SITE REMEDIATION PLAN FOR THE FORMER ZIRCALOY BURN AREA

SPECIALTY METALS PLANT
WESTINGHOUSE ELECTRIC COMPANY
BLAIRSVILLE, PENNSYLVANIA

Revision 0, March 2000

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1.0 GENERAL INFORMATION

1.1 Introduction

This document presents the Site Remediation Plan (SRP) for the Former Zircaloy Burn (FZB) Area located at the Westinghouse Specialty Metals Plant Site (WSMPS), Blairsville, Pennsylvania (Figure 1). The selected remediation alternative for the FZB Area consists of excavating soils containing concentrations of uranium that exceed the performance objectives identified in the "Disposal or Onsite Storage of Residual Thorium or Uranium Waste From Past Operations" SECY-81-576 *(NRC, October 1981)* and NUREG/CR-5849 "Manual for Conducting Radiological Surveys in Support of License Termination" *(NRC, June 1992)*. Concrete and other construction debris type material associated with the FZB Area will be remediated to the levels specified in "Guidance for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Materials" *(NRC, August 1987)*. Site remediation activities for the buildings and openland areas will be carried out under the direction of Westinghouse.

1.2 Purpose, Scope and Format

The general purpose of this plan is to:

- Describe the methodology necessary to remediate the FZB Area and related surroundings to levels acceptable for unrestricted release and
- Conduct remediation activities in a controlled manner consistent with applicable federal, state and local regulations for maintaining the health and safety of workers, and the general public and the environment.

The scope, format and content of this plan has been prepared consistent with the following guidelines:

- Regulatory Guide 3.65, "Standard Format and Content of Decommissioning Plans for Licensees under 10 CFR Parts 30, 40 and 70" Nuclear Regulatory Commission, August 1989.

1.3 Applicable Regulatory Requirements, Regulations and Guidance

Although the radioactive materials license for the WSMPS (SUC-509) was terminated by the NRC on December 31, 1964, remediation activities and the related survey and sampling methodologies presented herein will conform to the regulations and guidelines set forth in the following documents to the extent they are applicable.

<u>NRC</u>

- Code of Federal Regulations, Title 10.
- Disposal or Onsite Storage of Residual Thorium or Uranium Waste from Past Operations SECY-81-576 *(NRC, October 1981)*.

- NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination (draft) *(NRC, June 1992)*.

- NRC Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product, Source or Special Nuclear Material *(NRC, August 1987)*.

- Action Plan to Ensure Timely Remediation of Sites Listed in the Site Decommissioning Management Plan SECY-92-106 (*NRC, April 1992)*.

1.4 Overview of Operational History

During the period from approximately 1955 to 1961, fuel manufacturing operations were conducted at the WSMPS facility using enriched uranium in both metal and oxide forms. This involved both highly enriched uranium for the Navy fuel program (under subcontract with the Bettis Atomic Power Laboratory) and low enriched uranium for atomic power plants (under License SNM-37 from the U.S. Atomic Energy Commission). AEC license SUC-509 authorized Westinghouse to perform research and development for fuel elements using depleted uranium at the Blairsville facility. This license was terminated on December 31, 1964. As part of a Nuclear Regulatory Commission (NRC) program to ensure that AEC and NRC licenses that have been terminated meet the NRC's current criteria for release for unrestricted use, the Blairsville site was determined to require additional review.

Beginning in 1993, Westinghouse personnel performed preliminary screening measurements in areas of the facility where licensed material had been handled. Several interior and exterior areas have since been characterized and remediated.

Records indicate that the radioactive wastes were processed and packaged in the area known as the FZB Area (or Cow Palace) of the Blairsville site in addition to other potential areas. The investigation into the FZB Area was initiated in 1995. Several reports included data from the initial investigations. The results of the initial investigations did not indicate the presence of significant radioactive contamination.

During remediation activity to remove an underground pipe and sumps in the FZB Area conducted in June 1998, evidence of more significant radioactive contamination of the area was identified. Subsequent investigation and characterization has identified a variety of uranium contamination, including low enriched, high enriched, depleted uranium, and processed unenriched uranium.

1.5 Overview of Environmental Setting

Information in this section is summarized from investigations performed on the FZB Area and surroundings by Cummings/Riter Consultants, Inc. during 1995-1996 *(Cummings/Riter Consultants, Inc., 1995a, "Data Summary Report, Site Investigation, Westinghouse Electric Corporation, Specialty Metals Plant, Blairsville, Pennsylvania," Cummings/Riter Consultants, Inc., 1995b, "Data Summary Report, Phase II Investigation, Westinghouse Electric Corporation, Specialty Metals, Blairsville, Pennsylvania," and Cummings/Riter Consultants, Inc., 1996, "Addendum Data Summary Report, Phase II, Westinghouse Electric Corporation, Specialty Metals Plant, Blairsville")*.

1.5.1 Topography

1.5.1.1 Regional Topography

1.5.1.2 Site Specific Topography

1.5.2 Geology

1.5.2.1 Regional Bedrock Geology

1.5.2.2 Regional Glacial Geology

1.5.2.3 Site Specific Geology

1.5.3 Hydrogeology

1.5.3.1 Regional Hydrogeology

1.5.3.2 Site Specific Hydrogeology

1.5.4 Meteorology and Climatology

Meteorology and climatological data for the greater Pittsburgh area recorded for the years ______________________ is presented below:

- The average annual maximum and minimum temperatures are _______________ °F, respectively.
- The average annual rainfall is _____ inches.
- The annual snowfall is ____ inches.

The predominant wind direction is from the southwest *(DOC, 1989)*. Summer precipitation comes mainly in the form of thundershowers. Annually, thundershowers will occur on an average of 36 days.

1.6 Overview of Previous Site Characterization Activities

Site characterization activities were conducted by Cummings Riter Consultants, Inc. (Cummings Riter) at the FZB Area during 1995-1998. A summary of the site characterization efforts are presented in Section 3.1.2.

1.7 Evaluation of Remediation Alternatives

At the WSMPS, a relatively small amount of radioactive material is present in low concentrations, distributed in a relatively large volume of uncontaminated soil. Alternatives that were considered in developing this remediation plan were:

- No Action; and

- Offsite disposal of soil containing an average concentration of 30 pCi/g in excess the NRC release criteria specified in "Disposal or Onsite Storage of Residual Thorium or Uranium Waste from Past Operations" (SECY-81-576 *(NRC, October 1981)* and NUREG/CR-5849 "Manual for Conducting Radiological Surveys in Support of License Termination *(NRC, June 1992)*.

1.7.1 No Action Alternative

Under this alternative no cleanup or remediation would be conducted. There are no health effects to the general public due to the radioactive contamination, as it is presently distributed at the WSMPS, even without further cleanup. Access to the site would be controlled. With proper precautions, workers at the site can be easily protected from any exposure to radiation in excess of existing guidance or regulations.

1.7.1.1 Advantages

Under this alternative, minimum additional work is required. Some confirmatory test and surveys would be required, but the results are not likely to change the basic conclusions regarding the site. Leaving the contamination in place minimizes the potential for increased exposures during soil excavation and removal, and construction debris decontamination.

1.7.1.2 Disadvantages

The no action alternative would require that special precautions be taken to protect workers from exposure to radiation in excess of existing guidance or regulations. Controls would be necessary to limit access to the site by the general public. Thus, the site would not be released for unrestricted future use.

1.7.2 Offsite Disposal of Soils >30 pCi/g

A detailed characterization of the subsurface soil would be required to identify soils with average concentrations of uranium in excess of the "Disposal or Onsite Storage of Residual Thorium or Uranium Waste from Past Operations" (SECY-81-576 *(NRC, October 1981)* and NUREG/CR-5849 "Manual for Conducting Radiological Surveys in Support of License Termination *(NRC, June 1992)*. Soils so identified would be excavated and disposed of offsite. Contaminated concrete, steel and other construction type material surfaces would be decontaminated to the levels specified in "Guidance for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Materials" *(NRC, August 1987)*.

1.7.2.1 Advantages

Residual soil contamination would be remediated in accordance with the NRC performance objectives and a site specific radiological assessment would not be required to demonstrate compliance with NRC release criteria *(NRC, October 1981)*. The FZB Area would be released for unrestricted use and available for future utilization by Westinghouse.

1.7.2.2 Disadvantages

The major disadvantage would be the expenditure of significant Westinghouse resources to fund this project during the calendar year 2000 that would otherwise be committed to other purposes. Some incremental dose to the remediation workers would occur, albeit small.

1.7.3 Conclusion

Offsite disposal of soils as described in Section 1.7.2 is the overall cost effective, least disruptive remedial action resulting in unrestricted use of the site and hence is the selected option.

1.8 Summary of Planned Remediation Activities and Related Efforts

The overall strategy of the FZB Area remediation is to perform site characterization and final radiological survey efforts of this area simultaneously (Section 2.0). Results of the combined site characterization/final radiological survey will be used to identify grids within the FZB Area which do not meet the release criteria. These grids will require additional sampling and/or remediation and a follow-up final radiological survey to demonstrate compliance with the release criteria. Grids which meet the criteria will require no remediation and no further final survey effort.

Results of the combined site characterization/final survey will be incorporated into this remediation plan as an addendum. The addendum will identify the specific grids requiring remediation and follow-up final survey.

This remediation strategy will allow for a more streamlined approach and provide a better estimate of the contaminated soil required to be remediated and hence, a better remediation cost estimate.

Activities to be performed by Westinghouse for the remediation of the FZB Area at the WSMPS are:

1.8.1 Openland Areas

- Additional site characterization of the openland areas (FZB Area and surroundings) to determine extent of the radiological contamination present onsite. This effort will include walkover surface scans, direct exposure rate measurements and surface and subsurface soil sampling. This characterization effort will be conducted consistent with the final release survey guidance per NUREG/CR-5849.

- Excavation, consolidation and shipment of the contaminated material exceeding the NRC cleanup criteria to a licensed low-level radioactive waste disposal facility.

- Final radiation survey of the openland areas to verify that the remedial objectives have been achieved. (See Section 4.0).

1.8.2 Construction Debris Material

- Survey scan and direct measurements of construction debris material (i.e., concrete, steel, wood).

- Decontamination of the construction debris material exceeding NRC surface contamination criteria as feasible and cost effective.

1.8.3 Cleanup Criteria Guidelines

The cleanup criteria proposed for the site are based on SECY-81-576 (*NRC, October 1981*):

Soil	-	30 pCi/g total uranium (average)
	-	90 pCi/g total uranium (maximum - three times limit)

The following limits are based on Regulatory Guide 1.86 (*NRC, August 1987*):

Concrete, steel, wood	-	5,000 dpm/100 cm^2 α, $\beta\gamma$ average over 1 m^2
	-	15,000 dpm/100 cm^2 α, $\beta\gamma$ maximum over 100 cm^2
	-	1,000 dpm/100 cm^2 α, $\beta\gamma$ removable

The following limits are based on the NRC SDMP Action Plan *(SECY-92-106)*:

Exposure rates - 10 μR/hr above background (average) at one meter from soil surface
- 20 μR/hr above background (maximum) at one meter from soil surface

As a voluntary effort, a dose assessment will be performed using the RESRAD Code to confirm compliance with the NRC dose criteria of 25 mRem/yr (10 CFR 20, Subpart E).

1.9 Site Remediation Plan Overview

This SRP is comprised of six major sections:

Section 1. Provides background information involving applicable regulatory requirements, facility history and operations, environmental setting, site characterization data, and other general information related to the FZB Area and the WSMPS.

Section 2. Identifies the remediation objectives and describes how the proposed remediation activities and tasks will achieve these objectives. This section includes a description and an analysis of the proposed methods for accomplishing the remediation activities and contains a schedule for the estimated time for completion of the specified remediation efforts.

Section 3. Describes the methods used to ensure protection of workers, the public, and the environment against radiation hazards during remediation. This section includes discussion of the Westinghouse WSMPS Radiological Control program including ALARA and the Radioactive Waste Management program that will be implemented during remediation.

Section 4. Describes the planned final radiation survey of the FZB Area to demonstrate that the openland areas and construction debris material meet the desired cleanup criteria.

Section 5. Provides a detailed cost estimate for the remediation of the FZB Area and surroundings and a plan for assuring that adequate funds for completion of the remediation are available.

Section 6. Provides a description of the WSMPS physical security program.

Section 7. Provides a list of references used in preparation of this SRP.

1.10 Procedure for Revising This Plan

In the event that conditions other than those anticipated in developing this SRP are encountered, the plan or associated procedures will be revised and submitted for approval or acceptance. Plan revisions or field changes are not required for minor alterations that do not affect the quality of work, objectives, or cause a potential safety or environmental impact.

All plan revisions or field changes will be reviewed by the Westinghouse Project Manager or designee as to the change and whether the change is significant or not in accordance with the appropriate administrative procedure for field changes.

Major changes to this SRP will be submitted to the NRC for acceptance. These changes will be, at a minimum, changes that result in unreviewed safety questions. Field changes are to be submitted to the Westinghouse Project Manager within one day of the change and review must be complete within two working days of the date of the change. All changes (minor and major) will be maintained as part of the WSMPS Project Files.

Plan revisions will be reviewed and approved in the same manner as this original SRP. It is the responsibility of the Westinghouse Project Manager or his designee to obtain the necessary approvals, to advise the appropriate parties of work which is affected by the revisions, and to ensure the correct plan revision is being used at the work site.

Changes will be highlighted in the revision draft by marking a change bar in the right hand margin with the revision number. Review of this revision draft should be limited to the revisions and their affect on remediation program objectives. The revision number and date will appear at the top of each page of the revised plan.

It should be noted that the planned remediation activities, sampling locations, radiological surveys, design, depths, type, and waste amounts presented in this document were established based upon information as a result of previous characterization efforts and may be revised, in accordance with the procedures described above, based on actual field conditions and interim findings as site characterization and/or remediation progresses.

2.0 DESCRIPTION OF PLANNED SITE REMEDIATION ACTIVITIES

2.1 Site Remediation Plan Objectives, Activities, Tasks and Schedules

2.1.1 Site Remediation Plan Objectives, Activities, and Tasks

The overall objectives of the Site Remediation Plan (SRP) are to:

- Conduct a detailed assessment of the radiological condition of the FZB Area.
- Conduct appropriate remedial actions.
- Conduct a final radiological survey of the FZB Area.
- Prepare the documentation necessary to complete the project and release the FZB Area for unrestricted use.

Specific remediation program objectives for the openland areas are: excavation of contaminated soils in which the concentration of uranium exceed the performance objectives in "Disposal or Onsite Storage of Residual Thorium or Uranium Waste From Past Operations" SECY-81-576 *(NRC, October 1981)* and shipment of the soils to a licensed low-level radioactive waste disposal facility.

Specific remediation program objectives for the construction debris material are the cleanup criteria specified in Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product, Source or Special Nuclear Material (Section 1) *(NRC, August 1987)*.

As an ALARA objective, Westinghouse has selected an ALARA goal of 500 mRem for the project.

2.1.2 Planned Remediation Methodology

2.1.2.1 Overview

Remediation activities and related health and safety monitoring support activities will be conducted in accordance with approved plans, procedures, instructions, and drawings. A management control system described in Section 2.1.3 will be established to ensure that all work is conducted in accordance with the established and approved procedures and methods.

Remediation of the contaminated soils will require excavation and shipment to a licensed low-level radioactive waste disposal facility. Remediation will be conducted using standard and readily available earth-moving equipment. No specialized equipment will be required to excavate the contaminated soil. Handling of contaminated materials will be performed and monitored in accordance with procedures outlined in the Westinghouse WSMPS Radiological Control Program, which includes the Project Radiological Control Plan and implementing procedures. At a minimum these procedures will include:

- monitoring radioactivity in airborne particulates during remediation activities at the work areas and locations on the perimeter of the site;
- monitoring radiation levels in the work areas and at locations around the perimeter of the site;
- dust suppression controls, such as wetting, tarps and the use of portable contamination control structures (i.e., tents), to reduce the potential for airborne contamination during excavation and handling of contaminated concrete and/or soils;
- decontamination procedures for cleaning equipment prior to removal from radiologically controlled areas;
- storage requirements for temporary stockpiling of potentially contaminated materials such as tarps, covers and/or containers, such as 55-gallon drums and/or B-25 boxes.

A summary of the WSMPS Radiological Control Program is provided in Section 3.0. Details of the program are described in the Radiological Control Plan (Appendix A).

An analysis of the potential radiological exposures to the workers and general public due to routine remediation activities and non-routine scenarios demonstrates that remediation of the FZB Area and surroundings can be accomplished in a safe manner (see Appendix B of this Site Remediation Plan).

Common sampling techniques such as geoprobe, hollow steam auger and split spoon samplers and backhoes will be used for surface and subsurface characterization. Common earth-moving equipment such as excavators, bulldozers, compactors, and dump trucks will be used to remediate the site. Contaminated materials will be placed into the shipping containers using dump trucks and excavators.

2.1.2.2 Detailed Approach

With respect to the overall remediation methodology, it is proposed that the final release survey be combined with remedial activities in a streamlined, two-step approach. This combined effort will ensure a timely and cost effective remediation strategy.

<u>Step One</u>

Step one will consist of the following activities:

- Establishing a 10 meter x 10 meter grid on the impacted area (FZB Area and surroundings)(Figure 1). The impacted area is defined by three sub areas as follows:

  - Sub Area A (E20 to E70) x (N0 to N100)
  - Sub Area B (E70 to E110) x (N30 to N100)
  - Sub Area C (E110 to E140) x (N30 to N100)

  The areas of A, B and C are 5,000 m^2, 2,800 m^2 and 2,100 m^2, respectively, for a total of 9,900 m^2.

- Conducting a 100% walkover gamma scan utilizing a Ludlum Model 2221 or 2241 (or equivalent) coupled with a Ludlum 44-10 (2" x 2" NaI) detector to identify elevated areas. The high, low and average readings will be recorded for each 10 m x 10 m grid. Elevated readings will be marked for further investigation.

- Obtaining surface (0-6") and subsurface soil samples, consistent with NUREG/CR-5849 guidance, within each 5 meter x 5 meter area for each grid (i.e., four samples per 100 m^2 grid). The surface samples will be collected using a hand shovel. The subsurface soil samples will be collected using a Geoprobe sampler or a hollow stem auger with a split spoon sampler. The subsurface soil samples will be collected at four foot intervals until native till is reached. The soil cores will be scanned with a Ludlum Model 2221 or 2241 (or equivalent) coupled with a Ludlum Model 44-9 detector for field screening and handling purposes. The cores will be divided into 2.5 foot sections and submitted for uranium analysis.

  Based on the calculated areas of Sub Areas A, B and C, a 5 meter x 5 meter overlay will encompass 396 25 m^2 grids. Table 1, Figure 2 and_ indicate that the depth of fill (i.e., the potentially impacted material) varies from nothing to the north (SC-1) to 12 feet to the south (SC-44). Based on this information, it is assumed that each grid location would yield on average two 2.5 foot soil samples. Hence, approximately 792 soil samples will be collected.

  The surface and subsurface soil samples will be analyzed for U-238 (or U-235) via gamma spectroscopy. The total uranium concentration will be calculated using a U-238 (or U-235) to total uranium conversion factor. The conversion factor will be derived from results of isotopic uranium analysis of surface/subsurface soil which contain measurable amounts of uranium.

  The surface and subsurface soil sampling described above may be supplemented with uranium analysis results from previous characterization efforts.

- Exposure rate measurements will be obtained using a Ludlum Model 19 exposure rate survey meter at each soil sampling location.

  Evaluation of the surface and subsurface soil samples, results and exposure rate measurements will be performed consistent with NUREG/CR-5849 methodology (see Section 4.0). Grids whose surface and subsurface uranium concentrations and exposure rate measurements are less than the cleanup criteria (i.e., rate measurement) (30 pCi/g) will be deemed as meeting the NRC guidelines for unrestricted release. No additional final survey/sampling or remediation efforts will be required.

Step 2

For those grids that exceed the NRC release criteria, one of the following options will be carried out:

- Additional samples and analyses will be performed to determine compliance with the weighted average limit as permitted by NUREG/CR-5849; or

- The grid/area will be excavated and the contaminated material stockpiled and the grid resampled and the sample analyzed to determine compliance with the release criteria.

This in-situ characterization/final survey approach will be used for all of the soil encompassing the FZB Area, with the exception of the filled-in former lagoon, located to the south (Figure 1). Since it is know that construction debris material has been placed in the former lagoon as backfill, it may not be possible to utilize the in-situ characterization/final survey approach completely. To supplement the in-situ characterization/final survey, an ex-situ characterization/final survey methodology is proposed.

This methodology will involve excavating the soil and construction debris material from the lagoon, segregating the construction debris material and stockpiling the soil. The construction debris material will be surveyed to determine compliance with the NRC release criteria. Fixed and removable surface contamination data will be obtained to determine compliance with Regulatory Guide 1.86. Where feasible and economical, decontamination will be performed to meet the criteria.

The contaminated soil will be stockpiled, sampled and the samples analyzed for total uranium. Guidance in NUREG/CR-5849 will be used to determine the number of samples required to be collected and analyzed. Soils exceeding the guidelines for release limit will be disposed of at an offsite LLRW disposal facility. Soils containing less than 30 pCi/g will be disposed of at a local solid waste landfill and/or used as onsite backfill.

The excavated lagoon will then be subjected to a 100% walkover gamma scan, soil sampling consistent with NUREG/CR-5849 (i.e., four samples per 100 m^2) and exposure rate measurements obtained at each soil sample location. Grids or areas containing contaminated soil above the release criteria will be handled in a manner as described in Step 2.

2.1.3 Management Controls and Procedures

Remediation activities and related health and safety monitoring support activities will be conducted in accordance with Westinghouse approved plans, procedures, instructions and/or drawings.

Remediation activities affecting quality, including those of contractors, subcontractors, and suppliers will be performed in accordance with approved plans, procedures, instructions, and/or drawings. Such documents include this Site Remediation Plan and related field procedures, Radiological Control Plan, and related radiation monitoring and sampling procedures, training manual, design specifications, drawings and instructions. These plans, procedures, instructions and/or drawings will be readily available to remediation project personnel for their use at the WSMPS.

Quality Assurance (QA) and technical requirements for all activities affecting quality will be specified by means of individual QA and technical plans or procedures. Technical plans, procedures and/or drawings will be reviewed and approved by the Site Supervisor, Radiation Safety Officer and the WSMPS Project Manager. All instructions, plans, procedures, and drawings developed or implemented for the WSMPS Remediation Project will be retained by Westinghouse as project QA records.

Preparation, review, approval, distribution, and revisions of QA and technical plans and/or procedures will be controlled. Documents will be controlled during review, approval and distribution to ensure that those persons responsible for achieving and ensuring the project objectives are met, understand such documents, and have approved current copies (and revisions) at the work locations where the activity is to be performed before work commences.

Controlled copies will be distributed to the WSMPS Program Manager, WSMPS Project Manager, Site Supervisor, and the QA Coordinator, and to other project personnel performing or supervising work, as deemed appropriate by the WSMPS Program Manager.

An overview of remediation activities and a tentative schedule for carrying out these activities are presented in Tables 2 and 3, respectively.

2.2 Remediation Organization and Responsibilities

2.2.1 Overall Organizational Structure

The remediation activities at the FZB Area and surroundings at the WSMPS will be performed by a team composed of qualified and experienced personnel. The WSMPS Remediation Project Organization is shown in Figure 3.

This organizational structure results in the use of established safety, quality assurance and administrative systems, plans, procedures, and qualified and experienced personnel to effectively manage the remediation operations in a manner that protects the health and safety of the workers, the general public, and the environment. This organizational structure also ensures the independence of the safety and quality assurance related functions for the project. Furthermore, this organizational structure ensures that the established remediation project objectives will be met.

2.2.2 Key Westinghouse Specialty Metals Plant Rules, Responsibilities and Authority

Key positions are filled by those individuals that are responsible for assuring the safe the expedient remediation of the WSMPS. Key positions for the WSMPS Remediation Project are described below.

2.2.2.1 Program Manager (Westinghouse)

The WSMPS Program Manager (PGM) has the overall responsibility for the planning and management of the remediation activities at the WSMPS. The PGM is responsible for ensuring that the WSMPS Remediation Project activities meet the established environmental, health and safety, and quality assurance requirements, technical performance, and budgeting and scheduling criteria.

2.2.2.2 WSMPS Project Manager

The WSMPS Project Manager (WPM) has overall responsibility and authority to exercise management controls necessary to assure safe implementation of the site characterization and/or remediation activities, including matters related to health and safety, licensing, quality assurance and regulation. This responsibility and authority includes implementation of the Radiological Control Plan. The PM reports directly to the PGM. The PM will work together with the Contractor Project Manager (CPM) and the Project Radiation Safety Officer (PRSO) to ensure that all radiological protection and control measures are carried out.

Additionally, the WPM will review and approve all radiation control procedures and work procedures that are developed for the project activities.

2.2.2.3 Remediation Project Review Committee

The WSMPS Remediation Project Review Committee (PRC) has overall responsibility and authority to exercise management controls necessary to assure safe implementation of the site characterization and/or remediation activities, including matters related to health and safety, licensing, quality assurance and regulation. The committee will consist of a minimum of three people. The membership includes persons with experience in areas such as management, radiological protection, industrial hygiene and safety or quality assurance. The membership of the PRC is appointed by the Westinghouse Project Manager (WPM) and the PRC reports directly to the WPM. All members of the committee have the authority and responsibility to issue stop work orders for any matters involving health and safety.

The PRC holds meetings on at least a monthly basis to review project operations. The responsibility of the committee includes:

- Assuring implementation of the Radiation Control Plan.
- Review and approval of radiation control procedures.
- Review and approval of work procedures.
- Conducting reviews of project activities.

The PRC will work together with the Contractor Project Manager (CPM) and the Project Radiation Safety Officer (PRSO) to ensure that all health and safety protection measures and controls, including radiological protection, are carried out.

2.2.2.4 Contractor Project Manager

The Contractor Project Manager (CPM) is responsible for managing contractor personnel and other resources necessary to carry out the specific remediation project or activity. The CPM will work closely with the PRSO to ensure work being conducted by contractor personnel is in accordance with either 1) the requirements specified in the WSMPS Health and Safety Plan, Radiological Control Plan and related procedures; or 2) with requirements contained in the contractor developed Health and Safety Plan. The CPM reports directly to the WPM.

2.2.2.5 Quality Assurance Coordinator

The Quality Assurance Coordinator (QAC) reports to the Program Manager for administrative activities and for quality assurance guidance. The QAC communicates and coordinates directly with the Project

Manager on project-related matters, and has the delegated responsibility and authority to direct and control QA functions to assure that the QA objectives are met.

The QAC is responsible for the coordination, integration, and overview of project QA activities and for ensuring that the appropriate quality management, policy, training, and verification controls are present. Additional QAC responsibilities include: conducting QA audits and surveillances, correcting conditions which could adversely affect quality, and providing documented evidence that the required quality levels have been maintained in all remediation work activities.

2.2.2.6 Project Radiation Safety Officer

The WSMPS Project Radiation Safety Officer (PRSO) is responsible for developing and implementing policies and procedures in accordance with NRC Regulations (Title 10 CFR Parts 19 and 20) and any other applicable requirements/regulations. The PRSO has direct recourse to the PGM to prevent unsafe practices or to halt an operation which is deemed radiologically unsafe. The PRSO is also responsible to oversee and control the day-to-day radiation protection activities in accordance with the requirements contained in the Radiological Control Plan.

Specific duties of the PRSO may include, but are not limited to, the following:

(1) Provide training to project personnel.

(2) Verify that site personnel receive (or have received) appropriate radiological training.

(3) Verify implementation of the Radiological Control Program, including ALARA.

(4) Provide technical expertise to on-site radiation safety personnel.

(5) Conduct periodic radiation safety audits at the site.

(6) Interface between site radiation safety personnel and site management.

(7) Review surveys conducted during and after the site activities.

(8) Implement additional health and safety requirements as directed by the PM.

(9) Develop and implement radiation control procedures specific to the project.

2.2.2.7 Environmental Safety and Health Coordinator

The Environmental Safety and Health Coordinator (ES&HC) reports to the Project Manager. The ES&HC is responsible for ensuring implementation measures that provide safe and healthy work conditions, for maintaining radiation exposures as low as reasonably achievable, and for minimizing release of radioactivity and chemicals to the environment. This is accomplished through the review of work plans, instructions, procedures, monitoring and surveillance, training, and investigation and evaluation of routine monitoring data and unusual events.

2.2.2.8 Laboratory Manager

The Laboratory Manager (LM) reports to the Project Manager. The LM is responsible for managing the activities for in-house subcontractor laboratory services and ensuring that all sampling and analyses for the remediation project are performed in accordance with approved procedures and Quality Assurance programs. Additional responsibilities include ensuring that the laboratory data is compiled, validated, and appropriate evaluation and comparisons to established limits were performed.

2.2.2.9 Field Operations Supervisor

The Field Operations Supervisor (FOS) reports directly to the Project Manager. The FOS is responsible for ensuring that remediation activities are being performed in accordance with plans, procedures, and design requirements established for the remediation project.

2.2.3 Minimum Qualifications for Key Positions

2.2.3.1 Program Manager

The Program Manager must possess a BS degree in engineering or science and have a minimum of 10 years nuclear experience. Five years of this experience should involve management of nuclear projects.

2.2.3.2 Project Manager

The Project Manager must possess a BS degree in engineering or science and have a minimum of 10 years of nuclear experience, including five years of broad management experience.

2.2.3.3 Coordinator of Quality Assurance

The Coordinator of Quality Assurance must possess a BS degree in science or engineering and have a minimum of two years experience in quality assurance, or quality control related activities.

2.2.3.4 Radiation Safety Officer

Qualifications of the Project Radiation Safety Officer are:

(1) A Bachelors of Science degree in Engineering or Science.

(2) A minimum of 5 years of applied radiation protection experience.

(3) Previous training consistent with Regulatory Guide 10.4, Item 7, Topics.

2.2.3.5 Environmental Safety and Health Coordinator

The Environmental Safety and Health Coordinator must possess a BS degree in science or engineering and have two years experience in the nuclear field or a high school diploma with at least eight years experience in the nuclear field.

2.2.3.6 Laboratory Manager

The Laboratory Manager must possess a BS degree in science or engineering and have five years experience in nuclear related operations or remediation activities. Three of these years should be in laboratory analysis.

2.2.3.7 Field Operations Supervisor

The Field Operations Supervisor must possess a BS degree in science or engineering and have five years experience in supervision of field activities, such as decontamination and decommissioning, remediation, site characterization, or a high school diploma and ten years experience in supervising such activities.

2.3 Training Requirements

2.3.1 General

The purpose of training for the WSMPS Remediation Project characterization and remediation activities is to provide qualified personnel to work with the radiological and general hazards at the WSMPS. The training will be provided by radiological control personnel and will be in accordance with the WSMPS Radiation Worker Handbook and Training Manual. The training program will be reviewed by the WSMPS and kept up to date to reflect changes in the facility and procedures, as applicable.

Training will be required of, but not limited to: all workers involved in day-to-day operations of the remediation project, project and management personnel who will visit the site regularly and other personnel identified by the WSMPS Project Manager (i.e., State, Federal regulators).

2.3.2 Site Orientation and Training

Prior to entry into radiologically controlled areas of the WSMPS, all personnel will be given a site and radiological orientation. The objectives of this orientation are to familiarize personnel to:

(1) Recognize labeled radioactive materials and understand the meaning of radiological warning signs;

(2) Understand that, as long as radiological control procedures and limits are followed, harmful effects to personnel or to the environment from radioactivity on site will be minimized; and

(3) Recognize and understand the meaning of, and proper response to, emergency signals and use of emergency equipment such as fire extinguishers.

This orientation is required for all personnel involved in the remediation activities at the WSMPS, including contractor and subcontractor personnel, as well as Federal and State regulatory personnel.

2.3.3 Radiation Safety Training

Personnel who will require routine site access will receive basic Radiation Safety Training in accordance with the WSMPS Radiation Handbook and Training Manual.

Radiation Safety Training will include the following topics:

(1) Radiation Fundamentals - basic characteristics of radiation and contamination.

(2) Radiation Exposure Limits and Controls - external radiation exposure control methods, procedures and equipment.

(3) Radiation Contamination Limits and Controls - contamination and internal radiation exposure control methods, procedures and equipment.

(4) Employee and Management Responsibilities for Radiation Safety.

(5) Emergency Procedures and Plans - an administrative system to report conditions potentially adverse to safety or quality.

(6) Biological Effects of Radiation - basic understanding of biological dose and methods of assessment.

(7) Contents of 10 CFR 19, Rights of Workers.

(8) Prenatal Exposure (Regulatory Guide 8.13).

(9) Airborne Radioactivity Program (Regulatory Guide 8.15).

(10) Dosimetry, Bioassay Requirements.

(11) Radiation Work Permits.

(12) ALARA.

Prior to being allowed unescorted worker access to the site and issuance of a TLD, all personnel will be required to pass (80%) a written examination demonstrating a basic knowledge of radiation worker training and provide evidence of a recent medical examination.

Personnel training requirements are presented in Table 4.

2.3.4 Industrial Safety Training

The WSMPS industrial safety program, as documented in the WSMPS Health and Safety Plan, will be used for training all management, contractor, and subcontractor personnel involved in activities at the WSMPS. A copy of the WSMPS Health and Safety Plan is included in Appendix C. The purpose of the program is to promote an awareness of the potential risks involved in performing various activities, including characterization and remediation, and to provide knowledge and proficiency in industrial safety, consistent with the assigned tasks. Personnel involved in the WSMPS Remediation Project will be trained to be able to carry out their assigned responsibilities safely. Classroom training, on-the-job training and equipment specific training will be provided as part of the training program.

Safety training will take place on a continuing basis throughout the remediation of the FZB Area and surroundings. Training will be updated as necessary. Training in the proper use of specialized equipment will be given prior to the individual using that equipment.

The primary objectives of the industrial safety training program are:

- To provide information on the potential industrial hygiene and safety hazards associated with the remediation of the FZB and surroundings and the steps taken to provide safe working conditions and a safe environment.
- To enable each person to understand his responsibilities as a worker and to comply with WSMPS rules and to respond properly to warnings and alarms under normal and accidental conditions.
- To enable individuals to recognize potential hazards and to take appropriate measures to prevent personal injury and/or damage to facilities and equipment.

The industrial safety training program includes the following topics:

- Periodic shoptalks - pertinent industrial safety information, injury statistics and specific safety topics.
- Specific on-the-job training on hazards related to specialized equipment - cranes, forklift trucks, front end loaders, dump trucks, drilling rigs, hydraulic lifts and portable platforms.
- General industrial safety topics - proper lifting, hearing, and eye protection, tripping hazards, elevated heights work, hazardous material handling, use of power tools, personnel hygiene.
- Specialized training - first aid, CPR, fire fighting, use of respirators, as required.

The status and extent of the training of each individual will be documented to verify that workers are adequately trained for each assigned task.

2.3.5 Training Verification and Documentation

All persons working onsite will have evidence of initial training and pertinent refresher training as required by Sections 2.3.3 and 2.3.4 (e.g., training certificates, letter of certification, etc.) prior to being permitted to perform work involving a potential for exposure to safety or health hazards. In addition, all site personnel will be required to sign a statement documenting that they have received site-specific training and that they understand the potential site hazards along with the necessary control measures to reduce and/or eliminate those hazards.

All training documentation, including the content of Site Specific Training and any other subsequent training (e.g., periodic safety meetings, specific task safety training, etc.) will be maintained on site as part of the WSMPS project remediation file and available for inspection until the Final Survey is completed and NRC releases the FZB Area for unrestricted use.

2.3.6 Employee Access to Information

All pertinent information concerning the health and safety of onsite workers will be conveyed initially via site-specific training. Subsequently, documents such as the Radiation Worker Handbook and Training Manual, will either be provided to employees or be made available to them upon request. In addition, any new information concerning safety or health conditions associated with this project will be conveyed to project personnel.

2.4 Contractor Assistance

It is Westinghouse's intention to remediate the FZB Area and surroundings primarily by using contractor and subcontractor employees. The responsibility for project performance of characterization and remediation activities, however, will rest with Westinghouse. Existing and additional WSMPS plans and procedures, identified by Westinghouse which delineate the environmental, safety and health policies and administrative guidelines, will be applied to the WSMPS Remediation Project, as deemed necessary. Site characterization and remediation work will be performed in accordance with these and other project approved documents (Site Remediation Plan, work plans and work permits, Radiological Control Plan, Health and Safety Plan, Radiation Worker Training Manual and radiological and safety procedures and QA Plan).

2.4.1 Contractors

2.4.1.1 Remediation Contractor

The overall Remediation Contractor Manager of the WSMPS Remediation Project will be _______(TBD)_______________. The remediation contractor manager will serve in the Project Manager, RSO, Coordinator of Quality Assurance, Environmental Safety and Health Coordinator and Site Supervisor roles. The responsibility and authorization of each of these key positions is discussed in Section 2.2.2.

The overall role and responsibility of Remediation Contractor Manager is to provide the management and supervision necessary to ensure that:

(1) The WSMPS remediation activities are planned and performed in accordance with the requirements established for this project.

(2) The site is remediated to acceptable levels and conditions which allow for release of the site for unrestricted use.

The selected remediation contractor personnel will have had experience in several remediation projects involving radioactive and/or solid waste. The qualifications of the selected remediation contractor organization will be incorporated as an Addendum to this SRP, once the contractor has been selected.

2.4.2 Subcontractors

Subcontractors for excavation/construction and laboratory services will be selected prior to the start of remediation of the WSMPS. The qualifications for the selected subcontractors will be established and verified by the remediation contractor, and/or Westinghouse.

3.0 DESCRIPTION OF METHOD USED FOR PROTECTION OF OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

3.1 Facility Radiological History Information

The Specialty Metals Plant was founded in 1955 as a research and development manufacturing facility for Westinghouse. Westinghouse began manufacturing zircaloy tubing in 1967. The Specialty Metals Plant historically manufactured two lines of nuclear grade tubing, including stream generator tubing and fuel clad tubing. Manufacture of the tubing includes the use of a variety of lubricants, solvents, acid pickle solutions, and alkaline cleaners. Several spent solutions and/or materials used in the plant process are managed as hazardous wastes under the Resource Conservation and Recovery Act. These materials are treated and disposed of off site.

During the period from approximately 1955 to 1961, fuel manufacturing operations were conducted at the Specialty Metals Plant using enriched uranium in both metal and oxide forms. This involved both highly enriched uranium for the Navy fuel program (under subcontract the Bettis Atomic Power Laboratory for U.S. Atomic Energy Commission work) and low enriched uranium for atomic power plants (under License SNM-37 from the U.S. Atomic Energy Commission).

In conjunction with the fuel fabrication work in the main building, a separate building was used for various waste treatment and packaging operations. These operations consisted of an evaporator for liquids, an incinerator, and solid waste packaging and storage in preparation for shipment. This building was located south of the main building. The area encompassing the location of this former building is now referred to as either the "Former Zircaloy Burn (FZB) Area" or the "Cow Palace Area". The NRC radioactive materials license for the WSMPS (SUC-509) was terminated on December 31, 1984.

3.1.2 Summary of Previous Site Characterization Activities

3.1.2.1 Former Zircaloy Burn Building Area

A series of radiological investigations which included extensive surface and subsurface characterization have been performed in the vicinity of the FZB Area. In addition, exploratory trenches were dug to investigate subsurface features. These investigations conducted during 1994-1998 are summarized as follows:

<u>1994 - 1996</u>

- <u>Phase I Site Investigation</u>: Cummings/Riter Consultants, Inc. performed a Phase I site investigation of soils, sediments, groundwater, and surface water at the site in October and November, 1994 *(Cummings/Riter, 1995a)*. Included in this investigation were ten subsurface boring in the vicinity of the FZB Area, with twelve soil samples from these borings analyzed for radiological parameters. In addition, 234 discrete surface soil samples were collected from a 25-foot grid established in the same area for initial screening using a gamma survey instrument. Seventeen of these surface soil samples were then submitted for analysis of specific radioisotopes. Radiochemistry results for selected surface and subsurface soil samples indicated the presence of total uranium of concentrations in excess of 30 picoCuries per gram (pCi/g). Such results were indicative of enriched uranium rather than natural uranium.

- Phase II Investigation: Cummings/Riter performed a Phase II investigation of soils and groundwater at the site in August through October, 1995 *(Cummings/Riter, 1995b)*. As part of this investigation, 28 surface soil samples were collected from a 25-foot grid established immediately east of the Phase I sampling grid at the FZB Area. Samples were screened using a gamma survey instrument. A magnetometer survey was also performed at the areas, as well as additional surface scanning using a gamma survey instrument in areas that had been identified as exhibiting radiological activity above background. After an initial surface remediation effort established that impacts were present at greater depths, a series of test trenches were excavated at the area to a depth of up to two meters. Upon completion of each trench, the exposed soils were scanned using a gamma survey instrument, and samples were collected from the trenches at five meter intervals for subsequent radiological analysis. The results of the various surveys performed as part of the Phase II investigation (radiological, trenching, and magnetometer) indicated the presence of enriched uranium, with total localized uranium concentration exceeding 30 pCi/g in surface and subsurface materials at the FZB Area.

- Addendum - Phase II Investigation: Cummings/Riter performed an additional Phase II characterization of site soils and groundwater in April, September, and October, 1996 *(Cummings/Riter, 1996)*. Included in the additional work was an assessment of a former lagoon reportedly adjacent to the existing sludge drying beds. As part of this work, electromagnetic geophysical surveys and trenching were performed in order to locate and characterize the former lagoon, and two soil samples were collected from the trenches for radiological analysis. Small quantities of processed uranium were identified with some of the debris encountered in the former lagoon, but general levels of radioactivity were consistent with normal background.

Summary of 1994 - 1996 Characterization Activities

In general, the Phase I, Phase II and Phase II-Addendum investigation efforts conducted during 1994-1996 identified a few surface contamination areas but did not identify significant contamination.

As a result, a decision was made to prepare a Risk Analysis that would include review of the available data, recommendations for additional sampling if required and an assessment of public risk that might accrue if no further remedial actions were taken. One previously identified item in the FZB Area was a buried terra-cotta pipe line. A decision was made to relocate that terra-cotta line and remove it during the summer of 1998, coincident with the removal of a remaining underground line in the Finishing Area of the Main Building. The relocation and removal of the terra-cotta line lead to the identification of additional contamination as described in Section 3.1.3.

A complicating factor in the previous characterization studies was the lack of knowledge that the FZB Area had been covered over at some time in the past with a layer of fill soil. Some of the soil appears to have come from the several expansions of the on-site pond that is located to the southwest of the FZB Area. There appeared to be a minimum layer of approximately 2 feet of fill soil covering the original topography of the FZB Area.

1998

During November 16-24, 1998, Cummings/Riter conducted an additional soil sampling program at the WSMPS *(Cummings/Riter, Inc., June 15, 1999)*. The program consisted of:

- Drilling and Coring: Collection of soil cores from 48 boring locations (Figure 2) utilized a 4¼ inch inside diameter (ID) hollow stem auger equipped with a 3½ inch ID split core barrel sampler. The majority of the borings were advanced to five feet below the ground surface. Some locations (i.e., south of the underground gasoline transmission line) were deeper due to thicker sequences of consolidated deposits at this location. The borings were advanced to below the fill/indigenous soil interface (in borings which encountered fill), to the top of bedrock, or to a maximum of 15 feet. Cores were logged for color, grain size, soil type, moisture content, and presence of waste material. In addition, corings were monitored for organic vapor using an HNU Systems photoionization detector (PID) and radioactivity using a Ludlum Model 2221 coupled with a 1" x 1" NaI detector (Ludlum 43-10) and/or a beta/gamma survey meter (Model 140 meter coupled with a 44-9 GM pancake probe).

- Downhole Low-Energy Gamma Survey: Following completion of the soil coring program, a low-energy gamma (LEG) radiation survey was performed by Westinghouse representatives on each boring at six-inch intervals (starting at the surface and ending at the bottom of the hole) using a Ludlum Model 2221 with a 1" x 1" NaI (Ludlum 43-10) detector. All counts taken were accumulated for one minute in gross counts per minute. The data presented in Table 5 denotes portions of the borings that collapsed and could not be surveyed using the downhole probe.

- Initial Core Sampling and Laboratory Analysis: Based on the visual observation from the soil cores and the downhole LEG survey data, 70 samples intervals most likely to exhibit the higher levels of radioactivity were identified per additional radiological analyses. These 70 samples plus approximately 100 additional samples were analyzed for U-235 and other radiological isotopes via gamma spectroscopy. A summary of the MS-2 counting data and the U-235 results for the Antech for these 78 samples and approximately 100 additional samples are presented in Table 6. The correlation of these data is depicted in Figure 5.

- Radiological Counting of the Core Segments: Soil cores recovered from the coring program were segmented into two to four inch intervals and placed in clean plastic containers. The core segments from areas with known or suspected radiological activity above background based on downhole LEG and gamma spectroscopy results, were then counted using an MS-2 counter with a 1" x 1" NaI detector shielded counting geometry. The results for each core interval are presented in Table 7. Because in many instances several sample results were obtained for each twelve inch interval, the maximum result within each twelve inch interval was assumed to represent the entire interval (Table 8).

Summary of 1998 Characterization Activities

3.1.2.2 Physical Characterization

Non-indigenous fill and waste materials were encountered in 41 of the 48 borings advanced in this area to depths of up to 12 feet below existing ground surface. Waste material encountered consisted predominantly of zircaloy shavings, ash, and fragments of limestone, asphalt and concrete. Slag and roof tar fragments were also observed at select locations during coring activities.

Based on a visual field classification, the non-indigenous fill consisted primarily of silt and fine-grained sand, with some sandstone fragments. Based on visual classification of the soil cores alone, compared to the unified soil classification system (USCS), the non-indigenous fill would be expected to be composed of particles primarily ranging in size from less than a No. 200 sieve (0.075 mm) up to a No. 40 sieve (0.425 mm). However, some sandstone fragments would be expected in the range of 4.75 mm (gravel size) to greater than 300 mm (boulders). The percentage of these larger fragments increases with depth.

A black organic layer was observed in Borings SC-43 and SC-46. This thin organic layer is interpreted to represent the original ground surface prior to placement of non-indigenous fill, and may represent a "marker bed" associated with the contact between the fill material and indigenous soils.

Indigenous soils in the area consist of silt, fine-grained sand, and some sandstone fragments (with the quantity of sandstone fragments increasing with depth). In addition, clay was encountered in select locations at depth, particularly south of the underground gasoline line. The USCS particle distribution for indigenous soils would be expected to be similar to that listed above for non-indigenous fill. A three-dimensional fence diagram depicting the subsurface based on the 48 soil core borings is included as Figure 4.

3.1.2.2.1 Radiological Characterization

Downhole radiological data was collected from each of the cased soil core holes at six-inch intervals using a gamma survey meter with an NaI detector. The counts were integrated for a one-minute interval. The highest readings from this data were observed at location SC-35, at the western edge of the area of interest, as indicated in Table 5. A comparison of this data and the analytical results of the selected samples indicated that the gross gamma counting for each core was subject to natural background variations, and was not necessarily indicative of impacts caused by human activities.

A review of the correlation chart between gamma spectrometry data for U-235 (Table 6) content and the MS-2 data (Figure 5) indicated that there was a significant uncertainty due to the variations in the natural background concentrations and isotopic distributions. This uncertainty limited the ability to establish U-235 concentrations with any degree of confidence when the MS-2 results are low. In order to group the MS-2 results into reasonable categories, the following ranges were selected for plotting each 12-inch interval on Figures 6 through 11.

- 0-0.2 net counts per minute per gram (cpm/gram): This range corresponds approximately to less than 1 pCi/g for U-235 and is considered to be less than the acceptance criteria for total uranium concentration.

- 0.2 - 0.5 cpm/gram: This range is considered to be suspect since the uncertainty in the U-235 appears to be above 1 pCi/g, but the variability is high.

- 0.5 - 0.75 cpm/gram: This range has a higher probability of being contaminated.

- $\geq$0.75 cpm/gram: This range is considered to be contaminated.

3.1.2.2.2 Soil Volume Estimates

From Figures 6 through 11, an estimate of the value of material with MS-2 data in specified ranges was determined. As shown in Table 9, approximately 18,100 cubic feet of soil exceeds 0.75 net counts per gram, per minute. An additional 13,200 cubic feet ranges from 0.5 to 0.75 net counts per gram per minute, and approximately 131,200 cubic feet of soil ranges from 0.2 to 0.5 net counts per gram per minute. A majority of the radiologically impacted material is located within four feet of the existing ground surface, primarily along the western portion of the study area and north of the gasoline transmission pipeline. Since the contours on the figures were generated using computer software to interpolate between available data points, the areas and associated volumes presented in Table 9 are estimated and may not be representative of actual conditions at the site.

3.1.3 Summary of Remediation Actions in Former Zircaloy Building Area

During the site characterization and investigation that occurred in the 1995-1996 time frame, a buried pipe segment, of what has since been found to be a 70 foot section of terra-cotta piping, was located under the surface of the FZB Area. The pipe was believed to have been connected to the floor drain system of the former building structure. At the time of the pipe's discovery it was confirmed that the contents of the pipe was contaminated with materials characteristic of enriched uranium. It was determined that the line would need to be removed in the future. No other information or evidence of other materials buried beneath the surface were evident at the time of the initial investigation. Furthermore, site history and knowledge of the former process and use of the drain line as well as the disposition of the former building structure was never fully detailed.

Remediation of the drain line began in early June, 1998 with the relocation of the pipe segment. At the time, the drain line was the only identified subsurface feature. However, prior to the excavation activity, drawings were identified that showed the presence of two sumps that had been connected to the drain line. The approximate locations of the sumps were identified and a search for the sumps was performed coincident with the removal of the terra-cotta line. When the line was uncovered only about half of the line remained intact with the other half dispersed throughout the immediate area as evidenced by broken sections of terra-cotta piping and pipe contents sludge. There were indications that material leakage had occurred from around the joints of the piping and as a result radiological contamination had leaked from the piping and leached into the soil.

Excavation and removal of the affected soil was required. During this phase of the remediation large sections of concrete were uncovered. It became apparent that much of the building structure had been buried on site both within the footprint of the former building and the area immediately in from of the building (east side). Radiological contamination was found to be more wide spread than originally believed. During the initial site investigation in 1995, both shallow and deep samples were collected from the FZB Area, without any indication of contamination. The shallow soil samples were collected from a depth of 0-6" and 6-12" and the deep soil samples collected down to bedrock. It was discovered in June, 1998 that the shallow soil that had been collected represented clean fill material placed on top of the original soil following the final excavation and burial of the former building structure. It was estimated that an 18-24" layer of clean fill was placed over the original surface.

The sumps were located and excavated. Upon access to the sump interiors it was noted that equipment and other related debris had been placed inside of the sumps prior to closure. Many of these materials were found to be radiologically contaminated as well as a significant volume of soils and concrete that were also contained in the sumps. All such equipment was removed and packaged accordingly for ultimate disposal as radiological waste.

Based on the observations during sump excavation radiological screening of debris, concrete and other assorted materials contained within the sump, it was determined that the foot print of the former building needed to be investigated in greater detail. During this investigation, the primary structure of the building, such as the floor and portions of the wall, was confirmed to have been buried in the area.

Remediation of specific areas of the FZB Area are described separately below. The locations of these features are provided on Figure 7.

3.1.3.1 Drain Pipe Excavation

The entire length of the remaining terr-cotta pipeline was exposed for excavation. Approximately half of the line was found in place. The other half (the shallow end) had apparently been dispersed during the removal of the building foundation since fragments of the terra-cotta pipe material were found throughout the area as the excavation proceeded. The portion of the line that remained in place was severely fractured and was essentially plugged with contaminated sediment. There was also indication of soil contamination beneath the pipeline. Since a red dye had been used in the ceramic magnet manufacturing process housed in the building during its later use, the red coloring of the soil also provided a visual indication of leakage from the pipe. The terra-cotta pipeline and all the surrounding contaminated material was removed based on visual indications and radiological field measurements. Soil samples were taken along the length of the pipeline for analysis by gamma spectrometry. Additional soil was removed until the samples indicated that the remaining surface area would meet the release criteria for uranium contamination.

3.1.3.2 Removal of Sumps

Two buried sumps were located at the northern end of the terra-cotta pipe line. The terra-cotta pipeline apparently ended in the one sump. The other sump has a line leading to it but the feed and use of this sump is not clear. Both sumps had been demolished to a level below grade and then backfilled with debris. Some of the sump contents included contaminated fragments of process equipment. The sumps were emptied of their contents and the remaining concrete sumps were removed from the ground. The contamination in the vicinity of the sumps was removed based on both visual indications and radiological field measurements. Soil samples were taken in the sump excavations for analysis by gamma spectrometry. Additional soil was removed until the samples indicated that the sump excavation surface would meet the release criteria for uranium contamination.

3.1.3.3 Identification of Leach Field System

During the remediation of the pipeline and sumps, a piece of heavy equipment broke through into a buried concrete pit covered with a concrete lid. Subsequent excavation of the area identified the initial pit, a concrete distribution box, and a system of three parallel pipelines. These components were identified as a leach field system that was not identified on the available Westinghouse Specialty Metal Plant drawings. The piping system consisted of short lengths of terra-cotta pipes that were laid end-to-end in a gravel bed layer. There was no connection between the pipe ends so leakage would occur at each location where the pipes were butted together. There was no odor associated with the system and no sludge in the concrete pit, both of which indicated that the system had not been used for sanitary waste disposal. Samples taken along the three pipelines did not indicate the presence of radiological contamination. Based on the sampling information the location, of the ends of the pipelines and the concrete pit were documented and the area was backfilled using the excavated soil. This action was taken to provide additional area in which to maneuver equipment and stockpile soil.

3.1.3.4 Separation of Building Rubble

Along with the excavations discussed above for the terra-cotta pipelines and the sumps, the entire area beneath and in front (Eastern Side) of the former building was excavated to reclaim various rubble. It appears that the plant floor and subsurface foundation were disposed of in an excavation in front of the former building. In order to assess the condition of the building rubble, all such material was segregated in a separate pile. Smaller items which were found to be contaminated were immediately packaged for disposal. The resulting pile of building rubble was then surveyed for radiological contamination and the small fraction of pieces that exceeded the release criteria for surface contamination were set aside for eventual disposal in a license burial facility. The large fraction of rubble that met the free release criteria was transported to a permitted landfill for disposal as industrial waste.

3.1.3.5 Formation and Evaluation of "Clean" Soil Pile

After separation of the building rubble, the remaining material excavated from under and around the former building consisted of about 43,000 cubic feet of soil. In order to evaluate the radiological condition of this soil in a meaningful manner, it was spread out into a layer about 4 feet thick.

An initial evaluation of the "spread out" pile was made by conducting a gamma survey of the pile on an established grid pattern. This data was compiled and entered into a computer graphics program (Surfer) to plot the data in both 3-D and control plots to help visualize the information.

The evaluation including the data and the computer generated plots are included in Appendix D. The conclusion from the evaluation was that the soil pile appeared to be relatively uniform in radiation level.

Soil samples from the pile were then collected on a predetermined pattern.

The sample results were then subject to two statistical evaluation (NUREG/CR-5849 and Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) NUREG-1575). The measured U-235 concentration (converted to total uranium) and the statistical evaluation of the data supported the conclusion that the uranium concentration in the soil pile were less than the concentration guideline of 30 pCi/g at a confidence level of 95% or greater. The evaluation (sampling, analysis and conclusions) of this "clean" soil pile is found in Appendix D.

3.1.3.6 Identification of Ash Layer

Initial Findings

During excavation to remove building debris and rubble in the vicinity of the footprint of the former building, a well defined layer of dark ash-like material was observed. Also observed within this "ash" layer were materials similar to zirconium turnings and chips. Upon further observation many of the zirconium pieces appeared to be heat affected, as if they were residual material as a result of an incomplete burning process. A radiological field survey of the ash layer indicated the likely presence of radiological contamination. The layer was found at a depth of ~2-2.5 feet below the surface and was approximately 6" thick. The layer was first located along the southeast end of the former building footprint excavation and bordering the roadway leading to the pond. Investigation indicated that the layer was present, parallel to the roadway and it appeared to continue east below the surface of the existing access road. Discovery of this ash layer indicated a need for further investigation, including radiological survey and collection of samples for gamma spectrometry analysis to identify the extent and nature of the radiological contamination.

Trench Investigations

Further investigation of the extent of the ash layer entailed excavation of shallow, narrow trenches. The depth of these trenches was limited such that once the potentially contaminated layer of ash was identified, either visually or via field survey instrumentation, no further vertical investigation was conducted. This series of trenches provided evidence of the ash layer under the roadway as well as on the eastern side of the road leading toward a former lagoon. The ash layer in this area varied from ½ to 1" thickness to a layer of ~8-12" in depth. In general, whenever ash material was encountered it also contained the zirconium turnings/chips. The locations of the excavated trenches dug for this portion of the investigation are indicated in Figure 7.

During the trenching operation along the east side of the roadway, field instrumentation indicated what appeared to be an area of elevated radiological contamination. Further investigation identified what appeared to be a fuel pellet of a size consistent with commercial product. This was uncovered approximately 6"-12" below the surface. The soil in the immediate area also indicated elevated radiological levels above background. The pellet as well as soil samples from the vicinity of its discovery were taken to the Antech Laboratory, in Madison, PA for gamma spectrometry analysis.

Identification of Contaminants

Gamma spectrometry analysis of ash material, soil and the pellet indicated the presence of a variety of uranium enrichments. Ash and soil samples showed contamination due to depleted, low and moderately enriched uranium. The pellet discovered to the east of the road was depleted uranium.

Decision to Conduct Core Boring Investigations

Based on analytical and field survey data, and visual observations from the shallow trenching investigations, the ash layer was not uniformly dispersed throughout the area, rather it appeared to be distributed in a spotty, haphazard manner. Additional subsurface investigations were needed to delineate the vertical and horizontal extent of contamination. At this time Cummings/Riter Consultants, Inc. was retained to provide assistance in the development of the protocol and methodologies for a detailed evaluation of the area.

3.1.3.7 Identification of Former Lagoon

Previous Investigations/Findings

A former lagoon had been previously identified and evaluated by Cummings/Riter (*Cummings/Riter Consultants Inc., 1996)* in Section 5.4 of Reference 3. During that investigation three trenches were excavated in the area of the approximate location of the lagoon, as based on review of historical aerial photographs. Two samples were taken of soil material associated with some metal debris found during the trenching. The isotopic composition of these samples is consistent with the processed uranium that would have been used in the fuel fabrication work. The amount of contaminated material was very small and unlikely to be representative of the average concentration in the soil. Based on these results it did not appear that further investigation was warranted.

Identification of Line Leading to Lagoon

During the excavation of the area under the footprint of the former building, a black PVC line was uncovered that led from the building towards the area of the former lagoon. This line was investigated by excavating a trench along its length until the line terminated at the apparent southeast corner of the former lagoon. Based on this physical information, a portion the former lagoon was found to be located further north than had been originally thought.

Exploratory Excavations in Lagoon Area

To further evaluate the lagoon area, excavation was initiated at the southeast corner where the PVC line terminated. More detailed review of the historical aerial photograph indicated that this corner was indeed where the water effluent entered the lagoon. The initial excavation did not indicate the presence of radiological contamination but did indicate that the lagoon had been filled in with rubble. When some of the concrete slabs were overturned for removal, several isolated pockets of radioactivity well above background were identified. These locations were gray in color and included some zirconium metal turnings and chips. A sample of this material was collected and sent to the laboratory for gamma spectrometry analysis.

Identification of Contaminants

The analytical results indicated that the soil was contaminated with uranium and that the isotopic composition was highly enriched uranium consistent with material that would have been used in the fabrication of Navy fuel designs.

3.1.3.8 Other Areas

Tree Line Parking Lot

Two parallel rows of pine trees that border the paved parking lot were located directly north of the former. Since several of the trees were located such that they would interfere with additional trench investigations, these trees were removed. Tree ring counting of the trunks indicated that the trees were about 25 years old which would mean that they were planted around 1973. Zircaloy turnings and ships were found under the root ball of the overturned tree stumps indicating that such materials had been scattered in this area prior to the planting of the trees. Gamma surveys conducted beneath the tree stumps did not indicate readings above expected background levels. As part of the erosion control measures associated with the excavation activities, a shallow trench was excavated around the entire excavation for the installation of a cloth mesh erosion control fence. In the area adjacent to the parking lot, the soil overturned during the shallow trenching indicated radiation levels above normal background levels. This indicated the probable presence of uranium contamination in this area that had not been fully characterized.

Areas Not Investigated

The excavated area around the former building focused primarily on the area beneath and east of the original building footprint. The area west of the building had not been thoroughly investigated because of the presence of soil piles in the area when the soil coring program was conducted. At this time essentially no investigation had been conducted of the original ground surface beneath the soil piles.

3.1.4 Conclusions

Based on the extent and nature of the contamination identified in the above described activities, it was decided to conduct a more extensive subsurface investigation of the area in order to quantify the extent of the contamination in terms of both area and depth. Cummings/Riter was retained to assist the investigation and prepare a report documenting the findings. Based on the coring, test trenching and other excavation activities, the following conclusions/information were noted:

- Radiological contamination is not uniformly distributed throughout the FZB Area, rather the materials are found at varying depths and areal extents.

- There are multiple sources of contamination with regard to the origin of the contamination including: processed natural uranium; depleted uranium; low enriched uranium materials consistent with commercial fuel; and high enriched uranium consistent with Navy fuel.

- In the FZB Area there are other sub-areas which will require additional characterization (surface and subsurface); beneath the current lay down area for the "Clean Soil Pile"; beneath the lay down area for the contaminated soil pile; the area to the north along the tree line adjacent to the parking lot; and possibly further investigation of the subsurface areas beneath the former leach bed.

3.2 Radiological Control Program

3.2.1 ALARA Program

WSMPS management is committed to maintaining radiation exposure to workers and the general public "As Low As Reasonably Achievable" (ALARA). WSMPS management will demonstrate their commitment by assigning high priority to work plans and procedures that will reasonably reduce personnel and environmental radiation exposures. The WSMPS Remediation Project will utilize the WSMPS Radiological Control Program to maintain the remediation project individual and collective exposure ALARA. In addition to implementation of the ALARA policy, WSMPS management will incorporate the ALARA philosophy into applicable operating procedures. Furthermore, WSMPS management will place primary emphasis on design and engineering features to maintain exposures ALARA. When practicable, design features will be selected in lieu of administrative controls to maintain exposures ALARA.

The ALARA philosophy is a fundamental objective of all effective radiation protection programs. Thus, maintaining individual and collective radiation exposures ALARA is a critical element of the WSMPS Radiological Control Plan (RCP) which enhances other parts of the Radiological Protection Program through better planning of work, training of workers, and tracking of exposures. The RCP reflects a strong commitment to monitoring and controlling occupational exposures and environmental releases as part of the ALARA Program. Westinghouse's commitment to the ALARA concept is emphasized in its policies, plans and procedures as evidenced by the implementation of:

- Radiation Protection and Contamination Control Program to control radioactive sources and minimize spreading of contamination.

- Work Activity Control Program through the use of Radiation Work Permits to control and track worker exposures.

- Safety Assessment and Review Program to evaluate potential exposure that may be received in performing the assigned task.

- Respiratory Protection Program to detect radiological hazards and provide appropriate respiratory protection equipment.

- Handling and Storage Program to ensure the proper handling, packaging and storage of radioactive material.

- Training Program which stresses the importance of continuous effective exposure control.

Ultimately, these efforts benefit the safety and reliability of the WSMPS Remediation Project by improving the quality and the efficiency of work performed.

The remediation alternative selected by Westinghouse also results in exposures to the public that are ALARA. Potential exposures to the public and other workers is kept to a minimum with the selected alternative. This is achieved by continuous monitoring of the radiological conditions at the site during remediation activities and by reducing to as little as possible the amount of material transported offsite. By so doing, potential exposures to the workers and the public during remediation activities and transportation to and handling at the low-level radioactive waste disposal facility is minimized.

3.2.1 Health Physics Program

The WSMPS Project Health Physics Program utilizes the Radiological Control Plan and related field procedures (Appendix A). Elements of this program include:

- Health and safety protection measures and policies as expressed in the appropriate WSMPS Environmental Safety and Health Plans, manuals and procedures.
- ALARA.
- Quality Assurance Program.
- Calibration and maintenance of survey equipment and instrumentation.
- Monitoring policy methods, frequency and procedures.
- Radiological Control Program.
- Airborne Radioactivity Program.
- Respiratory Protection Program.
- Radiation Work Permit (RWP) and work controls.
- Emergency Action Procedure.
- Posting and labeling.
- Records and reports.
- Potential sources of contamination exposure.
- Radioactive liquid handling procedure.
- Radiation Worker Handbook and Training Manual.
- Surface Contamination Program.

- Radioactive waste packaging procedure.
- Handling storage and disposal of radioactive material procedures.
- Radioactive check source accountability procedure.
- Various field sampling, tracking and analysis procedures.
- Bioassay.
- Dosimetry.

3.3.1 Quality Assurance Program

The WSMPS Remediation Project is subject to management controls and quality assurance requirements. In addition to general QA review and independent oversight, surveillances and audits may be performed.

Radiological surveys, including sampling and analysis, are performed in order to evaluate the effectiveness of remediation efforts in maintaining adequate radiological controls and to evaluate materials for removal and disposal.

Health Physics instrumentation and equipment is inspected prior to use. Equipment failing the inspection due to equipment malfunction, poor calibration, or inappropriateness due to use restrictions, are identified, marked, and not used. Respiratory protection equipment is inspected according to the requirements and schedules specified in the Radiological Control Plan and Airborne Radioactivity Program.

Periodic surveillances and audits of the Health Physics Program may be conducted, depending on the length of the remediation activities. The audits are performed by the Coordinator of Quality Assurance. Unusual events will be investigated as they occur.

Details of the QA Program is presented in the QA Plan (Appendix E).

3.3.2 Selection, Calibration and Maintenance of Equipment and Instrumentation

Radiological control personnel will determine the quantity, performance, necessary capabilities, and proper use of radiation detection monitoring instrumentation and sampling equipment. They will be responsible for calibration, maintenance, proper storage of such equipment, and the control of the instrument check sources.

3.3.2.1 Selection Criteria

Selection criteria for portable and laboratory counting equipment are based upon the types of radiation to be detected, maintenance and calibration requirements, ruggedness, interchangeability, and upper and lower limits of detection capabilities.

3.3.2.2 Instrument Type, Purpose and Range

Table 10 lists the typical types of radiation detection instruments expected to be used during remediation of the FZB Area and surroundings. The data include manufacturer, model, probe, radiation type, efficiency, and detector sensitivity.

3.3.2.3 Storage, Maintenance, Calibration and Testing

Radiation detection and monitoring instrumentation and sampling equipment will be stored and made available for routine use by radiological control personnel at locations such as the radiation protection field office and controlled contamination changeout areas. Maintenance of the radiation detection sampling equipment will be provided by radiological control personnel, instrument manufacturer's representatives, or contracted service vendors.

Radiation detection and sampling instrumentation and laboratory counting instruments utilized for radiation safety purposes will be calibrated before initial use, after major maintenance, and on a routine basis. Portable radiation detection and sampling equipment/instrumentation will be calibrated semi-annually by a qualified vendor in accordance with ANSI N42.17A-1989 guidance for each type of radiation of concern at the site. All calibrations will consist of performance checks on each scale range of the instrument with a radioactive source of known activity traceable to the National Institute of Standards and Technology. Calibration and maintenance will be performed in accordance with the radiation control procedures. Portable instrumentation will be source checked each day that the instrument is in use.

3.3.3 Policies, Methods, Frequency and Procedures

The WSMPS policies, methods, frequency and procedures for effluent and environmental monitoring, radiation surveys and personnel monitoring (internal and external) are described in the subsequent sections.

3.3.3.1 Effluent and Environmental Monitoring

Effluent and environmental monitoring will be conducted as part of site characterization and remediation activities of the WSMPS. The effluent and environmental monitoring activities for the remediation project will consist of:

(1) Environmental Air Sampling

Environmental monitoring stations will be established on the WSMPS to obtain airborne radioactivity baseline data during site characterization activities. Each station will be equipped with a low volume continuous air sampler. Collection and analysis of the continuous air samples will be performed on a weekly basis (sooner if high dust loading was experienced) in accordance with WSMPS field sampling procedures. Selected air samples were analyzed for isotopic uranium. The air sampler and counting instrumentation was calibrated using a standard traceable to NIST. Air sampling results are considered quality records and are stored and maintained as part of the WSMPS Project Files.

Environmental air sampling will be reinstituted for remediation activities. Four environmental monitoring stations will be installed on the perimeters of the site. Samples will be collected at least weekly and analyzed for gross alpha, gross beta, and isotopic or total uranium (as required) on a selected basis.

(2) Surface Water Sampling

Surface water will be sampled during site characterization and remediation activities, as appropriate. The water will be analyzed for gross alpha, gross beta and/or uranium.

(3) Groundwater Sampling

During site characterization activities, groundwater samples will be obtained. Samples will be analyzed for gross alpha, gross beta, and/or total uranium. Results of the analyses will be evaluated against the EPA drinking water standards. Additional groundwater sampling will be planned during remediation activities if deemed necessary.

(4) Soil Sampling

To develop contaminated waste volumes, soil sampling consisting of surface and subsurface soil will be performed. Sampling will be performed in accordance with approved field sampling procedures. Results of the surface and subsurface sampling will be considered as quality records and will be stored and maintained as part of the WSMPS Project Files.

Additional surface and subsurface soil sampling may be performed as part of the remediation activities in order to determine maximum concentration levels of uranium contaminated soil to be shipped to the low-level radioactive waste disposal facility.

(5) Direct Radiation

As part of the environmental monitoring program, environmental thermoluminescent dosimeters (TLDs) will be placed at various locations around the perimeters of the FZB Area. The purpose of the TLDs is to assure that direct radiation does not exceed the limits specified in 10 CFR 20.1301. TLDs will be analyzed by a contracted vendor (Landauer, Inc.) to measure the integrated gamma dose at each location. The TLD results will be considered quality records and will be stored and maintained as part of the WSMPS Project File.

The TLD monitoring program will continue as part of the remediation activities and TLDs will be collected on a quarterly (or sooner) basis. Environmental TLDs, together with the remediation personnel TLDs, will be used to evaluate the effectiveness of the WSMPS Radiation Control Program.

(6) Environmental Monitoring Instrumentation and Equipment

Radiation measurement instruments/equipment will be used for monitoring environmental samples for alpha, beta, and gamma activities. Alpha and beta contamination will be typically measured using GM or gas proportional instruments. Gamma contamination will be measured using scintillation or ionization instruments.

All instruments will be maintained, calibrated, and stored in accordance with approved WSMPS procedures. Standards used for calibration will be traceable to NIST. The frequency of calibration will be every six months, or more frequent if necessary (i.e., maintenance of instrument, instrument damage).

3.3.3.2 Radiation and Contamination Surveys

Routine radiation and contamination surveys will be performed, as necessary, to ensure that personnel do not exceed established occupational exposure limits and controls and do not receive unnecessary exposure to radiation. The primary objective of the WSMPS Health Physics Program is to minimize personnel exposures to As Low As Reasonably Achievable (ALARA) by providing information to radiation workers on the radiation levels in the work area so work will be completed efficiently without undue exposure to the workers.

Radiation and contamination surveys will be also used to determine the effectiveness of the overall radiological contamination and protection program. Information obtained from radiation and contamination surveys are used to re-evaluate operations and activities as well as operation processes and methods to further reduce personnel exposures to ALARA.

Radiation and contamination control surveys will be performed using approved procedures, qualified personnel, and instruments appropriate to the type of radiation and/or contamination and type of survey required.

Types of routine radiation and contamination control surveys include:

(1) Personnel Contamination Surveys (Self-Monitoring or Frisking)

Personnel contamination surveys (self-monitoring or frisking) are performed to detect and quantify the possible presence of radioactive material on the body. Self-monitoring frisking is a critical element of the WSMPS Remediation Project contamination control program. Only individuals who are trained and qualified as radiation workers are permitted to perform self-monitoring. Visitors and non-radiation workers will be surveyed by a radiological control technician.

All personnel will be instructed in the proper method of removing outer clothing/tyveks and boot covers and monitoring for personal contamination as part of the formal radiation safety training program. Friskers (personal contamination monitors) will be available at each exit from a controlled area. Instructions will be provided at each personal frisking station. Instrumentation/specification of instruments used to monitor for personal contamination are presented in Table 10. In the event that personnel contamination is suspected or found, the radiological control personnel will be notified and appropriate action taken as directed by the WSMPS Radiation Safety Officer (RSO).

Radiological control personnel will supervise any necessary personnel decontamination activities and evaluate the need for bioassay analysis. Bioassay will be initiated unless proper respiratory protection was used and nasal smears are negative. Whole body counts may be performed at the discretion of the RSO.

(2) Area Contamination Surveys

Surveys for surface contamination will be conducted during remediation activities in all controlled and uncontrolled areas established on the FZB Area site. These surveys will be performed in accordance with the WSMPS Surface Contamination Program and the General Radiological Survey Procedure. Surveys will include direct (fixed) and removable contamination measurement commensurate with the potential for contamination in the area. Survey frequencies are daily and weekly for controlled areas and uncontrolled areas, respectively. If levels of contamination exceed the WSMPS established limits (see Section 3.14), corrective actions will be taken, as directed by the RSO.

In general, area surface contamination surveys will be performed to provide:

(a) Data for determining radiological conditions that will be used for the issuance of RWPs and for termination of the RWP.

(b) Continuous monitoring of ongoing radiological work.

(c) Data for the planning and implementation of sampling/remediation plans for soil and concrete debris.

(d) Survey results are compared to WSMPS established limits.

(3) Characterization and Remediation Surveys

Radiation and surface contamination surveys will be used to provide assessments of the radiological conditions of the FZB Area in support of the design of characterization and/or remediation plans. Such surveys serve as the basis for determining the probability regarding the unrestricted release of the material or property. Characterization and remediation surveys and related sampling may be conducted in a systematic or a random manner depending on the probability of contamination existing at that location. Characterization and/or remediation surveys will be performed in accordance with approved plans or procedures. Final radiological surveys in support of remediation will be performed consistent with NUREG/CR-5849 *(NRC, 6/92)*, except that limited soil samples will be obtained.

Details of the final remediation surveys are discussed in Section 4.0.

(4) Materials and Equipment Surveys

Radiation and contamination surveys will be performed on material and equipment in controlled areas to be released for unrestricted use. The material or equipment surfaces are surveyed for direct (fixed) and removable contamination in accordance with approved procedures. Survey results are compared by Westinghouse to established release criteria *(Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product, Source or Special Nuclear Material, August, 1987)*. If the piece of equipment or material exceeds the established limits, decontamination and resurveying of the material or equipment will be performed until the item meets the acceptable release criteria.

Material and equipment survey results are considered quality records and will be stored and maintained as part of the WSMPS Project Files.

(5) Shipping Surveys

Radiation and contamination surveys will be performed on radioactive material packaged to be shipped offsite in accordance with 49 CFR requirements and WSMPS packaging and shipping procedures. Shipping surveys are considered quality records and will be stored and maintained as part of the WSMPS Project File.

3.3.4 External Radiation Exposure Control

3.3.4.1 General

It is the objective of the WSMPS Radiological Control Plan not only to maintain exposures within the limits established by Federal and State law, but also to minimize exposures to individuals, the total work force and the general population in accordance with the As Low As Reasonably Achievable (ALARA) principle.

Remediation activities at the FZB Area and surroundings will be controlled such that no worker will exceed any 10 CFR 20 occupational limit and the total of all workers' exposure will be limited to the lowest reasonably achievable. In addition, operations will be controlled to preclude releases to the environment of airborne radioactivity greater than the concentration limits of 10 CFR 20, Appendix B, Table 2, Column 1 or no release to surrounding water of radioactive liquids greater than 10 CFR 20, Appendix B, Table 2, Column 2 limits.

3.3.4.1.1 Personnel Monitoring for External Radiation

The purpose of personnel monitoring for external radiation is to provide an indication of the level of external radiation exposure. Occupational exposure limits for "licensed" facilities and the WSMPS administrative exposure limits to external radiation are given in Table 11.

Upon the initial site visit by any personnel, a complete USNRC Form 4 will be completed and signed.

3.3.4.1.1.1 Exposure to Minors

Individuals under the age of 18 will not be permitted to enter any controlled or any radiation area at the FZB Area.

3.3.4.1.1.2 Exposure to Unborn Child

As part of the radiation safety training (and reverification training) and prior to issuance of TLDs, all personnel authorized to receive radiation exposure will be given specific instruction regarding prenatal exposure risks to a developing embryo and fetus. This instruction will include both oral and written, information contained in the Appendix to U.S. Nuclear Commission Guide 8.13 "Instruction Concerning Prenatal Radiation Exposure."

3.3.4.1.1.3 Exposure to Visitors

Westinghouse will control the exposure of visitors at the FZB Area site to levels ALARA. For exposure control purposes a "visitor" is defined as any person not qualified as a "radiation worker" and who requires access to controlled areas.

Entry by a visitor to a controlled area will require the following:

(1) Assignment of a temporary TLD badge or self-reading dosimeter.

(2) Escort by a qualified radiation worker at all times while in the controlled area.

(3) Documentation of the following information:
   (a) Name
   (b) Social Security Number
   (c) Date of Visit

3.3.4.1.2 Personnel External Exposure Monitoring

3.3.4.1.2.1 Equipment

Monitoring for external radiation exposure will be accomplished with the use of primary dosimetry and radiation survey dose rate meters. The primary dosimeter for this project will be the thermoluminescent badge (TLD badge) capable of measuring the worker's whole body exposure.

Other devices that will be available for exposure control are self-reading dosimeters and dose rate survey meters. The self-reading dosimeters will be used by visitors to the site and as directed by the RSO.

The radiation survey dose rate meter for this project will have a minimum detection rate of 2 μRem/hr, an accuracy of $\pm 10\%$, and a response time of 15 seconds. Radiation and/or contamination instrumentation and specifications are presented in Table 10.

3.3.4.1.2.2 Calibration

Portable dose rate survey instrumentation used to evaluate personnel exposure will be calibrated semi-annually by a qualified vendor in accordance with ANSI N42.17Z-1989 guidance for each type of radiation of concern at the site. Portable instrumentation will be source checked each day that the instrument is in use. All calibrations will be traceable to the National Institute of Standards and Technology (NIST).

Self-reading dosimeters will be tested semi-annually by a qualified vendor in accordance with ANSI N13.5-1972 (R 1989) guidance. TLD badges do not require field calibration, but must meet the performance criteria found in ANSI N13.15-1985.

3.3.4.1.2.3 Survey and Dosimetry Requirements

Surveys for radiation levels and/or contamination levels will be performed using appropriate portable radiation survey dose rate meters prior to working on materials known or suspected of being contaminated, to assess the level of hazards and aid in the establishment of appropriate radiological controls.

As part of the voluntary program, all personnel required to regularly enter and work in the radiologically controlled area will be provided with a primary dosimeter (TLD). This dosimeter will be worn daily, while at the work site, throughout the duration of the project. Dosimetry will be analyzed quarterly or at the time of employee termination (whichever is earlier) to determine radiation exposure of the individual. Visitors will be assigned a temporary dosimeter (TLD) or a self-reading dosimeter (SRD).

3.3.4.1.2.4 Analysis

Dosimetry will be provided and processed by a National Voluntary Laboratory Accreditation Program (NAVLAP)-Certified vendor. Dosimeters will be processed on a quarterly basis or sooner or at the time of employee termination, whichever is earlier.

3.3.4.1.2.5 Recordkeeping

When self-reading dosimeters are used, the daily exposure will be recorded and tracked as a portion of the radiation work permit. Exposure results will be monitored and evaluated by the RSO. Appropriate investigative action will be taken in the event that an individual's exposure exceeds the administrative limits shown in Table 11. Copies of TLD results as they relate to a named employee will be maintained on site and available for inspection. Personnel monitoring reports will be maintained in accordance with guidance from USNRC Regulatory Guide 8.7, Rev. 1, 1992. Records of all surveys and TLD results will be considered quality records and will be stored and maintained as part of the WSMPS Project Files.

3.3.5 Internal Radiation Exposure Control

3.3.5.1 General

It is Westinghouse's policy to maintain the internal exposure of radioactive materials to ALARA. The use of engineering controls will be employed to the maximum extent possible. If engineering controls are not adequate as demonstrated by work area air sampling, then respiratory protection will be considered to control internal exposures to radioactive materials. Internal exposure monitoring will consist of two major components: airborne exposure monitoring (air sampling) and internal monitoring (bioassay and in-vivo counting).

3.3.5.1.1 Engineering Controls

Engineering controls will be utilized to the maximum extent possible to control the production of dusts during the WSMPS Remediation Project. Engineering controls may be, but are not limited to water misting or dust control additives. Contamination control structures (i.e., tents) will also be used to minimize the spread of airborne contamination.

3.3.5.1.2 Monitoring of Airborne Radioactivity

Air sampling of the work areas will be performed daily during soil excavation activities in accordance with the WSMPS Airborne Radioactivity Program. The frequency and location of sampling equipment will be dictated by the activities that occur each day. An adequate number of samples will be collected to be representative of the air in the work area.

Representative samples will be collected daily in the general work areas, at the breathing zone (within 18") of workers and downwind of the work area at the restricted area boundary. As most workers will be within the confines of equipment operator's cabs, air samples will be collected in the operator's cabs daily or as directed by the RSO. Work area air sample volumes will be a minimum of 36 cubic feet and collected using high volume or low volume air samplers as directed by the RSO.

If work involves activities outside the operator cab or when deemed appropriate by the RSO, representatives samples will be collected daily in the general work area as close to the workers as practical. If air sampling determines the possibility of an airborne release, then the RSO will evaluate the possibility of an uptake. Evaluation will include, but not be limited to nasal smears and bioassay methods to determine exposures due to an uptake of uranium. Additionally, during soil excavation operations site perimeter air samples will be collected and analyzed daily. The sampler(s) will be positioned at appropriate locations downwind of the site to collect potential releases from the site.

One background sample will be collected daily from the upwind location to the remediation site. At a minimum, one sample will be collected downwind to the remediation site. The site perimeter air samplers will collect a minimum of 36 cubic feet using a low volume sampler. Downwind perimeter air samples will be collected during periods of remediation activities to verify that quantities of uranium above the established limits are not released from the site.

3.3.5.1.3 Equipment

Air sampling equipment will be calibrated in accordance with ANSI N13.1-1969 (R/1982) within six months of the start of the project and every six months thereafter. Flow rates for the air samplers will be variable from 0.5 to 20 CFM. The analysis of air samples will be performed with equipment capable of a minimum detectable activity of ________ μCi/ml for alpha and beta-gamma activities. The analysis equipment will be calibrated in accordance with ANSI N42.17A-1989 guidance.

3.3.5.1.4 Analysis

Results of air samples will be compared with the limits from 10 CFR 20 for uranium (U-235). If the air sample results are above 50% of uCi/ml.gross alpha or gross beta, the RSO will be notified.

3.3.5.1.5 Respiratory Protective Equipment

In the event the engineering controls are not adequate to maintain airborne activity to established limits, then respiratory protection will be issued to provide the necessary internal exposure control. Respiratory protective equipment (RPE) will be issued and monitored in accordance with the existing WSMPS Radiological Control Program and Airborne Activity Program. RPE will always be selected on the basis of hazard or presumed hazard. Whenever the degree of hazard cannot be determined prior to task initiation, a conservative approach for protecting personnel will be utilized. All respiratory protective equipment (RPE) will be recommended by the Project Radiation Safety Officer (RSO) prior to the initiation of each new task or operation. The Respiratory Protection Program is described in further detail in Section 3.3.8.

3.3.5.1.6 Recordkeeping

Copies of air sampling results will be monitored and evaluated by the RSO. Appropriate investigation will be initiated in the event that an individual's personal air samples, work area samples, or perimeter samples results exceed the administrative limits (NEED URANIUM VALUES). Records of all air sampling results and air sampling instrumentation calibrations will be considered quality records and will be stored and maintained as part of the WSMPS Project Files.

3.3.5.1.7 Internal Monitoring

The primary means for monitoring for potential airborne-internal contamination is air sampling.

The Bioassay Program, as defined in the WSMPS Radiological Control Program, will be used as a supplement to airborne sampling during site remediation activities. This program will be used to aid in the determination of the extent of potential internal exposure to radioactive material to an individual. In-vitro (urinalysis) and in-vivo counting (lung counting, when deemed necessary) will be utilized to develop estimates of:

(1) The quantity of the radioactive material deposited in the critical organ;

(2) The rate of biological elimination; and

(3) The airborne radioactive concentrations to which the individual may have been exposed. The bioassay sampling program is performed in accordance with the guidelines contained in Regulatory Guides 8.9, 8.11 and 8.26.

The WSMPS Urinalysis Program will be used to allow the determination of transportable uranium intake and to verify the effectiveness of the WSMPS Radiation Protection and Control Program and the WSMPS Airborne Activity/Sampling Program. In-vitro sampling will be performed at least twice during the duration of the site remediation activities. Sampling will be performed prior to the actual start of work and upon work completion or termination of individual. In-vitro samples will also be collected for unusual occurrences or emergency situations.

In-vivo analysis (whole body or lung counting) may be performed to determined both transportable and non-transportable fractions of radionuclides, if deemed necessary by the RSO. However, since this analysis is usually utilized for individuals whose work area poses a significant potential for intake of radioactive material, in-vivo analysis is not anticipated to be required for the WSMPS Remediation Project.

In the unlikely event of an internal contamination incident or an uncontrolled or suspected occurrence of airborne radioactivity, nasal smears of the potentially exposed individuals will be collected and analyzed. Nasal smears may also be taken prior to and following use of personal respiratory protection, as specified by the RSO.

An evaluation of elevated bioassay results will be performed and documented. As part of this evaluation, the individual's dose commitment due to the potential uptake will be calculated. Based upon these calculations, the individual may be restricted from performing further work. WSMPS administrative control levels are presented in Table 11.

Bioassay sampling may also be performed at any time (non-routine work, airborne incidents, etc.) at the discretion of the RSO.

3.3.5.1.7.1 Contamination Control Limits

The main goal of the WSMPS Contamination Control Program is to maintain all radioactive contamination and radiation levels ALARA. To achieve this goal, action limits for the WSMPS Remediation Project have been established for surface, equipment, liquid, and airborne contamination. These action limits are specified in the WSMPS Radiological Control Program and Airborne Radioactivity and related procedures, and are summarized in Table 12. Specific radiation and contamination limits for shipping radioactive material packages are also contained in these documents.

3.3.5.1.7.2 Airborne Contamination Control

Contamination at the FZB Area exists as dry, non-volatile uranium compounds. This contamination may exist in contaminated soil and construction debris material (i.e., concrete, metal, wood). Remediation activities conducted at the FZB Area may generate potentially contaminated airborne dust.

Personnel and public exposure to airborne radioactivity is controlled using engineered controls, contamination containment structures (tents), high efficiency particulate air (HEPA) ventilation systems, and respiratory protection equipment. Engineering controls include dust suppressants and coverings and tarps for minimization of the generation of uranium contaminated dust during excavation of contaminated soil. Contamination containment structures include temporary herculite tents or enclosures to maintain airborne contamination within a confined area. Contamination containment structures are normally used in conjunction with HEPA-filtered ventilation systems and equipment.

Temporary HEPA-filtered ventilation contamination enclosures may be used during the remediation and decontamination of the contaminated concrete pieces. These HEPA-filtered enclosures, maintained under negative pressure with respect to outside air, will provide the necessary controls of airborne radioactive contamination to ensure protection of the worker, the general public, and the local environment. The HEPA filters have a rated efficiency of 99.97% for a 0.3 micron filter at rated air flow.

In general, as specified in the WSMPS Radiological Control Program and the Airborne Activity Program, any remediation activities which have the potential to generate airborne contamination approaching 25 percent of 10 CFR 20, Appendix B, Table 1, Column 3 limits will be conducted within temporary contamination control structures with HEPA ventilation systems to minimize the internal radiological exposure to workers and the general public and to maintain those exposures to ALARA levels.

3.3.6 Radiological Contamination Control Program

Radiological contamination control is an essential part of the WSMPS Health Physics Program. Radiological contamination control during the WSMPS remediation of the WSMPS buildings and openland areas will be based on the requirements specified in the existing WSMPS Radiological Control Program, Surface Contamination Program and the Airborne Radioactivity Program.

The critical elements of the WSMPS Radiological Contamination Control Program, as defined in the referenced documents, consists of:

- Establishment of contamination control limits.
- Implementation of airborne contamination control measures.
- Identification and monitoring of controlled areas.
- Implementation of work controls (i.e., radiation work permits).
- Implementation of contamination control surveys.
- Utilization of personal protective clothing and equipment.
- Implementation of controlled containment and storage of radioactive materials.

3.3.6.1 Identification and Monitoring of Access to Controlled Areas

To aid in the control of radiation exposure and limit the spread of radioactive material, a system of identifying radiologically controlled areas will be implemented for the WSMPS Remediation Project as specified in the WSMPS Radiological Control Program. The FZB Area and surroundings will be divided into two distinct areas for radiation exposure control. These areas are unrestricted and restricted areas.

Unrestricted area means any area access to which is not controlled by Westinghouse for purposes of protection of individuals from exposure to radiation and radioactive materials, and any area used for residential quarters.

Restricted area means any area access to which is controlled by Westinghouse for purposes of protection of individuals from exposure to radiation and radioactive materials, and any area used for residential quarters. Within the restricted areas, different radiological control zones (RCZ) will be designated to aid in radiation exposure control and control of the radioactive materials present. Such areas include, but are not limited to: *RADIOACTIVE MATERIALS AREA, RADIATION AREA, SURFACE CONTAMINATION AREA, and CONTAMINATED AIRBORNE ACTIVITY.*

In all cases, the radiologically controlled area will be delineated with distinctive barrier tape or rope and signs. The signs will have the radiation symbol and appropriate wording to warn workers of the potential hazard. A description of the radiation symbol and appropriate signs can be found in USNRC Regulatory Guide 8.1 and ANSI standard N2.1-1969.

Entry points to controlled contamination areas will be posted in accordance with 10 CFR 20.1902. Instructions describing proper techniques of personal frisking, donning and doffing of protective clothing and other special entry requirements will be posted.

Each controlled area will consist of a controlled side and uncontrolled side. A step off area (pad) will separate the two sides. A personnel survey meter (frisker) will be available to be used for individuals to perform the required personnel survey.

3.3.6.2 Work Controls and Work Permits

The Radiation Work Permit (RWP) is an administrative tool used to control work occurring inside the radiologically controlled area and to make all of the personnel involved with the work aware of specific hazards and precautions in the work area.

Additionally, the RWP will instruct the workers as to what protective equipment may be needed and what monitoring will be required. All work performed on the WSMPS Remediation Project will be performed under the authority of an RWP, as specified in the WSMPS Radiological Control Program.

All work will be administratively controlled via RWPs. RWPs will be issued weekly or monthly (for routine activities) and reviewed daily by the RSO or his designee. The RWP will include the following information:

(1) Task(s) to be performed.
(2) Location of Task(s).
(3) Radiological Hazards Involved with Task(s).
(4) Most Recent Radiation Survey Results.
(5) Required Personnel Protective Equipment.
(6) Special Use or Restraints.
(7) Names and signatures of individuals performing the task(s).

A daily safety meeting will be conducted with all workers to review safety and radiological conditions and/or changes to the RWP.

A RWP will be issued at the start of remediation operations and weekly or monthly (for routine activities) thereafter. The RWP will be terminated at the end of seven days (or 30 days for routine activities) or when conditions change.

3.3.6.3 Contamination Control Surveys

Contamination surveys will be performed, as necessary, to ensure that personnel do not spread surface contamination beyond controlled surface contamination area (CSCA) boundaries. Surface contamination must be controlled to minimize unnecessary external and internal exposure resulting from the intake of loose radioactive material by inhalation, ingestion, or skin absorption. Surveys are taken to determine whether contamination levels exist and to determine the extent and magnitude of contamination levels.

Areas and/or equipment where surface contamination exceeds the limits specified in Section 3.1.4 will be designated CSCA until such surfaces are decontaminated or covered, as specified in the WSMPS Surface Contamination Program. Loose contamination above limits found in non-radiologically controlled areas require implementation of established emergency actions, including immediate decontamination. Routine surveys of surface contamination will be performed with frequencies indicated per the RSO's instructions. As a general practice, surface contamination surveys will be performed daily in controlled areas and at least weekly in uncontrolled areas.

Surveying for personnel contamination is the responsibility of and will be performed by individuals who are trained and qualified as radiation workers. Radiological Control Technicians (RCT) will survey all other persons. The instructions for using the equipment, the acceptable limits of contamination, and the action to be taken if any individual exceeds the limits will be posted at each survey station. Individuals exceeding the established limits will be decontaminated in accordance with the decontamination methods specified in the WSMPS Surface Contamination Program.

3.3.6.4 Personal Protective Clothing

Protective clothing is provided to all individuals who are required to enter controlled contaminated areas. Anti-contamination (anti-C) clothing is worn by personnel to break the chain of contamination transfer and keep the body free from contamination. Anti-C clothing, as specified by the RCT, will be worn when either surface contamination or airborne radioactive contamination may exceed allowable limits.

Anti-contamination clothing is designed to protect the worker's head, neck and ears, body, and extremities from radioactive contamination. Anti-contamination includes, but is not limited to: coveralls, hoods, caps, overshoes, anti-contamination gloves, safety shoes, and respiratory protection equipment. Protective clothing requirements, including donning and doffing, are specified in the WSMPS Surface Contamination Program and related procedures. For specific work assignments, the protective clothing requirements will be stated on the RWP for that task. Proper donning and doffing of protective clothing and whole body frisking techniques will be covered as part of the site-specific training.

3.3.6.5 Controlled Containment and Storage

All work activities conducted at the FZB Area site involving removable (smearable) radioactivity above the WSMPS limits for unrestricted areas and unrestricted release for equipment will be performed in contamination control containments or with equipment equipped with HEPA filtration. Temporary containments will be used when a potential exists for airborne contamination to approach 25 percent of 10 CFR 20, Appendix B, Table 1, Column 3 limits, and will be operated in a negative pressure mode with respect to the outside air to prevent release of contamination to the outside area.

Equipment, tools, materials contaminated above unrestricted release limits will be controlled in accordance with the WSMPS Surface Contamination Program. Such material will be stored in identified storage areas. Contaminated metallic equipment and material may be stored in containers outside the main controlled area. The storage areas will be conspicuously posted with appropriate postings. Such material may also be stored in isolated identified storage areas inside buildings with the appropriate postings. Contaminated soil and rubble as a result of remediation activities may be stored inside or outside the main control area, but inside a fenced area. Such areas will be conspicuously posted and the material will be covered to minimize the potential for airborne dispersion of radioactive materials.

3.3.7 Airborne Radioactivity Monitoring Program

Airborne radioactivity monitoring will be conducted to confirm the effectiveness of the WSMPS Radiological Protection and Contamination Control Program. Airborne radioactive monitoring will include both perimeter sampling, and local work area sampling, or personnel (lapel) sampling.

Routine perimeter air samples will be collected with Radeco H-809V portable air samplers, variable flow rate samplers, low volume air samplers, or equivalents, with an appropriate media filter. Personnel (lapel) air samplers will be used, as required, when deemed necessary by the RSO.

The sampler head will be placed as close to the work area as possible and within the breathing zone of the workers in order to best collect a sample that is representative of the air which the workers are breathing. The samplers will be operated to collect a minimum volume of 36 cubic feet.

The frequency of sampling will be consistent with that specified in the WSMPS Airborne Radioactivity Program. As a minimum, air samples will be taken at least every four hours in areas where radiological work is being performed. For the most part, continuous air monitoring will be performed to support remediation activities conducted at the FZB Area site.

Routine air samples will be counted in the field using a gas proportional counter or equivalent for gross alpha and gross beta activity. Air samples may also be sent to a qualified outside laboratory for specific nuclide (isotope) analysis or cross check purposes.

Analysis of air samples will be performed by qualified personnel, calibrated equipment, and existing procedures. Air sampling equipment will be calibrated every six months, in accordance with ANSI N13.1-1969 (R/1982). Analysis equipment will be calculated in accordance with ANSI N42.17A-1989 guidance. Results of the air samples will be compared with the administrative limits (_______ uCi/ml) specified in the WSMPS Airborne Radioactivity Program.

3.3.8 Respiratory Protection Program

When establishing radiological controls for work involving potential airborne radioactivity, primary consideration is given to utilizing techniques that will prevent airborne radioactivity to maintain loose surface contamination in controlled areas to As Low As Reasonably Achievable (ALARA) levels. Airborne radioactivity generated during remediation of the FZB Area will be minimized to the extent practical by the use of engineered controls (dust suppressants, containment, HEPA ventilation equipment).

If such engineered controls are not feasible or cannot be adequately applied, respiratory protection will be used. Thus, when it becomes necessary for individuals to work in areas where airborne radioactive contamination could potentially exceed the levels specified in 10 CFR 20, Appendix B, Table 1, Column 3 and the WSMPS Airborne Radioactivity Program. Respiratory protection equipment will be issued and used in accordance with 10 CFR 20.1703. Respirators may be worn by workers to minimize inhalation of the dust even though not required by the WSMPS Airborne Radioactivity Program.

3.3.8.1 Wearing Respiratory Protective Equipment

When airborne radioactivity concentrations exceed the limits of Table 13, respiratory equipment must be used to protect personnel. The protection factor for a full-face filtered air respirator is 100. As shown in Table 13, full-face filtered air respirators will not be worn in airborne concentrations greater than 50 times the alpha or beta-gamma limit.

In situations where airborne concentrations of radioactive material exceeds the stated concentration guides for filtered air respirators in Table 13, the supplied air respirator will be used. A "Delmonex" air supply system or equivalent will be used to provide breathing air. As shown in Table 13, supplied air respirators will not be worn in airborne concentrations greater than 2,000 times the alpha or beta-gamma limit. The protection factor for particulates, gases, and vapors afforded by a continuous flow, full-face supplied air respirator is 2,000. No other respiratory equipment will be used at airborne concentrations 2,000 times the limit of _______ uCi/ml. All respirators will meet NIOSH/MSA approval.

3.3.8.2 Respiratory Protection Maintenance Program

All respirators will be maintained in accordance with the manufacturer's recommendations for repairs, cleaning, and disinfection. All respirators and auxiliary equipment will be surveyed after cleaning by a Radiological Control Technician (RCT) prior to packaging for issue. All respirators will be decontaminated by a RCT prior to packaging. The RCT will ensure that Westinghouse established surface contamination limits (Section 3.1.4) are not exceeded. The RCT will issue respirators only to respirator qualified personnel who have passed a physical exam and fitness for work evaluation and has successfully passed the respirator fit test. Prior to issuing a respirator, the RCT will inspect the respirator for damage and will seal it in a plastic bag for personnel issue.

3.3.8.3 Respiratory Protection Training Program

Training, including fit tests, is provided to all respirator users and individuals who direct the work of users of respirators. The training is conducted by the RSO or designee. Potential respirator users must have a medical exam and a fitness for work approval prior to issuance of a respirator. Training, medical exam for fitness and work approvals, and fit test records will be maintained by radiological control personnel.

3.3.9 Emergency Procedures

The WSMPS Emergency Action Procedure and related Health and Safety procedures identify various types of general and radiological emergencies and their required response actions. Such emergencies include, but are not limited to: radioactive spills, high airborne radioactivity, loss of radioactive material, medical emergencies (both non-life-threatening and life threatening) and fire. Additional response actions will be supplied by the local Livonia fire and emergency medical departments.

3.3.10 Posting and Labeling

All areas on the FZB Area site where radioactive materials are present will be posted in accordance with the requirements of 10 CFR 20.1902. Containers of radioactive materials and sealed source materials will be marked with the standard radiation symbol and the words *CAUTION RADIOACTIVE MATERIAL.* Areas will be classified and posted as *RADIATION AREAS* or *RADIOACTIVE MATERIAL AREAS*, per 10 CFR 20.1902. In addition, areas where radioactive material is handled in dispersible forms, such that the potential for inhalation of airborne radioactivity exists, are designated as controlled contamination areas and will be posted as *CONTAMINATION AREAS OR AIRBORNE RADIOACTIVITY AREAS.*

Determination of the area postings is made by radiological control personnel. Radiological control personnel will routinely inspect the site for proper postings, damaged or missing postings, and evaluate the need for additional postings.

3.3.11 Records and Reports

Records of individual exposures to radiation, radiation surveys and monitoring results and the disposal of licensed material will be maintained in accordance with 10 CFR 20 Subpart L (Records). Records related to the radiation safety program will be maintained as part of the WSMPS Remediation Project files. Records which will be maintained in this fashion include, but are not limited to: personnel training and indoctrination, personnel exposure, respiratory protection, fit tests, medical examination and fitness for worker results, radiation surveys and monitoring results, calibration and maintenance results, accident investigations, bioassay, liquid releases, TLD badge reports, and waste disposal.

3.3.12 Potential Sources of Contamination Exposure

Since enriched uranium is the primary contaminant, external and internal exposure present a potential source of exposure to occupational workers, visitors or the general public relative to the WSMPS Remediation Project. The major remediation and decontamination activities that have the highest potential of causing external and internal exposure and their respective primary control measures to be implemented by WSMPS are discussed below.

3.3.12.1 Buildings

The potential sources of contaminant exposure from remediation of the concrete building rubble include:

- Scabbling, Scarifying, Sandblasting, Vacuum Blasting

  Temporary contamination control containments equipped with High Efficiency Particulate Air (HEPA) filtered ventilation will be employed where large scale scabbling, scarifying, sandblasting, and vacuum blasting will be performed. Dust will be removed as generated to control the spread of airborne contamination. Dust control methods such as mist, foam and enclosures (whole or partial) will be used where practicable. For smaller areas, decontamination equipment equipped with a HEPA filter directly, may be used without the need for temporary containment enclosures.

3.3.12.2 Openland Areas

The potential sources of contamination exposure from remediation of the openland areas include:

(1) Soil Removal

Exposure rate measurements will be performed before and during soil excavation in order to maintain external exposure below the WSMPS administrative limit.

If the level of soil contamination is such that handling is likely to cause airborne contamination levels in excess of 10% of applicable limits, mist, foam, and other stabilizing agents will be used as needed to control the generation of airborne material during such soil removal.

(2) Loading and Transport

During any rubble and soil loading operations, radiological control personnel will determine the type and level of dust suppression required. Temporary contamination control containments may be used to control the spread of airborne contamination. Mist, foam and other wetting agents may be used to control the generation of airborne contamination during loading, unloading, and transport of soil and rubble. Trucks of soil or rubble will be covered when transporting contaminated soil for disposal.

(3) Scabbling, Scarifying, and Sandblasting

Concrete debris located on the FZB Area may require decontamination. Scabbling, scarifying, sandblasting, or other similar decontamination techniques may be necessary. Contamination control for these techniques will be identical to those previously discussed for the buildings.

3.4 Contractor Personnel

3.4.1 Radiation Protection and Contamination Control Program and Related Procedures

Westinghouse's existing radiation protection policies and procedures will be followed during performance of the remediation activities to ensure that contractor and subcontractor occupational exposure is controlled in accordance with the WSMPS Radiological Control Plan and ALARA. Contractors and subcontractors performing work at the FZB Area will be required to complete all radiation and industrial safety training, successfully pass the examination, participate in the bioassay program, complete a physical and fitness for work examination, and will be issued a TLD before starting work.

3.4.2 Westinghouse Contractor and Subcontractor Responsibilities

3.4.2.1 Westinghouse

In order to provide effective radiological safety support to contractors during remediation activities, Westinghouse is responsible to:

- Provide workers with a safe and healthful workplace in accordance with all federal, state and local regulations.
- Perform radiation and contamination surveys prior to performing remediation work in both the restricted and unrestricted areas of the site.
- Review and approve work authorizations through the issuing of RWPs.
- Support contractors in job planning to implement ALARA.
- Monitor contractor personnel for external exposure and contamination in both the restricted and unrestricted areas of the site.
- Post and label radiation and contamination area boundaries.
- Survey and approve for release for unrestricted use all materials and equipment before leaving the site.
- Ensure that all contractor support functions (surveys, reports, reviews, etc.) are properly documented, maintained and available for review.

- Ensure workers have been fully informed of and possess a thorough understanding of the health and safety requirements which apply to their job assignments.
- Ensure that all training is scheduled and completed prior to job startup and to maintaining auditable training records which will include any follow-up training and all annual refresher training.

3.4.2.2 Contractors and Subcontractors

All WSMPS Environmental Safety and Health Plans, including Radiological Protection and Contamination Control Programs, procedures and instructions will be available to personnel working at the FZB Area. All individuals working or frequenting the radiologically controlled areas of the site will be responsible for complying with the requirements established by these documents in support of the WSMPS Remediation Project.

All contractor/subcontractor personnel who could potentially come in contact with radioactive materials should understand that a knowledge of standard radiation protection rules and practices is an integral part of their job duties and responsibilities. Each person should be aware that it is their responsibility to minimize their own exposure to radiation and be cognizant of their obligations to WSMPS and co-workers for the safe handling of radioactive materials. Each individual working at the FZB Area is responsible to perform their job in accordance with WSMPS plans and procedures, job training and in accordance with the principle of maintaining his or her exposures ALARA. Each person who could reasonably be expected to handle radioactive materials will receive periodic instruction in the general and specific radiological aspects which they may encounter.

3.5 Radioactive Waste Management

Radioactive waste generated as a result of remediation activities at the FZB Area will be managed in accordance with the WSMPS Waste Management Program. This program, as presented below, ensures that waste generated from remediation activities are controlled, handled, transferred, stored and disposed of in accordance with applicable NRC, DOT and state regulatory requirements.

3.5.1 Waste Type

The following types of contaminated material are expected to be generated as a result of remediation activities at the FZB Area site.

3.5.1.1 Openland Areas

3.5.1.1.1 Soil

The bulk of the contaminated material on the FZB Area site is soil. The contaminated soil is contained within 1 foot of the surface for most of the site. Estimated volumes of contaminated soil and their related radioactive concentrations will be developed and incorporated into the Addendum.

Contaminated surface and subsurface soil will be excavated, consolidated, and shipped to a licensed low-level radioactive waste facility. Excavated soil, which requires stockpiling for an extended period of time prior to shipment will be covered with tarp, herculite or other suitable material.

3.5.1.1.2 Construction Debris Material

Small piles of potentially contaminated pieces of construction debris material (i.e., concrete, metal, wood) have been discovered during previous site characterization activities. Material which meets the unrestricted use release criteria will be stockpiled pending final disposition. Contaminated material will be shipped to the licensed low-level radioactive waste disposal facility.

3.5.1.1.3 Water or Liquids

No process water or liquids are expected to be generated as a result of site characterization or remediation activities at the FZB Area site. Therefore, special handling, processing and/or disposal of water on the FZB Area site is not expected.

3.5.1.2 Construction Debris Material

Contaminated construction debris material will be decontaminated to acceptable NRC release limits for unrestricted use *(NRC, August 1987)* if cost effective. Decontamination techniques to be applied include, but are not limited to: vacuuming, scabbling, scarifying and sandblasting. For disposal purposes, contaminated debris (i.e., dusts, powders, cuttings) resulting from application of these techniques will be collected, sampled to confirm that concentrations are less than 30 pCi/g total uranium.

3.5.1.2.2 Liquids

Although the volume of liquids generated during remediation is expected to be small, such liquids will be collected and analyzed to confirm that they meet the NRC 10 CFR 20, Appendix B, Table 2, Column 2 release limits for unrestricted use. The liquids will be released for unrestricted use if it is analyzed and verified to meet the NRC 10 CFR 20, Appendix B, Table 2, Column 2 release limits. Liquids that exceed the NRC release limits will be solidified or evaporated, reduced to a residue, and disposed of in an approved licensed low-level radioactive waste disposal facility.

3.5.1.2.3 Soil

Contaminated soils may be encountered around the building perimeter, open areas, and parking lots. These soils will be handled in the same fashion as the soil described in Section 3.5.1.1.1.

3.5.1.2.4 Dry Active Waste

Dry Active Waste (DAW) will be produced as a result of remediation activities on the buildings and openlands. The DAW will consist mainly of papers and plastic (gloves, anti-contamination clothing, tissues, wipes). The DAW material will be collected in metal containers, analyzed for radioactivity, and shipped to a licensed low-level radioactive waste disposal facility, if contaminated above the NRC release limits for unrestricted release. DAW that meets the NRC limits for unrestricted use will be placed in a staged refuse container and disposed of as normal waste.

3.5.2 Regulatory Requirements

The remediation activities conducted on the FZB Area site will be performed in accordance with the applicable requirements of 49 CFR, 10 CFR 71, 10 CFR 30, 10 CFR 20 and the applicable low-level radioactive waste disposal facility license conditions for the processing and disposal of radioactive waste. Compliance with the above stated requirements, conditions, and limits will ensure that:

(1) Remediation activities will be conducted without undue harm to the worker, public, or environment;

(2) Residual radioactive material (uranium) will result in potential doses below the allowable limits.

(3) Following site remediation and verification surveys the site will be suitable for release for unrestricted use.

The waste classification, surveying, packaging, and transportation requirements of these regulations will be met through implementation of WSMPS handling, packaging, surveying, and shipping procedures.

Radioanalysis will be performed by qualified NRC-licensed contractor radiological laboratories. Sampling and analysis of contaminated soil, water, and other material will be conducted in accordance with approved sampling survey plans or procedures and related quality assurance plans.

The primary analytical protocol for the analysis of contaminated material will be gamma spectroscopy. Gross alpha and gross beta analysis will also be performed, but to a lesser extent. Laboratory analysis will be performed by qualified personnel using calibrated and maintained equipment and approved laboratory procedures. The analysis will be performed in accordance with the laboratory's approved Quality Assurance Program. Cross checks will be performed with NRC/Oak Ridge Institute for Science and Education (ORISE). All analytical instrumentation and equipment will be calibrated using standards traceable to NIST.

3.5.3 Projected Quantities Material to be Transported Offsite

The bulk of the contaminated material on the FZB Area site is soil which will be excavated, consolidated and shipped to a licensed low-level radioactive waste disposal facility. Smaller volumes of other types of contaminated and potentially contaminated material include concrete, asphalt, as well as dry active waste. No significant quantities of special wastes, such as chelates, chemicals, or mixed waste, are expected to be generated as a result of remediation activities. Material that can be easily and economically decontaminated will be transported offsite for proper disposal. Based on the combined site characterization/final survey effort, an estimate of the volume of soil to be shipped offsite will be provided. This estimate will be incorporated into the Addendum.

3.5.4 Temporary Onsite Storage

Temporary storage of contaminated material, such as soil and concrete, and dry active waste may be necessary during remediation of the FZB Area site. Contaminated material stored will comply with exposure rate and surface contamination limits established by the WSMPS Radiation Protection and Contamination Control Programs.

If suspected mixed waste is encountered, it will be excavated, sampled, analyzed, and, if determined to be mixed waste, the NRC and PADEP will be notified. WSMPS will dispose of mixed waste, as approved by the cognizant regulatory authorities.

4.0 PLANNED FINAL RADIATION STATUS SURVEY

This final survey plan has been designed and subsequent survey activities will be performed in accordance with the applicable guidance provided in NUREG/CR-5849 "Manual for Conducting Radiological Surveys in Support of License Termination" *(NRC, June 1992)*.

4.1 Background Information

General background information on the FZB Area and surrounding areas is presented in Section 1.4.

4.2 Site Information

Site specific information regarding the location, history and physical setting of the WSMPS, as well as, previous characterization and remediation of the FZB Area is presented in Sections 1.5 and 3.1.

4.3 Final Status Survey Overview

4.3.1 Survey Objectives

Based on previous site characterization results, the principal contaminant at the FZB Area is enriched uranium. The proposed remedial alternative for the FZB Area is excavation of soils containing concentrations of enriched uranium in excess of the release criteria identified in Section _____ and subsequent shipment to a licensed low-level radioactive waste disposal facility. An evaluation of possible remediation alternatives is presented in Section 1.7.

In support of the preferred remedial alternative, a final radiological survey will be conducted by WSMPS to demonstrate that the FZB Area has been remediated and that the remedial objectives have been achieved. The initial final radiological survey will be conducted as part of the characterization effort to identify grids requiring remediation (Section 2.1.2.2). Contaminated soil will be excavated from the identified grids and a follow-up final radiological survey will be performed of the remediated grids.

4.3.1.1 Surface Activity of Construction Debris Material

The specific objectives of the radiological survey of construction debris material are to demonstrate that:

(1) Average surface contamination levels for each survey unit are within the acceptable release limits *(NRC, August 1987)*. Averaging will be based on 1 m^2 grid area direct measurements and indirect measurements (wipes) will be obtained at each grid intersection.

(2) Small areas of residual activity known as "hot spots" do not exceed three times the average value. NUREG/CR-5849 allows averaging elevated areas if the contamination levels are between one and three times the average limit and the weighted average over any contiguous 1 m^2 area is less than the average limit.

(3) Reasonable efforts have been made to clean up removable activity and removable activity does not exceed 20% of the average surface activity guidelines.

4.3.1.2 Soil Activity

The specific objectives of the radiological survey and analysis of potentially contaminated soil are to demonstrate that:

(1) Average uranium concentrations are within the release criteria. Averaging is based on 100 m^2 grid area.

(2) Small areas of residual activity know as "hotspots" do not exceed three times the average value. The hotspot limit applies to a 100 cm^2 grid area.

(3) Reasonable efforts have been made to identify and remove hotspots that may exceed the average guideline by greater than a factor of (100/A)½, where A is the area (in m^2) of the hotspot.

(4) Exposure rates do not exceed 10 μR/hr above background at 1 m above the surface. Exposure rates may be averaged over a 100 m^2 grid area. Maximum exposure rates over any discrete of < 100 m^2 may not exceed 20 μR/hr above background.

The above conditions will be demonstrated at the 95% confidence level for each survey unit as a whole.

The survey data will be used to calculate the total inventory of residual activity from site operations.

4.3.2 Identity of Contaminants and Compliance with Established Release Limits

Based on the knowledge of site operations and the results of site characterization efforts (Appendix A), the significant radiological contaminant has been determined to be enriched uranium. The uranium is enriched in U-234 and U-235 above naturally occurring levels. The average activity ratios of the uranium isotopes is:

U-234 _____%
U-238 _____%
U-235 _____%

4.3.2.1 NRC Release Criteria

On the basis of the combination of contaminants, the release criteria are:

- The soil cleanup criteria for enriched uranium is 30 pCi/g total uranium *(NRC, 1981)*.

The surface contamination guidelines for uranium are *(NRC, August 1987)*:

1,000 dpm alpha, beta-gamma/100 cm^2, average over 1 m^2

3,000 dpm alpha, beta-gamma/100 cm^2, maximum over 100 cm^2
200 dpm alpha, beta-gamma/100 cm^2, removable

The exposure rate guideline is *(NRC, ___________ 199__)*:

10 μRem/hr above background (average) at one meter from soil surfaces (if the weighted average over surrounding 100 m^2 is less than the average limit).

20 μRem/hr above background (maximum) at one meter from soil surfaces.

WSMPS will demonstrate compliance with the established surface contamination limits and exposure rate limits and soil concentration levels through the performance of a combined characterization/final radiological survey of the WSMPS areas, as described in Section _____. The characterization final radiological survey has been designed and will be conducted utilizing applicable guidance provided in NUREG/CR-5849 *(NRC, 1992)* titled "Manual for Conducting Radiological Surveys in Support of License Termination" and approved technical field procedures. The average exposure rates will be demonstrated at the 95% confidence level. The initial final survey/characterization will be completed and the results evaluated as a whole before a determination of the need for remediation. Following remediation of the identified areas (grids), a follow-up final radiological survey will be performed.

4.3.3 Organization and Responsibilities

The final radiological survey will be performed by a team composed of qualified personnel. The organizational chart for the survey activities is shown in Figure 3.

The team will operate under the supervision of the Project Manager (TBD). The Project Manager (TBD) will have the authority to make appropriate changes to the survey plan (subject to the established QA/QC program), as deemed necessary as the survey progresses.

Field measurements of radiological parameters and sample collection will be under the direction of the Field Operations Supervisor.

The Subcontractor Laboratory Manager will direct laboratory activities for both in-house analyses and the contractor laboratory services.

Quality Assurance/Quality Control (QA/QC) will be handled by a QA Coordinator whose work responsibilities are otherwise separate from those on the termination survey team. (TBD) will serve as the QA coordinator and will, in that capacity, coordinate all interface requirements during the final radiological survey process.

(TBD) will provide expertise on Health and Safety issues for the survey process. Health and safety considerations for workers and for the general public have been incorporated into this final radiological survey plan. The WSMPS Radiological Control Plan *(B. Koh and Associates, Inc., 2000)* and the FZB Area site Specific Health and Safety guidelines will be followed during the performance of the final radiological survey.

A description of the qualifications and experience of project personnel will be provided as an Addendum once the remediation contractor is selected.

Subcontractors for decontamination/excavation and laboratory services will be selected prior to the start of the Remediation and Final Radiological Survey of the FZB Area site. The qualification of the selected subcontractors will be transmitted to the NRC at that time.

4.3.4 Training

All members of the Final Survey Team will be qualified and trained commensurate with their assigned tasks. Training will vary according to potential exposure and the nature of the individual's job duties. In addition to the regular radiation worker training, special training will be provided on equipment, special techniques, and practices relative to the survey activities for those individuals who will be involved in taking radiological measurements and samples. All members of the final status survey team will attend an in-house training session reviewing radiation protection, survey procedures, and quality assurance activities. Documentation of training participation and results of testing to demonstrate knowledge and skills will be retained in the WSMPS Remediation Project Files.

4.3.5 Laboratory Services

Analytical services for measuring gross alpha/beta activities in air and water samples and for gamma spectrometry analysis for water and soil samples will be performed by an NRC licensed laboratory in accordance with documented and approved procedures and the laboratory's approved Quality Assurance Plan. Samples of soil and air will be collected for QC purposes and analyzed in accordance with approved procedures and an approved Quality Assurance Plan by an independent contractor laboratory. In addition, the contractor laboratory will be monitored by the QA Coordinator.

4.3.6 General Survey Plan

This radiological survey plan consists of systematic processes and procedures that have been deemed acceptable by industry standards and the NRC and are consistent with the guidelines provided in NUREG/CR-5849. Specific activities have been defined and detailed tasks have been delegated to the appropriate team members to ensure that a timely and thorough survey is conducted. Table __ provides a breakdown of activities and tasks that are currently a part of the WSMPS Final Radiological Survey Plan.

Tasks will be performed in accordance with guidelines stated in the "Manual for Conducting Radiological Survey in Support of License Termination" (NUREG/CR-5849).

4.4 Survey Plan and Procedures

4.4.1 General

The survey protocol for the openland areas will be based on the potential that residual uranium contamination may be excavated sometime in the future. The contamination potential of the openland areas has been based on a review of site history, review of records, interviews with employees and results of the characterization surveys.

4.4.2 Instrumentation

Two categories of instrumentation will be utilized by WSMPS in conducting the Final Radiological Surveys and Sample Analysis of the WSMPS areas. The categories are direct reading/measuring field instruments and laboratory equipment. All instruments used for the Final Radiological Survey will be appropriate for the measurements being made.

The field and laboratory instrumentation to be used for the survey activities, along with typical parameters and detection sensitivities for the instrumentation and survey technique, is listed in Table ___.

For instruments used for integrated measurements, the sensitivity (minimum detectable activity) is approximated by:

$$MDA = \frac{2.71 + 4.65\sqrt{BR \bullet t}}{t \bullet E \bullet \frac{A}{100}}$$

where

MDA	=	activity level in disintegrations/minute/100 cm^2
B_R	=	background rate in counts/minute
t	=	counting time in minutes
E	=	detector efficiency in counts/disintegration
A	=	active probe area in cm^2

MDA = activity level in disintegrations/minute/100 cm^2

For ratemeter instruments utilized for surface activity measurements, the sensitivity is approximated by:

$$MDA = 4.65 \frac{\sqrt{B_R/2t}}{E \bullet \frac{A}{100}}$$

where

MDA	=	activity level in disintegrations/minute/100 cm^2
B_R	=	background rate in counts/minute
t	=	counting time in minutes
E	=	detector efficiency in counts/disintegration
A	=	active probe area in cm^2

Measurements of the gamma dose rate, over the FZB Areas, will be made with a Sodium Iodide (NaI) Scintillator, μR-meters, μRem-meters, or other equivalent scintillation instruments.

Surface measurements will be used as indicators of undiscovered contamination. These measurements will be used to demonstrate attainment of the site release criterion ($\leq$ 10 μRem/hr above background). Based on historical data, qualified surveyors using the instrumentation and field techniques previously identified can detect the levels listed in Table 10 with a 90% confidence level. Sensitivities for scanning techniques are based on movement of the detector over the surface at 1 detector width per second and use of audible indicators to sense changes in instrument count rate.

All field instruments will be calibrated a minimum of once every six months, using NIST-traceable standards. Calibration will be for the alpha and beta-gamma energies present at the site.

An appropriate, dedicated check source will be available for performing field instrument efficiency response checks.. Daily checks will be logged for each instrument. If the response is not duplicated to within three standard deviations of the measurement, the instrument will be tagged and taken out of service pending recalibration. Operational and background checks will be performed at least once each four hours on instruments which are in continuous use during the day to be sure that the proper response is being obtained.

4.4.3 Survey Plan

4.4.3.1 Area Classification

As described in Section 3.0, previous characterization has been conducted on the FZB Area site by Cummings/Riter during 1994-1998.

4.4.3.1.1 Openland Areas

A summary of the radiological conditions of the surface and subsurface soils surrounding the FZB Area can be found in Section 3.0.

A more detailed description of the surface and subsurface soil is presented in the following Cummings/Riter reports:

- Cummings/Riter Consultants, Inc., 1995, "Data Summary Report, Site Investigation, Westinghouse Electric Corporation, Specialty Metals Plant, Blairsville, Pennsylvania."
- Cummings/Riter Consultants, Inc., 1995, "Data Summary Report, Phase II Investigation, Westinghouse Electric Corporation, Specialty Metals Plant, Blairsville, Pennsylvania."
- Cummings/Riter Consultants, Inc., 1996, "Addendum, Data Summary Report, Phase II Investigation, Westinghouse Electric Corporation, Specialty Metals Plant, Blairsville, Pennsylvania."

4.4.3.1.2 Affected and Unaffected Areas

As a result of the previous characterization surveys, the FZB Area and surroundings have been separated into two general classifications, affected areas and unaffected areas, for purposes of conducting the final radiological/characterization survey and establishing the sampling and measurement frequency and pattern. To facilitate survey design and assure that the number of survey data points from an area is sufficient to enable statistical evaluation, the areas have been divided into survey units which have common history or other characteristics naturally distinguishable from other portions of the site. The size of the survey unit was chosen to assure that the total number of data points or the spacing of measurements/sampling satisfies the 95% confidence level for that survey unit.

The basis for affected area and unaffected area classifications are described in the subsequent sections.

4.4.3.1.3.1 Affected Areas

Areas that have known uranium contamination based on previous radiological characterization efforts or characterization surveys. This includes areas where radioactive materials were used and stored, where records indicate spills or other unusual occurrences that could have resulted in spread of contamination, and where radioactive materials were buried. Areas immediately surrounding or adjacent to locations where radioactive materials were used or stored, spilled, or buried were included in this classification because of the potential for inadvertent spread of contamination.

4.4.3.1.3.1.1 Openland Areas

The affected areas identified for the FZB Area are shown in Figure 3.1-1. Affected areas specific to the FZB Area site include:

- Sub Area A (E20 to E70) x (N0 to N100)
- Sub Area B (E70 to E110) x (N30 to N100)
- Sub Area C (E110 to E140) x (N30 to N100)

The areas of A, B and C are 5,000 m^2, 2,800 m^2 and 2,100 m^2, respectively, for a total of 9,900 m^2.

4.4.3.1.4 Unaffected Areas

All areas not classified as affected. These areas are not expected to contain residual radioactivity, based on a knowledge of site history and previous characterization or survey information.

Unaffected areas include those areas outside the boundaries defined by Areas A, B and C.

4.4.3.2 Reference Grids

Grids will be established for the purpose of referencing locations of samples and measurements, relative to the buildings and openland areas. A 10 meter x 10 meter grid system will be established with soil samples and exposure rate measurements obtained at each 5 meter x 5 meter grid node.

4.4.3.3 Scanning Methodology

Concrete foundation surface scans will be conducted for beta and gamma radiations. Soil surfaces will be scanned for gamma radiations only at 1 cm from the ground surface using a 2" x 2" NaI (Tl) gamma scintillation detector, or equivalent instrument.

Instrumentation for scanning is listed in Table 10. The instruments having the lowest detection sensitivity will be used for the scans, wherever physical surface conditions and measurement locations permit.

Scanning speeds will be no greater than 1 detector width per second for beta gamma detection instruments and 0.5 m per second for gamma instruments. Audible indicators (headphones) will be used to identify locations, having elevated (1.5 to 3 times ambient) levels of direct radiation. All scanning results will be noted on standard field record forms.

Areas of elevated direct radiation (above the guideline limit) identified during scan surveys of structure or soil surfaces will be identified, documented, remediated, and the identified area re-scanned. Readings before and after remediation of the identified area will be documented. Locations of elevated radiation will be identified for later investigation and remediation, if necessary.

4.4.3.3.1 Openland Scans

After remediation of the contaminated soils, surface scans will be performed for gamma radiations only at 1 cm from the ground surface using a 2" x 2" NaI (Tl) gamma scintillation detector over 100% of the remediated area.

4.4.3.4 Surface Activity Measurements

4.4.3.4.1 Direct Measurements

4.4.3.4.1.1 Affected Surface Areas (Construction Debris Material)

Direct Measurements of beta-gamma surface activity will be performed on construction debris material using instrumentation described in Table 10. Approximately 10% of the direct measurements will be taken for alpha surface activity. Unless precluded by surface conditions or physical parameters, the most sensitive of the instruments listed for surface measurements (Table 10) will be used. Measurements will be conducted by integrating counts over a minute period.

Because the scanning techniques are not capable of detecting residual uranium activity at <25% of the guideline level, direct surface activity measurements will be systematically performed at 1 m intervals on the construction debris material, if the material is large enough.

4.4.3.4.1.2 Unaffected Surface Areas

If any additional construction debris material is to be surveyed as "unaffected" as part of the remediation activities, a minimum of 30 random measurements or an average measurement of 1 per 50 m^2 of the material surface area will be performed for each survey unit, if the material is large enough.

4.4.3.4.2 Removable Contamination Measurements

For both affected and unaffected areas, a smear for removable contamination will be performed at each measurement location. Beta-gamma and alpha activity will be determined for each smear.

4.4.3.6 Openland Areas Soil Sampling Exposure Rates

4.4.3.6.1 Surface and Subsurface Soil

4.4.3.6.1.1 Affected Areas

Based on previous site characterization data, the depth to indigenous soil or bedrock is 5 feet. Thus, two 2.5 foot subsurface soil samples will be collected at the intersection of each 5 meter x 5 meter grid line. Approximately 792 soil samples will be collected and analyzed for U-238 or U-235 via gamma spectroscopy.

4.4.3.6.2.2 Unaffected Areas

A 10 meter unaffected area perimeter will be established around Areas A, B and C. Two 2.5 foot subsurface soil samples will be collected within each unaffected 10 m x 10 m grid. Thus a total of 97 subsurface soil samples will be collected from the unaffected area.

4.4.3.7 Water

4.4.3.7.1 Groundwater Monitoring

As stated in Section 3.0, no additional groundwater monitoring will be performed as part of the remediation activities.

4.5 Background Level Determinations

Based on background analytical results from site characterization efforts, background uranium soil concentrations have been established at < 1 pCi/g for uranium.

If the NRC chooses to take confirmatory background samples, Westinghouse will request that the NRC provide the results and the background soil samples so that the Westinghouse independently analyze the samples.

4.6 Sample Analysis

4.6.1 Soil

All soil samples analysis will be performed by qualified individuals using approved and documented laboratory procedures in accordance with the laboratory's approved Quality Assurance Plan. The soil samples will be analyzed by gamma spectroscopy using solid-state detectors. Each gamma spectrum will be reviewed by a qualified gamma spectroscopist to identify interferences or other artifacts not identified by the computer program.

4.6.2 Water

If required, water samples will be analyzed for gross alpha and gross beta content utilizing EPA method 900.0 and gamma spectrometry utilizing EPA method 900.1. The primary laboratory and the QC laboratory will perform the analyses in accordance with their respective approved Quality Assurance Programs. Field chain-of-custody procedures and laboratory chain-of-custody procedures will be observed for all samples analyses.

4.7 Quality Assurance

4.7.1 Quality Assurance Plan

Final radiological survey activities which are deemed quality affective will be performed in accordance with a quality assurance plan established for the Project.

4.7.2 Definition of Responsibilities

The QA coordinator and other individuals responsible for assuring that an appropriate quality assurance program has been established and verifying that activities affecting quality have been correctly performed, have sufficient authority, access to work areas, and organizational freedom to:

(a) identify quality problems;

(b) initiate, recommend, or provide solutions to qualify problems through designated channels;

(c) verify implementation of solutions; and

(d) assure that further processing, delivery, installation, or use is controlled until proper disposition of a non-conformance, deficiency, or unsatisfactory condition has occurred.

Surveys will be performed by trained individuals following written procedures and using properly calibrated instruments sensitive to uranium or its daughters. Samples will be tracked from collection to analysis. Data will be recorded on prepared data sheets or log books and reviewed for accuracy and consistency. This data will be considered as part of the quality records and will be stored and maintained by WSMPS.

4.7.2.1 Quality Assurance Coordination

The QA Coordinator is responsible for ensuring all QA objectives of the survey are met, reviewing selected field and analytical data to ensure adherence to procedures and approving the quality of data before it is used to test hypothesis regarding attainment of cleanup standards. The QA Coordinator is not involved in survey activities that generate data and reports directly to the Project Manager.

4.7.3 Plans and Procedures

The final radiological survey, including sampling plans, direct measurements, sample analysis, instrument calibration, daily functional checks of instruments, and sampling methods will be performed according to written and approved procedures and /or plans. Field and Technical Plans will be reviewed by the Quality Assurance Coordinator and reviewed and approved by the Site Supervisor, Project Radiation Safety Officer and the Project Manager prior to issuance. The Document Control Administrator will control these documents.

4.7.4 Documentation Requirements

All data obtained in support of final radiological survey and remediation are considered quality records and will be recorded. Survey data to be considered as quality records is identified in Section 5.5. The QA Coordinator will ensure that chain-of-custody and data management protocols are followed for remediation related samples. In addition, Field procedures for the proper handling, shipping and storage of samples will be complied with.

All samples collected as part of the final radiological survey and which contributed data demonstrating attainment of release criteria will be retained by WSMPS.

4.7.5 Training and Qualification of Survey Staff

In addition to basic radiation worker training, all personnel conducting the surveys will receive training to qualify in the procedures being performed. The extent of training and qualifications will be commensurate with the education, experience, and proficiency of the individual and the scope, complexity, and nature of the activity. Training will be designed to achieve initial proficiency and to maintain that proficiency at least over the course of the decommissioning process. Records of training to demonstrate qualification will be documented.

4.7.6 Equipment Maintenance and Calibration

Measuring equipment will be maintained, calibrated, and tested to assure the validity of the survey data. Calibration and maintenance of each instrument will be documented.

Proper maintenance of equipment varies, but maintenance information and use limitations are provided in the vendor documentation. All measuring and analyzing equipment will be tested and calibrated before initial use and will be re-calibrated if maintenance or modifications could invalidate earlier calibrations. Field and laboratory equipment, specifically used for obtaining final radiological survey data, will be calibrated based on standards traceable to the National Institute of Science and Technology (NIST). In those cases where NIST-traceable standards are not available, standards of an industry-recognized organization will be used. Minimum frequencies for calibrating equipment will be established and documented.

Measuring equipment will be tested at least once on each day that the equipment is used. Test results will be recorded in tabular or graphic form and compared to predetermined, acceptable performance ranges. Equipment that does not conform to the performance criteria will be immediately removed from service until the deficiencies can be resolved.

4.7.7 Data Management

The generation, handling, computations, evaluation and reporting of final radiological survey data will be performed in accordance with NUREG/CR-5849 and standard WSMPS review and approval protocol. This protocol includes a system of data review and validation to ensure consistency, thoroughness and acceptability.

4.7.8 Sample Chain-of-Custody

The "Chain-of-Custody" procedure delineates the records of sample collection, identification, transport and disposal that will be maintained to ensure that samples are neither lost nor tampered with and that the sample analyzed in the laboratory is actually and verifiably the sample taken from a specific location in the field.

4.7.9 Audits/Surveillance

Field surveillance and inspections will be used to assure that the remediation project activities conducted at the FZB Area are being performed in accordance with specified technical and quality assurance requirements.

All findings and observations will be resolved. All surveillance documentation will be retained as project QA records.

4.7.10 Health and Safety

Consistent with the approach for any operation, remediation activities have been planned and will be monitored to assure the health and safety of the worker and the public are adequately protected. All remediation activities will be conducted in accordance with the WSMPS Radiological Control Plan and site specific Health and Safety guidelines. A Safety Analysis Report has been prepared (Appendix B) to estimate the potential radiological exposure both to the onsite worker and the public due to the remediation activities.

4.8 Data Interpretation

4.8.1 Data Presentation

Measurement data will be converted to units of μRem/hr (exposure rates) dpm/100 cm^2 (surface activity) for comparison with guidelines. Values will be adjusted for contributions from natural background. Average values for survey units will be determined and compared with guideline levels. Data for each survey unit will be tested against the confidence level objective, using guidance and procedures described in NUREG/CR-5849.

4.8.2 Defining the Release Criterion

4.8.2.1 Concrete Foundation Material

A survey grid (1 m x 1 m) will be considered to meet release criteria, if the average surface contamination level are within the limits established in Section 4.3.2.

If the contamination levels exceed the specified limits, attempts will be made to remediate and resurvey the area.

Small areas of residual activity known as "hot spots" do not exceed three times the average value. The hot spot limit will be applied to areas of up to 100 cm^2. The average activity level in the 1 m^2 area containing a hot spot must be within the guideline.

4.8.2.2 Openland

A survey volume (100 m^3) (10 meters x 10 meters x 1 meter) will be considered to meet the guidelines if the average concentration of total uranium in samples taken at the intersections of the 5 meter x 5 meter grid lines within the survey volume is 30 pCi/g or less.

The averaging criteria apply to any contiguous volume defined by the give number of 5 meter grid samples, where each sample represents 25 m^3. For averaging over a 100 m^3 volume, each combination of four samples in a given 1 meter layer will be evaluated. This would only be necessary if an individual sample exceeds 30 pCi/gm.

Soil samples collected from a 10 m x 10 m grid area may be analyzed individually or analyzed as a composite.

If composited, four contiguous samples in each layer will be composited prior to analysis. A survey volume will be considered to meet the guidelines if the concentration of total uranium of the composite sample is less than 7.0 pCi/gm. If the total uranium concentration of the composite sample exceeds 7.0 pCi/gm, the individual samples will be analyzed to demonstrate compliance with the guidelines.

4.8.3 Water

As discussed in Section 3.0, continuous monitoring of the groundwater will not be performed as part of the site remediation activities.

4.8.4 Calculating Means

The mean net concentrations for grid blocks and for the site as a whole will be calculated. The mean is defined as:

(1)

$$\overline{X} = \frac{1}{n}\sum_{x=1}^{n} X_i$$

Here n is the number of samples used in computing the mean and x_i is the concentration in the i_{th} sample. This mean of the concentrations of the samples taken from a particular survey unit is an approximation of the true mean concentration of the contaminant within that unit.

The variation of the concentrations in samples taken from a survey unit is an indication of the reliability of the sample mean as an estimate of the true mean. This is usually determined as the standard error of the mean.

(2)

$$s = \sqrt{\frac{\sum_{i=1}^{n} x_i^2 - \frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n}}{n-1}}$$

The variables have the same meaning here as they do for equation (1), above.

4.8.5 Comparing Means with the Release Criterion

If the soil uranium concentrations are less than the release criterion at the 95% confidence level, the site will be considered as releasable for unrestricted use. Sufficient samples will be taken to meet the data quality requirements. The background will be subtracted from the uranium concentration present in determining the release criterion.

Levels of residual activity, (i.e., elevated areas), which exceed the guideline values will be initially compared directly with the guideline. Areas of elevated activity between one and three times the guideline value will then be tested to assure that the average surface activity level within a contiguous 1 m^2 area (for foundation pieces) or 100 m^2 (for soil) containing the elevated area is less than the guideline value. To evaluate whether this averaging conditions is satisfied, additional measurements will be performed and the extent of the elevated area determined. The average (weighted average) for the 1 m^2 or 100 m^2 area will then be calculated, taking into consideration the relative fraction of the 1 m^2 or 100 m^2 occupied by the elevated area(s) using the relationship:

$$X_w = \frac{1}{n_s} \sum_{i=1}^{ns} x_i \left[1 - \sum_{k=1}^{nk} A_k\right] + \sum_{k=1}^{nk} y_k A_k$$

where

- $_w$ = weighted mean including elevated area(s)
- x_i = systematic and random measurements at point i
- n_s = number of systematic and random measurements
- y_k = elevated area activity in area k
- A_k = fraction of 1 m^2 or 100 m^2 occupied by elevated area k
- n_k = number of elevated areas.

The calculated average levels will be tested against the guideline limit at the 95% confidence level using the following equation:

where:

$t_{1-\alpha,df}$ = is the 95% confidence level obtained from Appendix B, Table B-1 (NUREG/CR 5849): df (degrees of freedom) is n-1. α is the false positive probability, i.e., the probability

$$\mu = \overline{X} + t1 - \alpha,df\frac{Sx}{\sqrt{n}}$$

that μ_α is less than the guideline value if the true mean activity level is equal to the guideline value.

X = is the calculated mean
Sx = is the standard deviation
n = is the number of individual data points used to determine x and s_x.

This will ensure that each survey unit provides a 95% confidence level that the true mean activity level meets the guideline.

4.9 Documentation

The FZB Area and related surroundings will be accurately mapped in relation to the surrounding areas including excavated areas containing replacement soil. Direct measurements and analytical results will be documented in the following manner:

(a) Location of the measurement or sample.
(b) Date of measurement or sample collection.
(c) If required, the measured concentration of uranium will be in pCi/l or pCi/g.
(d) Measurements of radiation will be reported in the following units: Alpha, beta or gamma emitting contamination in dpm/100 cm^2, beta-gamma dose rate in μRem/hr or μR/hr.
(e) The analytical error at (2σ) confidence level.
(f) Name of surveyor, sampler, and/or analyst.
(g) Analysis date.
(h) Confidence level, standard error, etc. attached to analytical results.
(i) Name of person verifying results.

In addition, the following information will be provided:

(a) Description of survey and/or sampling equipment.
(b) Survey and sampling procedures, including sampling times, rates, and volumes.
(c) Analytical procedures.
(d) Calculational methods.
(e) Calculation of the lower limit of detection.
(f) Calibration procedures and data.

The results for each survey and/or sample analysis will be listed in tabular form with its respective survey/sampling location as identified on the survey/sampling map. The results of the survey will be documented in a Final Radiological Status Report. These reports, documents and related information will be considered quality records and will be stored and maintained by WSMPS.

4.10 Report

The results of the Final Radiological Survey will be submitted to the NRC in a Final Radiological Status Report. The report will summarize the survey results and will demonstrate that the FZB Area and surrounding areas meet the unrestricted release criteria with the requisite level of certainty. Reference to procedures used, supporting calculations, figures identifying sample locations and tables showing the average and maximum exposure rates, as well as the related confidence levels for each grid or survey unit, will be included in the report. The report format and content will follow the recommendations contained in NUREG/CR-5849. Raw field and laboratory data will not be provided in the report because of the volume of this documentation. However, this information will be available for NRC review.

All field and analytical data will be stored and maintained by WSMPS as quality records.

5.0 FUNDING

Specific costs for this remedial option consist of onsite survey and sample collection, sample analysis, excavation of grids, final survey, waste disposal and site restoration. Excavation and waste disposal are estimated based on available site data. Analysis of the data indicates that between five and 20 grids would need to be removed to fulfill the guideline criteria. This conclusion is based on the following:

Of the 32 composite samples, three, all from Sub Area A, exceeded the guideline maximum concentrations of 90 pCi/g. If it is assumed the same distribution as in the characterization in Sub Area A, this would indicate that 20 grids require excavation. Using two feet as the average depth of excavation, this is equivalent to about 402 yd^3, which may require excavation.

If the 20 grids are excavated, the estimated cost for this remedial option is:

Item	Costs
Onsite Radiological Support	$ 65,000
Geoprobe	25,000
Analytical Services (800 samples)[1]	56,000
Mobilization	10,000
Excavation (402 yd)[2]	4,020
Waste Disposal (10,854 ft^3)[3]	542,700
Site Restoration (402 yd)[4]	3,216
Total	**$705,936**

The overall cost for the remediation of the FZB Area is the responsibility of Westinghouse Electric Company.

Notes:

[1] 800 samples x $70 each = $56,000
[2] 402 yd x $10/yd = $4,020
[3] 10,854 ft^3 x $50/ft = $542,700
[4] 402 yd x $8/yd = $3,216

Following completion of the characterization/final survey and sampling effort, this cost estimate will be revised to reflect the new information.

6.0 PHYSICAL SECURITY PLAN AND MATERIAL CONTROL AND ACCOUNTABILITY PLAN PROVISIONS IN PLACE DURING REMEDIATION

Since the radioactive contaminant is uranium waste in low concentrations, no Physical Security Plan and Material Control and Accountability Plans are required. However, it should be noted that the FZB Area site is enclosed with a fence and entry gate which is locked after business hours.

7.0 REFERENCES

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TABLE 2
OVERVIEW OF MAJOR ACTIVITIES AND TASKS
FOR WSMPS REMEDIATION PROJECT

ACTIVITIES	TASKS
Evaluate contaminated potential	1. Review operating history with respect to the construction debris material and openland areas. (Completed) 2. Review radiological data from previous characterization surveys. (Completed) 3. Identify radionuclides of concern and determine guidelines. (Completed) 4. Conduct site characterization of openland areas. (Completed) 5. Classify areas as to "affected" and "unaffected".
Establish grid reference system	1. Install grids (10m x 10m openlands). 2. Prepare openland area survey maps.
Determine background levels	1. Measure outdoor exposure rates. 2. Collect background soil samples.
Perform combined characterization/final survey measurements	1. Conduct surface walkover gamma scan of openland areas. 2. Conduct exposure rate measurements at each soil sample location. 3. Conduct surface/subsurface soil sampling. 4. Perform surface scan and direct measurements on construction debris material. 5. Collect additional samples (i.e., air, TLD, water).
Analyze samples	1. Count air sample filters 2. Analyze water, soil. 3. Run TLDs
Interpret data	1. Convert data to standard units. 2. Calculate average levels 3. Compare data with criteria.
Prepare report (Addendum to SRP)	1. Identify grids exceeding release criteria. 2. Revise volume of soil to be remediated, schedule and cost estimate, as necessary. 3. Prepare text, construct data tables, develop graphic. 4. Submit addendum report to NRC.
Perform remediation	1. Excavate grids which exceed the release criteria (stockpile and resample. 2. Excavate former lagoon area - scan/direct survey construction debris.
Prepare for transport and disposal	1. Fill (i.e., B-25 boxes, intermodals) roll-off boxes for shipment and disposal at off-site disposal facility. 2. Work with disposal facilities to accept waste.
NRC confirmation survey	1. NRC conducts confirmation survey (ongoing throughout the remediation effort). 2. NRC reviews the Final Survey Report. 3. NRC provides letter releasing the FZB and surroundings for unrestricted use.
Restore site	1. Regrade and restore site using fill soil and re-vegetate surface.