



Radiation Protection Program

Advanced Mixed Waste Treatment Project

Approval:

(Signature on file. See DCR-13783.)

11/11/14

Date

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PD-RS&C-01, Rev. 6	Issued: 11/11/14	Effective: 11/12/14
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REVISION LOG

Revision Number	Date Approved	Pages Affected	Description of Revision
0	08/30/06	All	DCR-5099. Creation of Program Description document for implementation of ISMS.
1	02/05/08	Various	DCR-6276. Title 10 Code of Federal Regulation was revised and published in Federal Register/Vol. 72, No. 110, on June 8 th , 2007. This revision is to incorporate the changes from this revision.
2	11/03/09	Various	DCR-8812. Removed link for Bluesheet-03. Incorporated Bluesheet-05.
3	08/30/10	Various	DCR-9407. Made changes per DOE comments.
4	11/22/11	Various	DCR-10211. Title 10 Code of Federal Regulation was revised and published in Federal Register/Vol. 76, No. 71, on April 13, 2011. This revision is to accept the changes made to Appendix C of 10 CFR 835 and reference the appropriate Federal Register. Some editorial changes for document title changes, etc.
5	05/02/12	Various	DCR-11160. Incorporated ITG Bluesheet-002.
6	11/11/14	Various	DCR-13783. Updated document to reflect the current radiological work control system.

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1.0 PURPOSE/SCOPE

The purpose of the Advanced Mixed Waste Treatment Project (AMWTP) PD-RS&C-01, Radiation Protection Program, is to identify the elements that establish an effective Radiation Protection Program for AMWTP individuals. The AMWTP Radiation Protection Program shall at all times conform to 10 CFR 835, Occupational Radiation Protection, and its amendments. If a requirement of 10 CFR 835 is inadvertently omitted, the AMWTP Radiation Protection Program shall be deemed to include by reference all provisions of 10 CFR 835. This Radiation Protection Program is written to be a working management tool as well as a means of demonstrating compliance with the requirements of 10 CFR 835.

This Radiation Protection Program establishes the radiation protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from the conduct of AMWTP activities. With the exception of the exclusions stated in 10 CFR 835.1(b), this RPP is applicable to all areas and activities of the AMWTP. Additional information with respect to AMWTP specific operational tasks is contained in RPT-DSA-02, Documented Safety Analysis.

No exemptions to the requirements of 10 CFR 835 have been requested in this Radiation Protection Program. Subcontractors working at the AMWTP shall operate in accordance with this Radiation Protection Program; LST-RS&C-01-IM, Radiological Control Implementation Matrix; and associated implementing procedures. No person, including Department of Energy (DOE) individuals, shall take or cause to be taken any action inconsistent with the requirements of this Radiation Protection Program, or any program, plan, schedule, or other process established by this Program. Nothing in this Radiation Protection Program shall be construed as limiting actions necessary to protect health and safety.

(10 CFR 835.3)

An update of this Radiation Protection Program will be submitted to DOE (a) whenever a change or addition to the Radiation Protection Program is made, (b) before the initiation of a task outside the scope of this Radiation Protection Program, or (c) within 180 days following changes to 10 CFR 835. In instances where changes to 10 CFR 835 are incorporated by reference (no modifications are required to the Radiation Protection Program), the AMWTP Radiological Controls manager will, within 180 days following changes to 10 CFR 835, notify DOE in writing that the changes have been incorporated by reference. Changes, additions, or updates to this Radiation Protection Program may become effective without prior DOE approval only if the changes do not decrease the effectiveness of the program and the changed program continues to meet the requirements of 10 CFR 835.101.

The programmatic requirements contained in this Radiation Protection Program represent a sustained commitment from AMWTP to achieve excellence in radiation protection and maintain radiation exposures as low as reasonably achievable (ALARA). Terms and words used in the Radiation Protection Program are as defined in 10 CFR 835, unless otherwise noted or defined in LST-RS&C-01-IM and associated implementing procedures.

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This Radiation Protection Program is a legally binding document between AMWTP and DOE. Reference to AMWTP throughout this document refers to facilities where radioactive material or radiation generating devices are located within AMWTP grounds, including the Advanced Mixed Waste Treatment Facility (AMWTF), the Transuranic Storage Area-Retrieval Enclosure, the Characterization Facility, and other buildings under AMWTP control; the physical location of these facilities, and the individuals working at the facilities, all of which are the responsibility of AMWTP.

The purpose of the AMWTP is to treat the alpha mixed low-level waste and transuranic (TRU) waste currently stored in drums and boxes for final disposal. The facility has the capability to treat the specified Idaho National Laboratory (INL) waste streams and other INL and DOE regional and national waste streams. The TRU waste product is to be suitable for disposal at the Waste Isolation Pilot Plant.

2.0 AMWTP RADIOLOGICAL SAFETY ORGANIZATION

The AMWTP Radiological Controls organization provides relevant support to all areas of the AMWTP and is accountable to the AMWTP Radiological Controls manager. The Radiological Controls supervisors and staff have a day-to-day reporting relationship with the Operations and Maintenance organizations to ensure that the Radiological Controls organization is fully integrated with Operations and Maintenance activities. However, to preserve an independent technical and oversight role, the Radiological Controls manager reports directly to the AMWTP Environmental, Safety, and Health (ES&H) director.

The AMWTP Radiological Controls organization monitors adherence to the Radiation Protection Program; MP-RS&C-6.3, ALARA Program; and associated implementing procedures, and provides for radiological support to the Operations and Maintenance organizations.

2.1 AMWTP Management Commitment

The responsibility for compliance with radiological protection requirements and for optimizing individual and collective doses starts at the worker level and broadens as it progresses upward through the organization. AMWTP line managers are fully responsible for radiological performance among their personnel and will take necessary actions to ensure requirements are implemented and performance is monitored and corrected as necessary. As part of the commitment to the Radiation Protection Program, AMWTP senior management ensures the following:

- Sound engineering techniques are used to reduce and to maintain occupational exposures in accordance with the ALARA Program.
- Individuals are made aware of the commitment from senior management to maintain exposures ALARA. At a minimum, employees are informed as to what “as low as reasonably achievable” radiation exposure means, why it is a good policy, and how they can implement it while performing their jobs.

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- Assessments are periodically conducted to determine how exposures might be reduced in accordance with the ALARA Program. This includes assessing design, operating, and maintenance procedures as well as past exposure records.
- A supervised and effective radiation protection capability with defined responsibilities exists at the AMWTP. All radiation protection individuals are trained and qualified commensurate with the responsibilities of their position and the potential problems expected in the performance of their duties.
- Employees receive adequate training. Instruction of individuals is in accordance with 10 CFR 835, Subpart J.

2.2 AMWTP Radiological Controls Manager

The AMWTP Radiological Controls manager has the designated responsibility for planning, administering, and maintaining the AMWTP Radiation Protection Program. The AMWTP Radiological Controls manager ensures that the Radiation Protection Program elements are appropriately implemented and maintained.

2.3 Requirements

This revision of the AMWTP Radiation Protection Program includes the changes made to AMWTP's Work Control process by implementing a radiological work permit (RWP) system. These changes include replacing approved methods of work/permits to work with RWP, as applicable, throughout the procedure, replacing DOE O 5400.5, Radiation Protection of the Public and the Environment, with DOE O 458.1, Radiation Protection of the Public and the Environment, and updating the references to DOE G 441.1-1C, Radiation Protection Programs Guide for Use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection. In addition, TLD (thermo-luminescent dosimeter) was replaced in this revision with personal dosimeter or dosimeter, as applicable, due to changing dosimetry providers. No updates were made to the previous additions that incorporated 10 CFR 835 posted in the Federal Register/ Vol. 72, No. 110, and Federal Register/ Vol. 76 No. 71. AMWTP is fully compliant with the requirements specified in 10 CFR 835 as amended June 8, 2007 and 10 CFR 835, Appendix C, as amended April 13, 2011. AMWTP procedures shall be reviewed and revised in accordance with the 36-month periodic internal audit schedule as required by 10 CFR 835.102 or when a revision to the document is deemed necessary prior to the 36-month internal audit.

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2.4 Occupational As Low as Reasonably Achievable Program

AMWTP's ALARA Policy is to reasonably limit radiation exposures to the lowest levels commensurate with the benefit of the work to be accomplished. AMWTP senior management and all levels of the work force are committed to this policy. The AMWTP ALARA committee has been established to help ensure that the ALARA policy is implemented.

2.4.1 ALARA Committee

The AMWTP ALARA committee includes individuals from management, Radiological Controls, Operations, Environmental, Security, and Industrial Safety/Industrial Hygiene organizations. The AMWTP plant manager serves as the chair of the ALARA committee.

Specific functions of the AMWTP ALARA committee include:

- Senior management's commitment to AMWTP's ALARA Policy, identified in MP-RS&C-6.3

(10 CFR 835.101)
- Reviewing the training requirements to confirm that the ALARA process is appropriately included

(10 CFR 835 Subpart J)
- Reviewing ALARA reviews of work controls, facility design, and proposed modifications

(10 CFR 835.1001 and 1002)
- Planning to achieve ALARA for specific operations, including first-time and high-risk jobs

(10 CFR 835.1003)
- Participating in the establishment of ALARA budgets and goals and of facility administrative control levels
- Reviewing the programs for, and the results of, audits and assessments on ALARA compliance and lessons learned

(10 CFR 835.102)
- Ensuring records of compliance with ALARA Program requirements are maintained.

(10 CFR 835.704)

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The AMWTP ALARA committee reviews the following:

- Administrative control levels
- ALARA goals
- ALARA budget.

Additionally, the ALARA committee routinely reviews relevant lessons learned from the AMWTP, DOE complex, and industry. The committee also evaluates items such as construction and design of facilities and systems, planned major modifications, and new and high-risk work activities.

The ALARA committee is responsible for advising the Radiological Controls manager on the overall conduct of the Radiation Protection Program. As a minimum, the ALARA committee receives and reviews the results of programmatic internal and external reviews, assessments, and audits.

(10 CFR 835.102)

2.4.2 Assessments

AMWTP policy is to implement assurance processes established in QAPP-01, Quality Assurance Program Plan, and described in PD-Q&SI-01, Contractor Assurance Program Description, to promote feedback and continuous improvement. Assessments are conducted to provide evaluations for feedback and continuous improvement to line managers to indicate the performance and effectiveness of the Radiation Protection Program. Inspections, reviews, investigations, and independent and management self-assessments are part of the numerous checks and balances in the AMWTP Radiation Protection Program. Assessments of the Radiation Protection Program are an integral part of the AMWTP Contractor Assurance System as well as the Integrated Safety Management System (ISMS). Internal audits will be conducted such that the all the functional elements are reviewed no less than every 36 months.

(10 CFR 835.102)

Program and performance deficiencies identified through assessment processes are documented, evaluated, have corrective actions taken to resolve and prevent recurrence of the deficient conditions, and are tracked to completion in the AMWTP issues management system, TrackWise, as required by MP-Q&SI-5.3, Corrective Action. Program and performance deficiencies are evaluated for formal external reporting as required by MP-COPS-9.6, Occurrence Reporting, and MP-Q&SI-5.2, DOE HSS OE Reporting.

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2.4.3 Administrative Control Levels and Dose Limits

AMWTP's objective is to maintain individual radiation doses well below regulatory limits. The numerical value of the administrative control level (ACL) will be set initially based upon the calculated dose and then modified using historical dose information and the projected work load. To accomplish this objective, challenging numerical administrative control levels are established below the regulatory limits to administratively control and help reduce individual and collective radiation doses. Unless otherwise indicated, administrative, lifetime, and special control levels and dose limits are stated in terms of the total effective dose, which is the sum of the effective dose (for external exposure) and the committed effective dose (for internal exposure).

AMWTP is committed to establishing facility ACLs below the 5 rem/yr regulatory limit.

(10 CFR 835.202[a][1])

These goals and ACLs are developed by Radiological Engineers with assistance from operations and maintenance management and presented to the ALARA committee for review. The ALARA committee presents the ACLs for final approval to the Radiological Controls manager. ACLs are established to minimize individual and collective radiation exposure. No individual will be allowed to exceed the ACL without prior written approval from the ES&H director, Radiological Controls manager, and the ALARA committee chairperson.

3.0 RADIOLOGICAL STANDARDS

The following section discusses occupational dose limits, contamination control, posting, controlling radiological work, individual monitoring, radioactive material, radiation generating devices (RGDs), radioactive waste management, design and control, respiratory protection, records and reporting, radiation safety training, and instrumentation and calibration.

3.1 Occupational Dose Limits

The following sections discuss planned special exposures, emergency conditions, accidental overexposure, special control limits, member of public dose limit, and embryo/fetus dose controls.

- Occupational dose limits are provided in Table 1, 10 CFR 835.202(a)(1)-(4). All occupational doses received during the current year, including dose received as a result of the excluded activities and radioactive material transportation listed in 10 CFR 835.1(b)(1) through (b)(4) and (b)(7), except those resulting from planned special exposures and emergency exposures, are included when demonstrating compliance with Table 1 limits 10 CFR 835.202(b) & 702(d). Reasonable efforts are made to obtain complete records of prior years' occupational internal and external

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doses 10 CFR 835.702(e). If formal records cannot be obtained, a written estimate signed by the individual may be accepted per 10 CFR 835.702(d). The process for conducting a written dose estimate is defined in the radiological safety and control (RS&C) procedures.

- The occupational dose limits provided in Table 1 apply to all employees who have successfully completed radiation worker training and passed an examination. Once training and the examination are completed, employees may be issued a dosimeter and granted unescorted access to radiological controlled areas.
- The dose limits for minors occupationally exposed to radiation and/or radioactive materials at a DOE activity are 0.1 rem (0.001 Sv) total effective dose in a year and 10 percent of the occupational dose limits specified at 10 CFR 835.202(a)(3) and 202(a)(4).

(10 CFR 835.207)

- AMWTP policy is to not hire minors (i.e., personnel under 18 years of age).

Table 1. Summary of Occupational Dose Limits.

Type of Exposure	Annual Limit (rems)
Employee: total effective dose. (10 CFR 835.202[a][1])	5
Employee: The equivalent dose to the lens of the eye. (10 CFR 835.202[a][3])	15
Employee: The sum of the equivalent dose to the skin or to any extremity for external exposures and the committed equivalent dose to the skin or to any extremity. (10 CFR 835.202[a][4])	50
Employee: The sum of the equivalent dose to the whole body for external exposures and the committed equivalent dose to any organ or tissue other than the skin or lens of the eye. (10 CFR 835.202[a][2])	50
Declared pregnant worker's embryo/fetus: The equivalent dose to the embryo/fetus from the period of conception to birth as a result of occupation exposure of the declared pregnant worker. (10 CFR 835.206[a])	0.5 per gestation period

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- Exposures from background radiation, from therapeutic and diagnostic medical procedures as a patient, or from medical research programs (while a subject) are not included in either individual radiation dose records or assessment of dose against the limits in Table 1.

(10 CFR 835.202[c])

- The total effective dose during a year is determined by summing the effective equivalent dose from external exposures and the committed effective dose from intakes during the year.

(10 CFR 835.203)

- Determinations of the effective dose are made using the radiation and tissue weighting factor values provided in 10 CFR 835.2.
- Non-uniform exposures of the skin from x-rays, beta radiation, and/or radioactive material on the skin are assessed as in accordance with 10 CFR 835.205.
- Planned Special Exposures: A planned special exposure is a preplanned, infrequent exposure to radiation, separate from and in addition to the annual dose limits. Planned Special Exposures are not expected in the operations of AMWTP. If they are required, however, procedures will be written in accordance with 10 CFR 835.204.
- Emergency Conditions: AMWTP emergency conditions are defined in PLN-EP&C-03, AMWTP Emergency Plan/RCRA Contingency Plan. Under emergency conditions where actions are necessary to protect life or save major property, individuals may receive doses that exceed the limits established in Table 1. If such emergency conditions occur, AMWTP adheres to the following requirements:

(10 CFR 835.1301 and 1302)

- Each individual authorized to perform emergency action must be trained in accordance with 10 CFR 835.901 and be briefed beforehand on the known or expected hazards to which the individual may be subjected.

(10 CFR 835.1302 [d])

- The risk of injury to those individuals involved in rescue and recovery operations is minimized through the use of preplanning and personal protective equipment (PPE).

(10 CFR 835.1302 [a])

- Operating management weigh actual and potential risks to rescue and recover individuals against the benefits to be gained.

(10 CFR 835.1302 [b])

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- No individual shall be required to perform a rescue action that might involve substantial personal risk.

(10 CFR 835.1302 [c])

- Operations after a dose was received in excess of the limits specified in 10 CFR 835.202, except those received in accordance with 10 CFR 835.204 (Planned Special Exposures), requires prior approval from the AMWTP president and project manager and the NE-ID Operations manager.

(10 CFR 835.1301[d])

- When conditions under which a dose was received in excess of the limits specified in 10 CFR 835.202, except those received in accordance with 10 CFR 835.204 (Planned Special Exposures), have been eliminated, AMWTP will notify the NE-ID Operations manager.

(10 CFR 835.1301[c])

- All of the doses exceeding the limits specified in 10 CFR 835.202 shall be recorded in the affected individual's occupational dose record.

(10 CFR 835.1301[b])

- An employee whose occupational dose has exceeded a limit specified in 10 CFR 835.202, except those received in accordance with 10 CFR 835.204 (Planned Special Exposures), requires (a) counseling from radiation protection and medical personnel regarding the consequences of receiving additional occupational exposure during the year, (b) prior approval from the AMWTP president and project manager and the NE-ID Operations manager.

(10 CFR 835.1301[a])

- Special Control Levels: Certain situations may require lower individualized exposure control levels. For example, a special control level would be appropriate for an individual undergoing radiation therapy. Such situations are evaluated on a case-by-case basis. The AMWTP Radiological Controls manager is responsible for establishing special control levels. The implementation of special control levels will not interfere with the individual's right to work.
- Member of the Public Dose Limit: Members of the public permitted access to the controlled area at AMWTP site are limited to a total effective dose of 0.1 rem in a year.

(10 CFR 835.208)

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- Embryo/Fetus Dose Controls. Dose controls that affect embryos and fetuses are as follows:

- After a female employee voluntarily informs AMWTP in writing that she is pregnant, for the purposes of fetal/embryo protection, she is considered a declared pregnant worker. A declared pregnant worker may revoke this declaration, in writing, at any time.

(10 CFR 835.2[a])

- For a declared pregnant worker, AMWTP provides 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 work involving occupational exposure:

- A. The equivalent dose limit for the embryo/fetus from conception to birth (entire gestation period) is 500 millirem.

(10 CFR 835.206[a])

- B. Measures are taken to avoid substantial variation above the uniform exposure rate necessary to meet the 500 millirem limit for the gestation period. In addition, efforts are made to avoid exceeding 50 millirem per month to the declared pregnant worker.

(10 CFR 835.206[b])

- C. If the equivalent dose to the embryo/fetus is determined to have already exceeded 500 millirem when an employee notifies AMWTP of her pregnancy, the employee is not assigned to tasks where additional occupational radiation exposure is likely during the remainder of the gestation period.

(10 CFR 835.206 [c])

3.2 Contamination Control

Work area monitoring for airborne radioactivity is in accordance with 10 CFR 835.403.

Control of radioactive contamination is achieved by using engineering controls, administrative controls, employee performance to contain contamination at the source, monitoring, minimizing the size of contaminated radiological areas, and by promptly decontaminating other areas that become contaminated.

Instruments and techniques used for radioactive contamination monitoring and control are adequate to ensure compliance with the requirements of 10 CFR 835.1102.

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The primary emphasis of the AMWTP is on engineered design features to contain radioactive contamination and to prevent airborne and surface contamination to demonstrate compliance with 10 CFR 835.1001(a). In addition to the provisions of this Radiation Protection Program, DOE-STD-1128-2013, Guide for Occupational Radiological Protection in Plutonium Facilities, and DOE-STD-1098-2008, Radiological Control, is considered for guidance in preparing the RS&C procedures. These procedures provide specific guidance related to dosimetry, radiological monitoring, instrumentation, contamination control, and applicable radiological control procedures that are considered for AMWTP plutonium operations.

AMWTP controls are implemented as necessary to prevent the spread of removable contamination outside of radiological areas under normal operating conditions in accordance with 10 CFR 835.1101(b). The extent of these controls depends on the type and level of contamination present and the activities in and around the area. The following measures are used to prevent the spread of contamination across the boundaries of contamination, high contamination, and airborne radioactivity areas:

- Use solid barriers to enclose areas wherever practicable.
- Mark and secure items such as hoses and cords that cross the boundary to prevent safety hazards and the spread of contamination.
- Control and direct airflow from areas of lesser to greater contamination.
- Use engineering controls and confinement devices such as glove bags, glove boxes, and tents.

3.2.1 Personal Protective Equipment and Clothing

Requirements affecting PPE and clothing, with respect to protection from exposure or contamination from radioactive material, are as follows:

Individuals wear PPE during work in contamination and high contamination areas in accordance with 10 CFR 835.1102(e) and during the following activities:

- Handling of contaminated materials with removable contamination in excess of the 10 CFR 835, Appendix D, values.
- Work in airborne radioactivity areas.
- Work in areas with posted requirements or with requirements specified by a RWP.

General guidelines for protective clothing selection and use are contained in the RS&C procedures.

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Guidance concerning use of respirators is also contained in the RS&C procedures.

3.2.2 Monitoring for Individual Contamination

Individuals exiting radiological areas established to control removable contamination and/or airborne radioactivity will perform appropriate monitoring to detect and prevent the spread of contamination. Requirements for monitoring individuals are contained in the RS&C procedures.

(10 CFR 835.1102[d])

3.2.3 Contamination Control Levels

A surface is considered contaminated if either the removable or total radioactivity detected is above the levels in 10 CFR 835, Appendix D, Surface Radioactivity Values. Controls are implemented for these surfaces commensurate with the nature of the contaminant and level of contamination. Management and entry control of fixed contamination is in accordance with 10 CFR 835.1102(c). The RS&C procedures contain additional detail regarding contamination control.

(10 CFR 835.1102[b])

3.2.4 Airborne Radioactivity Control Levels

The derived air concentration (DAC) values in 10 CFR Part 835 Appendices A and C are used to control occupational exposures to airborne radioactive material.

(10 CFR 835.209)

Monitoring of airborne radioactivity shall be performed in areas where an individual is likely to receive an exposure of 40 or more DAC-hours in a year or as necessary to characterize the airborne radioactivity hazard where respiratory protective devices for protection against airborne radionuclides have been prescribed.

(10 CFR 835.403[a])

Real-time air monitoring shall be performed to detect and provide warning of airborne radioactivity concentrations that warrant immediate action to terminate inhalation of airborne radioactive material.

(10 CFR 835.403[b])

Additional details regarding airborne radioactivity control levels are contained in the RS&C procedures.

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3.3 Posting

The following sections discuss general posting provisions, radioactive material labeling in radiation areas, and posting contamination and airborne radioactivity areas in accordance with 10 CFR 835.601 through 605. Controlled areas are posted in accordance with 10 CFR 835.602, as specified in the RS&C procedures.

3.3.1 General Posting Provisions

General posting provisions are as follows:

- Radiological postings are intended to alert individuals to the presence of radiation and radioactive materials within confinement systems.
- Radiological areas are clearly and conspicuously posted. Postings of doors are such that the postings remain visible when doors are open or closed.

(10 CFR 835.601[b])

- Each access point to a controlled area is posted whenever radioactive materials or radiation fields that would require posting under radiation, contamination, and airborne provisions may be present in the area.
- Detailed posting requirements are contained in the RS&C procedures.

3.3.2 Radioactive Material Labeling

Items or containers of radioactive material, except those meeting the 10 CFR 835.606 exceptions to labeling requirements, bear a clearly visible standard radiation warning trefoil and the words "Caution, Radioactive Material" or "Danger, Radioactive Material." The label provides sufficient information to permit individuals handling, using, or working in the vicinity of the items or containers to take precautions to avoid or control exposures. Details regarding radioactive material labeling are provided in the RS&C procedures.

3.3.3 Posting Radiation Areas

Areas are posted to alert individuals to the presence of external radiation in accordance with Table 2 and general posting provisions. Supplemental posting guidance is contained in the RS&C procedures.

(10 CFR 835.601 and 603)

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Table 2. Criteria for Posting Radiation Areas.

Area	Criteria	Required posting
Radiation area	> 0.005 rem in 1 h at 30 cm (10 CFR 835.2)	"CAUTION, RADIATION AREA" (10 CFR 835.603[a])
High radiation area	> 0.1 rem in 1 h at 30 cm (10 CFR 835.2)	"CAUTION, HIGH RADIATION AREA" or "DANGER HIGH RADIATION AREA" (10 CFR 835.603[b])
Very high radiation area	> 500 rad in 1 h at 1 m (10 CFR 835.2)	"GRAVE DANGER, VERY HIGH RADIATION AREA" (10 CFR 835.603[c])

a. Access requirements may be deleted or modified if personnel access is specifically prohibited.

3.3.4 Posting Contamination and Airborne Areas

Areas are posted to alert individuals to the presence (or potential presence) of surface contamination and airborne radioactivity in accordance with Table 3 and general posting provisions.

(10 CFR 835.1102[c][2] and 603)

Derived Air Concentration values found in 10 CFR 835, Appendices A and C, are used in posting airborne radioactivity areas in accordance with Table 3. Supplemental posting guidance is contained in the RS&C procedures.

(10 CFR 835.209[a])

3.4 Controlling Radiological Work

The primary methods used to control workplace exposures are engineered controls.

(10 CFR 835.1001[a])

AMWTP augments physical design features through area entry/exit requirements to control access to and from radiological areas with RWPs to control radiological work. The RS&C procedures contain details regarding the control of radiological work, including the use of RWPs, area entry/exit requirements, and monitoring and survey requirements.

(10 CFR 835.501[d] and 1003)

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Table 3. Criteria for Posting Contamination, High Contamination, and Airborne Radioactivity Areas.

Area	Criteria	Required posting
Contamination area	Removable contamination levels (dpm/100 cm ²) > 1 × but ≤ 100 × 10 CFR 835 Appendix D values (10 CFR 835.2)	"CAUTION, CONTAMINATION AREA" (10 CFR 835.603[e])
High contamination area	Removable contamination levels (dpm/100 cm ²) > 100 × 10 CFR 835 Appendix D values (10 CFR 835.2)	"CAUTION HIGH CONTAMINATION AREA" or "DANGER, HIGH CONTAMINATION AREA" (10 CFR 835.603[f])
Airborne radioactivity area	1. Airborne concentrations > the applicable derived air concentration (DAC) values given in 10 CFR 835 Appendix A or C; or 2. Individual without respiratory protection could receive > 12 DAC-hours in a week (10 CFR 835.2)	"CAUTION, AIRBORNE RADIOACTIVITY AREA" (10 CFR 835.603[d])

Proposed maintenance and modification plans are reviewed to identify and incorporate radiological protection requirements. AMWTP line management, with support and concurrence from the AMWTP Radiological Controls manager, is responsible for performing this review.

In addition, all AMWTP personnel have the authority and responsibility to stop work if unsafe work conditions are encountered.

3.4.1 Radiological Work Permit

The AMWTP RWP is an administrative mechanism used to establish radiological, controls for intended work activities. The RWP informs employees of area radiological conditions and entry requirements and provides a mechanism to relate employee exposure to specific work activities. Each RWP is written for the work being performed and includes required radiological PPE and criteria for suspension of work.

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3.4.2 Entry and Exit Requirements

AMWTP has established specific requirements for entering and exiting radiological control areas. These entry requirements are consistent with 10 CFR 835, Subpart F, and are specified in the RS&C procedures. Radiation safety training commensurate with the hazards and required controls is required before unescorted access to radiological areas, in accordance with 10 CFR 835.901, is allowed. AMWTP minimum radiation safety training guidelines are contained in Table 4. Specific training requirements are contained in AMWTP radiological worker training discussed in MP-RTQP-14.20, Training Implementation Matrix, and associated implementing procedures.

Table 4. Minimum Radiological Control Training Guidelines.

Activities	Minimum training	Frequency
Member of the public escorted entry into controlled areas	Accomplished via Site Hazards List	Calendar Year
Member of the public unescorted entry into controlled areas	General Employee Radiological Training	Biennial
Unescorted entry into controlled areas	General Employee Radiological Training	Biennial
Unescorted entry into posted radioactive material areas	Radiological Worker Training I	Biennial
Unescorted entry into radiation areas	Radiological Worker Training I	Biennial
Unescorted entry into contamination areas	Radiological Worker Training II	Biennial
Unescorted entry into high radiation areas	Radiological Worker Training II	Biennial

3.4.3 Monitoring and Surveys

AMWTP workplace and individual monitoring is performed to (a) demonstrate compliance with the requirements of this Radiation Protection Program, (b) document radiological conditions in the workplace, (c) detect changes in radiological conditions, (d) detect the gradual buildup of radioactive material in the workplace, (e) verify the effectiveness of engineered and administrative controls in containing radioactive material and reducing radiation exposure, and (f) identify and control potential sources of individual exposure to radiation and/or radioactive material.

(10 CFR 835.401[a])

Surveys for radiation, contamination, and airborne radioactive materials are performed as specified in the RS&C procedures and RWP.

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The AMWTP uses nuclear accident dosimeters capable of measuring the estimated neutron dose and approximate neutron spectrum from a criticality accident.

(10 CFR 835.1304)

These dosimeters are in addition to the criticality monitoring system (in accordance with ANSI/ANS 8.3, Criticality Accident Alarm System).

3.5 Individual Monitoring

AMWTP provides the results of internal and external dose determinations to the organization responsible for maintaining INL historical dosimetry files in accordance with MP-DOCS-18.2 Records Management, and in accordance with contracted service provider procedures. The following sections discuss AMWTP internal dosimetry and external dosimetry.

3.5.1 Internal Dosimetry

AMWTP obtains support for internal dosimetry from one or more facilities accredited by the DOE Laboratory Accreditation Program. These support functions include bioassay services, external dose determinations, dose record maintenance, and dose reporting. The contracts with these laboratories require services and records maintenance in accordance with 10 CFR Part 835. The AMWTP internal dose evaluation program, described in the RS&C procedures, is adequate to demonstrate compliance with 10 CFR 835.202.

(10 CFR 835.402[d])

The following individuals participate in the AMWTP internal dosimetry program:

- Radiological workers identified by their occupation and work location as likely to receive a committed effective dose of 100 millirem or more from all occupational radionuclide intakes in a year.

(10 CFR 835.402[c][1])

- Declared pregnant workers likely to receive intakes resulting in a equivalent dose to the embryo/fetus of 50 millirem or more during the gestation period.

(10 CFR 835.402[c][2])

- Members of the public who enter a controlled area and are likely to receive an intake resulting in a committed effective dose exceeding 50 millirem in a year.

(10 CFR 835.402[c][4])

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The estimation of internal dose is based on bioassay data rather than air concentration values unless one of the following conditions exists:

(10 CFR 835.209[b])

- Bioassay data are unavailable.
- Bioassay data are inadequate.
- Internal dose estimates based on air concentration values are demonstrated to be as accurate or more accurate than bioassay data.

The RS&C procedures contain details of the bioassay program.

3.5.2 External Dosimetry

AMWTP obtains support for external dosimetry from qualified providers that are accredited by the DOE Laboratory Accreditation Program for personnel dosimetry. These support functions may include dosimeters and their processing, dose determinations, dose record maintenance, and dose reporting. The contracts or agreements shall require services and records maintenance in accordance with 10 CFR Part 835.

3.5.2.1 External General Provisions

External dosimetry general provisions are as follows:

- AMWTP individual dosimetry is provided to and used by individuals based on the following thresholds:
- Individuals identified by their occupation and work locations likely to receive an effective dose of 100 millirem or more in a year or an equivalent dose to the extremities, or organs and other tissues (including lens of the eye and skin) of 10 percent or more of the corresponding limits specified in Table 1.

(10 CFR 835.402[a][1])

- Declared pregnant workers expected to receive from external sources an equivalent dose of 50 millirem or more to the embryo/fetus during the gestation period.

(10 CFR 835.402[a][2])

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- Members of the public likely to receive in 1 year, from external sources, a dose in excess of 50 millirem.
(10 CFR 835.402[a][4])

- Individuals entering a high radiation area or very high radiation area.
(10 CFR 835.402[a][5])

Neutron dosimetry is provided when an individual is likely to exceed the applicable thresholds just provided from neutron radiation.

The RS&C procedures contain details of the external dosimetry program.

3.6 Radioactive Material

The following sections describe basic requirements for radioactive material, radioactive material labeling, packaging, and storage. Additional detail is contained in the RS&C procedures.

3.6.1 Radioactive Material Requirements

Materials in contamination or airborne radioactivity areas are considered contaminated until surveyed and released from removable contamination controls. Any equipment or system component removed from a process area that may have had contact with radioactive material is considered contaminated until disassembled to the extent required to perform an adequate survey, surveyed, and shown to meet the criteria in 10 CFR 835, Appendix D. Details regarding release of materials from radiological areas are provided in the RS&C procedures.

(10 CFR 835.1101)

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3.6.2 Radioactive Material Packaging

Radioactive material that is outside contamination or airborne radioactivity areas and is confirmed or suspected of having removable radioactive contamination levels greater than Table 3 values is securely wrapped in plastic or placed in a closed container.

Details regarding radioactive material packaging are provided in the RS&C procedures.

3.6.3 Radioactive Material Storage

Any accessible area in which radioactive material is used, handled, or stored shall be posted with the words "Caution Radioactive Material." The posting meets the requirements of 10 CFR 835, Subpart G. The following areas are exempt from the posting requirements:

- Areas, for periods of less than 8 continuous hours, when placed under continuous observation and control of an individual knowledgeable of, and empowered to implement, required access and exposure control measures.

(10 CFR 835.604[a])

- Areas when (1) posted in accordance with 10 CFR 835.603(a) through (f); or (2) each item or container of radioactive material is labeled in accordance with 10 CFR 835, Subpart G, such that individuals entering the area are made aware of the hazard; or (3) the radioactive material of concern consists solely of structures or installed components that have been activated (i.e., such as by being exposed to neutron radiation or particles produced by an accelerator).

(10 CFR 835.604[b])

- Areas containing only packages received from radioactive material transportation labeled not degraded need not be posted in accordance with 10 CFR 835.603 until the packages are monitored in accordance with 10 CFR 835.405.

(10 CFR-835.604[c])

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3.6.4 Release of Radioactive Material to Controlled and Uncontrolled Areas

Once materials have entered radiological areas controlled for surface contamination or airborne radioactivity, evaluations of the potential for contamination of that material are required before releasing the material to controlled areas to demonstrate compliance with 10 CFR 835.1101. Implementing requirements for releasing radioactive material to controlled areas are contained in the RS&C procedures in compliance with 10 CFR 835, Appendix D. Equipment and Material releases to uncontrolled areas are conducted in accordance with DOE O 458.1. Implementing requirements for uncontrolled release of materials and equipment are contained in the RS&C procedures.

3.6.5 Sealed Radioactive Source Controls

The policy of AMWTP radiological operations is to control sealed radioactive sources so that they are used, handled, and stored in a manner commensurate with their radiological hazard.

(10 CFR 835.1201)

Nominally, the inventory frequencies and survey requirements specified in 10 CFR 835.1202 shall be performed for all accountable sealed radioactive sources at AMWTP. The RS&C procedures implement acquisition, receipt, labeling, storage, transfer, inventory, leak testing, and use of sealed radioactive sources.

(10 CFR 835 Subpart M)

3.6.6 Receipt of Packages Containing Radioactive Materials

The receipt of packages containing radioactive material shall be consistent with the requirements of 10 CFR 835.405. These activities are coordinated with other AMWTP departments. The RS&C procedures implement the receipt, survey, and time requirement restrictions associated with the receipt of packages containing radioactive materials.

(10 CFR 835.405)

3.7 Radiation Generating Devices

AMWTP waste characterization operations involve the use of various designs of Non Destructive Examination (NDE) and Non Destructive Assay (NDA) equipment. The NDE units generate x-rays and the NDA units generate neutrons.

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The policy of AMWTP radiological operations is to comply with applicable criterion recommended in ANSI N43.3, General Radiation Safety – Installations Using Non-Medical X-Ray and Sealed Gamma-Ray Sources, Energies up to 10MeV, and other applicable ANSI standards listed within DOE G 441.1-1C. EDF-0119, Safe Installation and Use of X-Ray Generating Devices at AMWTP, provides a table of ANSI recommendations that the AMWTP Radiological Control organization has deemed applicable. MP-RS&C-6.27, Control and Registration of Radiation-Generating Devices, implements the control and registration of the RGDs in use at AMWTP.

3.8 Radioactive Waste Management

Waste management is discussed in RPT-DSA-02. The policy of AMWTP radiological operations is to minimize the generation of radioactive waste. In general, AMWTP radioactive waste generation is minimized by the following:

- Segregating known uncontaminated from potentially contaminated waste
- Restricting material entering radiological areas to only those needed for performance of work
- Restricting the quantities of hazardous materials including, but not limited to paints, solvents, chemicals, cleaners, and fuels entering radiological areas
- Substituting recyclable items in place of disposable ones and reuse of equipment when possible
- Maintaining an assortment of tools primarily for use in controlled contamination or airborne radioactivity areas.

3.9 Design and Control

AMWTP design is controlled in accordance with 10 CFR 835, Subpart K. The following sections discuss radiological design criteria and control procedures.

3.9.1 Radiological Design Criteria

AMWTP design criteria is to limit radiological doses to employees to 20 percent of the values in 10 CFR 835.202.

(10 CFR 835.1002[b])

To control airborne radioactive material, the design objective under normal conditions is to avoid releases to the work place atmosphere. In any situation, confinement and ventilation are normally used to control the inhalation of such material by workers to levels that are ALARA.

(10 CFR 835.1002[c])

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The design or modification of a facility and the selection of materials includes features that facilitate operations, maintenance, decontamination, and decommissioning.

(10 CFR 835.1002[d])

Optimization methods are used to ensure that occupational exposure is maintained ALARA in developing and justifying design and physical controls.

(10 CFR 835.1002[a])

Radiological design criteria are included in the AMWTP Project Design Criteria document.

(MP-CD&M-11.1)

3.9.2 Control Procedures

Administrative control and procedural requirements are developed and implemented as necessary to supplement facility design features.

(10 CFR 835.1001[b])

Administrative control procedures include such things as access control measures and permits to work or approved methods of work. These and other control procedures are written to implement the RS&C procedures. Written authorizations, including specific radiation protection measures, are used to control entry into and work within AMWTP radiological areas.

(10 CFR 835.501[d])

The AMWTP combination of design features and administrative control procedures ensure that during routine operation, the Table 1 dose limits for radiological employees are met and that doses are ALARA.

(10 CFR 835.1003[a][b])

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3.10 Respiratory Protection

AMWTP respiratory protection equipment includes respirators with particulate and/or gas-absorbing cartridges, supplied air respirators, PAPRs, and airline supplied air suits and hoods.

AMWTP requires that respiratory protection equipment selection be in accordance with 29 CFR 1910.134, Respiratory Protection. Additional respiratory protection requirements are contained in the RS&C procedures and LST-ISIH-02-IM, 10 CFR 851, Implementation Matrix, and their associated implementing procedures. In general the following applies:

- Respirators are issued only to individuals who are trained, fitted, and medically qualified to wear the specific type of respirator.
- Training and qualification testing is performed annually.

(29 CFR 1910.134)

- Monitoring of airborne radioactivity shall be performed as necessary to characterize the airborne radioactivity hazard where respiratory protective devices for protection against airborne radionuclides have been prescribed.

(10 CFR 835.403[a][2])

3.11 Records and Reporting

AMWTP policy is to generate and maintain complete and accurate radiological protection records for the AMWTP facilities. Except as listed below, records are recorded and maintained in accordance with the requirements of 10 CFR 835.701 through 704. Recording of monitoring results in an individual's monitoring record is not required if the dose is estimated at the values listed below:

(10 CFR 835.702[b])

- For a non-uniform equivalent dose to the skin that is <2 percent of the limit specified for the skin at 10 CFR 835.202(a)(4)
- Neither the committed equivalent dose nor committed effective dose need be recorded if the monitoring result is estimated to be less than 0.01 rem committed effective dose. The bioassay or air monitoring result used to make the estimate shall be maintained per 10 CFR 835.703(b) and the unrecorded internal dose estimated for any individual in a year shall not exceed the applicable monitoring threshold at 10 CFR 835.402(c).

MP-DOCS-18.2 establishes the AMWTP Records Management program. Radiological records generated in accordance with this radiological records program will be retained until final disposition is authorized by DOE in accordance with 10 CFR 835.701(b).

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Reports to individuals are formatted in accordance with and contain the data required by 10 CFR 835 Subpart I. AMWTP uses these records (a) to help ensure that individuals are prevented from receiving unnecessary radiation exposure, (b) to make these records available as prescribed by the Privacy Act of 1974, and (c) to document compliance with 10 CFR 835.701(a). These records are also used for (a) evaluation of the effectiveness of the Radiation Protection Program, (b) demonstration of compliance with regulations and requirements, and (c) defense of the Radiation Protection Program against unwarranted litigation.

AMWTP maintains dose records sufficient to evaluate compliance with all applicable dose limits and monitoring and reporting requirements.

(10 CFR 835.702[c][1] and [2])

Requirements for maintaining employee radiological control records are contained in MP-DOCS-18.2. In addition, AMWTP provides records of individual exposures to the current INL contractor for Radiation and Dosimetry Records organization on an ongoing and timely basis.

The current INL Radiation and Dosimetry Records organization is responsible for the production and distribution of reports to individuals as specified in 10 CFR 835, Subpart I. As a minimum, AMWTP provides exposure reports to individuals under the following conditions:

- Upon the request from an individual terminating employment, records of exposure are provided to that individual as soon as the data are available, but not later than 90 days after termination

(10 CFR 835.801[b])

- If requested, a written estimate of radiation dose based on available information at the time of termination is provided

(10 CFR 835.801[b])

- Annual radiation dose reports to individuals

(10 CFR 835.801[c])

- If requested, detailed exposure information

(10 CFR 835.801[d])

- Reports to individuals when AMWTP is required to report to DOE pursuant to (a) occurrence reporting or (b) planned special exposures.

(10 CFR 835.801[e] and 204[e])

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3.11.1 General Provisions

- Where radiological services (i.e., dosimetry and laboratory analyses) are purchased, there is a clear agreement regarding records responsibility during performance of the service.
- Detailed information concerning an individual's exposure is made available to that individual, upon request, consistent with the Privacy Act of 1974, which contains requirements to protect the privacy of individual records.
(10 CFR 835.702[d] and [f])
- Unless otherwise specified, radiological control records shall use the special units of curie, roentgen, rad, and rem, including multiples and subdivisions of these units, or other conventional units, such as dpm, dpm/100 cm² or mass units. Use of the international system of units [Becquerel (Bq), gray (Gy), and sievert (Sv)] may be provided parenthetically for reference with scientific standards.
(10 CFR 835.4)
- AMWTP forwards a copy of the assay or dosimetry results to the appropriate INL Radiation and Dosimetry Record Organization.

3.12 Radiation Safety Training

AMWTP radiation safety training is commensurate with the employee's duties. AMWTP radiation training is performed to meet the requirements of 10 CFR 835, Subpart J, Radiation Safety Training.

AMWTP uses DOE standardized core courses to the extent practicable and supplements these with AMWTP site-specific information. These standardized core courses are referred to as General Employee Radiological Training, Radiological Worker Training I and II, and Radiological Technician Training. Table 4 lists minimum training guidelines.

The AMWTP facility-specific instruction is commensurate with the nature of the activities performed at the facility and includes special instructions in plutonium waste handling to ensure adequate radiation safety. The AMWTP training requirements are contained in MP-RTQP-14.20 and associated implementing procedures.

3.13 Instrumentation Calibration

The AMWTP Radiation Protection Program utilizes both in-house calibration capabilities and support functions from qualified providers. Both the in-house calibration capabilities and the qualified providers must meet AMWTP Quality Assurance Program Plan calibration requirements. The contracts or agreements with qualified providers shall

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require services and records maintenance in accordance with 10 CFR 835. AMWTP uses commercially available radiological instrumentation where practical.

In general, instruments used for monitoring and contamination control are:

- Maintained and calibrated on an established frequency
(10 CFR 835.401[b][1])
- Appropriate for the type(s), levels, and energies of the radiation(s) encountered
(10 CFR 835.401[b][2])
- Appropriate for existing environmental conditions
(10 CFR 835.401[b][3])
- Routinely tested for operability.
(10 CFR 835.401 [b][4])

4.0 DEFINITIONS

None

5.0 REFERENCES

- (1) 10 CFR 835, Occupational Radiation Protection
- (2) 29 CFR 1910.134, Respiratory Protection
- (3) ANSI N43.3, General Radiation Safety – Installations Using Non-Medical X-Ray and Sealed Gamma-Ray Sources, Energies up to 10MeV
- (4) ANSI/ANS 8.3, Criticality Accident Alarm System
- (5) DOE G 441.1-1C, Radiation Protection Programs Guide for Use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection
- (6) DOE O 458.1, Radiation Protection of the Public and the Environment
- (7) DOE P 441.1, DOE Radiological Health and Safety Policy
- (8) DOE-STD-1098-2008, Radiological Control
- (9) DOE-STD-1128-2013, Guide for Occupational Radiological Protection in Plutonium Facilities
- (10) EDF-0119, Safe Installation and Use of X-Ray Generating Devices at AMWTP

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- (11) LST-ISIH-02-IM, 10 CFR 851 Implementation Matrix
- (12) LST-RS&C-01-IM, Radiological Control Implementation Matrix
- (13) MP-CD&M-11.1, Change Control
- (14) MP-COPS-9.6, Occurrence Reporting
- (15) MP-DOCS-18.2, Records Management
- (16) MP-Q&SI-5.2, DOE HSS OE Reporting
- (17) MP-Q&SI-5.3, Corrective Action
- (18) MP-RS&C-6.3, ALARA Program
- (19) MP-RS&C-6.27, Control and Registration of Radiation-Generating Devices
- (20) MP-RTQP-14.20, Training Implementation Matrix
- (21) PD-Q&SI-01, Contractor Assurance Program Description
- (22) PLN-EP&C-03, AMWTP Emergency Plan/RCRA Contingency Plan
- (23) QAPP-01, Quality Assurance Program Plan
- (24) RPT-DSA-02, Documented Safety Analysis

6.0 RECORDS

Records generated by this procedure are classified in accordance with the table below and dispositioned in accordance with MP-DOCS-18.2, Records Management.

Record Description	Classification
PD-RS&C-01, Case File	Misc. Other Record/A 16-1.2/Destroy 5 years after submittal or being superseded

7.0 EXHIBITS

None

8.0 APPENDICES

Appendix A – Requirements Table

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Appendix A – Requirements Table

This appendix presents the effective date and title of all applicable and mandatory requirements that relate to AMWTP's Radiation Protection Program. Requirements include only those portions of the regulation(s) cited that are applicable to the AMWTP and that were applicable on or before the August 1, 1996 contract date (unless otherwise noted).

Table A-1. Requirements Table for Radiation Protection Program.

Requirement (Date)	Title
10 CFR 835, Subpart A (6/8/2007)	General Provisions
10 CFR 835, Subpart B (4/13/2011)	Management and Administrative Requirements
10 CFR 835, Subpart C (6/8/2007)	Standards for Internal and External Exposure
10 CFR 835, Subpart E (6/8/2007)	Monitoring of Individuals and Areas
10 CFR 835, Subpart F (6/8/2007)	Entry Control Program
10 CFR 835, Subpart G (6/8/2007)	Posting and Labeling
10 CFR 835, Subpart H (6/8/2007)	Records
10 CFR 835, Subpart I (6/8/2007)	Reports to Individuals
10 CFR 835, Subpart J (6/8/2007)	Radiation Safety Training
10 CFR 835, Subpart K (6/8/2007)	Design and Control
10 CFR 835, Subpart L (6/8/2007)	Radioactive Contamination Control
10 CFR 835, Subpart M (6/8/2007)	Sealed Radioactive Source Control
10 CFR 835, Subpart N (6/8/2007)	Emergency Exposure Situations
29 CFR 1910.134 (7/1/2004)	General Industry Standards-Respiratory Protection
DOE P 441.1 (04/26/96)	DOE Radiological Health and Safety Policy
DOE O 458.1 (2/11/2011)	Radiation Protection of the Public and the Environment