as required.

> QTA MVF policy is to require employees to give urine, fecal, and specimen samples only when such analyses are necessary for the determination of internal dose at sensitivity levels required in Articles 1012 and 1014.
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7. Counseling of persons about radiological concerns **should** be documented and this documentation retained and it **is desirable** that the counseled person signs the documentation to acknowledge participation.

8. Records of authorization to exceed Administrative Control Levels **shall** be retained.

723 Other Personnel Radiological Records

1. The complete records of radiological incidents and occurrences involving personnel dose **shall** be retained.

2. Records of employee radiological safety concerns that have been formally investigated and documented **should** be maintained.

724 Medical Records

> QTA MVF medical records, not including dosimetry results, which fall under the “privacy act” of Article 712, are maintained by the Operations Manager and/or MVF RSO based on reporting structure.
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1. Medical evaluations and treatment performed in support of the radiological program **shall** be documented if appropriate or necessary.

725 Radiological Training and Qualification Records

> The general QTA MVF employee training records are maintained by the Operations Manager and MVF RSO.
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1. Records of training and qualification in radiological knowledge and experience **shall** be maintained to demonstrate that a person received appropriate information to perform the work assignment in a safe manner. Qualification standard records **shall** be retained for on-the-job and practical training as well as for formal classroom training.

2. Formal records of training and qualification **shall** be readily available to first-line supervision and management of involved personnel to aid in making work assignments.

3. Personnel training records **shall** be controlled and retained and, at a minimum **shall** include:
   a. Course title
   b. Attendance sheets with instructor's name
   c. Employee's name, identification number and signature
   d. Date of training
   e. Verification document or record confirming satisfaction of the training requirement
   f. Documentation related to exceptions for training requirements and extensions of qualification as applicable
   g. Acknowledgements of training, with the date and signature of the person trained
   h. Special instructions to females, concerning prenatal radiation dose, acknowledged by the female worker's signature.

4. Records **shall** be retained for the following types of training:
   a. General employee training
   b. Radiological Worker training
   c. Periodic retraining
   d. Respiratory protection training, if applicable
   e. Instructor training
   f. Qualifications for Instructors
   g. Orientation and training of visitors
   h. Training of emergency response personnel.

5. The following instructional materials **shall** be maintained:
   a. Course name, with revision and approval date.
   b. Instructor's manuals, course content, or lesson plans containing topical outlines.
   c. Video and audio instructional materials, including the dates and lessons for which they were used.
   d. Handouts or other materials retained with the master copy of the course.
   e. Job-specific training documents, such as instrument use, radiological procedures, pre-job briefings and mock-up training.
   f. Controlled copies of training materials will be maintained in accordance with the record control procedure.

PART 3 - Visitors

731 Record Requirements

For unescorted visitors entering a radiation area where radiation monitoring is required, the following records **shall** be maintained:

1. Documentation of completion of Radiological Visitor Training

2. Radiation dose records, including zero dose

732 Reports

1. Upon request, non-zero radiation doses **shall** be reported.

> Visitors to the MVF facilities will indicate if a report of zero exposure is desired. Upon request, non-zero radiation doses to visitors, the reports will be sent to the address indicated by the visitor. Dose history requests from individuals and employers which comply with the Privacy Act will also be honored.
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2. Upon request, visitors who receive zero dose shall be provided a report.

> It is the QTA MVF policy to immediately inform any visitor using self-reading pocket dosimeters of his/her dose. This is typically done verbally at the time of dosimeter reading, with the dose recorded in a logbook or similar type of document. It is also the policy of QTA MVF to provide to the visitor, upon request, any positive or zero dose he/she received while at the MVF.
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PART 4 - Radiological Control Procedures

741 Policies and Procedures

1. Records of the Radiation Safety Program **should** include policy statements, procedures, and supporting data.

2. The records **should** be maintained in a reverse chronological sequence that will allow correlation with the corresponding support information. For example, procedures for performing radiation surveys **should** be identifiable with the survey results.

742 ALARA Records

1. Records of As-Low-As-Reasonably-Achievable (ALARA) plans and goals **shall** be maintained to demonstrate the adequacy of the ALARA Program.

2. These records **should** include the minutes of management meetingswhere radiological safety issues are formally discussed.

743 Quality Assurance Records

1. Records of quality assurance reviews and audits developed for Radiological Control functions **shall** be retained to ensure that sufficient records are specified, prepared, reviewed, approved and maintained to accurately reflect completed work. 10 CFR 20 provides additional information regarding audits, incorporation of “lessons learned” into procedures, training, etc. that are addressed in the Quality Assurance Manual.

PART 5 - Radiological Surveys

> Survey records shall be filed and maintained in reverse chronological order so that previous radiological conditions can be readily reconstructed and background data for radiological engineering evaluations are readily available. Management or designated alternate(s) shall review these records to detect trends toward increasing radiation levels. MVF RSO and/or OM review shall be verified by signature and date on all survey records. Facility managers should establish a method to ensure surveys and trending are completed as applicable. Records that establish conditions under which personnel are exposed including records of surveys for the release of property and workplace surfaces shall be maintained to provide a chronological and historical record
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751 Radiation Surveys

1. Radiation Safety Programs require the performance of radiation, airborne radioactivity, if necessary, and contamination surveys to determine existing conditions in a given location. Maps with sufficient detail to permit identification of original survey and sampling locations **should** be maintained.

2. Records **should** contain sufficient detail to be meaningful even after the originator is no longer available.

3. Radiological surveys **should** be recorded on appropriate standard forms and include the following common elements:
   a. Date, time and purpose of the survey.
   b. General and specific location of the survey.
   c. Name and signature of the surveyor and analyst.
   d. Pertinent information needed to interpret the survey results.
   e. Instrument serial number

752 Contamination Surveys

1. In addition to the elements required by Article 751, records of contamination surveys **shall** include, at a minimum, the following information:

   a. Contamination levels (using appropriate units) and supporting parameters including counting efficiency, counting time, correction factors, type of radiation and whether the contamination was fixed or removable.
   b. Location of areas found to contain contamination.
   c. Follow-up survey results for decontamination processes cross-referenced to the original survey.

PART 6 - Instrumentation and Calibration Records

761 Calibration and Operational Checks

1. Records of calibration and periodic operational checks of fixed, portable and laboratory radiation measuring equipment **shall** be maintained and include frequencies, method, dates, personnel, training and traceability of calibration sources to National Institute of Science and Technology or other acceptable standards, as required.

2. Calibration records **should** be maintained for the following equipment:
   a. Portable survey instruments
   b. Laboratory, counting room and fixed radiation measuring equipment
   c. Workplace monitoring and sampling equipment
   d. ISOCS waste monitoring equipment

3. Maintenance histories, including the nature of any defects and corrective actions taken, and calibration results for each instrument **should** be created and retained.

PART 7 - Records Management

771 Media

1. A combination of media **may be** used for a comprehensive records system.

2. For records that have long-term retention requirements and are stored on media subject to degradation or obsolescence, the records system **shall** provide for conversion to a more stable medium.

3. All records **shall** be stored in a manner that ensures their integrity, retrievability and security.

772 Computerization of Records

1. Records **may be** transferred to magnetic or optical storage media provided certain precautions are taken to ensure that the information is maintained in a retrievable configuration.

2. Controls for the use and handling of magnetic storage media **should** include the following:
   a. A master index of documents on the magnetic storage medium
   b. A program to ensure back-up and retrievability of information
   c. Quality control during data entry and analysis
   d. An index identifying software applications used in conjunction with the data
   e. Software validation and verification
   f. Periodic quality audits of software
   g. Prevention of unauthorized manipulation of data
   h. Assurance that previously stored information is retrievable and useable after system modifications.

773 Retention

> It is QTA MVF Policy to retain all radiological records and radiation dose data in accordance with Table 7.1.
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1. Once a record has been created, reviewed and signed by appropriate supervision, the record is considered complete and **shall** not be modified.

2. Subsequent errors identified in a completed record **may be** corrected by creating a supplemental record that includes traceability for the correction.

Table 7.1 Retention Times

RECORD	RETENTION TIME
Dose Records	**75 years or until termination of NRC license**
Calibration Records	**3 years from date of performance**
Training Records	**5 years from date of performance or 3 years after termination of employment**
Radiological Area Survey	**5 years from date of performance**
Medical Records	**75 years or until termination of NRC license**
Radiological Control Procedures	**3 years from date of last revision**
Radiological Incident Reports	**Until termination of NRC license**
Shipping records (Haz. Dec.)	**2 years from date of performance**
Waste Manifests	**Until NRC terminates license**

774 Physical Protection of Records

1. Methods for protecting documents **should** include vaults, file rooms with fixed fire suppression, fire rated cabinets, duplicate storage, or combinations of these.

2. Storage arrangements **should** address physical damage that could be caused by temperature extremes, moisture, infestation, electromagnetic fields, excessive light, stacking, theft and vandalism.

3. Records **should**, as a minimum, be protected from:
   a. Exposure to fire, equivalent to an Underwriters Laboratories, Inc., 1.5-hour, or greater, fire resistance rating
   b. Exposure to water damage caused by a 100-year flood recurrence.
   c. Exposure to windstorm velocities of 100-year recurrence.

PART 8 - Annual Radiation Dose Reports

781 Reports to Individuals

1. Personnel who are monitored by the personnel dosimetry program **shall** be provided an annual report of their dose. This requirement does not apply to visitors covered by Article 732.

2. Upon request, a monitored person **shall** be provided a current radiation dose record within 30 days of such request for direct reading dosimeters and within 30 days of receiving the dose report.

3. Terminating employees **shall** be provided a report, within 90 days of the last day of employment that summarizes radiation dose for the total period of employment at the reporting facility.

CHAPTER 8 - CONTAMINATION CONTROL

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811 Personnel Contamination Control

1. Personnel exiting Radioactive Material or Contamination Areas established for contamination control **shall** frisk for contamination as required by Article 817. This does not apply to personnel exiting areas containing only sealed sources.

2. Monitoring for contamination **should** be performed using frisking equipment that under laboratory conditions can detect total contamination of at least the values specified in Table 8-1.

3. Personnel found with detectable contamination on their skin or personal clothing, other than noble gases or natural background radioactivity, **should** determine the extent of skin contamination as described in Article 818 and then be promptly decontaminated as described in Article 820.

Table 8-1 Summary of Contamination Values

NUCLIDE (See Note 1)	REMOVABLE (dpm/100 cm^2) (See Notes 2 & 3)	TOTAL (FIXED + REMOVABLE) (dpm/100 cm^2)
U-natural, U-235, U-238 and associated decay products	1,000	5,000
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20	300
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200	1,000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above. Includes mixed fission products containing Sr-90.	1,000 beta-gamma	5,000 beta-gamma
Tritium organic compounds, surfaces contaminated by HT, HTO and metal tritide aerosols	10,000	10,000

Notes:

1. The values in this Table apply to radioactive contamination deposited on, but not incorporated into the interior of the contaminated item. Where contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for the alpha-and beta-gamma-emitting nuclides apply independently.

2. The amount of Removable radioactive material per 100 cm^2 of surface area **should** be determined by swiping the area with dry filter, Q-tip, or soft absorbent paper while applying moderate pressure and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency.

   For objects with a surface area less than 100 cm^2, the entire surface **should** be swiped, and the activity per unit area **should** be based on the actual surface area. Except for transuranics, Ra-228, Ac-227, Th-228, Th-230, Pa-231 and alpha emitters, it is not necessary to use swiping techniques to measure Removable contamination levels if direct scan surveys indicate that the total residual contamination levels are below the values for Removable contamination.

3. The levels **may be** averaged over 1 square meter provided the maximum activity in any area of 100 cm^2 is less than three times the values in Table 8-2.

812 Posting Contamination and Airborne Radioactivity Areas

1. Areas **shall** be posted to alert personnel to contamination in accordance with Table 8-2 and the principles of posting requirements provided in Article 221.

Table 8-2 Criteria for Posting Contamination, High Contamination and Airborne Radioactivity Areas

AREA	CRITERIA	POSTING
Contamination	Levels (dpm/100 cm^2) > 1 time but ≤ 100 times Table 8-1 values	"CAUTION, CONTAMINATION AREA"
High Contamination	Levels (dpm/100 cm^2) > 100 times Table 8-1 values	"DANGER, HIGH CONTAMINATION AREA"
Fixed Contamination	No Removable contamination and total contamination levels > Table 8-1 Column 3 values	"CAUTION, FIXED CONTAMINATION"

813 Requirements for Entering Contamination and High Contamination Areas

1. Minimum requirements for unescorted entry into Contamination Areas **shall** include the following:
   a. Radiological Worker training
   b. Protective clothing
   c. Personnel dosimetry, as appropriate.

2. Minimum requirements for unescorted entry into High Contamination Areas **shall** include the following:
   a. Radiological Worker training
   b. Protective clothing and strongly recommended respiratory protection if High Contamination Area.
   c. Pre-job briefing as applicable
   d . Personnel dosimetry, as appropriate.

3. Personnel exiting Contamination or High Contamination Areas **shall**:
   a. Remove protective clothing as specified in Appendix 9A
   b. Perform whole body frisking to detect personnel contamination in accordance with Appendix 8A and Article 817
   c. Items and containers being removed from the area **shall** be monitored for release in accordance with Article 421 or Article 422, as applicable.

4. Exit points from Contamination or High Contamination Areas **should** include the following:
   a. Step-off pad located outside the exit point, contiguous with the area boundary
   b. Step-off pads maintained free of radioactive contamination
   c. Labeled containers inside the area boundary for the collection of protective clothing and equipment
   d. Contamination monitoring equipment located as close to the step-off pad as background radiation levels permit.

5. Multiple step-off pads **should** be used at the exits from High Contamination Areas. Use of multiple step-off pads is described in Appendix 9A.

814 Contamination Control Levels

1. A surface **shall** be considered contaminated if either the removable or total radioactivity is detected above the levels in Table 8-1.

2. If an area cannot be decontaminated promptly, then it **shall** be posted as specified in Article 812.

3. Surfaces exceeding the values of Table 8-1 for total contamination **may be** covered with a fixative coating to prevent the spread of contamination. However, reasonable efforts **should** be made to decontaminate an area before a coating is applied.

4. A fixative coating with an additional coating of contrasting color **shall** not be applied without the approval of the MVF RSO.

815 Airborne Radioactivity Control Levels

1. Personnel **should** not be exposed unnecessarily to airborne radioactivity.

2. Use of engineering and administrative controls to reduce the potential for internal exposure **should** be evaluated before allowing personnel, with or without respiratory protection, to enter areas with airborne radioactivity.

816 Contamination Surveys

1. In addition to the requirements of Article 521 routine contamination surveys **should** be conducted as follows:
   a. Prior to transfer of uncontained radioactive equipment and material from one Radioactive Material Area to another
   b. Prior to transfer of equipment and material from Radioactive Material Areas unless precautions such as bagging or wrapping are taken prior to transfer
   c. Daily, at contamination area control points, change areas, or step-off pads when in use, or per shift in high use situations
   d. Periodically, during initial entry into a known or suspected contamination area, during work, at completion of job
   e. After a leak or spill of radioactive materials.

2. Survey requirements for the release of radioactive materials **shall** be conducted in accordance with Articles 421and 422.

3. Contamination surveys **should** incorporate techniques to detect both removable and fixed contamination where applicable.

4. Swipe surveys for removable contamination **should** be reported in units of disintegrations per minute per 100 cm^2 (dpm/100 cm^2).

5. Representative large area wipes are encouraged and **should** be used to supplement standard swipe techniques in areas generally assumed not to be contaminated. If a wipe indicates that an area is contaminated, a thorough contamination swipe survey **should** be performed.

817 Monitoring for Personnel Contamination

1. Personnel **should** perform a whole-body frisk under the following conditions:
   a. Immediately upon exiting MVF controlled processing area or a posted Contamination Area

b. As directed by the RSO.

2. Where frisking cannot be performed at the exit of the controlled processing area or Contamination Area due to high background radiation levels, personnel **shall**:
   a. Remove all protective equipment and clothing at the exit
   b. Proceed directly to the nearest designated monitoring station
   c. Conduct a whole body frisk.

3. Personnel frisking **shall** be performed after removal of protective clothing and prior to washing or showering, if necessary.

4. Personnel frisking **shall** be performed using instruments that meet the minimum detection requirements of Article 811.2. Guidelines for personnel frisking are provided in Appendix 8A.

5. Personal items, such as notebooks, papers and flashlights, **shall** be subject to the same frisking requirements as the person carrying them.

6. Instructions for personnel frisking **should** be posted adjacent to personnel frisking Instruments or monitors.

7. The personnel frisking requirements contained in this Article are not applicable at those facilities that contain only radionuclides, such as tritium, that cannot be detected by currently available hand-held or automated frisking instrumentation. At such facilities, additional emphasis **should** be placed on worker bioassay programs and routine contamination and air sampling programs.

818 Skin Contamination

1. Best practice techniques **shall** be established to determine the extent of skin contamination.

2. When personnel detect skin contamination, they **shall** notify the MVF RSO.

3. The extent of skin contamination **should** be determined prior to initiating decontamination procedures in Article 820.

> QTA MVF policy is to decontaminate as rapidly as feasible in order to minimize exposure consistent with the ALARA philosophy as well as documenting the area and levels of contamination.
>
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4. Skin decontamination methods **should** be established for site-specific radionuclides. Skin abrasion **should** be avoided during the decontamination process and intrusive decontamination methods, such as tissue removal, **require** medical assistance.

5. Levels of skin contamination that trigger the need for dose assessments **should** be established for site-specific radionuclides. These trigger levels **should** not exceed 100 mRem.

6. Personnel with skin contamination that triggers the need for dose assessment **should** be informed of the initial dose estimate to their skin as soon as practicable, preferably prior to the end of their work day.

7. Personnel with skin contamination for which dose assessment was not performed **should** be informed of the nature of the contamination and an upper estimate on the potential dose (such as less than 10 mRem) as soon as practicable, preferably prior to the end of their work day.

8. An assessment of skin exposure requires time to conduct a detailed evaluation. Assessments **shall** be conducted promptly, and after completion, the results **should** be explained to the persons affected.

819 Contaminated Wounds

1. Emergency medical care **should** be administered immediately for injuries involving radioactive materials in accordance with National Council on Radiation Protection and Measurements Report Number 65. Medical treatment of injuries takes precedence over radiological considerations.

2. The treatment of contaminated injuries **should** include the following:
   a. Treatment of contaminated wounds by medically qualified personnel
   b. Monitoring of wounds and associated bandages for contamination, including alpha emitters if applicable
   c. Identification of the radionuclides involved
   d. Medical determination of the need for therapeutic intervention such as blocking or chelating agents
   e. Initiation of appropriate bioassay monitoring
   f. Determination of need for work restrictions

3. An injured person **should** be counseled promptly on the medical and radiological implications resulting from contaminated wounds that result in internal doses greater than 2 percent of the Table 2-1 limits.

820 Decontamination

1. Technical guidance documents **shall** include provisions to control contamination at the source to minimize the amount of decontamination needed.

2. Work preplanning **shall** include consideration of the handling, temporary storage and decontamination of materials, tools and equipment.

3. Decontamination activities **shall** be controlled to prevent the spread of contamination.

4. Soap and lukewarm water are the preferred decontamination agents. Other cleaning agents or decontamination methods **should** be selected based upon their effectiveness, hazardous properties, amount of waste generated and ease of disposal.

5. Decontamination methods **should** be used to reduce the number of contaminated areas.

6. Efforts **should** be made to reduce the level of contamination and the number and size of contaminated areas that cannot be eliminated.

7. MVF RSO **should** be responsible for directing decontamination efforts.

821 Vacuum Cleaners and Portable Air-Handling Equipment

Improper use of vacuum cleaners and portable air-handling equipment may result in the generation of airborne radioactivity, loose surface contamination or high dose rates.

1. Vacuum cleaners and portable air-handling equipment used in Contamination or Radioactive Material Areas **shall** be equipped with High-Efficiency Particulate Air (HEPA) filters.

2. ANSI/UL 586 provides HEPA filter integrity testing criteria. Vacuum cleaners equipped with HEPA filters qualified by the manufacturer will be used for contaminated jobs.

3. Vacuum cleaners used for radiological work **shall** be:
   a. Uniquely marked and labeled
   b. Controlled to prevent unauthorized use
   c. Designed to ensure HEPA filter integrity under conditions of use
   d. Designed to prevent unauthorized or accidental access to the inner surfaces of the vacuum.

4. Radiation and contamination surveys **shall** be performed periodically for vacuum cleaners in use and labels on these units **shall** be updated. The frequency of radiation surveys **should** depend on the specific use of the vacuum cleaner. At no time should a vacuum cleaner cause a “radiation area”.

5. Airborne radioactivity levels **shall** be monitored when a vacuum cleaner is used in a contaminated area.

Appendix 8A

Guidelines for Personnel Monitoring with Hand-Held Survey Instruments*

General Requirements

1. Verify that the instrument is calibrated, has efficiencies for the radionuclides of concern and passes all operational and QC checks including a bump test and is set to the proper scale.
2. Hold probe less than 1/2 inch from surface being surveyed for beta and gamma contamination, approximately 1/4 inch for alpha contamination.
3. Move probe slowly over surface, approximately 2 inches per second.
4. If the count rate increases during frisking (eg. audible rate increase, is an early indicator of a count rate increase), pause for 5 to 10 seconds over the area to provide adequate time for instrument response.
5. If the count rate increases to a value greater than a pre-established contamination limit or the instrument alarms, remain in the area and notify the MVF RSO.
6. The whole body frisk **should** take at least two to three minutes.

Performance of Monitoring:

1. Frisk the hands before picking up the probe.
2. Perform the frisk in the following order:

    a. Head (pause at mouth and nose for approximately 5 seconds) including top and back of head
    b. Neck and shoulders
    c. Arms (pause at each elbow)
    d. Chest and abdomen
    e. Back, hips and seat of pants
    f. Legs (pause at each knee)
    g. Shoe tops
    h. Shoe bottoms (pause at sole and heel)
    .

3. Return the probe to its holder and leave the area.

4. The probe **should** be placed facing right or left (not face up) to allow the next person to monitor their hands before handling the probe and prevent probe contamination.

    *Comparable instructions to those presented here **should** be posted adjacent to monitoring instruments in accordance with Article 817.6.

Appendix 8B

CONTINGENCY OPERATIONS

Contingency operations commence when uncontrolled radioactive contamination greater than the levels identified in Table 8-1 are discovered during an operation at the MVF. A contamination incident could involve receipt of a waste or material shipment or handling of a waste spill. Radioactive contamination presents the potential for internal personnel contamination/uptakes and consequential uptake assessments and investigations, airborne release assessments and investigations, , decontamination and consequential waste disposal, and other situations that detract from the main purpose of MVF operations. Therefore, when radioactive contamination is discovered, operations must revert to contamination controls, decontamination and the most direct path back to normal operations.

> ***NOTE:*** **Only personnel who are qualified Radiological Worker and trained Emergency Response personnel shall be allowed to operate in the "Contingency" operation mode.**

CONTAMINATION CONTROL

Control of radioactive contamination is achieved by using engineering controls and worker performance to contain contamination at the source, reducing existing areas of contamination and promptly decontaminating areas that become contaminated. In the event contamination is identified, MVF personnel shall revert to the ALARA practices and techniques of mitigating the situation up to and including evoking the Emergency Procedure (EP-PRO-033 MVF).

CHAPTER 9 - PROTECTIVE EQUIPMENT

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911 Personal Protective Equipment and Clothing

> "It is QTA MVF Policy that all references to personal protective equipment or clothing (including respiratory protection, either voluntary or required) and requirements concerning their issuance and use pertain only to radiological work activities, operations, or areas. Similar types of protective equipment, clothing, and respirators are routinely issued to workers by MVF management for non-radiological safety purposes. It is QTA's understanding that the issue and use of personal protective equipment and clothing for non-radiological situations is outside the scope of intent of the Manual."
>
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1. Personnel **shall** wear protective clothing (PC), commensurate with the appropriate degree of protection, during the following activities:
   a. Handling of contaminated materials with removable contamination in excess of Table 8-1 levels
   b. Work in Contamination Areas
   c. As directed by the RSO.

2. Protective clothing (PC) and shoes designated for radiological control **shall** be:
   a. Marked in accordance with item 11 of this Article.
   b. Used only for radiological control purposes.

3. Protective clothing (PC) dress-out areas **should** be established directly adjacent to the work area.

4. Workers **should** proceed directly to the radiological work area after donning Personal Protective Equipment and clothing.

5. Personal Protective Equipment (PPE) and clothing **shall** be selected as prescribed by RSO. General guidelines for protective clothing selection and use are provided in Appendix 9A and in Table 9-1.

7. Tyvek **should** be used, when necessary, as protective clothing for performing physical work activities in Contamination Areas.

8. Instructions for donning and removing protective clothing **should** be posted at the dress-out and step-off pad areas.

9. The use of Personal Protective Equipment or clothing (including respiratory protection) beyond that authorized by the RSO detracts from work performance and is contrary to ALARA principles and waste minimization practices and **should** not be authorized.

10. Only clothing and PPE issued and authorized by the Company shall be used when processing and handling radiological materials.

11. Protective clothing designated for radiological control use **shall** be specifically identified by color, symbol or appropriate labeling.

12. Protective clothing designated for radiological control use **shall** not be used for non-radiological work.

13. Personal Protective Equipment and clothing **shall** not be stored with personal street clothing.

14. Sites and facilities **are encouraged** to:
    a. Apply the latest techniques and instrumentation to detect contamination on Personal Protective Equipment and clothing below Table 8-1 total contamination values.
    b. Continue efforts to reduce contamination levels on reusable Personal Protective Equipment and clothing.

15. Clothing **should** be free of tears, separated seams, deterioration and damage, or repaired in a manner that provides the original level of protection.

Table 9-1 Guidelines for Selecting Protective Clothing (PC)

WORK ACTIVITY	REMOVABLE CONTAMINATION LEVELS		
	LOW (1 to 10 times Table 8-1 values)	**MODERATE** (10 to 100 times Table 8-1 values)	**HIGH** (> 100 times Table 8-1 values)
Routine	Full set of Tyvek	Full set of Tyvek, double gloves, double shoe covers	2 Full set of PCs, triple gloves, triple shoe covers

Note: For hands-off tours or inspections in areas with Removable contamination at levels 1 to 10 times the values in Table 8-1, lab coats, shoe covers and gloves **may be** used instead of full Tyvek.

Appendix 9A

Contamination Control Practices

Selection of Protective Clothing

1. Workers **should** inspect protective clothing prior to use for tears, holes or split seams that would diminish protection. Any defective items **should** be replaced with intact protective clothing.

2. Protective clothing as prescribed by the RSO **should** be selected based on the contamination level in the work area, the anticipated work activity, worker health considerations, and regard for non-radiological hazards that may be present. Table 9-1 provides general guidelines for selection. As referenced in the table, a full set and double set of protective clothing (PC) typically includes:

   Full Set of PCs
   a. Coveralls or Tyvek suite with hood (bunny suit)
   b. Cotton glove liners
   c. Gloves
   d. Shoe covers
   e. Rubber overshoes
   f. Hood

3. Cotton glove liners **may** be worn inside standard gloves for comfort, but **should** not be worn alone or considered as a layer of protection.

4. Shoe covers and gloves **should** be sufficiently durable for the intended use.

5. Leather work gloves **should** be worn in addition to standard gloves for work activities requiring additional strength or abrasion resistance.

6. Hard hats as required by conditions **should** be distinctly colored or marked “for radiological work only”.

7. Shoe covers and gloves **should** be secured or taped at the coverall legs and sleeves to prevent worker contamination.

8. Tape **should** be tabbed to permit easy removal.

9. Supplemental pocket or electronic dosimeters, as applicable, **shall** be worn outside the protective clothing, in a manner accessible to the worker. Workers **should** protect such dosimeters from contamination by placing them in an outer coverall pocket or in plastic bags or pouches.

10. Only bare essential personal clothing **should** be worn under protective clothing for entry to Contamination Areas or during work conditions requiring a double set of protective clothing.

    Removal of Protective Clothing
    a. Potentially contaminated protective clothing **should** be removed without spreading contamination and in particular without contaminating the skin.
    b. Workers **should** be instructed not to touch the skin or place anything in the mouth during protective clothing removal.
    c. Instructions for protective clothing removal comparable to the sequence presented below **should** be posted adjacent to the step-off pad in accordance with Article 911.8.

Sequence for Removing a Full Set of Protective Clothing at the Step-Off Pad

Before stepping out of the Contamination Area or Airborne Radioactivity Area to the step-off pad, the worker **should** remove clothing in the following order, as the clothing is removed it should be placed in the appropriate container for disposition as directed by the RSO or OM:

a. Remove exposed tape
b. Remove rubber overshoes
c. Remove outer gloves
d. Remove hood from front to rear
e. Remove dosimetry from coveralls (hand to clean person) and monitor for contamination
f. Remove tape or fastener from inner shoe cover
g. Remove coveralls, inside out, touching inside only
h. Remove each shoe cover, placing shoe onto clean step-off pad
i. Remove respiratory protection, as applicable
j. Remove cloth glove liners
k. Commence whole body frisking

The sequence for the removal of primary and supplemental dosimetry is dependent upon where the dosimetry was worn and the potential for contamination.

If double PC’s are worn an additional intermediate disrobing station will need to be established at a secondary control point.

CHAPTER 10 - INTERNAL DOSE

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1011 Internal Exposures

1. Control and prevention of internal exposure from long-lived radionuclides in the workplace present special challenges to a Radiation Safety Program and warrant particular attention. Even though internal exposure is measured in the same units as external exposure and carries the same risk per unit effective dose equivalent, the perception exists that it is of greater significance since the exposure is the result of radioisotopes retained within the body.

2. Administration of internal dose assessment is costly in dollars and worker time. Control and analysis of samples is also more complicated than the elements of external dosimetry.

3. In order to minimize internal exposures, the MVF personnel **shall** take deliberate actions to prevent internal intake by controlling contamination at the source to minimize the potential for Airborne Radioactivity and Contamination Areas.

4. Work **should** be planned to avoid the routine use of respiratory protection devices for radiological protection.

5. Internal exposures **should** be reduced to the minimum practicable level and the following **should** be considered:
   a. If workers may be exposed to unanticipated levels of elevated airborne radioactivity.
   b. Collecting representative airborne radioactivity samples and the time required for technicians or automated instruments to determine the airborne concentration of radionuclides may contribute to worker intakes of radioactivity.
   c. If controls fail, internal depositions of radionuclides can occur in a short period of time.
   d. The continued exposure of workers to airborne radioactivity over extended periods of time can create worker concerns.
   e. Doses from some internal radionuclides are difficult to measure. Although some radionuclides, such as cesium and tritium, can be readily measured at levels that produce only very low doses a few mRem, some long-lived radionuclides like plutonium, may result in dose measurements in the hundreds of mRem over 50 years. Medical intervention, such as the administration of blocking and chelating agents, to mitigate internal deposition adds risks by introducing additional chemicals into the body.
   g. Sampling of body excretions and whole-body or organ counting techniques encourage worker perceptions of internal exposure significance.

1012 Requirements

1. Personnel who enter Contamination Areas **shall** participate in a bioassay program when they are likely to receive intakes resulting in a committed effective dose equivalent of 100 mrem or more. An internal dosimetry program is not required if it can be shown with air monitoring, contamination levels, and modeling that personnel are not anticipated to receive a Committed Effective Dose Equivalent (CEDE) of 100 mrem or more annually.

2. If applicable, personnel **shall** participate in follow-up bioassay monitoring when their initial bioassay results indicate an intake in the current year with a committed effective dose equivalent of 100 mRem or more.

3. Personnel who are exposed to personal contamination greater than 100 times Table 8-1 values or airborne contamination greater than 12 DAC-hours per week or to radionuclides readily absorbed through the skin, such as tritium, **shall** have a bioassay performed.

4. Personnel **shall** submit bioassay samples, such as urine or fecal samples, and may be requested to participate in bioassay monitoring, such as whole body or lung counting, in the unlikely event that it is required.

5. Personnel **shall** be notified promptly of positive bioassay results and the results of dose assessments and subsequent refinements.

6. Dose assessment results **shall** be provided in terms of mrem for the CEDE.

1013 Prevention and Minimization of Internal Exposure

1. The prevention or minimization of internal exposure as discussed throughout this Manual **should** be conducted in accordance with the following hierarchy of controls:

   1.1 Engineering controls, including containment of radioactive material at the source wherever practicable, **should** be the primary method of preventing/minimizing airborne radioactivity and internal exposure to workers.

   1.2. Administrative controls, including access restrictions and the use of specific work practices designed to prevent/minimize airborne contamination **should** be used as the secondary method to prevent worker internal exposure.

   1.3. When engineering and administrative controls have been applied and the potential for airborne radioactivity above 12 DAC-hrs. per week still exists, respiratory protection **shall** be used to prevent/limit internal exposures.

      1.3.1. When contamination levels are below 12 DAC-hrs. per week, personnel in the radiation control area (RCA) should voluntarily wear dust masks during the following conditions:
         a. During breach of containment systems or components
         b. Dusty work activities
         c. Work in areas or on equipment with removable contamination levels greater than 100 times the values in Table 8-1
         d. During work on contaminated or activated surfaces with the potential to generate airborne radioactivity.

      1.3.2. The selection of respiratory protection equipment **shall** include consideration of worker safety, comfort and efficiency in accordance with 10 CFR 20.1703-1705.

1014 Technical Requirements for Internal Dosimetry

1. Until accreditation programs are available, this Manual provides the technical guidance to implement the internal dosimetry programs.

2. Baseline bioassay monitoring of personnel who are likely to receive intakes resulting in a committed effective dose equivalent greater than 100 mrem **shall** be conducted before they begin work that may expose them to internal radiation exposure.

3. Periodic bioassay monitoring methods and frequencies **shall** be established for personnel who are likely to receive intakes resulting in a committed effective dose equivalent greater than 100 mrem. The technical basis in NCRP 87 gives the methods and frequency of bioassay monitoring.

4. Management **shall** provide termination bioassay monitoring when a person who participated in the bioassay program terminates employment or concludes work involving the potential for internal exposure and requests such monitoring in writing.

QTA MVF policy is to make every attempt to perform appropriate bioassay monitoring including samples from terminating employees. Those terminating employees that refuse to submit samples will be required to sign a statement of refusal.

5. Bioassay analyses **shall** also be performed when any of the following occurs:
   a. Facial contamination is detected that indicates a potential for internal contamination
   b. Nasal contamination is detected
   c. Airborne monitoring indicates the potential for intakes exceeding 100 mrem committed effective dose equivalent (CEDE)
   d. An intake is suspected for any reason.

6. A preliminary assessment of any intakes detected **should** be conducted prior to permitting an employee to return to radiological work.

7. In the event bioassay analyses become necessary, the MVF RSO or management will use bioassay laboratory services with procedures that have traceable certifications.

1015 Technical Requirements for Dose Assessment

1. Interpretations of bioassay results and subsequent dose assessments **should** include the following:
   a. Characteristics of the radionuclide, such as chemical and physical form
   b. Bioassay results and the person's previous exposure history
   c. Exposure information, such as route of intake, time and duration of exposure
   d. Biological models used for dosimetry of radionuclides
   e. Models to estimate intake or deposition and to assess dose

Appendix 10A
Weighting Factors for Organs and Tissues

ORGANS OR TISSUES	WEIGHTING FACTOR
Gonads	0.25
Breasts	0.15
Red bone marrow	0.12
Lungs	0.12
Thyroid	0.03
Bone surfaces	0.03
Remainder	0.30

Notes:

1. Weighting factors as defined in ICRP Publication 26 and NCRP Report 91 are used to convert organ or tissue dose equivalent to effective dose equivalent for the whole body. The effective dose equivalent is obtained by multiplying the organ dose by the weighting factor. For example, a 5 Rem dose to the thyroid would be multiplied by the weighting factor 0.03 to yield 0.15 Rem.

2. "Remainder" means the five other organs or tissues with the highest dose (e.g. liver, kidney, pancreas, stomach, small intestine and upper large intestine). The weighting factor of 0.3 results from 0.06 for each of the five Remainder organs.

Appendix 10B

Guidelines for Control of Emergency Exposures

In extremely rare cases, emergency exposure to radiation **may be** necessary to rescue personnel or to protect major property.

The dose limits for personnel performing these operations are listed below.

DOSE LIMIT (Whole Body)	ACTIVITY PERFORMED	CONDITIONS
5 Rem	All	
10 Rem	Protecting major property	Highly valuable assets, irreplaceable company IP or potentially compounding hazards
25 Rem	Lifesaving or protection of large populations	Short non-technical rescue operations and avoidance of compounding hazards
>25 Rem	Lifesaving or protection of large populations	Only on a voluntary basis to personnel fully aware of the risks involved

Notes:
1. The dose limit to the lens of the eye is three times the listed values.
2. The dose limit to the skin of the whole body and the extremities is ten times the listed values.

CHAPTER 11 - RADIOLOGICAL WASTE

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1111 Requirements

1. LLRW and materials for recycling **shall** be received, inventoried, stored and handled for disposition in accordance with OP-PRO-607MVF.

2. All waste and material will be tracked for inventory and disposal purposes while on-site to ensure our license possession limits are not exceeded.

1112 Waste Minimization

1. MVF personnel will strive to minimize operationally generated waste.

2. A radioactive waste minimization program **shall** be in effect to reduce the generation of radioactive waste and spread of contamination.

3. All waste generated at the MVF will be treated as LLRW and dispositioned at an authorized disposal facility.

4. The following practices **should** be instituted to support waste minimization:
   a. Restrict material entering Radiological Controlled Area to those needed for performance of work.
   b. Restrict quantities of hazardous materials, such as paints, solvents, chemicals, cleaners and fuels, entering Radiological Controlled Area and take measures to prevent inadvertent radioactive contamination of these materials.
   c. Substitute recyclable or burnable items in place of disposable ones and reuse equipment when practical.
   d. Select consumable materials such as protective coverings and clothing that are compatible with waste-processing systems, volume reduction and waste form.
   e. Minimize the number and size of Radioactive Material Areas.
   f. Emphasize training in waste reduction philosophies, techniques and improved methods.

1113 Minimization and Control of Radioactive Liquid Wastes

1. If any liquid non-mixed waste is generated it will be solidified and properly disposed of at an authorized disposal facility according to the waste acceptance criteria.

2. If any liquid mixed waste is generated it will be containerized and properly disposed at an authorized disposal facility according to the waste acceptance criteria.

END OF RADIATION SAFETY PROGRAM MANUAL