Radiation Protection Program
Battelle Columbus Laboratories Decommissioning Project

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PLAN APPROVAL PAGE

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Battelle Columbus Laboratories Decommissioning Project
Radiation Protection Program (RPP)

0.0 Introduction

The Battelle Columbus Laboratories Decommissioning Project (BCLDP) requires that staff members maintain doses from both internal and external sources of ionizing radiation as low as reasonably achievable (ALARA). This is achieved by using protective equipment, methods, and designs that are technically and economically effective along with the application of administrative limits that are set lower than applicable regulations. BCLDP's radiation protection program strives to maintain high professional standards and is responsive to applicable requirements of the U.S. Nuclear Regulatory Commission (NRC), U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and other regulatory agencies.

0.1 Organization and Responsibilities

The BCLDP Radiation Protection Responsibilities Matrix is depicted in Table 0.1. Since the licenses and other regulatory documents governing the activities of the BCLDP are issued to Battelle, the ultimate responsible party for implementation of the BCLDP Radiation Protection Program is the Battelle Chief Executive Officer (CEO). He delegates responsibility through both sides of the program; to the Battelle Columbus Operations (BCO) Radiation Safety Officer (RSO) who is responsible for oversight of the Radiation Protection Program, the Site RSO who is responsible for day-to-day implementation of and compliance with the Decommissioning Plan (DP) and RPP Plan, and the Decontamination and Decommissioning Operations Program Manager (DDO Program Manager) who is responsible for the technical and line managers of the project. The DDO Program Manager is also responsible for appointing and empowering the BCLDP Management Oversight Committee (MOC).

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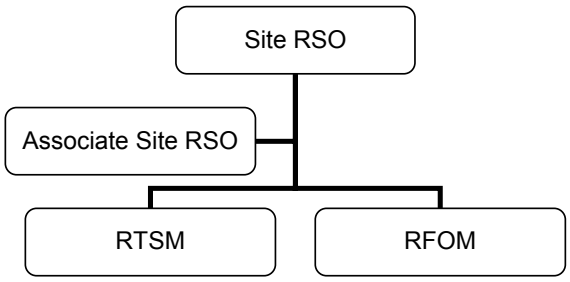

Table 0.1
BCLDP Radiation Protection Responsibilities Matrix

0.1.1 DDO Program Manager

The DDO Program Manager has direct responsibility for the overall project and ensures that the technical managers and project managers within the BCLDP provide the necessary support

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required for the successful implementation of the Radiation Protection Program. The Health Safety, and Environmental Affairs (HSEA) Manager reports directly to the DDO Program Manager. The Radiological Field Operations Manager (RFOM) and Radiological Technical Support Manager (RTSM) both report to the DDO Program Manager through the HSEA Manager. They are responsible to the Site RSO, who is also the HSEA Manager, for all radiation protection activities to which they are assigned or delegated. The Site RSO makes their work assignments and is responsible for their personal evaluations, with regard to radiation protection activities.

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0.1.2 Radiation Safety Officer (RSO)

The BCO RSO is charged with oversight and assessment of the BCLDP RPP as delegated by the CEO. The BCO RSO functionally reports directly to the BCO Vice President for Environment, Safety, Health, and Quality (ESH&Q), who in turn reports directly to the CEO. The BCO RSO always has available an open line of communication to interact directly with the CEO, as needed.

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Deleted: The RSO always has available an open line of communication to interact directly with the CEO, as needed. RSO responsibilities include the following:**Table 0.1BCLDP Radiation Protection Responsibilities Matrix**

The Site RSO is appointed by the Vice President ESH&Q and the DDO Program Manager in consultation with the BCO RSO. The HSEA Manager has been assigned as the Site RSO. Responsibilities of the Site RSO include the following:

- Appointing the ALARA coordinator and the Associate Site Radiation Safety Officer (ARSO), as desired
- Maintaining BCLDP radiation survey data and radiation-related records
- Verifying that radioactive materials and radiological areas are controlled by line managers in accordance with applicable regulatory requirements
- Implementing and monitoring the ALARA policy
- Evaluating, approving, implementing, and administering the radiation protection training program
- Developing BCLDP policies and implementing procedures regarding radiation protection
- Providing administrative and support services for health physics such as: dosimetry; instrumentation; technical support for operations; respiratory protection; personnel protective equipment; and radiation shielding recommendations; and
- Implementing and maintaining a license compliant BCLDP radiation protection operations and activities, in general; and
- Providing appropriate information, as requested, to the BCO RSO.

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The BCO RSO shall be an employee of Battelle and shall meet the following minimum qualifications:

- Bachelor's degree in one of the physical sciences, biological sciences, or engineering disciplines
- Have a minimum of five (5) years experience in operational health physics
- Be eligible for certification by the American Board of Health Physics

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- Possess demonstrable judgment and technical capability sufficient to conduct and review radiological safety operations
- Have demonstrable management experience; and
- Have course work and/or experience with the following:
- Principles and practices of radiation protection
- Radioactivity measurements, monitoring techniques, and the use of instruments
- Mathematics and calculations basic to the use and measurement of radioactivity
- Biological effects of radiation applicable to the types and forms of radioactive material and radiation-producing machines at Battelle
- Safety practices applicable to protection from the radiation, chemical toxicity, and other properties of the radioactive materials in use at Battelle facilities
- Conducting radiological surveys and evaluating results
- Familiarity with applicable USNRC, United States Environmental Protection Agency (USEPA), United States Department of Energy (USDOE), and Occupational Safety and Health Administration (OSHA) regulations, as well as the terms and conditions of any licenses and permits issued to Battelle by these agencies.

The Site RSO need not be an employee of Battelle, but will have minimum qualifications, training, and experience requirements equivalent to the BCO RSO.

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The BCO RSO and Site RSO will communicate frequently and maintain such records as are deemed necessary to conduct their operations.

In the absence or unavailability of the Site RSO (e.g., vacations, illness, attendance at off-site training), the authority for implementing the Radiation Protection Program described herein may be delegated to the Associate Site RSO (ARSO). The HSEA Senior Technical Advisor shall serve as the ARSO. The ARSO shall have equivalent qualifications to the Site RSO or will function under the direct supervision of the Site RSO until such time as equivalent qualifications are achieved. Should the Site RSO be unavailable to serve in an on-site capacity for longer than 30 days, a new Site RSO will be identified and the license amended. If, however, the absence: 1) is one that would allow routine and "as needed" telephone or electronic communication to consult with the ARSO or other staff; 2) periodic returns are made to the BCLDP site by the Site RSO; and 3) the total absence does not exceed a period of 90 days, the ARSO would function for the Site RSO, and no amendment would be submitted. Upon permanent departure, notification will be required to be made to the NRC within 30 business days of departure or 15 business days of assignment, whichever is less. If the incumbent provides insufficient notice to allow the above commitment to be met, the Associate Site RSO will assume Site RSO responsibilities until a permanent replacement can be made, and the NRC will be notified within 15 business days of the incumbent's departure. A similar approach will be taken for the remaining positions identified in Table 0.1, above. Additionally, Battelle will assign an interim manager or a permanent replacement for the following positions, in a timely manner, if the incumbent should depart for any reason: HSEA Manager/Site RSO, ARSO, RTS Manager, and RFOM.

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When referred to in the course of this document, Site RSO means the individual holding that position along with the staff and resources available to him/her, and individuals designated by him/her to act on his/her behalf for specific functions. Project procedures or other documents may specify individual delegations from the Site RSO.

0.1.3 Radiological Field Operations Manager (RFOM)

The Site RSO will delegate authority for certain radiological field operations and other designated aspects of the Radiation Protection Program to the RFOM. As indicated above, the RFOM shall be responsible to the Site RSO for radiation protection issues and will provide continuing information to the Site RSO.

Responsibilities and authority delegated to the RFOM include:

- Administering and implementing the radiological surveillance and maintenance (S&M) and radiological release programs
- Evaluating health physics technician qualifications
- Evaluating hot cells for downgrade or human entry
- Maintaining radiological control over the shipment of radioactive waste leaving Battelle
- Controlling the storage of radioactive materials not currently in use
- Providing direct in-field coverage of radiological operations, surveys of working areas, posting, access controls, and issuance of Radiation Work Permits (RWPs)
- Preparing and delivering training in radiation safety
- Ensuring radiation-related records are maintained in accordance with regulatory and procedural requirements.

The RFOM shall have the following minimum qualifications prior to assuming this position:

- A Bachelor's degree in one of the physical sciences, biological sciences, or engineering disciplines
- A minimum of five (5) years experience in operational health physics, including experience in Decontamination and Decommissioning involving large quantities of dispersible transuranic and fission product radioactive materials.
- Eligibility for certification by the American Board of Health Physics (ABHP).

Other experience and education as may be acceptable upon review by the Site RSO.

0.1.4 Radiological Technical Support Manager (RTSM)

The Site RSO will delegate authority for certain technical portions of the Radiation Protection Program to the RTSM. As indicated above, the RTSM shall be responsible to the Site RSO for radiation protection issues and will provide continuing information to the Site RSO.

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Responsibilities and authority delegated to the RTSM include:

- Implementing the internal and external dosimetry programs, including: distributing personnel monitoring devices; determining the need for and evaluation of bioassays; maintaining records associated with personnel dosimetry; notifying personnel and managers of exposures approaching action levels
- Administering the respiratory protection program
- Administering the radiological instrumentation program
- Administering the personal protective clothing program
- Implementing the ALARA program
- Providing technical support and consultation to the remedial action and field operations groups and other BCLDP functions, as needed
- Approving volumetric release criteria
- Ensuring radiation-related records are maintained in accordance with regulatory and procedural requirements; and

The RTSM shall have the following minimum qualifications prior to assuming this position:

- A Bachelor's degree in one of the physical sciences, biological sciences, or engineering disciplines
- A minimum of five (5) years experience in operational health physics, with an emphasis on technical and licensing aspects as well as related experience on the D&D of facilities involving large quantities of dispersible transuranic and fission product radioactive material.
- Eligibility for certification by the ABHP.

Other experience and education as may be acceptable upon review by the Site RSO.

0.1.5 Line Managers

Line managers shall support the Site RSO in the implementation of the BCLDP Radiation Protection Program. They will ensure consideration for aspects of radiation safety for daily activities such as general tasks, procedure writing, and employee training. Line managers are charged with communicating openly with staff members regarding ALARA considerations, safety concerns, and waste management issues. Line managers shall ensure that personnel working under his supervision are trained in the safe handling of radioactive material; do not eat, drink, smoke, or apply cosmetics in controlled areas; participate in the assigned exposure monitoring program; secure radioactive materials against tampering, loss, theft or unauthorized removal; dispose of radioactive waste in accordance with approved procedures; and comply with the requirements of the BCLDP Radiation Protection Program.

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0.1.6 Staff Members

Staff members will fully implement the directives and policies as mandated in accordance with the BCLDP Radiation Protection Program. Staff members are required to participate fully in radiation safety training exercises and to understand, to the best of their abilities, the BCLDP Radiation Protection Program. The results and effectiveness of the BCLDP ALARA policy and Radiation Protection Program will be measured on the basis of the staff doses resulting from work with ionizing radiation. Staff members shall not perform assigned work until they have received appropriate training and are qualified to do the assigned work.

0.1.7 Management Oversight Committee

The BCLDP Management Oversight Committee (MOC) shall provide oversight for the Radiation Protection Program. The MOC shall meet at least four times per year. The DDO Program Manager or the Site RSO may call other meetings, as needed. The permanent members of the MOC shall include the DDO Program Manager, the Site RSO, the ARSO (if an ARSO has been designated), the RFOM, the Characterization Supervisor and the RTSM. The BCO RSO shall have a standing invitation to attend MOC meetings and to participate therein. The Site RSO shall serve as the chair of the MOC (Note: A single individual may serve dual roles on the MOC with the exception of the DDO Program Manager.) A quorum consists of the Site RSO, DDO Program Manager, and two other members. An individual appointed to do so by the Site RSO will maintain meeting minutes and records of determinations.

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Depending upon the topic(s) to be addressed, the composition of the MOC may on occasion be expanded to include other Battelle staff or consultants as deemed appropriate by the Site RSO.

The MOC shall be responsible for the review of all elements of the BCLDP Radiation Protection Program and for ensuring compliance with USNRC license requirements and other requirements per procedure (e.g., the MOC satisfies the requirement for an ALARA Committee). The Decontamination and Decommissioning Subcommittee of the Corporate Radiation Safety Committee shall serve as the interface between the BCLDP MOC and the Corporate Radiation Safety Committee. MOC functions and responsibilities include:

- Review and comment with regard to BCLDP Radiation Protection Program components (e.g., ALARA functions, training) and overall project input from a radiation protection/compliance standpoint, as requested by the DDO Program Manager
- Maintaining an awareness of proposed, new, or changed regulations and license conditions, and their implications
- Assist the Battelle RSC in the performance of an annual review of BCLDP radiation-related operations, as requested
- Assisting in the identification of radiation-related problems, their causes, and solutions; and
- Development of policies and requirements specific to the maintenance of BCLDP radiation safety and compliance, including modification of the RPP and supporting documents.

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0.1.8 Program Oversight

The BCLDP Quality Program provides for management walk-downs and self-assessments of project activities, including radiation protection activities. These functions allow periodic evaluation by management outside of the program knowledge gained through routine operations and involvement. These activities are performed, documented, and reported in accordance with the applicable portions of the BCLDP Quality Program relating to management self-assessment.

The BCO RSO conducts surveillances of program components on a quarterly basis. All of the following program components are evaluated on an annual basis, with different components reviewed during each of the quarterly surveillances. The program components for BCO RSO surveillance are: Training (radiation worker and radiation protection staff); Documentation and Records; Exposure Control; Instrumentation; Surveillance; sealed source and radioactive materials accountability; control of work; waste management/disposal; contamination control; ALARA; and shipping/receiving radioactive material. These activities are performed, documented, and reported in accordance with the applicable portions of the BCLDP Quality Program relating to management self-assessment. Procedures identified in the fourth paragraph of this section are also intended to be used by the BCO RSO to accomplish the requirements of this paragraph. The BCO RSO may also use corporate level procedures to fulfill the surveillance requirement. These will be submitted to the NRC prior to first use.

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A Radiological Awareness Report (RAR) program has been established that is used to notify management of radiological deficiencies, incidents, or concerns relating to the Radiation Protection Program. Using RARs, management is made aware of radiation-related issues. Identified concerns are documented, evaluated, resolved, and tracked. The RAR program allows participation of all staff (not just radiation protection staff) in the identification of potential problems, determination of causes, and the formulation of corrective actions, and serves as another means of program oversight.

Independent oversight and independent quality assessment of the Radiation Protection Program is conducted by the Independent Oversight organization. This is accomplished through the conduct of walkdowns and assessments of BCLDP work activities and records, including radiation protection. These activities are performed, documented, and reported in accordance with procedures RC-AP-1.0, Environment, Safety, and Health Oversight; QD-AP-18.1, Independent Programmatic Assessments; and QD-AP-18.2, Independent Activity Assessments. The Quality Engineering Section performs quality-related oversight for the Operations Department through self-assessment vehicles (i.e., procedures MA-AP-20.1 and MA-AP-20.2). The BCO Radiation Safety Committee conducts an annual audit of BCLDP activities in conjunction with the MOC. Battelle corporate ESH&Q or outside consultants may perform programmatic assessments at the request of the BCO RSO.

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External independent oversight is conducted by the Department of Energy, NRC, and certain waste disposal facilities (e.g., WIPP, Nevada Test Site, Envirocare).

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0.2 Stop Work Authority

Radiation protection personnel at all levels of authority have the responsibility and authority to stop any work activity that poses an unreviewed or indeterminate radiological hazard, or will violate the radiation protection measures required by BCLDP.

0.3 Program Content

This program presents the basic radiation protection standards for BCLDP. The program requirements apply to all BCLDP operations and staff at the West Jefferson and Battelle Columbus locations.

All individuals who work with radioactive materials shall be knowledgeable in the radiation protection requirements and shall adhere to the requirements stated in this program. Line managers shall be familiar with the contents of this program and shall ensure that staff members have been provided with training in the radiation protection requirements that apply to the staff member's job assignments. No work will begin prior to the completion of required, applicable training.

This program contains radiation protection practices that are based on requirements of various organizations including: DOE, NRC, EPA, the State of Ohio Department of Health, Bureau of Radiation Protection, as well as recommendations of the National Council on Radiation Protection and Measurements (NCRP), the International Commission on Radiological Protection (ICRP), and the American National Standards Institute (ANSI).

0.4 ALARA Philosophy

BCLDP is committed to maintaining a radiation protection program that will serve to keep individual and collective radiation doses as low as reasonably achievable. ALARA means making every reasonable effort to maintain exposures to radiation as far below the regulatory dose limits as is practical, consistent with the purpose for which the use of radiation was undertaken, while taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations.

In short, it means taking an approach to the safe uses of radiation, by going beyond the minimum requirements of the regulations, while considering resources, and the common good.

The components of this program include: training for users, management, and ancillary staff (including briefings); written policies and procedures for the control of sources of radiation; comprehensive safety evaluations of individual uses; periodic reviews of the Radiation Protection Program; the establishment of administrative dose limits; periodic reviews of doses resultant to using sources of radiation; management and staff commitment to the tenets of the ALARA program.

Refer to Section 8.0 of this document for discussion of ALARA program components.

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0.5 Environmental Monitoring

The impact of operations on the health and safety of the public is evaluated routinely by an environmental monitoring program. The basic objective of the environmental monitoring program is to evaluate BCLDP operations so that effluent levels are maintained as low as reasonably achievable and well within applicable standards.

Environmental monitoring under the BCLDP consists of routine monitoring of liquid and atmospheric media at locations of active work. In addition, samples of various environmental constituents, including air, surface water, groundwater, grass, fish, food crop, sediment and soil are collected from the region surrounding the site and analyzed. The monitoring data is collected, reviewed, and reported in an annual environmental report.

Detailed information regarding the Environmental Monitoring Program is included in the plans and procedures in the *BCLDP Environmental Monitoring Procedures Manual*.

0.6 Indication of Requirements

Throughout this document, certain terms show the degree of rigor associated with specific criteria. *Shall*, *will*, and *must* are used to denote mandatory requirements. *Should* and *would* denote expected requirements or actions. *May* is used to denote permissible requirements or actions.

0.7 Variances

Any variance from the contents of this document requires the approval of the Site RSO.

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1.0 Dose Equivalent Limits, Controls, and Policies / Radiation Protection Program Records

1.1 Introduction

BCLDP bases its radiation protection policies and procedures on recommendations from ICRP, NCRP, and NRC. Occupational dose equivalent limits are maximum doses. BCLDP has established administrative limits below the limits specified in NRC regulations. Actual operations shall conform to ALARA practices.

1.2 Responsibilities

Site RSO

The Site RSO shall:

- Develop dose-related policies and procedures.
- Ensure the policies and procedures comply with applicable federal and state requirements, contracts, and inter-contractor agreements.
- Forward to Project Records and ES&H Radiation Protection files all manuals and other documented material that define BCLDP policy and practices for radiation protection.
- Develop operating controls to limit personnel doses and aid in setting any restrictions on radiation dose required for health purposes.
- Promptly inform line managers and each staff member of their routine dose status, as well as the status of any person involved in a radiation occurrence.
- Record the results of all measurements that assess the radiological conditions in BCLDP facilities.
- Evaluate the information needed for evaluation of internal or external dose.
- Provide pertinent radiation monitoring information needed for evaluation of internal or external dose.
- Evaluate data on doses from offsite visits or employment.

Line Managers

Line managers shall:

- Keep staff members informed of their dose status.
- Inform the Site RSO promptly of questions a staff member may have on radiation dose status and provide a response to those questions after concurrence by the Site RSO.
- Inform female staff members of the radiation dose limits for pregnant workers.

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- Ensure that staff members' resultant doses are commensurate with ALARA philosophy.

Dosimetry

The Dosimetry Unit shall:

- Determine staff dose status.
- Perform routine Dosimetry functions.
- Maintain dosimetry-related records and provide reports in accordance with this plan.

Staff Members

Staff members are obligated to:

- Provide documentation of prior radiation dose history to the Site RSO.
- Forward reports of off-site radiation doses (internal and external) to the Site RSO.
- Inform Dosimetry of any dose to a personnel dosimeter from radiation therapy or diagnostic procedures.
- Inform their line manager of any personal conditions that may affect the status of their dose (including medical doses and pregnancy).

1.3 Occupational Dose Equivalent Limits

The annual dose equivalent limits listed in 10 CFR 20.1201 apply to persons 18 years of age and older who receive occupational exposure to ionizing radiation. The numerical values do not represent dose equivalents above which injury will occur. Rather, they represent a dose that should not result in any significant deleterious effect or an unacceptable risk of delayed effects. Maintaining dose within the limits does *not* ensure that there is *no* risk to the individual. Therefore, management shall keep staff members' dose to a practical minimum.

BCLDP maintains an occupational radiation dose history file for all staff members. A staff member's radiation dose history file shall include occupational dose received at other nuclear installations. Both the calendar year and the lifetime radiation dose equivalent totals shall include that dose.

1.3.1 BCLDP Administrative Dose Equivalent Limits

The DDO Program Manager has established administrative limits for dose from ionizing radiation to assist in the minimization of personnel dose. Table 1.1 summarizes the BCLDP administrative dose limits and Table 1.2 lists the BCLDP Administrative/ALARA Dose Control Plan. These BCLDP administrative limits and controls have been established to provide a graded approach for controlling potential doses to personnel and to assist in the administration of the ALARA program. BCLDP managers use the administrative limits as a management tool. The administrative limits are also used as performance criteria to ensure that radiation dose to

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personnel and the public is maintained ALARA. These administrative limits and controls are not intended to replace regulatory limits.

1.3.2 Planned Special Exposures

Any planned exposure that could result in an individual exceeding regulatory limits requires the express written authorization of both the Site RSO and the DDO Program Manager prior to the work being conducted. Planned Special Exposures must be made in accordance with 10 CFR 20.1206 and reported to the BCO RSO. Line managers shall send a copy of this authorization to the individual's radiation dose history file.

1.3.3 Unborn Child

The annual dose equivalent received by an unborn child as a result of occupational exposure of a female worker, who has notified line managers in writing that she is pregnant, shall not exceed 0.5 rem (0.005 Sv). The dose period shall be from conception to birth (the entire gestation period). Efforts should be made to avoid substantial variation above the uniform monthly dose rate that would satisfy this limiting value. If the dose to the unborn child has already exceeded this limit by the time the worker notifies line managers in writing of her pregnancy, line managers shall not assign the worker to tasks where additional occupational exposure is likely. The handling of declared pregnancies and dose to the fetus will be in accordance with 10 CFR 20.1208.

1.3.4 Member of the Public

Line managers, support managers, the Site RSO, and staff members shall ensure that the total effective dose equivalent (TEDE) received by any member of the public at a BCLDP facility shall not exceed 0.1 rem (0.001 Sv) in a year. Dose to the general public will be addressed as specified in 10 CFR 20.1301.

1.4 Specific Requirements

This section describes the BCLDP requirements used by Radiological Technical Support (RTS) staff for determining individual dose equivalents.

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Table 1.1
BCLDP Administrative Dose Limits

BCLDP annual administrative exposure limits for monitored personnel are:

- 2 rem total effective dose equivalent (TEDE)
- 20 rem total organ dose equivalent (TODE)
- 6 rem lens of the eye dose equivalent (LDE)
- 20 rem shallow (skin) dose equivalent (SDES)
- 20 rem shallow (extremity) dose equivalent (SDEE)
- 500 millirem TEDE for the duration of pregnancy
- 100 millirem TEDE to members of the general public

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Table 1.2
BCLDP Administrative/ALARA Dose Control Plan

TOTAL EFFECTIVE DOSE EQUIVALENT[a]	AUTHORIZATION
≤ 500 mrem per quarter	Standard Operating Practice
>500 to ≤1000 mrem per quarter	Review & Signature of RTS Manager, RFO Manager and ALARA Coordinator
>1000 to ≤1250 mrem per quarter	Review & Signature of RTS Manager, RFO Manager, ALARA Coordinator and Site RSO
>1250 to ≤ 1500 mrem per quarter	Review & Signature of RTS Manager, RFO Manager, ALARA Coordinator, Site RSO and MOC
EXPOSURES TO LENS OF THE EYE	
≤1.5 rem per quarter	Standard Operating Practice
>1.5 rem per quarter	Review & Signature of MOC
One exception to this part:	See "hot particle doses" below
SKIN, EXTREMITY AND OTHER ORGAN AND TISSUE DOSE	
≤5 rem per quarter	Standard Operating Practice
>5 rem to ≤7.5 rem per quarter[1]	Review & Signature of MOC
One exception to this part:	See "hot particle doses" below
DERIVED AIR CONCENTRATION	
<10 DAC-hours per week	Standard Operating Practice
>10 DAC-hours per week	Review & Signature of MOC
HOT PARTICLE DOSE	
≤75 µCi-hrs per exposure	Standard Operating Practice

[a] TEDE shall not exceed applicable regulatory limits.

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1.4.1 Combining Internal and External Dose Equivalents

The TEDE includes doses from external radiation and the dose from radionuclides deposited in the body. It does not include medical dose, dose from natural background radiation, or dose from sources unrelated to the individual's employment.

The primary means of assigning internal dose is the application of Regulatory Guide 8.25, Rev 1, Air Monitoring. Bioassay is accomplished by means of urine bioassay and, along with other *in vivo* or *in vitro* measurements, may be used to confirm the retention of radionuclides in the body.

1.4.2 Dose Equivalent Restrictions

Special approval from the Site RSO, with DDO Program Manager concurrence, is required for an occupational worker to re-enter a radiological area if the worker received an unplanned or accidental dose above the limits in Exhibit 1.1. The approval shall be based on recommendations of appropriate health physics and medical personnel and have the concurrence of the worker. Any dose received under the unplanned or accidental condition shall be included in the individual's dose record.

If a dose above the regulatory limits occurs (not authorized in accordance with 1.3.2), operations shall be stopped immediately and line managers shall not allow operations to resume without the approval of the MOC. BCLDP line managers and health physics staff must verify that the conditions that permitted the over- dose to occur have been eliminated before staff members continue working in the circumstances where the exposure occurred. Investigating and reporting of the event shall be in accordance with NRC requirements as implemented by BCLDP procedure HP-AP-7.0, *Requirements for Reporting Information to the NRC*.

Lifetime occupational dose equivalent shall be limited to one rem multiplied by the age of the worker.

1.4.3 Derived Air Concentrations

Appendix B of 10 CFR 20.1001-20.2402 contains derived air concentrations (DACs) for control of the work place. BCLDP health physics staff members shall use the DAC to calculate the internal dose equivalent received by a worker. Bioassay results may be used as supporting or confirmatory data.

1.4.4 Design and Control

Radiation dose rates in controlled decontamination and decommissioning (D&D) workplace areas should be reduced to ALARA levels by proper facility design and control. The primary means of maintaining doses ALARA are through physical controls, such as confinement, ventilation, remote handling, and shielding. Administrative controls and procedural requirements are to be considered supplemental means to achieve control.

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During design of D&D operations, the following objectives shall be applied:

- Optimization principles, as discussed in ICRP Publication 37, shall be used for developing and justifying facility design modifications and physical controls.
- Personnel doses from external sources in continuously occupied controlled areas shall be ALARA and shall not exceed 0.5 mrem (5 µSV) in one hour on average.
- Dose of personnel due to inhalation of airborne radioactive materials is to be avoided under normal operating conditions to the extent reasonably achievable. This shall be accomplished normally by confinement and ventilation.
- During D&D operations, the combination of design and control procedures in the work place shall ensure that the anticipated committed effective dose equivalent (CEDE) from intakes plus external sources will not exceed 5 rem (0.05 Sv) in a year. The anticipated committed dose equivalent to any organ or tissue from uptakes plus external dose shall not exceed 50 rem (0.5 Sv) in a year. These limits may be exceeded under special circumstances, in accordance with section 1.3.2.

1.5 BCLDP Dose Equivalent Controls

The BCLDP controls contained in Exhibit 1.2 help line managers ensure that personnel doses are maintained ALARA. The administrative controls are tiered; as a worker's cumulative dose increases, the level of administrative approval needed to authorize additional dose increases. Prior to seeking the required approvals, the following conditions shall be met (see Exhibit 1.2):

- The staff member's radiation dose status is known
- Authorization to exceed these administrative limits can be obtained by submitting a letter or dose extension form to the Site RSO and DDO Program Manager requesting the dose increase and obtaining the required approvals on the letter. Records will be filed in accordance with Section 1.8.2.1.

Normally within BCLDP, the DDE to the whole body will be the limiting consideration. Active control of the DDE to the whole body will, in most cases, adequately control skin, lens of the eye, and extremity doses to below BCLDP administrative limits. However, if whole body DDE is not the most limiting factor, a dose tracking system will be required.

1.5.1 Unborn Child

Line managers shall advise female staff members of the requirements regarding potential radiation doses to an embryo or fetus. The requirements include keeping dose to the lowest practical level during the entire gestation period.

BCLDP managers encourage any female staff member who enters radiological areas to inform her line manager (in writing) as soon as she suspects pregnancy. Line managers will inform the staff member of the limit for radiation dose during pregnancy. That limit requires keeping the radiation dose to the embryo or fetus to the lowest practical level during the entire gestation period. The BCLDP control limit for this dose is 0.5 rem (0.005 Sv) and shall not be exceeded for the entire gestation period.

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RSO, line managers, and the involved staff member shall, on an individual basis, determine methods for limiting dose to pregnant females. Consideration shall be given to the difficulty in assessing the dose to the fetus from intakes of radionuclides by the mother. If the staff member's current assignment prevents achieving adequate control of potential dose, line managers shall provide a temporary reassignment of work responsibilities to ensure adequate dose control.

1.5.2 Extreme Dose Rates

Work in areas of extreme dose rate (i.e.,>500 rad in one hour whole body/lens of the eye, or 5000 rad in one hour extremity/skin), even for very short periods, requires the written approval of the MOC. The approval request must justify entry into these areas.

1.6 Short-Term Controls

Line managers shall prevent additional dose if an individual's dose status becomes uncertain or may have exceeded dose controls. Line managers shall promptly inform the Site RSO of the circumstances. The Site RSO, in cooperation with the Dosimetry Unit, shall determine the staff member's dose status. They shall recommend to line managers any special dose controls or restrictions. Line managers shall implement these recommendations with the help of the Site RSO.

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1.7 Occupational Dose Policies

Adherence to the following dose policies should aid staff members from exceeding individual BCLDP dose controls. The policies, if implemented properly, should prevent an accidental exclusion of doses that should be part of a staff member's dose records.

The DDO Program Manager shall ensure that sufficient trained personnel are available to perform each operation such that administrative exposure limits are not reached.

Persons under 18 years of age shall not be permitted unescorted access to radiologically restricted areas at Battelle facilities.

1.7.1 Determination of Prior Dose

Before allowing any staff member entry into a radiological area, line managers shall have the individual's current dose status. This includes the current dose resulting from internal or external dose received during previous employment. Based on that status, line managers shall make sure the individual's dose will not exceed dose equivalent controls because of work for BCLDP.

The new staff member shall provide their BCLDP line manager with a signed radiation dose history form. The form either documents the staff member did not receive any current annual occupational radiation dose, or it provides a listing where a current annual occupational dose may have occurred.

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If the individual documents a prior occupational dose for the current calendar year, the line manager may permit entry into radiological areas, provided that the special controls placed on the staff member are enforced. One of the following special controls will be required:

- Until a staff member's current annual dose is determined, an individual's dose must not exceed 100 mrem until the dose estimate is recorded. Line managers may request priority processing of the prior dose determination.
- If the staff member's prior dose can not be obtained, an estimate may be assigned.

A completed NRC Form 4 or its equivalent (with the appropriate supporting documentation), signed by the staff member, is acceptable documentation of prior dose. The dose shown should be the record dose. Any dose restrictions will be entered into the individual's radiation dose history file.

1.7.2 Dose Limitations

Special limitations on individual occupational radiation doses may be necessary. Limitations may be due to external dose or dose from internally deposited radionuclides , or may be made for health reasons. The Site RSO will provide restriction recommendations in writing to line managers. Line managers of the involved individual shall enforce those limitations.

1.7.3 Offsite Occupational Dose

Staff members scheduling a business trip to an offsite location where there is a potential for radiation dose must inform the Site RSO prior to the staff member's departure. Staff members shall provide the Site RSO with a signed dose request form prior to leaving to perform work at or visit another nuclear installation. If the staff member's dose is approaching annual or administrative limits, he or she may require special controls, which may include the use of supplemental devices identified by the Site RSO.

Staff members shall not use the normally assigned BCLDP dosimeter while visiting or working at other nuclear installations. This requirement includes work in U.S. facilities as well as visits to nuclear facilities in other countries. Staff members may request a special dosimeter from the Dosimetry Unit at least 1 week before the trip begins. Staff members may only use this special dosimeter for the offsite assignment. They shall return the dosimeter to the Dosimetry Unit upon return from the visit. The staff member shall continue to use his or her normally assigned dosimeter for any further onsite dose measurements. Staff members who receive letters reporting any offsite dose shall forward the letters to the Dosimetry Unit for inclusion in the individual's occupational dose history file.

NOTE: Staff members visiting NRC-licensed, agreement state-licensed, or DOE-operated facilities do not need a special dosimeter before visiting the installation. The dosimetry assigned at the facility will provide the information needed for the individual's dose record. The individual's BCLDP dosimeter must not be worn during the visit.

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1.7.4 Medical Exposures

Any staff member who receives radiation dose due to medical procedures shall report the procedure to his or her management and the Dosimetry Unit. Medical procedures include radiation therapy or administration of radioactive material under the control of a physician.

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Staff members shall not wear assigned personnel dosimeters during medical and dental procedures involving radiation doses. Staff members shall inform the Dosimetry Unit if such dose occurs accidentally.

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1.7.5 Termination of Employment

Battelle staff members who have received the appropriate termination forms shall have a final physical. The examination may be limited to an update of recent medical history if the last complete physical occurred within 6 months, no exposure to hazardous materials has occurred since then, and the employee has suffered no symptoms associated with exposure. Radiation workers shall receive appropriate bioassay measurements before completing the procedure.

1.7.6 Dose Equalization

Collective TEDE (person-rem) is an important indicator of the effectiveness of TEDE control measures. Just as important is the mechanism by which dose is distributed throughout the work groups. The BCLDP mechanism by which this is controlled is called Dose Equalization.

Dose equalization is an ALARA practice aimed at reducing individual doses by distributing the collective accumulated dose among all qualified staff.

BCLDP is committed to practicing Dose Equalization and as such, Project Mangers and Work Group Supervisors shall monitor and equalize their subordinates' quarterly and year to date radiation doses through appropriate job assignments. In addition, Radiation Worker Training shall instruct all staff in the concept of Dose Equalization and how it is achieved.

To ensure Project Managers and Work Group Supervisors maintain Dose Equalization consistent relative to a common baseline, Dose Equalization shall be tracked and measured to an annual ALARA goal developed by the ALARA Coordinator and approved by the DDO Manager and the Site RSO.

The ALARA Coordinator shall supply, at least monthly, to Work Group Supervisors and Project Managers the individual DDE status as the reference tool for adjusting job assignments. In addition, the Monthly ALARA report shall include collective DDE by work group and collective CEDE for management review.

1.8 Radiation Protection Program Records

The Site RSO generates and maintains records that describe or support the scope, depth, and quality of the radiation protection program.

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The Dosimetry Unit maintains records documenting active personnel dose and programmatic functions. These records shall include records of individual staff members. Staff members receiving records of dose from offsite activities, or from BCLDP contractors, shall send them to the Dosimetry Unit for inclusion in their radiation dose history.

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1.8.1 Records About the Radiation Protection Program

Radiation protection program records shall include:

- Radiation protection policies and procedures
- Organizational changes that affect the Radiation Protection Program
- Procedures and methods for control and evaluation of individual dose
- Capabilities of dosimeters and instruments
- Instrument calibration and maintenance procedures and schedules
- Records of audit and performance tests showing the reliability of the measurement program
- Records of planned special doses in accordance with 10 CFR 20.2105
- Records of surveys
- Determinations of prior occupational dose
- Records of dose to individual members of the public.

1.8.2 Dosimetry Records

Dosimetry records shall include individual records show an individual's TEDE and shall describe any unusual doses staff members received during their employment with BCLDP.

1.8.2.1 Individual Records

Examples of records for an individual's radiation dose historical file include the following:

- Annual effective dose equivalent received during the year from radioactive material deposited in the body (Prior to January 1, 1989)
- Annual dose equivalent to the organ or tissue of concern received during the year from radioactive material deposited in the body (Prior to January 1, 1989)
- CEDE from intakes occurring during the year
- Committed dose equivalent to the organ or tissue of concern from intakes occurring during the year
- Annual effective dose equivalent from external sources of radiation received during the year
- Annual dose equivalent to the lens of the eye
- Annual dose equivalent to the skin

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- Annual dose equivalent to the extremities received during the year, including hands and forearm below the elbow and feet and legs below the knee
- Other data having a bearing on the individual's dose status, such as skin decontamination records
- Summation of the annual effective dose equivalents received from external and internal sources during the year
- TEDE received while employed at BCLDP (after January 1, 1989)
- Data necessary to support or recalculate doses at a later date
- Previous employment dose history
- Special dose evaluations
- Reports of unusual doses or occurrences
- Work restrictions
- Bioassay measurement results
- Special instructions on pregnancy.

Records that identify an individual are “strictly private” information and such records shall be available only to individuals needing them for the performance of their duties and to the individuals involved. The release of this information to uninvolved persons requires specific written approval of the individual or an authorized agent, unless otherwise specified by law.

Each entry made in the radiation dose historical file shall include the measurement date and the identity of the individual to whom the data applies.

1.8.3 Reports to Staff Members

Dose records are available to all staff members on an individual basis. The Dosimetry Unit provides dose records to terminated employees when the data are available and evaluated, or within 30 days of termination or request, whichever is longer.

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The Dosimetry Unit provides each staff member with an annual statement showing a summary of their TEDE and total organ dose equivalent. The Dosimetry Unit also provides staff members with a summary of their CEDE from his or her involvement in an occurrence.

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2.0 Control of Dose

2.1 Introduction

The requirements in this section provide a basis for controlling personnel doses. They will help reduce the chance of any person accidentally exceeding the dose equivalent limits. They will also help maintain personnel doses ALARA. Also see Section 8.0, “ALARA”.

2.2 Responsibilities

Site RSO

The Site RSO shall:

- Maintain a knowledge of radioactive materials, equipment, and radiological conditions in BCLDP facilities that have a potential for personnel doses.
- Review radiological hazards involving radionuclides.
- Advise management of methods that may reduce personnel exposure to radiation.
- Prepare and supply RWPs.
- Aid in setting any restrictions on radiation dose required for health purposes.
- Perform the necessary evaluation to determine the adequacy of the respiratory protection and air sampling programs.
- Provide standards and technical information to maintain the adequacy of internal dose controls.
- Determine the airborne and surface contamination status of work locations throughout BCLDP facilities.
- Define requirements for wearing protective clothing and respiratory protection equipment.

Line Managers

Line managers must:

- Plan and control activities of staff members so individual doses do not exceed BCLDP controls. Ensure that staff members maintain their doses ALARA.
- Ensure staff members know and follow procedures established to control internal doses.
- Promote radiation protection policies and procedures.
- Prepare work instructions for requesting new RWPs and provide to the Site RSO.

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Staff Members

Staff members are obligated to:

- Know the radiation levels in individual work areas. Conduct activities to maintain personal doses ALARA.
- Be aware of dose status to ensure it does not exceed BCLDP operating controls.
- Know and follow procedures for controlling internal dose, as described in this section and in the applicable RWPs.
- Report any potential or actual doses to line managers and the Site RSO.

2.3 Control of Dose During Operations

Line managers shall impose restrictions during individual job operations to help keep doses within BCLDP's dose limits. Line managers shall control work time, as necessary, to ensure that doses do not exceed the BCLDP controls in Section 1.0.

Routine working conditions at Battelle that may cause an individual to incur a radiation dose of less than 100 millirem TEDE per calendar year may not require dosimetry.

Control of work that is likely to subject an individual to exposures equal to or greater than 100 millirem TEDE per calendar year shall be accomplished by:

- Establishing radiological standards and responsibilities
- Using line managers, the RFOM and/or the Site RSO to monitor performance of radiological work
- Training workers in recognition of radiation hazards and their responsibility to prevent their occurrence
- Providing personnel with radiation protection procedures and/or RWPs that include the radiological protection measures and controls necessary for safe completion of the job
- Performing mock-ups and/or dry runs of new or significantly modified radionuclide handling procedures.

The Site RSO should not initiate work in areas that may subject members of the general population to exposures equal to or greater than 100 millirem per year TEDE.

An RWP shall be prepared for all routine uses and non-routine operations in radiological areas in accordance with the approved BCLDP procedure. The RWP for a job shall specify the need for surveillance of dose levels during work in the radiation area.

Note: For the purposes of this Plan, the term "non-routine" refers to radiological operations not covered by an existing procedure.

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2.4 Control of Dose Due to "Hot Particles"

Dose to the skin from a "point" particle or a particle of unknown size but less than 1 mm in diameter must be limited to 10^{10} beta particles emitted from the radionuclides contained in the particle. For the case where 1 beta particle is emitted per disintegration, this limit may be expressed as 10 GBq-s or 75 µCi-hr.

The BCLDP hot particle control program is based upon the guidance described in NCRP Report Number 106 and proven programs from the commercial nuclear power industry. Potential "Hot Particle" areas will be identified and assessed. Appropriate control measures will be incorporated into work documents to minimize personnel doses and support the ALARA program.

2.5 Protection Against Airborne Radioactivity

BCLDP shall prevent internal deposition of radionuclides as much as practical by using engineered controls (e.g., confinement, ventilation, reduce surface contamination). In addition, line managers shall use administrative radiological controls to prevent airborne radioactivity in work areas. The BCLDP respiratory protection program is consistent with Regulatory Guide 8.15. Respiratory protection plans and procedures are included in Volumes II and IV of the *Health Physics Procedures Manual.*

2.5.1 Respiratory Protection Equipment

This subsection contains requirements for use of respirators with radioactive materials. It also provides specific information pertinent to respirators commonly used for radiation protection purposes.

2.5.1.1 Respirator Protection Factors

Respiratory protection factors shall be assigned as described in 10 CFR 20.1001-20.2402, Appendix A.

2.5.1.2 Use of Respiratory Protection Equipment

All facepiece-type respirators, including PAPRs and supplied air, shall be NIOSH-approved and require a quantitative facepiece fit. Bubble hoods do not require a quantitative fit.

Individuals shall *not* use half-mask type respirators for any work with radioactive materials that requires respiratory protection.

The Site RSO shall determine the type of respiratory protection needed and assign them using an RWP along with specifying the requirements for using respiratory protection equipment before or during radiation work. Either potential or actual contamination may be the basis for the requirements.

Individuals may use only approved respirators. Individuals may not reuse respirators (i.e., one time use) until they have been cleaned, inspected, and reissued.

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Workers should not wear negative pressure respirators for more than 3 hours in one session, or 6 hours in one day. Stay times will be evaluated by industrial safety staff.

2.5.1.3 Respirator Use Responsibilities

Line managers are responsible for ensuring their staff members are qualified to use respiratory protection equipment. Qualified staff shall have a quantitative respirator fit, training, and medical clearance. Line managers must be sure unqualified staff members do not enter areas that require respiratory protection.

Individual users shall perform a qualitative fit test of the respirator facepiece to ensure a proper seal prior to each use. They must perform this check before entering an area requiring the respirator. The individual shall not enter an area requiring respirators without a proper seal.

2.6 Workplace Air Sampling and Monitoring Program

The air sampling and monitoring program for the workplace provides the primary means of assigning internal dose consistent with Regulatory Guide 8.25, Rev 1, NUREG 1400, and at a minimum, should fulfill the following criteria:

- Warn personnel of an accidental or unexpected release of radioactive material.
- Provide data on the continued effectiveness or deterioration of containment mechanisms and procedures.
- Provide an indication of the need for follow-up bioassay measurements.
- Provide permanent data on the radiological conditions in the workplace.

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RSO shall use data from air monitoring to assess the control of airborne radioactive material in the workplace as well as using the data to determine the dose equivalent to radiation workers.

All air filter media used to sample the work place (e.g., room samplers, grab samples) shall be analyzed and the data recorded for permanent record purposes.

2.6.1 Room Air Samples

The room air samplers function as a measure of process control. They also provide a tool to check containment adequacy.

2.6.1.1 Locations for Room Air Samplers

As a rule, room air samplers shall be located to maximize the chance of detection of airborne contamination. Room air samplers shall monitor each routinely occupied area where significant potential exists for radioactive releases into the workplace air.

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The following shall be considered when determining the number of room air samplers required for each work area:

- The number of potential sources for a radionuclide release and the size of the potential source term
- The number of normally occupied work stations within the area
- The air flow patterns and potential for significant changes in normal air flow
- The chance of containment/confinement failure.

2.6.1.2 Criteria for Room Air Samplers

Each sampler shall have a stationary air flow rate measuring device, and the flow rate shall be verified at least once each 6 months using a calibrated flow rate measuring device.

2.6.2 Personal Air Monitoring

Personal air monitoring, if used for internal dose assessment, shall include provision for the following:

- Samples taken in a work location occupied by a worker should be drawn representative of worker's breathing zone.
- The sampling methodology shall not fractionate by particle size or in other ways distort the physical and chemical properties of the airborne radioactive constituents.
- Airborne radioactivity shall be collected with an air pump connected to a filter cartridge.
- Filters may be submitted to an analytical laboratory or counted in-house for determination of retained radioactivity.

A formal investigation shall be performed by the Site RSO if any personal monitoring result varies from those that would be expected.

2.7 Protection from Surface Contamination

Surface contamination must be controlled to reduce unnecessary external and internal dose to staff members. The primary concern is to avoid internal dose. Internal dose can occur from the intake of radioactive material by inhalation, ingestion, or absorption through the skin. An additional concern is to prevent skin and clothing contamination. Personnel shall not smoke (or use other tobacco products), eat, or drink in contaminated or potentially contaminated radiological areas. BCLDP believes that controlling contamination and access to contaminated areas leads to less need for protective clothing, reduced waste generation, and enhanced access to all project areas.

2.7.1 Protective Clothing Requirements

The Site RSO shall prescribe the protective clothing for personnel entering locations with surface contamination areas. Individuals shall use the clothing prescribed in the RWP.

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2.7.1.1 General Requirements

- Staff members shall control protective clothing throughout its life as potentially contaminated equipment.
- Personnel shall not wear protective clothing in uncontrolled areas without the approval of the Site RSO.
- Each person entering a posted contaminated area shall wear the protective clothing specified in the RWP.

2.7.1.2 Radioactively Contaminated Laundry Requirements

- Normally, individuals should use freshly laundered protective clothing. Individuals should inspect the clothing and segregate damaged items for repair or disposal. Contamination limits for nuclear laundry facility will be established in procedure.
- Staff members shall segregate protective apparel as required by the laundry before returning for cleaning.
- If protective apparel does not meet the laundry criteria, staff members shall dispose of the laundry as radioactively contaminated waste.

2.7.2 Skin Breaks

Personnel with skin breaks will not be allowed to work in contaminated areas without prior evaluation by the Site RSO.

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3.0 Control of Visitor Dose

3.1 Introduction

A visitor is any individual entering BCLDP hazardous materials facilities or areas who is not familiar with the potential hazards. Visitors are classified as trained visitors, observers, or casual visitors. The classification depends on the nature of the visits and the potential dose from ionizing radiation. This section describes the criteria to be followed in classifying and identifying visitors and applying the dose limits. It also specifies radiation protection methods for visitors.

3.2 Responsibilities

Site RSO

The Site RSO shall:

- Identify any special precautions and controls appropriate in the facility or area while visitors are present and advise line managers or the appointed escort of the controls.

Dosimetry Unit

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The Dosimetry Unit shall:

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- Maintain records of the dose received by each visitor.
- Prepare reports of visitors' doses during their visits.
- Provide visitors with the dosimeters required for entry into BCLDP-controlled facilities or areas.

Line Managers

Line managers shall:

- Be aware of the presence of visitors in the facility or area.
- Ensure that visitors wear the dosimeters that were issued to them.
- Notify the Site RSO in advance of the time when the visitor must enter a controlled area.
- Provide an escort for visitors, as required.
- Limit the visitor's access or the work to ensure that the visitor's dose does not exceed limits.

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Staff Members

Staff members shall:

- Report immediately to the Site RSO any possible deviation from the established limits or possible contamination of the visitor.
- Ensure that visitor compliance with the facility or area management and ES&H instructions is maintained.
- Collect visitors' BCLDP-issued dosimeters when visitors leave the BCLDP-controlled facilities or areas and return them to the Dosimetry Unit.

3.3 Trained Visitors

Trained visitors are business visitors with verified radiation safety training who are not employees of Battelle. These visitors may be allowed to enter a controlled area as non-escorted observers and are required to take the same training offered to occupational workers. The Dosimetry Unit maintains dose records for trained visitors. Line managers shall limit the planned dose of these visiting persons to:

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- TEDE - 50 mrem/visit but not more than 100 mrem/yr for those without dose records
- Trained visitors with dose records will be treated as radiation workers in accordance with Section 2.3.

Planned dose above these limits requires approval from the visitor's employer. If a trained visitor's employer specifies in writing controls more restrictive than the above, the Site RSO shall apply the more restrictive controls.

Each trained visitor is required to have proper dosimetry before entering a BCLDP-controlled facility or area.

Line managers shall provide the Dosimetry Unit and the Site RSO with the following information for each trained visitor:

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- Visitor's name (first name, middle initial, last name)
- Visitor's social security number (or equivalent)
- Name and address of employer
- Beginning and ending date of visit
- Name of person visited (or escort).

3.4 Casual Visitors

Casual visitors are those persons who visit BCLDP-controlled facilities or areas escorted or as part of a tour. They will be escorted by a radiation worker the entire time they are in a controlled area. The escort shall be familiar with the radiation protection requirements for that radiological

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area. This staff member shall ensure that the visitors meet all protection requirements applicable to that radiological area.

Line managers shall ensure that a casual visitor's dose during a tour of BCLDP-controlled facilities or areas does not exceed 10 mrem/day, not to exceed 100 mrem/yr. BCLDP line managers shall notify, in writing, the Site RSO and the Dosimetry Unit about a tour or visit. Line managers shall supply the following information:

- Date, time, and duration of the planned visit
- The purpose of the visit and the identification and address of the visiting group
- Name and social security number (or equivalent) of each visitor
- Route of the visit, including building numbers
- Name and payroll number of escort.

The Dosimetry Unit will assign personnel dosimeters to cover about 10% of the casual visitors in a group. A minimum of two visitors in each group shall have a dosimeter. If a visitor will not remain in the assigned group, the Dosimetry Unit will assign a dosimeter to all individuals. The Dosimetry Unit will apply any positive dosimeter results to each group member not assigned a dosimeter.

On leaving a radiological or controlled area, a health physics technician shall survey each visitor's personal items. If the health physics technician detects contamination, he or she shall contact the Site RSO and line managers immediately. All visitors shall exit through a portal monitor.

If there is evidence of surface contamination, airborne activity, or abnormal external dose before, during, or after the visit, line managers shall contact the Site RSO immediately.

3.5 Report of Radiation Doses to Visitors

BCLDP shall maintain a record of the dose received during each visit by a trained or casual visitor. The Dosimetry Unit shall report TEDE >50 mrem to the visitors or their employer within 30 days of the determination of the dose. Other notifications may be made, depending upon the dose, in accordance with BCLDP and Battelle policies and procedures.

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4.0 Occupational Dose Measurement and Evaluation

4.1 Introduction

BCLDP maintains external and internal dosimetry programs to ensure an accurate evaluation of radiation doses. These programs provide quantitative and timely dose information and demonstrate compliance with applicable limits. This section describes the basic methods and requirements for detecting and measuring the external and internal doses of BCLDP staff members.

4.2 Responsibilities

Site RSO

The Site RSO shall:

- Provide radiation measurement information that will permit evaluation of doses that personnel dosimeters cannot measure.
- Provide the technical evaluation and guidance to limit the staff member's work as a result of internal deposition of radionuclides.
- Provide dose measurement information for short-term control of personnel external dose.
- Provide monitoring data on radiation occurrences and routine work environments to aid in the evaluation of internal and external dose.
- Record the occupational dose of staff members.
- Identify staff members who require bioassay measurements.
- Set up the minimum external and internal dosimetry requirements for staff members and visitors.
- Perform the necessary evaluations to determine the adequacy of the external and internal dosimetry programs.
- Approve secondary dosimeter methodology and measurements used to supplement individually assigned dosimeters.
- Periodically review records to ensure proper assignments of personnel dosimeters, dosimeter holders, and bioassay measurements.
- Inform line managers of appropriate bioassay measurements for staff members who are terminating.
- Schedule staff who require bioassay measurements.
- Determine occupational radiation dose equivalent received and issue reports.
- Set up calibration and dosimetry methods by which BCLDP will measure the occupational radiation dose of staff members.
- Provide guidance on bioassay measurements and frequency.

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- Notify line managers when staff members are restricted from working in radiological areas if they are not in compliance with dose monitoring requirements (bioassay, dosimeter assignment).

Health Services (Medical) Department

Health Services shall:

- Share and exchange data with Health Physics and Dosimetry as required.

Line Managers

Line managers shall:

- Ensure appropriate bioassay measurements are completed before assigning staff members to work with radioactive materials. Ensure staff members also receive appropriate measurements if internal dose conditions (for example, radionuclide type or form) change.
- Ensure that staff members are available for bioassay measurements, and submit samples as required.
- Implement special dose controls for those staff members whose dose is approaching quarterly or annual controls. This includes those who will be performing radiological area work at offsite facilities.
- Ensure that staff members receive and wear current dosimeters and appropriate holders.
- Ensure that staff members exchange personnel dosimeters on the dates scheduled by the Dosimetry Unit.
- When notified by the Site RSO, restrict staff members from working in radiological areas if they are not in compliance with dose monitoring requirements (bioassay, dosimeter assignment).
- Contact the Site RSO when a staff member receives diagnostic or therapeutic radioactive materials.

Staff Members

Staff members shall:

- Always wear the assigned personnel dosimeter during working hours in designated, posted areas, whether working in assigned BCLDP facilities or entering other Battelle facilities.
- Participate in scheduled bioassay measurements.
- Contact line managers if physician dispenses diagnostic or therapeutic radioactive materials. Provide the Site RSO with a note from the physician stating the type and quantity of material dispensed.

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4.3 Measurements of External Dose

4.3.1 Dosimetry

The Dosimetry Unit uses the individually assigned dosimeters as the primary technique to determine the dose from external sources. Dosimeter types include beta/photon, beta/photon/neutron, and finger ring.

The vendor for the BCLDP personnel dosimetry program shall be accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

Individual dosimetry records will be reviewed by the Dosimetry Unit and Site RSO to ensure that doses appear to be reasonable. A dosimetry investigation shall be performed by the Site RSO if a personnel dosimeter shows an unexpected exposure or if it is lost.

Dosimeter deployment duration shall be selected in conjunction with dosimeter detection capabilities to ensure identification of doses above specified limits.

4.3.2 Assignment of Personnel Dosimeters

The following requirements apply to the assignment of personnel dosimeters.

All employees with the potential to exceed 100 millirem DDE within the calendar year shall be assigned a personnel dosimeter. The Dosimetry Unit will make personnel dosimeter assignments based on the potential of an individual receiving a dose during entry into radiological areas.

The Dosimetry Unit may change a staff member's dosimeter assignment during the year. The Site RSO and line managers must review and approve the assignment change.

The Dosimetry Unit shall assign an extremity dosimeter to a staff member in accordance with the requirements of the RWP.

4.3.3 Requirements for Wearing Dosimeters

Staff members shall wear assigned dosimeters according to the following:

The dosimeter shall be at or above the waist and at the front of the body. The face of the badge shall be away from the body. Ring dosimeters shall be oriented to increase the response of the dosimeter to the radiation source.

Individuals shall inform line managers immediately of dosimeter problems. Examples of problems include suspected or known mistreatment, contamination, loss, or damage. Health physics shall be promptly informed of any instance where individuals perform radiation work without the required dosimetry.

Beta/photon, beta/photon/neutron, and finger ring dosimeters are reliable when given reasonable care. However, the results may be erroneous if the thermoluminescent material is exposed to

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excessive light or heat. Similarly, a pocket ion chamber (PIC) may lose its charge if opened, severely jarred, or immersed in liquids. Individuals must take care to avoid subjecting dosimeters to such abuse.

Staff members shall not allow dosimeters to receive radiation dose as a result of medical or dental procedures or any other non-occupational dose.

Individuals should make every reasonable effort to prevent contamination of dosimeters. In areas requiring two layers of protective clothing, individuals should wear the dosimeter on the inner layer. If the dosimeter is worn on the outer layer, individuals should enclose it in a plastic bag.

Staff members should not take assigned dosimeters home. Staff members shall not place dosimeters near sources of radiation or in locations with unusually high temperatures (>140°F). Normally, staff members shall not use assigned dosimeters offsite. See Section 1.0 for use of dosimeters specifically assigned for offsite use.

Where required, staff members shall wear PICs on the front of the body at or above the waist. The dosimeter shall be read by the staff member before entering and after exiting their work area at a minimum and more frequently if the dose levels require it.

4.3.4 Estimation of Dose Equivalent

Under certain circumstances, estimates must be made of personnel doses, in lieu of an actual dosimeter measurement. It is assumed that the individual received the dose measured by an assigned dosimeter unless an evaluation shows the result is invalid, or if an assigned dosimeter result is lost.

The Site RSO shall use industry-accepted methods to estimate the dose and shall complete a written estimate of that dose.

Line managers shall ensure that involved staff members are told of any changes to reported doses. Staff members should acknowledge changes by signature. BCLDP will make the change regardless of whether the staff member signs, and note the lack of acknowledgement on the change document.

4.4 Measurement of Internal Dose

All employees with the potential to exceed 100 millirem CEDE from internal sources within the calendar year shall participate in a routine internal radiation monitoring program. The BCLDP internal monitoring program is consistent with Regulatory Guide 8.9.

The routine internal radiation monitoring program shall consist of:

- Personal air monitoring (e.g., breathing zone sampling)
- Direct bioassay sampling on a baseline, routine or special schedule to be determined by the Site RSO

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- Indirect bioassay sampling at the beginning and end of employment and on a planned and periodic basis thereafter; or
- A combination of air monitoring, direct bioassay and indirect bioassay.

BCLDP uses field measurements to assign worker dose. Examples of these field measurements may include workplace air sampling, nasal smears, and contamination surveys.

BCLDP may use indirect bioassay measurements, including *in vivo* measurements, urinalysis, and fecal analyses for radionuclides to confirm and assess internal doses.

Staff members shall provide samples for bioassay within 1 month of the originally scheduled date. Line managers shall restrict staff members overdue for sample submission from entering radiological areas.

4.4.1 Initial Bioassay

Line managers shall ensure that staff members receive an initial bioassay measurement, as specified by the Dosimetry Unit, *before* qualifying them as radiation workers. Individuals must also receive a bioassay measurement before line managers may allow them to work with unsealed radioactive materials.

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4.4.2 Routing Evaluation

Line managers shall ensure that staff members receive a periodic bioassay, as required. The Site RSO shall review and approve the bioassay program chosen for BCLDP staff members.

Routine monitoring for intakes by inhalation determined by indirect bioassay shall be performed at a frequency that is appropriate for the methodology used, sufficiently sensitive to meet an applicable performance criterion and as deemed appropriate by the Site RSO.

4.4.3 Special Bioassay

Special bioassay monitoring may be performed whenever an administrative limit may have been exceeded, a nasal smear reveals the presence of detectable radioactivity, or the Site RSO deems it appropriate. The Site RSO will determine if staff members involved in an off-normal event require special bioassay measurements.

Special bioassay measurements may be performed at the request of a staff member.

4.4.4 Final Bioassay

BCLDP shall schedule staff members for a final bioassay measurement based on the following:

- Staff members who are reassigned so they do not work with radioactive materials shall receive a final bioassay measurement at the time of transfer.
- All terminating staff members who are radiation workers shall submit a bioassay sample within 1 week of termination.

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5.0 Control of Access to Sources of Radiation

5.1 Introduction

This section describes the methods used to identify those areas where radiation protection controls are required and ensure that radiation protection controls are communicated to staff members.

5.2 Responsibilities

Site RSO

The Site RSO shall:

- Monitor personnel dose conditions including radiation dose rates and surface contamination and airborne radioactivity levels.
- Establish radiologically controlled areas.
- Assist line managers in minimizing the levels of radiation and contamination dose to personnel.
- Specify the radiation protection requirements or restrictions for keeping personnel doses at or below operational controls and ALARA.
- Prepare RWPs.
- Establish procedures to control radiation work in and personnel access to radiological areas.
- Require that current RWPs and operating procedures be available, posted, and followed.
- Provide and maintain supplies of required radiological protective equipment.
- Require that staff members entering a radiological area be aware of the significance of the area. Ensure staff members know they are responsible for following the requirements of the applicable RWP.
- Maintain personnel doses at or below operational controls and ALARA.

Staff Members

Staff members shall:

- Attend radiation worker training as required for entry into radiological areas.
- Follow the requirements of the applicable RWP.
- Exercise reasonable care in the performance of work.
- Inform management and Site RSO of any failure of control procedures or protective equipment.
- Maintain personal dose at or below occupational controls and ALARA.

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5.3 Area Designations

The potential for both external and internal dose is the basis for radiological area designations. Areas of external dose designations include radiation area, high-radiation area, or very high-radiation area. Areas containing radioactive material or with internal dose potential will identify the dose source. Those identifiers include radioactive material, airborne radioactive material, and surface contamination. Implementing procedures may typically set posting limits lower than those indicated in this document. The application of posting limits and common area designation practices may be determined by senior radiation protection staff within the guidelines established here.

5.3.1 Uncontrolled Area

An uncontrolled area is any area not within a radiologically controlled area.

The DDE in uncontrolled areas shall be less than 2 mrem in one hour, not to exceed 100 mrem in one year.

Radioactive materials are not permitted in uncontrolled areas unless packaged according to the requirements of *49 CFR 100-177*.

5.3.2 Controlled Areas

A controlled area designation is used to protect individuals by controlling exposure to radiation and access to radioactive materials.

The Site RSO shall establish a controlled area when any of the following conditions exist:

- It is adjacent to a radiological area and could become contaminated by accidental spreads or releases from the radiological area
- It may occasionally contain radioactive material due to the transportation of radionuclides between radiological areas
- The anticipated whole-body dose equivalent rate exceeds 2 mrem in one hour or 100 mrem in one year.

5.3.3 Radiological Areas

A radiological area is any area within a controlled area where any of the following conditions exist:

- An individual can receive a dose equivalent greater than 2 mrem in one hour at 30 cm from the radiation source or any surface through which the radiation penetrates
- Airborne radioactive concentrations greater than 1/10 of the DACs are present

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- Loose surface contamination levels are greater than those specified Regulatory Guide 1.86
- An individual could receive a dose equivalent exceeding 100 mrem in 1 year during normal occupancy.

The Site RSO uses the following external dose potential criteria to classify radiological areas within a controlled area. In addition to the radiological area designation, the source of the radiation (radioactive material, surface contamination, or airborne radioactivity) is included in the posting of an area.

Radiation area - any location where an individual can receive a dose equivalent greater than 5 mrem but less than 100 mrem in one hour at 30 cm from the radiation source or from any surface through which the radiation penetrates.

High-radiation area - any location where an individual can receive a dose equivalent of 100 mrem or greater at 30 cm but less than 500 rad in one hour at 1 meter from the radiation source or from any surface through which the radiation penetrates.

Very high-radiation area - any location where an individual can receive a dose equivalent of 500 rad or greater in one hour at 1 meter from the radiation source or from any surface through which the radiation penetrates.

5.4 Access to Radiological Areas

All radiological areas shall have access control consistent with the degree of hazard.

5.4.1 General Access Requirements

Permanent radiological areas require walls, fences, or some other means consistent with 10CFR20 to prevent access other than through the normal entrances.

Contaminated areas where a high potential for spread of contamination exists require a step-off pad at the entrance. The applicable RWP instructs staff members as to the type of protective clothing required.

5.4.2 Access Requirements for High- and Very High-Radiation Areas

High- and very high-radiation areas require at least one of the following:

- Entrance or access point with a control device that 1) functions automatically to prevent entry when a high- or very high-radiation area exists, 2) permits entry only after the radiation level is reduced below 0.1 rem/hr, and 3) prevents use or operation of the radiation source, thereby preventing the existence of a high- or very high-radiation area while an individual is in the area
- A control device that energizes a conspicuous visible alarm signal so that the individual entering the area is aware of the radiation level and the Site RSO is made aware of the

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entry (administrative procedures shall define the required actions of personnel to activated alarms)

- Locked entry ways, except during periods when access to the area is required, with positive control over and radiation surveys made for the initial entry and periodically as necessary
- Control devices that will automatically generate audible and visible alarm signals to alert staff members in the area before use or operation of the radiation source and in enough time to permit evacuation of the area or activation of a secondary control device that will prevent use or operation of the source.

Transient conditions within a radiation area resulting in dose rates greater than 100 mrem/hr at 30 cm from the radiation source shall require placing a suitable barrier around the area and posting the area as high- or very high-radiation area, as appropriate. The area shall not be left unattended unless the access door(s) are locked and posted as restricted access. If access cannot be locked, line managers responsible for the area shall provide continuous surveillance, or other means, to prevent unauthorized entry to the area. Transient conditions shall not exceed an 8-hour period.

Refer to BCLDP procedure HP-AP-17.0, *Human Entry Into Hot Cells*, for more detailed information regarding such entries.

5.5 Posting and Labeling

The signs described in this section meet radiological posting requirements. Other signs used for special applications require the approval of the Site RSO.

5.5.1 General Posting and Labeling Requirements

The purpose of radiological posting and labeling is to identify the actual or potential presence of radiation or radioactivity. Postings are in accordance with 10 CFR 20.1901 and 20.1902. Any other radiological signs or tags shall be approved by the Site RSO.

The Site RSO shall direct all radiological posting. Posted signs shall be clearly visible to personnel entering a radiological area.

Movement or removal of posted radiological signs by personnel other than Site RSO staff members is not permitted. Staff members may remove tags from empty uncontaminated containers. (If the container is removed from a radiological area, a health physics technician shall release the container.)

Posting of areas defined by a chain or radiation rope shall be visible from any reasonable avenue of approach.

Radiological postings require the use of a radiation symbol (trefoil) that conforms to ANSI standard N2.1-1969. The background color for radiological signs shall be yellow, the symbol color shall be magenta, and lettering shall be magenta or black.

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5.5.2 Posting for Airborne Radioactive Material

Access to any area where airborne radioactive material concentrations greater than 1/10 of the DAC are present shall be clearly and conspicuously posted with a sign that identifies the radiological conditions that exist (e.g., “Airborne Radioactivity”).

5.5.3 Posting for Contaminated Area

Access to contaminated areas shall be clearly and conspicuously posted with a sign that identifies the radiological conditions that exist (e.g., “Contaminated Area”).

5.6 Radiation Work Permit

This subsection provides requirements for RWPs and describes how staff members can obtain an RWP. BCLDP procedure HP-AP-1.0, *Issue and Use of Radiation Work Permits*, implements the requirements for requesting, preparing, reviewing, approving, issuing, using, and retiring RWPs. It is based on the following criteria.

5.6.1 General RWP Requirements

Staff members shall not enter a radiological area unless a current RWP is available and entry is allowed. In case of accident or emergency conditions, emergency procedures control personnel access to sources of radiation. Visitors shall enter a radiological area only under the conditions described in Section 3.0.

All work in a radiological area shall be performed under the provisions of an RWP.

The Site RSO forwards the original of all RWPs to Project Records in accordance with the applicable BCLDP procedures.

All current RWPs are available at the work site. The location of RWPs shall be such that staff members are not required to enter the radiological area to determine the requirements of the RWP.

5.6.2 Obtaining an RWP

Line managers are responsible for obtaining RWPs and initiating the request for an RWP.

5.6.3 RWP Content

The RWP shall contain the following information:

- RWP and Work Instruction numbers
- The estimated time period covered by the RWP
- Specific work location(s)
- Description of the nature, worker requirements, and extent of the work authorized

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- Radiological limits, health physics requirements, protective equipment requirements, and any special instructions
- Additional ALARA requirements
- The signatures of the Site RSO and the project manager.

5.6.4 RWP Review Requirements

The immediate supervisor of staff members performing the work shall also review the requirements and limitations of the RWP.

The Site RSO and line managers shall review each RWP before its void date and shall revise, void, or extend it. RWPs may be revised only one time.

5.7 Radiation Protection Coverage

Line managers shall require an additional person to be present during work that presents a significant hazard potential to a worker. That second staff member shall stay close to the work area to help the worker if emergency assistance is required. This requirement is even more important during off-shift hours when the normal building occupants are not present.

If the hazardous work is with radioactive material, BCLDP policy requires radiation monitoring coverage by a health physics technician; i.e., a health physics technician is available near or at the work area to provide any needed radiation monitoring. Health physics technicians shall meet the requirements of ANSI 3.1. Line managers shall request this monitoring for work during both regular and off-shift hours.

The health physics technician can provide the second-person coverage for other potential emergency assistance besides radiation monitoring. Both the health physics technician and the worker shall agree that the health physics technician will perform both functions before starting the work.

If a significant personnel hazard does not exist, the work may not require either radiation monitoring or second-person coverage; however, line managers and the Site RSO shall agree in advance that the work does not need radiation monitoring.

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6.0 Control of Radioactive Material

6.1 Introduction

Staff members may use or store radioactive material only in radiological areas. The radioactive material may leave these areas only under specific procedures that provide for safety and accountability.

6.2 Responsibilities

Site RSO

The Site RSO shall:

- Ensure that a health physics technician surveys and releases all items leaving BCLDP controlled areas.
- Maintain a surveillance program that shows the radiological status of materials, equipment, and facilities.
- Advise operating management of the controls appropriate for radioactive or contaminated items.
- Provide radiation release surveys.
- Include additions and disposals of sources in the inventory records.
- Arrange for leak testing of sealed sources within the required time frame.
- Notify line managers of any missing source.
- Designate BCLDP release program evaluators.

Line Managers

Line managers shall:

- Know the types and quantities of radioactive or contaminated material and equipment present within the facility.
- Limit the introduction of new radioactive material into facilities except with the explicit approval of the Site RSO.

Staff Members

Staff members shall:

- Know and follow procedures for maintaining contamination control and maintaining radiation doses ALARA.
- Follow the provisions of applicable RWPs.

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- Inform management of deficiencies in or violations of control procedures.
- Contact the Site RSO promptly upon receipt of radioactive material (see Section 6.8).

6.3 Definitions

Radioactive material - is any material or combination of materials that spontaneously emit ionizing radiation.

Radioactive source **-** any item containing radioactive material used exclusively for its emitted radiation and which retains its physical form and configuration during use.

Sealed source - a radioactive source sealed in a capsule or having a bonded cover; the capsule or cover being strong enough to prevent contact with or dispersion of the radioactive material under normal conditions of use.

Unsealed source - a radioactive source containing radioactive material attached to a surface or embedded in a matrix of non-radioactive material (any source not fully meeting the definition of a sealed source).

Until released by an evaluator, items or materials in a radiological area are considered as potentially contaminated. An applicable RWP shall specify any exceptions.

6.4 Control of Radioactive Contamination

Staff members must control radioactive or contaminated items to prevent an accidental spread of radioactive material.

6.4.1 General Criteria

Staff members should limit the materials taken into radiological areas to those amounts necessary to accomplish the work assigned. They should adequately shield waste or other radioactive material stored in radiological areas normally occupied by personnel.

RWPs shall normally specify controls on the quantities of radioactive material allowed in radiological areas. There are not sufficient quantities of fissionable material in BCLDP to require criticality controls.

6.4.2 Ventilation Systems

Intake ventilation systems shall be provided with either HEPA filtration or fail-safe backflow prevention to minimize the chance of release of particulates through the inlet path.

All exhaust ventilation HEPA filters required for preventing environmental releases or releases to occupied areas require testing. Personnel shall perform the test immediately after placement, and at least annually, using a cold aerosol testing procedure. Each HEPA filter or filter bank shall be at least 99.95% efficient. The test shall include pressure drop measurements across each filter bank. The testing personnel shall replace a filter when the pressure drop exceeds the

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manufacturer's recommendations or when the filtering efficiency is below 99.95%. HEPA filters used to reduce duct contamination or extend the life of primary filters are exempt from testing. Examples of exempt filters are those located directly within shielded hot cells, hoods, or gloveboxes.

6.4.3 Vacuum Cleaners

Unless approved by health physics supervision, vacuum cleaners used in radiological areas shall have a HEPA-filtered exhaust. Vacuum cleaners shall be labeled radioactive materials and be used only for radioactive constituents. The HEPA filter shall be aerosol-tested in place and be at least 99.95% efficient before placing the vacuum cleaner in service. The equipment custodian shall have the filter re-tested annually. Any seal disturbance also requires re-testing.

6.4.4 Radioactive Sources

All new sealed sources must be evaluated against the performance requirements specified in ANSI standard N542. The BCO RSO must approve any deviation in writing.

Sealed sources and/or holders must be permanently marked to permit individual source identification. Source identification shall consist of:

- Unique source identification number
- Material type (radionuclide, material form)
- Activity and date of assay.

6.4.4.1 Leak Test Requirements

The Site RSO is responsible for maintenance of sealed source inventories and performance of leak tests. The leak test /inventory program extends to all eligible sources possessed by BCLDP, including those used at temporary job sites. The program for leak testing adheres to the guidance provided in NRC Regulatory Guide 10.8, Proposed Rev. 2, 1985, Appendix H, and ICRP 25. In addition, leak testing is conducted as specified in communication between Battelle and NRC entitled, "License Condition for Leak Testing Sealed Byproduct Material Sources," dated April 1993, and "License Condition for Leak Testing Sealed Plutonium Sources", dated April 1993, with NRC relief deviations as specified below:

- Sealed Sources and detector cells shall be tested for leakage and/or contamination at intervals not to exceed 6 months or at such intervals as specified by the certificate of registration referred to in 10 CFR 32.210.
- Not withstanding Bullet 1 above, sealed sources designed to emit alpha particles shall be leak tested for leakage and/or contamination at intervals not to exceed 3 months.
- In the absence of a certificate from a transferor indicating that a leak test has been made within 6 months prior to transfer, a sealed source received from another person will not be put into use until tested.

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- Each sealed source fabricated by the licensee shall be inspected and tested for construction defects, leakage, and contamination prior to any use or transfer as a sealed source.
- Sealed sources need not be tested if:
  a. They contain only hydrogen-3; or
  b. They contain only a radioactive gas; or
  c. The half-life of the isotope is 30 days or less; or
  d. They contain not more than 100 microcuries of beta and/or gamma emitting material or not more than 10 microcuries of alpha emitting material; or
  e. They are not designed to emit alpha particles, are in storage, and are not being used. However, when they are removed from storage for use or transferred to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source or detector cell shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

The leak test shall be capable of detecting the presence of 0.005 microcuries of radioactive material on the test sample. If the test reveals the presence of 0.005 microcuries or more of removable contamination, a report shall be filed with the NRC in accordance with 10 CFR 30.50 (b)(2), and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with NRC regulations. The report shall be filed within 5 days of the date the leak test result is known with the ODH, Bureau of Radiation Protection, should the material be under the jurisdiction of the State of Ohio. The report shall specify the source involved, the test results, and corrective action taken.

Tests for leakage and/or contamination will be performed by Battelle or by other persons specifically licensed by the NRC, ODH or Agreement State to perform such services.

6.4.5 Controlled Items

Certain regulated items may contain contamination on normally inaccessible surfaces. That contamination requires radiological control for inspection or servicing activities. In some cases, the Site RSO may exempt the item from storage and use within a radiological area. The following criteria apply to controlled items:

- The item shall be free of smearable contamination on accessible surfaces.
- The dose rate at any accessible surface shall not exceed 1 mrad/hr beta-gamma.
- Staff members shall identify controlled items using a firmly attached tag or label.

The labeling of these items shall include survey results. The labeling shall also include instructions to prevent removal of the items without the prior approval of the Site RSO. The tag or label shall remain on the items until a health physics technician releases it.

6.5 Covering Over Radioactive Contamination

This section provides requirements and guidelines for covering radioactive contamination.

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6.5.1 Painting Over Contamination

The following general criteria apply to all painting over of radioactive contamination:

- Line managers may not substitute painting of surface contamination in lieu of cost-effective decontamination efforts.
- A health physics technician must survey all potentially contaminated surfaces before painting. The health physics technician shall survey normally accessible surfaces for both smearable and fixed alpha and beta-gamma contamination.
- ALARA Paint is considered a temporary covering or decontamination method and is exempt from these requirements.

6.5.2 Contamination and Approval Levels

Covering over radioactive contamination requires prior written approval of the Site RSO.

6.6 Radiation Release Surveys

This section provides requirements for the two types of radiation release surveys.

6.6.1 Release Survey Exemptions

Release surveys are not required for people leaving BCLDP-controlled areas. The surveys required in Section 6.7 provide acceptable controls. Other specific instances and conditions where the policy does not normally apply include the following:

- Removal of items routinely carried between work and home from a radiologically controlled area (for example, security badges, books, papers, lab notebooks, pens and pencils, hand-held calculators, personal items).

CAUTION: Staff members shall not bring certain personal effects into a radiological area if they will be working with radioactive material.

NOTE: If an individual detects any radioactive contamination on clothing or skin, a health physics technician must perform a survey of personnel and appropriate items.

6.6.2 General Release Survey Requirements

A health physics technician shall survey any item or material being removed from a controlled area. Staff members shall request this survey before they remove items from BCLDP facilities or control.

When performing a controlled area material release survey, a health physics technician must include all accessible surfaces. Detecting radioactive contamination on items being removed from radiological areas is a principal concern; however, BCLDP must also consider that other items could have unknowingly become contaminated. Also, labels identifying contamination may become covered or detached from the item.

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6.6.3 Unconditional Release

An unconditional release means a health physics technician has surveyed all accessible surfaces of the item with appropriate portable instruments and found residual contamination less than the criteria stated in Table 6.1. The criteria in Table 6.1 represent the upper bound for contamination limits. Materials released for unrestricted use per the release criteria will be considered for further decontamination in accordance with ALARA. If the item has inaccessible surfaces, an authorized staff member must also provide an evaluation that shows the item could not be internally contaminated. There are no restrictions placed on the use of unconditionally released items.

It is BCLDP policy that all items leaving BCLDP radiological areas will receive an unconditional release survey, except as described in Section 6.6.1. The Site RSO maintains a routine survey program for all areas under BCLDP control; however, this program in itself cannot provide enough assurance to prevent transfer of contamination to the public. Therefore, this policy applies regardless of the item's current location. Specific examples of when staff members must request an unconditional release include returning items to a vendor and excessing equipment or furniture.

Inaccessible surfaces of equipment may become contaminated even when accessible surfaces are free of contamination. An evaluator may unconditionally release the item only when the design or usage of the equipment removes any chance of interior contamination and all accessible surfaces have been surveyed and found to be free of detectable radioactive contamination. If practical, staff members should dismantle the equipment so a health physics technician can completely survey interior surfaces. Before evaluating an item to be free of contamination, the evaluator should be sure of the following:

- The design of the equipment prevented contamination of the inaccessible surfaces during use.
- If decontaminated in the past, those efforts did not introduce contamination to inaccessible surfaces.

NOTE: The Site RSO may waive the requirement for evaluation for some items being unconditionally released from controlled or uncontrolled areas. This requirement shall only be waived if it is unlikely that the item could be internally contaminated. The waiver shall be in writing. The health physics technician shall attach this waiver to the release survey report instead of the evaluation form. A waiver shall not be used when material historical certification is possible or for items released from radiological areas.

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Table 6.1
Acceptable Surface Contamination Levels For Uncontrolled Release Of Equipment And Materials*

Nuclide[a]	Average[b,d]	Maximum[b,c,e]	Removable[b,c,e]
U-nat. U-235, U-238, and associated decay products	5000 dpm α/100 cm^2	1000 dpm α/100 cm^2	1000 dpm α/100 cm^2
Transuranics. Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat. Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.[f]	5000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1000 dpm $\beta\gamma$/100 cm^2

* Adapted from Regulatory Guide 1.86.

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting reactides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emissions by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contamination should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionately and the entire surface should be wiped.

[f] Release levels for I-125 are in accordance with BCLDP letter to NRC dated September 29, 1997.

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6.7 Radiological Surveys

6.7.1 Personal Effects in Radiological Areas

The Site RSO shall prescribe protective clothing to prevent the contamination of personnel and their effects under normal conditions. The staff member shall make every effort to prevent contamination of personal effects. Staff members shall restrict personal effects to those required in the normal course of work in the radiological area. Examples of required personal effects are underclothing, shoes, socks, prosthetic appliances, and eyeglasses.

Personal clothing may be approved for cold temperature protection when performing work in radiological areas. Individuals should wear this clothing *under* the required protective clothing.

6.7.2 Surveillance and Maintenance (S&M) Surveys

Routine exposure rate surveys, contamination surveys, air monitoring, and other surveillance activities in all controlled areas and selected uncontrolled areas shall be performed in accordance with the following criteria:

- Routinely occupied areas within controlled areas shall be surveyed weekly.
- High traffic areas and contamination control points within and at the boundaries of controlled areas shall be surveyed daily.
- All other areas within controlled areas shall be surveyed at least quarterly.
- Controlled areas in which access is restricted by the use of barriers, guards or locked doors (e.g., high radiation areas) shall be inspected monthly to ensure that the control measures are in place and have not been altered.

  NOTE: A survey is not required to be performed during this inspection.

6.7.2.1 Personnel Surveys

A personnel survey is a comprehensive check of an individual's potentially exposed clothing, personal effects, and body for radioactive contamination. Any individual who works with radioactively contaminated items shall have a personnel survey on completion of the work. The RWP shall specify if any additional surveys are necessary. Qualified radiation workers may perform self-surveys; a health physics technician shall survey all others. Individuals shall perform self-surveys for contamination with the appropriate alpha and beta-gamma detection instruments.

6.7.2.2 Instrumentation/Detection Equipment

Instrumentation used by the BCLDP shall be:

- Of sufficient sensitivity and accuracy to assess radiation exposure levels found in BCLDP areas

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NOTE: Instruments should provide a response in units of exposure or dose rate (e.g., milliRoentgen per hour).

- Able to detect the presence of radioactivity on tools, equipment, clothing, and personnel at all levels typical of those in BCLDP areas

  NOTE: These instruments should provide a response in units of radioactivity (e.g., counts per minute).

- Of sufficient quantity to support on-going or planned operations
- Instrumentation shall be purchased, tested and calibrated by methods that are consistent with ANSI N323A recommendations
- Calibration frequencies for hand-held or portable survey instruments in the active inventory shall be 6 months. Certain types of radiation-related instrumentation (e.g., spectrometers, air monitors) will be calibrated based upon manufacturers specification and in accordance with applicable BCLDP procedures. Calibration and repair records shall be maintained.

6.7.2.3 Personnel Contaminations

A health physics technician shall perform the exit surveys if an off-normal event occurs that may have resulted in personnel contamination. The health physics technician shall also perform the exit surveys if the RWP so specifies.

6.7.3 Personnel Contamination Release Criteria

Line managers shall normally not allow personnel with detectable contamination to eat or go home. Line managers must get the prior approval of the Site RSO before permitting either action.

The Site RSO shall direct all skin decontamination of personnel.

6.8 Purchase and Receipt of Radioactive Material

The purchase, receipt, use, and storage of radioactive sealed sources and standards requires that an approved Radioactive Materials Application (RMA) be in place. This serves as an indication that Battelle is licensed to possess the materials solicited, and that the materials, once received, will be incorporated into the routine surveillance and accountability program.

The Site and BCO RSOs shall be notified of and authorize all radioactive material introduced into the BCLDP, regardless of activity or means of production. All radioactive sources must be authorized for use and/or possession by an approved RMA prior to the procurement, unless approved otherwise by the Site and BCO RSOs. All RMAs must be approved by the RSC. The Site and BCO RSOs may approve RMAs as specified in Battelle's BCO Radiation Safety Manual with the RSC validating approval at the next RSC quarterly meeting.

Procurement includes radioactive materials from any source, i.e., purchase by requisition from a supplier, furnished by the client or donated by other suppliers, transfer within Battelle, or "left-over" from previous work.

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Sources may be shipped and received at the BCLDP with Site and BCO RSO approval, but may not be used without final approval of the RMA. All purchase requisitions, or requests for internal transfer of sources must reference the RMA number and must be approved by the Site and BCO RSO before being processed by Purchasing or before the material is otherwise obtained. This step serves to prevent the ordering and receipt of unauthorized materials. The requested isotopes, quantities and physical and chemical forms are matched to the limits set for a particular approved RMA, as well as license limits. Purchase requisitions must contain a statement requiring the vendor to address the package to "Radiation Safety Officer" and must include the RMA number as part of the address. If Purchasing Agents are unsure if the material is radioactive, they will contact the BCO RSO's office for clarification prior to processing the requisition.

Since all incoming packages of radioactive materials are addressed to the BCO RSO, those packages will be surveyed by health physics staff prior to distribution. After survey results are verified, users are notified for pick-up of packages. Shipping of radioactive material requires a combined effort of the Shipping Department and health physics staff. Procedural guidelines are established to facilitate processing and help maintain adherence to the requirements of U.S. Department of Transportation (DOT), as provided in 49 CFR, for the shipment of radioactive materials.

Individuals shall open all packages in a radiological area having appropriate contamination controls. When the shipper provides unpacking instructions with the shipment, the recipient shall follow the instructions. The recipient shall inform a hazardous material transportation officer of any deficiency. Deficiencies include contamination, leakage, or otherwise not following shipping regulations.

The recipient shall remove or destroy all DOT shipping labels upon emptying the package. Individuals shall dispose of or salvage packaging materials and reusable containers according to standard waste disposal procedures. The health physics technician shall survey reusable shipping containers both internally and externally. If the health physics technician finds contamination, the container shall be either decontaminated or appropriately sealed and labeled. If decontamination of inner surfaces is not practical, the recipient shall be sure external surfaces are free of smearable contamination. After the recipient securely closes the container, the health physics technician shall appropriately label it to show its contamination status.

Radioactive material shall be marked as such to ensure proper handling and storage.

NOTE: Markings may include tags or stickers indicating "Radioactive Materials."

Items identified as radioactive materials shall be maintained in a radioactive material storage area established for this purpose within a controlled area.

6.9 Radioactive Material Storage

This section applies to radioactive and contaminated materials removed from service and stored for possible reuse. It does not cover materials used in performance of day-to-day tasks and materials in transit.

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6.9.1 General Storage Requirements

The following general criteria apply to the storage of all radioactive material:

- Line managers shall keep stored quantities of radioactive or contaminated materials to a minimum. The Site RSO shall review storage locations at least annually. Line managers shall dispose of those items that are no longer needed.
- Line managers having ownership are responsible for radioactive material until it is disposed of or transferred to another owner. The responsible line manager shall provide all necessary manpower, materials, and funding to accomplish any work required for proper storage.

6.9.2 Outside Storage

Radioactively contaminated material may not be stored outside without prior written approval of the Site RSO.

Outside storage of radioactively contaminated material must also follow these requirements:

- The storage must have a current RWP.
- The radioactive material package must withstand the natural elements such as wind, rain, and snow. Packaging shall provide a minimum of two containment barriers unless waived by the Site RSO.
- The Site RSO must post the storage area as a radioactive materials area and other postings as appropriate.
- The Site RSO shall place the area on a routine surveillance program.
- The Site RSO shall periodically review the outside storage with project management for disposal options or relocation to indoor storage.

6.9.3 Radioactive Waste Storage

Radioactive waste may be stored on site or disposed of by one of the following means:

- Transfer to an authorized recipient as provided for in 10 CFR 20.2001.
- Release into the sanitary sewer in conformance with 10 CFR 20.2003 and applicable Battelle Discharge permits. Release according to the provisions of 10 CFR 20.1302
- Any other means specifically approved in advance by the USNRC.
- Some radioactive wastes generated under the BCLDP will be disposed of at sites as directed by the Department of Energy (DOE). DOE has accepted title to these wastes and radioactive materials and they will be transferred as authorized above and or in accordance with 10 CFR 30.12, 40.11, and 70.11.

Manifests, Certificates of Disposal, or other documentation to confirm transfer/disposal shall be maintained by the Waste Management Section.

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7.0 Radiation Safety Training

7.1 Introduction

BCLDP's radiation safety training program provides staff members with the knowledge and skill to perform their radiation work safely. This section identifies radiation protection training requirements for all staff members whose work involves potential radiation doses.

7.2 Responsibilities

Site RSO

The Site RSO shall:

- Provide technical content for new staff member's radiation protection training.
- Conduct, test, and document training and retraining for radiation workers as requested by line managers.
- Conduct, test, and document qualification and requalification for health physics technicians.
- Identify and document radiation safety training required for each staff position.
- Ensure that all new staff members receive radiation protection orientation.
- Evaluate radiation protection training and retraining.
- Evaluate requests for radiation protection training exemptions and waivers.

Training Unit

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The Training Unit shall:

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- Maintain radiation protection training documentation.
- Maintain auditable records of each staff member's job-specific radiation protection training and retraining.

Line Managers

Line managers shall:

- Ensure that staff members who need unescorted access to radiological areas receive radiation worker training before conducting such work and annual retraining thereafter.
- Provide and document appropriate job-specific training and annual retraining for radiation workers.
- Ensure that radiation workers using respirators receive respiratory protection training at least annually.

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7.3 Requirements

The Site RSO shall ensure that all workers who may enter a controlled area receive training in accordance with the BCLDP Training Program. Line managers shall not allow any unescorted person to enter a controlled area until he or she receives the training. Workers who enter controlled areas must receive refresher training annually.

The level of training is to be commensurate with the staff member's job assignment. General Employee initial training shall include the following, as a minimum:

- The risk of low-level occupational radiation dose, including cancer and genetic effects
- The risk of prenatal dose
- Basic radiation protection concepts
- BCLDP radiation protection policies and procedures
- Staff and management responsibilities for radiation protection
- Emergency procedures.

The Site RSO shall ensure that radiation workers receive training and retraining to familiarize them with the basics of radiation protection and the ALARA process. Training should include both classroom and applied training and should emphasize procedures specific to the individual's job assignment. The level of training in the following topics is to be commensurate with each worker's assignment. Radiation Worker training shall include the following, as a minimum:

- Radioactivity and radioactive decay
- Characteristics of ionizing radiation
- Man-made radiation sources
- Acute effects of exposure to radiation
- Risks associated with occupational radiation dose
- Special considerations in the dose of women of reproductive age
- Dose equivalent limits
- Mode of dose - internal and external
- Dose equivalent determinations
- Basic protective measures - time, distance, shielding
- Specific BCLDP procedures for maintaining doses ALARA
- Radiation survey instrumentation - calibration and limitations
- Use of portable radiation detection instruments for personal surveys
- Radiation monitoring programs and procedures
- Contamination control, including protective clothing, equipment, and workplace design

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- Personnel decontamination
- Emergency procedures
- Warning signs and alarms
- Responsibilities of employees and management
- Interaction with Site RSO and staff
- Procedures associated with specific job assignments (for example, gloveboxes).

A staff member who has received the above documented training, along with site-specific briefings, is a qualified radiation worker. Radiation workers may enter BCLDP radiological areas unescorted. The refresher training shall be conducted annually. A radiation worker requires re-training to maintain qualification as a radiation worker.

The Site RSO may waive generic radiation training (not specific to a facility) provided the following items apply:

- The staff member received the training at another D&D-type facility.
- Line manager has documentation of the training that contains the individual's name, date of training, and specific items covered.
- An appropriate official has certified the training of the individual.

Line managers shall have certification of a radiation worker's knowledge of radiation protection basics. The certification shall be determined by examination.

7.4 Documentation

The Site RSO shall document training in enough detail to determine the adequacy of the training. This documentation should include the following:

- A description of the material presented
- The attendees' printed names and social security number (or equivalent)
- Attendees' signatures and date
- Payroll numbers
- Section cost code
- Location of training/retraining
- Evaluation of the effectiveness of the training (written examination, oral examination, or observation of performance)
- Trainer's signature and date

Personnel providing the training or retraining shall send *original* documentation to the Training Unit and a *copy* to the staff member's manager, if requested.

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7.5 Visitors

Visitors are persons (non-staff or Battelle staff) who are unfamiliar with the hazards of the BCLDP sites (refer to Section 3.0). A qualified radiation worker shall escort and supervise all visitors entering BCLDP radiological areas. Visitors may not require general radiation worker training unless their work requires unescorted access to BCLDP radiological areas. Visitors shall be subject to briefing on escorting requirements and certain radiation protection requirements.

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8.0 ALARA

8.1 Introduction

This section defines the requirements of the BCLDP program to maintain radiation doses as low as reasonably achievable (ALARA).

All exposures shall be assumed to entail some risk to the employee.

Line managers shall adopt the following principles to govern all work activities with the potential for exposure to radiation or radioactive materials:

- Activities and operations shall produce a positive net benefit.
- All radiation doses shall be kept ALARA in light of economic and societal costs.
- Radiation doses received by individuals shall be controlled as specified in Section 1.3 and not exceed the limits specified in 10 CFR 20.

ALARA activities shall include the following:

- A program shall be established that integrates management philosophy and regulatory requirements, with specific goals and objectives for implementation included.
- The Site RSO in conjunction with the ALARA Coordinator shall establish applicable and appropriate radiological goals to direct all levels of management and workers at BCLDP toward improvement in radiological performance.
- Pre-job planning, ALARA Reviews, and ALARA Audits shall be performed.

8.2 Responsibilities

Site RSO

The Site RSO shall:

- Appoint the BCLDP ALARA Coordinator.

Line Managers

Line managers shall:

- Review work environments, procedures, and equipment to maintain staff dose ALARA.
- Actively promote the ALARA philosophy.
- Attend ALARA pre-job planning meetings, as required.
- Be aware of the actual or estimated TEDE status of reporting staff members and provide timely status reports to staff members.
- Assist in the development of ALARA Goals.

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Staff Members

Staff members shall:

- Maintain individual and coworkers' doses ALARA.
- Make suggestions to line managers about ways to reduce individual dose.
- Attend and participate in required pre-job planning meetings.

BCLDP ALARA Coordinator

The BCLDP ALARA Coordinator shall:

- Provide guidance to BCLDP staff and line managers on maintaining staff dose due to ionizing radiation ALARA.
- Develop ALARA Goals.
- Provide monthly and quarterly reports on the status of the BCLDP ALARA program to line managers.
- Provide annual reports on the BCLDP ALARA program to the Site RSO and line managers.
- Conduct and document ALARA Job Reviews.
- Conduct and document ALARA Planning Reviews.
- Conduct and document ALARA Design Reviews.
- Conduct an active program to maintain staff awareness of the BCLDP ALARA program.
- Review and approve dose evaluations for staff members whose TEDE, Total Organ Dose Equivalent, Skin, Extremity, or Lens of the Eye dose may exceed the BCLDP administrative limits described in Table 1.1.
- Document the measures that are taken to control radiation doses.
- Review applicable RWPs.
- Review individual and collective TEDE, Total Organ Dose Equivalent, Skin, Extremity, or Lens of the Eye dose and advise workers and line managers of their current status.
- Attend ALARA pre-job planning meetings

8.3 Organization

Line managers are responsible for conducting operations in such a manner that assures exposure to radiation is ALARA and supports the BCLDP ALARA Policy.

The ALARA Coordinator administers the BCLDP ALARA program. The Site RSO appoints the ALARA Coordinator and ensures that the ALARA policy is implemented.

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8.4 Establishing ALARA Goals

ALARA Goals are the primary performance indicators for the ALARA program. ALARA Goals may be either facility-related or organization-related.

8.4.1 Requirements

ALARA Goals shall be developed by the ALARA Coordinator in conjunction with project or line managers and then submitted in writing to the DDO Program Manager and the Site RSO annually for approval.

8.4.2 Guidance on Development of ALARA Goals

ALARA Goals should be specific, measurable, and have one or more clearly defined end points. Goals related to reduction of personnel dose may address one or more of the following measures:

- Average TEDE for a group, job classification, task, or location
- Maximum individual TEDE for a group, job classification, task, or location
- Collective TEDE for a group, job classification, task, or location.

ALARA Goals related to reduction of personnel dose may also address identification and elimination of nonproductive radiation dose. ALARA Goals may also address other non-dose-related measures.

8.4.3 Format for ALARA Goal Submittals

ALARA Goal submittals shall include the following:

- Responsible line manager signature(s)
- Site or facility
- Statement of the goal
- Performance indicators, including dates for completion.

8.4.4 Revisions to ALARA Goals

The ALARA Coordinator in conjunction with line managers may revise ALARA goals at any time during the calendar year. Revisions shall be approved as specified in Section 8.4.1.

8.5 ALARA Audits

The BCLDP ALARA Coordinator shall audit ALARA Goals at least annually. Audits of ALARA activities should include a review of pre-job planning records, radiation dose tracking records, and related documents to evaluate conformance to ALARA Goals and overall program performance.

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8.6 ALARA Reports

Periodic ALARA Reports provide line managers with the information necessary to assess the TEDE status of their organizations.

8.6.1 Monthly ALARA Report

The Monthly ALARA Report provides information on CEDE, and actual and estimated DDE for staff as of the most current dosimeter and pocket ion chamber processing.

8.6.2 Quarterly ALARA Report

The Quarterly ALARA Report summarizes the current and year-to-date status of ALARA Goals. This may report and identify groups that are required to take specific actions to meet BCLDP ALARA program requirements.

8.6.3 Annual ALARA Report

The Annual ALARA Report provides documentation of the activities related to the BCLDP ALARA program. It summarizes TEDE statistics for tracking purposes to help provide an annual evaluation of performance and lessons learned. It also evaluates the final BCLDP ALARA status relative to the annual ALARA goals.

8.7 Radiation Dose Tracking

The purpose of tracking TEDE is to provide line managers with the information necessary to ensure that doses are in fact ALARA.

8.7.1 Individual Doses

The ALARA Coordinator provides individual DDE estimates and CEDEs to line managers through the ALARA Monthly Report.

Line managers must control the DDE received between quarterly dosimeter exchanges. Line managers may accomplish this by estimating whole-body doses using PICs or electronic dosimeters.

The ALARA Coordinator shall prepare quarterly evaluations of radiation dose for any staff member whose TEDE may exceed 2,000 mrem at year end.

8.8 ALARA Planning and Review

Line managers shall ensure that staff conduct pre-job planning for any job expected to result in a collective dose equivalent rate of 100 person-mrem/day or greater. In addition to pre-job planning, personnel pre-job briefings shall occur immediately preceding performance of the job. The purpose of these briefings is to ensure staff involved in the job understand where and how

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the job is to be done, the radiation protection requirements, and what measures are taken to control radiation dose and radioactive contamination.

The ALARA Coordinator shall be involved in initial work planning to ensure ALARA principals are integrated into the Work Instruction preparation. In addition, all Work Instructions shall be approved by the Site RSO.

The ALARA Coordinator shall conduct pre-job planning through the use of ALARA Job Reviews, ALARA Planning Reviews and ALARA Design Reviews. Dose estimates used for work planning shall be based on estimated TEDE unless the extremity to whole body ratios at the work location exceed 10 to 1.

8.8.1 ALARA Job Reviews

Radiological work, including new jobs, shall receive an ALARA Job Review when:

- Individual worker TEDE is estimated to exceed 100 mrem .
- Collective estimated TEDE is greater than 1 Rem for the work covered by an RWP.
- Respiratory protection is required.
- Engineering controls to lower internal and external exposure are required.

This ALARA Job Review shall evaluate the Work Instruction and RWP to ensure ALARA principals are followed. Exhibit 8.1 provides guidelines for ALARA Job Reviews. Where applicable, ALARA Job Reviews shall include considerations of the optimization principal.

8.8.2 ALARA Planning Reviews

ALARA Planning Reviews are required for jobs expected to exceed an estimated collective TEDE of 2.5 person-rem or if the personnel general area exposure rates are expected to exceed 1 R/hr. ALARA Planning Review is a process above and beyond ALARA Job Reviews provided to assist line managers in preparing Work Instructions that adequately describe the work scope with sufficient detail to perform the job in a radiologically safe and ALARA manner. Where applicable, ALARA Planning Reviews shall include considerations of the optimization principal.

8.8.3 ALARA Design Reviews

The primary means for maintaining dose ALARA is through the use of physical controls such as confinement, ventilation, remote handling, and shielding.

All changes to existing facilities, directly or indirectly affecting radiation dose, shall receive an ALARA Design Review by the Site RSO as part of the modification permit review process. Where applicable, ALARA Design Reviews shall include considerations of the optimization principal.

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8.9 ALARA Debriefings and Post-Job Reviews

The ALARA Coordinator should conduct a debriefing meeting upon completion of jobs involving collective TEDE of greater than 100 person – mrem/day. Debriefings should include the following:

- Identification of problems encountered
- Techniques for improving the future performance of similar tasks, including techniques for further reducing dose
- Comparison of actual dose equivalent for the job to the estimated dose equivalent
- Lessons learned and recommendations for future jobs.

The ALARA Coordinator shall document a Post-job Review upon conclusion of all work involving a collective TEDE or Total Organ Dose Equivalent of greater than 5 person-rem or 25 person-rem respectively, when dose received is greater than 25% of the work dose estimate, or if requested by the line manager, project manager, MOC, or RFOM. The Post-job Review shall:

- Identify any problems encountered and the resolutions for those problems.
- Include suggestions for improving the further performance of similar tasks, including techniques for further reducing dose.
- Include a comparison of actual total DDE to the estimated DDE.

8.10 ALARA Training

General radiation worker training shall include a discussion of the ALARA principle and the BCLDP ALARA Policy. This training shall also include specific procedures for maintaining doses ALARA (including the use of time, distance, shielding, and any other factors).

Line managers shall provide additional, job-specific ALARA training as appropriate.

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EXHIBIT 8.1
ALARA Job Review Guidelines

- ALARA
  - Shielding
    - For workers
    - For assistants
    - For HPTs
    - In low-dose waiting areas
    - Types
      - Blankets
      - Bricks
      - Water
      - Matting
      - Sheet lead
      - Lead glass
      - Lead gloves
      - Lead aprons
  - Remote Handling
    - Manipulators
    - Tongs
    - Tweezers
    - Special tools
    - Cranes
    - Robotics
  - Temporary Confinement
    - Greenhouses
    - Tents
    - Plastic on floor
    - Glovebag
    - Airlocks
    - Filtration
    - Ventilation (air balance)
  - Decontamination
    - Drain/flush systems
    - High pressure wash
    - Vacuum
  - Remove Sources
    - Shielded position or area
    - Lock and tag
  - Worker Comfort
    - Ice vests
    - Time in Mask
    - Air supply
  - Communications
    - Radios
    - Hand signals
- RWP Requirements
  - R PT coverage
  - Protective Clothing
  - Respiratory protection
  - Dosimetry
  - RAMs
  - CAMs
  - Air monitoring
  - Posting
  - Temporary radiation areas
  - Radiological hold points
- SOPs
- Variances
- Notifications
  - Other operations groups
  - Project manager
- Required Equipment
  - Tools
  - Bags
  - Protective clothing
- Job Assignments
  - Number of personnel required
  - Briefing
- Qualifications
  - Radiation worker training current
  - Job-specific training
  - Mask fit
  - Whole body count
- Training
  - Dry runs
  - Mock-ups
- Contingency Plan
- Radiological Conditions
  - Maximum whole body dose rate
  - Maximum extremity dose rate
  - Contamination levels
  - Airborne contamination
- Current Dose Status of Personnel
- Cleanup
  - Status of work area on completion of job
  - Decontamination
- Job Completion
  - Debrief workers
  - Lessons learned

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