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UCAR

UCAR CARBON COMPANY INC.

P.O. Box 500, Lawrenceburg, TN 38464

August 19, 1998

Mr. Thomas R. Decker, Chief
Materials Licensing/Inspection Branch 1
Division of Nuclear Material Safety
United States Nuclear Regulatory Commission Region II
Atlanta Federal Center
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Atlanta, Georgia 30303-3415

SUBJECT: REMEDIATION (DECOMMISSIONING) PLAN FOR THE FORMERLY LICENSED UNION CARBIDE CORPORATION FACILITY (UCC), LAWRENCEBURG, TENNESSEE (LICENSE NOS. SNM-00724 (TERMINATED) AND SMB-00720 (TERMINATED))

Dear Mr. Decker:

Enclosed are two (2) copies of the Remediation (Decommissioning) Plan developed for the formerly licensed Union Carbide Corporation facility in Lawrenceburg, Tennessee. This Plan includes the site radiological characterization data collected from sampling as detailed in the UCAR Carbon Company Inc. (UCAR) sampling plan approved by the Nuclear Regulatory Commission (NRC) on November 3, 1995.

This Remediation (Decommissioning) Plan, submitted to the NRC by August 20, 1998, ensures that UCAR meets the "grandfather clause" deadline in the July 1997 Decommissioning Rule and, therefore, can decommission the site to SDMP program release criteria applicable to surfaces and the new 25 mrem/year criteria applicable to soils, as referenced in the July 24, 1998 letter from Ms. Juanita M. Bursley of UCAR to Mr. Bryan A. Parker of the NRC.

Please contact us at (931) 762-7101 if you have any questions.

Very truly yours,
UCAR Carbon Company Inc.

J. D. Erwin

J. D. Erwin
Site Manager

Enc.

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REMEDIATION (DECOMMISSIONING) PLAN

(Volume 1)

for the

Formerly Licensed
Union Carbide Corporation Facility (UCC)
Lawrenceburg, TN

Submitted to the

U.S. NUCLEAR REGULATORY COMMISSION

by the

UCAR CARBON COMPANY INC.
LAWRENCEBURG, TN

August 19, 1998

Prepared By

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Volume 2

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Attachment B	Correspondence Chronology
Attachment C	Development of Dose to Source Factors and Dose Based Guidelines for Soil

1.0 GENERAL INFORMATION

This Remediation (Decommissioning) Plan is prepared in accordance with the guidance of the U. S. Nuclear Regulatory Commission (NRC) Regulatory Guide 3.65, "Standard Format and Content of Decommissioning Plans for Licensees Under 10 CFR Parts 30, 40, and 70," NRC's final rule (10 CFR 20, Subpart E) "Radiological Criteria for License Termination" (Federal Register, July 21, 1997) and NRC's "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-product, Source, or Special Nuclear Material" (April 1993).

1.1 Purpose

The purpose of this Remediation (Decommissioning) Plan is to detail the proposed remediation activities to be accomplished at the UCAR Carbon Company Inc. (UCAR) site located at Highway 43 South, Lawrenceburg, Tennessee. This remediation plan consists of two volumes. Volume one is the Remediation (Decommissioning) Plan. Volume 2 is a series of three attachments. Attachments to Volume 2 include a characterization report (Attachment A) detailing current radiological conditions, copies of significant correspondence referenced in the remediation plan and arranged in chronological order (Attachment B), and the detailed calculations for soil concentration guideline levels (CGL's) (Volume 2, Attachment C).

1.2 Licensee Information

The former Union Carbide facility licenses (SNM-724 and S-5002-H3, formerly AEC SMB-720) were terminated on June 4, 1974, and August 28, 1975, respectively, and the facility released for unconditional use. (The high bay area of Building 10, Room 133, had been previously released on October 22, 1968, the Metallurgy Laboratory and Building 5 Annex on May 29, 1968.) Currently, the facility is not governed by an NRC, State radioactive materials license, SDMP or any other nuclear regulatory program. UCAR, the current owner, was advised by the NRC in 1993 (as part of a commitment by the NRC to Congress in 1989 to review and evaluate all licenses terminated after 1965) that there were substantive concerns associated with the final release survey performed in 1974 upon which the termination of the licenses was made. At the request of the NRC, UCAR agreed to collect supplemental radiological survey data at its expense, the scope of which was documented in the NRC approved "Sampling Plan for UCAR Carbon Company, Inc." approved November 3, 1995.

This voluntary Remediation (Decommissioning) Plan is based upon the results from the 1996 sampling plan as well as supplemental sampling data detailed in report entitled "Radiological Characterization Report for the UCAR Carbon Facility, Lawrenceburg, TN" dated August 15, 1998. The remediation plan format and content is written in conformance with the intent of relevant Federal regulations concerning the decommissioning of facilities contaminated with radioactive materials.

All proposed decommissioning activities will be performed by a responsible and experienced remedial contractor licensed by the State of Tennessee. The contractor will take temporary possession of all material and secondary waste generated by remedial activities that is radioactively contaminated, package the material, manifest the material and transport the material to a licensed disposal facility.

1.3 Facility Description

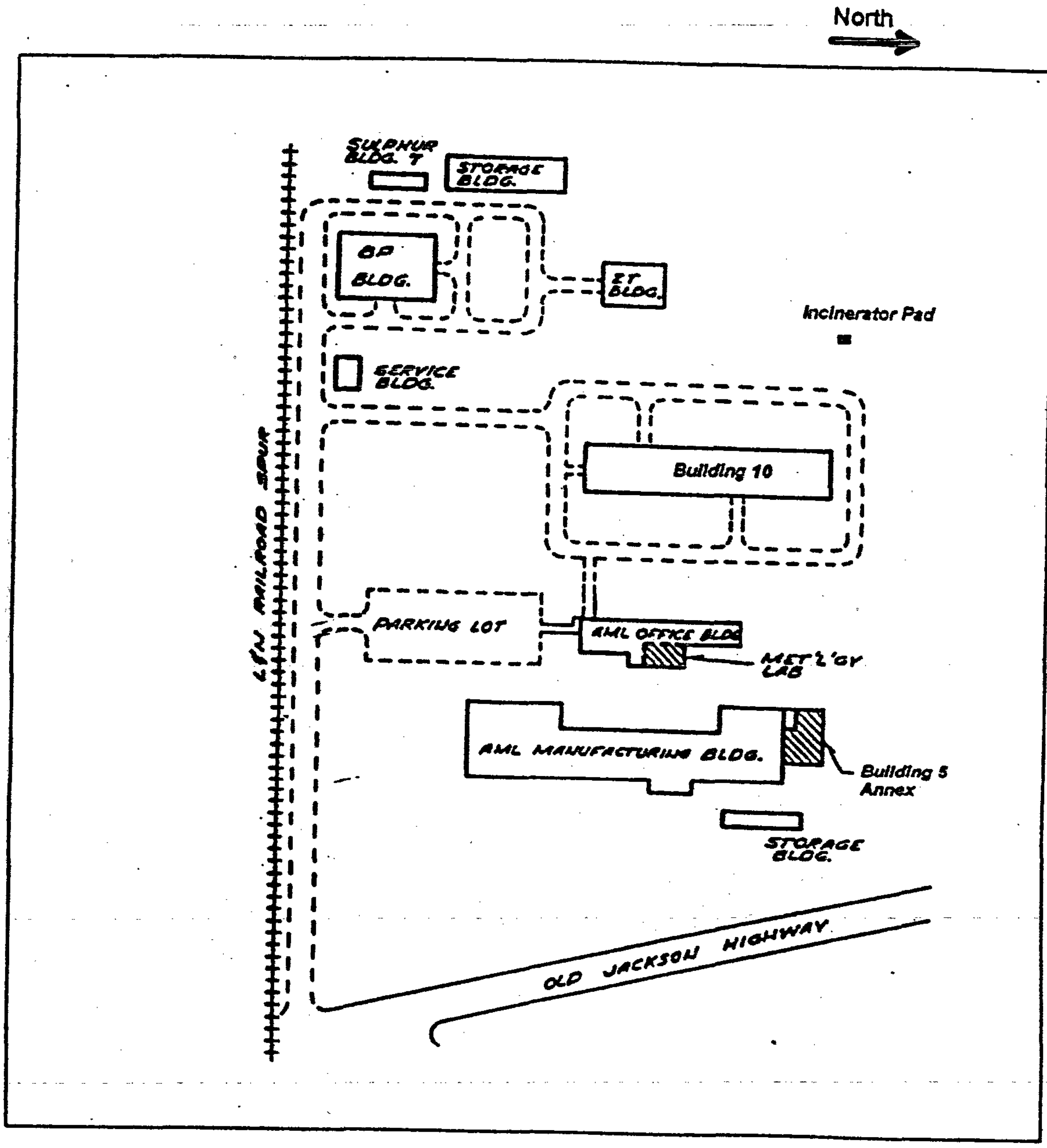
The UCAR facility (Figure 1-1) is located in Lawrence County off of Highway 43 South in Lawrenceburg, TN, and is approximately 75 miles south southwest of Nashville, TN, and three miles south of Lawrenceburg. The facility consists of approximately 583 acres of which approximately 10 acres are fenced. The buildings and facilities formerly used to process licensed radioactive material are within the 10-acre fenced area. These facilities have been used since license termination and continue to be used to manufacture a variety of non-radiological carbon products. Outside the fenced area, and to the northwest, is a primary settling pond connected by an unlined drainage ditch to a secondary settling pond which, in turn, historically discharged to Shoal Creek. Figure 1-1 is a diagram (not to scale) of the facility layout.

Three buildings and/or portions of three buildings were formerly utilized to perform licensed nuclear activities:

1. Building 10
2. Building 5 Annex
3. Metallurgy Laboratory.

FIGURE 1-1

Processing Facilities Layout



Building 10 is approximately 20,500 square feet in area. Building 10 was also referred to as Area 1, the Nuclear Fuels and Development Facility and the Development Facility Building. During operations, the building was divided into 34 separate rooms. The southern portion of the building is a one-story structure whereas the northern portion of the building (Room 133) is a two-story structure with a penthouse (approximately 1,600 square feet). The penthouse houses a fan, filter system and associated ductwork for the building ventilation system. Building 10 was used for the production of graphite coated uranium/thorium carbide fuel particles using a high temperature furnace. Process descriptions are found in correspondence dated July 29, 1963, September 21, 1964, July 27, 1966, and January 9, 1963 (see Volume 2, Attacment B). This correspondence is summarized below:

- UO_2 powders were blended with stoichimetric quantities of graphite in gloveboxes (Room 120),
- The UO_2 powders were then converted to UC_2 (di-carbide) in a tube furnace under an inert atmosphere (Room 133),
- The di-carbide uranium was milled (ball mill) to produce spheroid-like particles (Room 133),
- The material that had been processed through the ball mill was then heated in a plasma arc torch furnace under an inert atmosphere to produce spheroid fuel particles (Building 5 Annex),
- The spheroid fuel particles were then weighed and screened for size,
- Fuel particles were then mixed with graphite and a binder and heated in a fluidized bed, high temperature induction furnaces (primary and secondary) to produce a graphite coated fuel particle (Rooms 128-1 and 2),
- The coated fuel particles were sorted, by size, under a hood, inspected, weighed and placed into containers,
- The finished material was stored in a locked vault (Room 121) until shipped to the customer or the material was formed into shapes, and
- Coated particles were mixed with graphite and binder (Room 122) to form a plastic mass and formed into shapes by molding or extrusion into an ATJ graphite shell.

- Formed shapes were cured, baked, graphitized or impregnated in electric muffle or vacuum furnaces or in an autoclave (Room 133).

- Final shapes were sometimes machined or cut to size for test purposes (Room 124) in totally enclosed filtered dry boxes.

- Uranium bearing graphite-carbon scrap/residues were also oxidized (in air) to produce concentrated, but impure, U_3O_8, which was shipped off site for purification and reuse by the AEC.

- Besides reactor fuels, UCAR also shipped uranium oxides and carbides to other facilities for further fabrication.

Unit operations were performed under HEPA filtered (99.7% efficient) gloveboxes and/or enclosures. The entire facility was maintained under negative air pressure. Release of airborne contaminants to restricted and unrestricted areas were routinely monitored. Inspection reports noted that there were at least 30 air sampling stations permanently located in process and/or storage areas. There was at least one continuous air monitor, two Staplex air samplers and 14 exhaust stacks with air sampling probes that were routinely monitored. Four outside perimeter monitors were maintained at locations 300 to 400 yards from the plant. Records reviewed by inspectors indicated that air contamination to unrestricted areas never exceeded 4×10^{-13} microcuries/milliliter and 6×10^{-11} microcuries/milliliter to restricted areas. Only one area, the Batching Room (Room 120), required posting as an airborne hazard area (air contaminant level sometimes exceeded 30% of the permissible concentration for a restricted area).

Recovery work was done both on and off the site. On-site recovery work involved impure uranium oxides and other related special nuclear material. The material was dissolved in nitric acid, filtered, peroxide precipitated and recycled or shipped off site for recycle by others. Liquid wastes containing recoverable amounts of uranium (235 or natural) were collected in containers at various places of use, reduced in volume by evaporation and returned to an authorized agency for recovery. Liquids containing non-recoverable quantities of uranium were discarded into designated hot drains which in turn were discharged through a sewer system into a primary settling basin which in turn discharged by way of an unlined canal to a secondary settling basin. Discharge from the second impoundment flowed approximately 500 to 1,000 yards to Shoal Creek, the point of exit into an unrestricted area. Inspectors noted that daily samples were collected for uranium analysis from the discharge point of the second impoundment and that a review of the records indicated that none of the samples exceeded 7 x 10^{-6} microcuries/milliliter which was nearly an order of magnitude lower than permissible limits for natural uranium and uranium 235. Inspectors noted that water samples were collected above and below the discharge point to Shoal Creek and a review of the records noted that the maximum concentration detected was 22.2 pCi/liter. A State of Tennessee inspection, conducted December 12, 1966, noted that site records showed the maximum uranium concentrations from the second impoundment ranged from 103 to 293 pCi/liter over the period April to October, 1966. State analysis of samples taken from Shoal Creek in October, November and December, 1966, ranged from 4.6 to 6.25 pCi/liter downstream from the discharge point and was 2.0 pCi/liter upstream from the discharge point.

Solid waste was routinely collected in small containers at the point of waste generation and were then transferred to 55-gallon metal drums for eventual transport to a licensed disposal facility. A small, gas-fired incinerator was used to incinerate low activity, combustible waste. The incinerator was located on a concrete pad (approximately 5′ x 8′) north, northwest of Building 10. After incineration, the ash was dampened with water, collected and stored in containers for either off-site product recovery or shipment to an off-site licensed disposal facility. The bulk of the enriched uranium salvage material was stored in the Machining Room (Room 124).

The following list of rooms and their functions relative to the processes previously described is based on information gleaned from the former licensee's correspondence and various inspection reports (July 29, 1963, to August 28, 1975):

Room 101	Lobby
Room 102-1	Office/Administrative Space
Room 102/105	Office/Administrative Space
Room 106-1	Contaminated Laundry Area
Room 106-2	Contaminated Laundry Area and Steel Sump
Room 107	Laboratory
Room 108	Issue Room
Room 109	Men's Locker Room
Room 110	Men's Rest Room
Room 111&112	Women's Rest and Locker Room
Room 113-1&-2	Lunch/Break Rooms
Room 114	Locker/Change Room
Room 115	Shower Room
Room 116	Locker/Change Room

Room 117	Hallway
Room 118	Janitor's Storage Room
Room 119-1	Hallway
Room 119-2	Hallway to Laundry Room
Room 120	Batching Room (posted for airborne radioactivity), contained glovebox for blending powders
Room 121	Vault - locked storage area for SNM
Room 122	Forming Room - coated particles mixed with binder and extruded into forms, upright press, mixers and fume hood
Room 123	Maintenance Room
Room 124	Machining Room - finished products cut to size and/or testing. Contained Lindberg furnace and SS glovebox.
Room 125	Hallway
Room 126	Hallway
Room 127	Shipping and Receiving
Room 128-1&2	Coatings Room - contained furnace and chemical hoods
Room 129	Janitorial Storage and Sink
Room 130	Laboratory - chemical hoods and hot sinks
Room 131	Inspection Room - spectrascope and final inspection
Room 132	Ashing Room - contained gloveboxes, ion exchange columns, and furnace
Room 133	High bay area where final heat treatment of fuel element occurred, contained oven and Lindberg furnace. Non-contact cooling water was used for cooling the furnaces and was re-circulated through floor drains to two outside underground tanks.
Room 134	Penthouse where building fan/filter system was housed

The Metallurgy Laboratory was a five-room complex located in a portion of the east side of the AML Office Building (Building 6). The laboratory was used in the support of the start-up and production operations. This facility was also referred to in correspondence as Area II, the Analytical Laboratory, and the Chemical Laboratory. Inspection reports noted that the area where radioactive materials were handled had vinyl flooring and that only a few grams of material were handled at any one time.

The Building 5 Annex, approximately 3,500 square feet in area, was located on the north end of the AML Manufacturing Building (Building 5). Correspondence indicates this facility was used for research and development activities, in particular, technology related to graphite coatings/furnaces and plasma arcs for forming fuel particles. The Building 5 Annex consisted of seven rooms and a hallway. This facility was also referred to as Area III, the Modular Area and the Chemistry Lab.

The UCAR site is currently an operating facility that continues to produce non-radiological carbon and graphite products. As such, the licensed contractor who will perform the remedial action will be required to interface with key plant management, health and safety and operating personnel, keep them informed of all planned decommissioning activities and address any concerns raised by plant personnel throughout the remedial action and final survey.

2.0 DESCRIPTION OF PLANNED REMEDIATION (DECOMMISSIONING) ACTIVITIES

Radiological assessments performed at the UCAR facility and the immediate vicinity by Ogden Environmental and Energy Services Company, Inc. (OE&ESC) and Nuclear Fuel Services, Inc. (NFS) have identified the presence of enriched and depleted uranium on building surfaces and in soil in excess of current radiological release criteria. The Remediation (Decommissioning) Plan outlines a method for decontaminating facilities and structures and remediating contaminated soils in areas that are radiologically contaminated such that the identified areas will meet current standards for unrestricted use to the public.

2.1 Remediation (Decommissioning) Objectives

There are two primary objectives in the remediation of the UCAR facility:

1. To reduce residual surface contamination of building surfaces to below the current, unrestricted release criteria identified in NRC's "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-product, Source, or Special Nuclear Material" (April 1993) and

2. To reduce residual soil contamination concentrations to current, unrestricted release criteria identified in NRC's final rule (10 CFR 20, Subpart E) "Radiological Criteria for License Termination" (Federal Register, July 21, 1997).

July 24, 1998 correspondence between UCAR and the NRC clarified that submittal of a decommissioning plan by August 20, 1998 would ensure that these criteria would apply to remediation (decommissioning) activities.

Although the UCAR facility is not an NRC-licensed facility, the Remediation (Decommissioning) Plan is written following NRC Regulatory Guide 3.65, "Standard Format and Content of Decommissioning Plans for Licensees Under 10 CFR Parts 30, 40, and 70."

Residual Radioactive Surface Contamination

Surface contamination limits (fixed and removable) for building surfaces (e.g., floors, walls, ceilings) and associated structures (e.g., ductwork) will be based on NRC's "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-product, Source, or Special Nuclear Material" (April 1993) and are discussed in Section 4.2.1 Release Criteria.

Residual Radioactivity in Soil

Using simplified, conservative calculations, applicable concentration guideline levels (CGLs) have been developed for soil/sediment based on NRC's final rule (10 CFR 20, Subpart E) "Radiological Criteria for License Termination" (Federal Register, July 21, 1997) using an effective dose equivalent of 25 mrem/year to a member of the public. The CGLs were conservatively based on the presence of enriched uranium and are discussed in detail in Section 4.2.1 Release Criteria (See also Volume 2, Attachment C).

General Exposure Rate Levels

The guideline value for general area exposure rate measurements is 10 µR/hr above background at one meter above the surface being measured. (NMSS Handbook for Decommissioning Fuel Cycle and Materials Licenses, Table 1, Appendix C4, NUREG/BR-0241)

2.1.1 Remediation (Decommissioning) Tasks

Table 2-1 lists the major remedial tasks described below:

TABLE 2-1
Major Remediation Tasks

Task 1	Plans and Procedures Preparation, Review and Approval
Task 2	Procurement of Equipment/Materials
Task 3	Mobilization
Task 4	Site Training/Orientation
Task 5	Establishment of Access Controls
Task 6	Radiological Background Survey
Task 7	Designation of Affected and Unaffected Areas and General Facility Cleaning
Task 8	Supplemental Radiological Survey
Task 9	Remediation of Contaminated Areas
Task 10	Packaging, Characterization and Transportation of Contaminated Material
Task 11	Final Radiological Status Survey and Report
Task 12	NRC Confirmatory Survey of Facility and Final Release

Task 13 Demobilization
Task 14 Final Report

Task 1: Plans and Procedures Preparation, Review and Approval

Prior to conducting the activities described in this plan, UCAR will ensure that the contractor provides the necessary approved documentation This documentation may include a Site Health and Safety Plan, a plan for any additional planned radiological characterization, and specific work instructions for performing remedial tasks.

Task 2: Procurement of Equipment/Materials

Concurrent with Task 1, required remedial equipment, field monitoring equipment, materials and supplies, personal protective equipment, and waste storage/transport containers will be rented and/or purchased.

Task 3: Mobilization

UCAR will ensure that all required resources for safe conduct of the work described in this plan are mobilized by a qualified contractor to the UCAR site or provided by UCAR.

Task 4: Site Training/Orientation

UCAR will utilize a fully licensed, qualified contractor to implement this remediation. Contractor qualifications will include site specific safety and hazards training to assure that remediation (decommissioning) activities are carried out safely and in compliance with the license, regulations, and approved procedures and instructions.

Task 5: Establishment of Access Controls

Following specific work instructions for performing remedial tasks, access and egress controls will be established by the Radiation Safety Officer (or his qualified designee) for any Radiologically Controlled Areas (RCAs).

Task 6: Radiological Background Survey

Background materials will be identified for the major categories of building material that will be encountered (i.e., concrete, cinder block, conduit, etc.). Appropriate measurements of the radiological properties of the background materials will be obtained as directed by the Radiation Safety Officer (RSO) or his designee. Background data will be used in conjunction with radiological survey data to determine compliance with unrestricted release criteria.

Task 7: Designation of Affected and Unaffected Areas and General Facility Cleaning

Affected area building surfaces will be cleaned to remove dust or covering material (other than paint) to facilitate the gathering of applicable radiological survey data. Based on previous characterization surveys, affected and unaffected areas will be designated and appropriate sampling grids will be established in the affected areas.

Task 8: Supplemental Radiological Surveys

A supplemental characterization of specific areas (Rooms 120, 121, 122, 123, 124, 126, 129, 132) within Building 10 will be conducted for the purpose of determining average residual radioactivity levels. These levels will be compared against release criteria and the disposition for those areas will be confirmed as either requiring additional cleanup, or as meeting unrestricted release criteria and requiring no further action.

Task 9: Remediation of Contaminated Areas

Affected area building surfaces, such as concrete floors, walls and ceilings, will be decontaminated with pneumatic needle-scalers, floor scabblers, vacuums and/or similar decontamination equipment. Mechanical decontamination equipment will have appropriate health and safety devices such as High Efficiency Particulate Air (HEPA) filter equipment. As determined by the RSO, it may be necessary to construct containment enclosures for contamination control. Structures that cannot be cost effectively decontaminated (e.g., counter tops, wooden drawers, duct work, room 134 penthouse) will be mechanically removed for the purpose of containerization, volume reduction/minimization and disposal.

Soils and external paved areas which exceed the CGL's will be removed, sampled, and disposed of as low level radiological waste (LLRW) at a licensed facility.

Task 10: Packaging, Characterization and Transportation of Contaminated Material

Remediated material (debris, structures such as duct work, soils) will be containerized in appropriate storage/shipping containers. Data will be collected of sufficient quantity and quality so that the waste can be properly classified, manifested and transported to a licensed disposal facility.

Task 11: Final Radiological Status Survey and Report

Upon completion of the identified remedial activities, a Final Radiological Status Survey will be performed which will generally follow guidance from draft NUREG/CR 5849 "Manual for Conducting Radiological Surveys in Support of License Termination" and as specified in Section 4.0 (Final Radiological Status Survey). A Final Radiological Status Survey Report will be prepared and submitted to the NRC upon the completion of the survey.

Task 12: NRC Confirmatory Survey and Final Release

Upon notification by UCAR of completion of remediation (decommissioning) activities, the NRC may perform an independent confirmatory survey prior to releasing the site for unrestricted use.

Task 13: Demobilization

Upon the completion of remedial activities, the contractor will demobilize. All temporary facilities and structures will be removed from the site and the site returned, as far as is practicable, to its original condition prior to remedial activities.

Task 14: Final Report

A project final report will be prepared. The report will discuss the key elements of the remediation effort, the final status survey report, any findings of the NRC, their resolution, the packaging, manifesting, transport and disposal of removed waste. An integral part of the final report will be the documentation that all removed waste was properly disposed of as well as the documentation and/or certification that unrestricted release criteria have been met.

2.1.2 Remediation (Decommissioning) Procedures

The UCAR remediation tasks will be performed in accordance with the following documents:

1. This Remediation (Decommissioning) Plan,
2. A Site-Specific Health and Safety Plan,
3. A Final Radiological Status Survey Plan, and
4. Contractor standard operating procedures, radiation work permits, and/or specific work instructions.

Contractor prepared plans and procedures will be submitted for review and approval by appropriate UCAR personnel.

2.1.3 Remediation (Decommissioning) Schedule

Figure 2-1 contains a generalized schedule for the remediation tasks. The duration of each activity is shown in relation to other tasks. The estimated project duration is 254 days.

2.2 Remediation (Decommissioning) Organization and Responsibilities

Figure 2-2 provides an organizational chart of the personnel who will be involved in the UCAR remediation project. The following sections detail the specific responsibilities of all key project personnel. Due to the limited scope and duration, the duties of certain key project personnel may be combined (e.g., the duties of the Project Radiation Safety Officer [PRSO] and Radiological Controls Supervisor may be combined).

Figure 2-1 Generalized Schedule of Major Remedial Tasks

Plans and Procedures	11/2/98	60.00d	1/28/99
Procurement	11/2/98	45.00d	1/7/99
Mobilization	1/8/99	15.00d	1/28/99
Site Specific Training	1/29/99	5.00d	2/4/99
Access Controls / Background Surveys	1/29/99	3.00d	2/2/99
Designation of Affected and Unaffected Areas	2/3/99	3.00d	2/5/99
Characterization Survey	2/8/99	30.00d	3/22/99
Remediation	3/23/99	60.00d	6/15/99
Final Status Survey	6/16/99	30.00d	7/28/99
Final Status Survey Report	7/29/99	45.00d	9/30/99
Packaging / Characterization / Transportatiion	4/27/99	45.00d	6/29/99
NRC Final Release	10/1/99	30.00d	11/12/99
Demobilization	11/15/99	5.00d	11/19/99
Final Report	11/22/99	30.00d	1/4/00

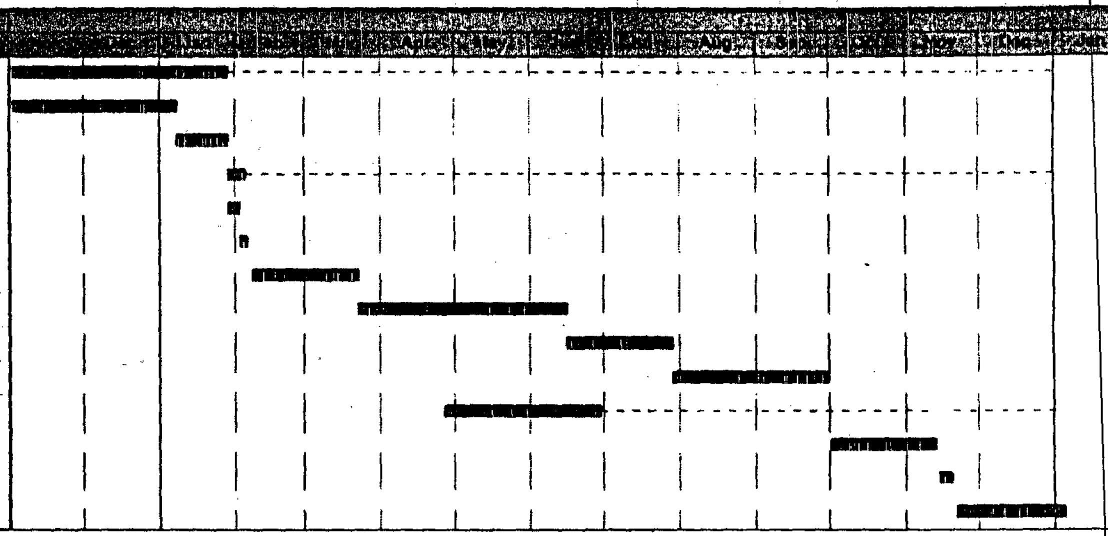
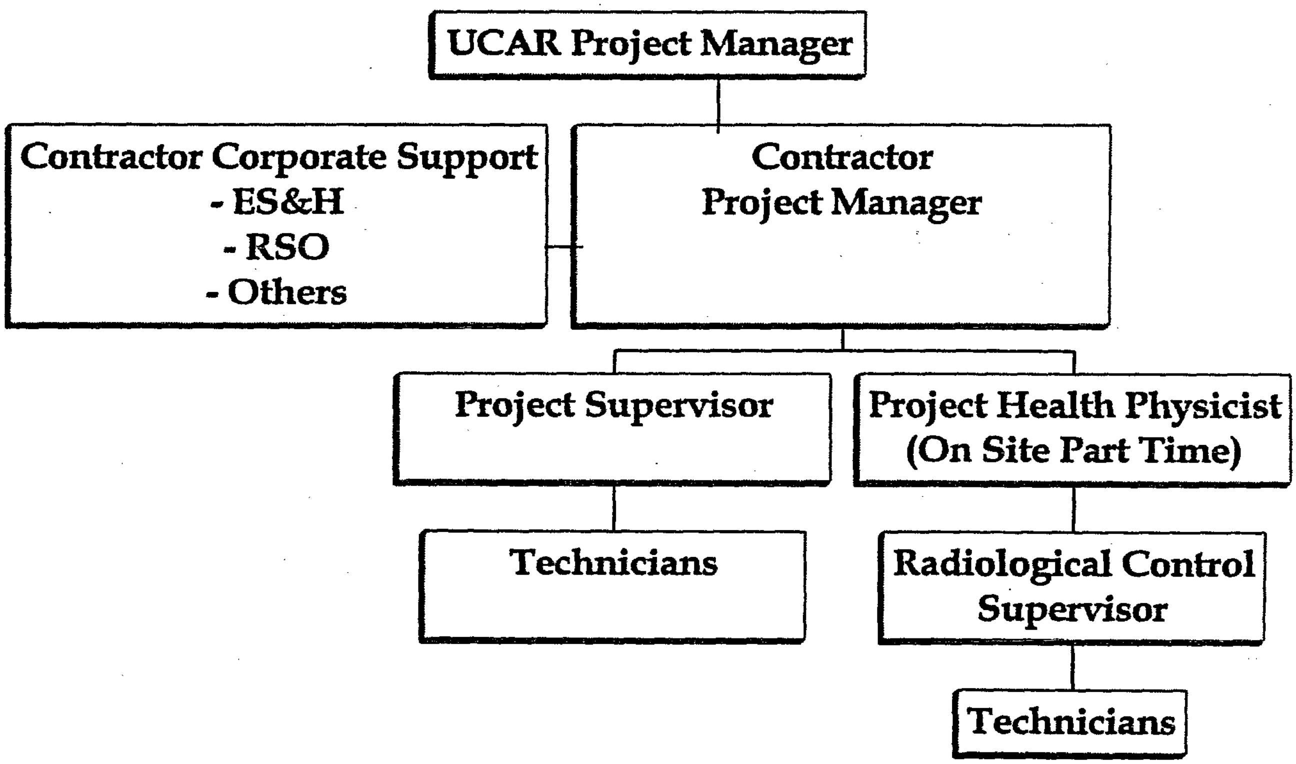


FIGURE 2-2

UCAR Remediation Project Organization (Tentative)



2.2.1 UCAR Project Manager

The UCAR Project Manager will function as the UCAR representative for the remediation project and will provide oversight for all project activities. The UCAR Project Manager will coordinate cost and schedule reporting requirements with the Contractor Project Manager.

2.2.2 Contractor Project Manager

The Contractor Project Manager will maintain overall responsibility for the performance of project operations and will be on site during remedial activities. The Contractor Project Manager will report directly to the designated UCAR Project Manager for all project-related activities. The Contractor Project Manager will have the responsibility and authority to control on-site professional, technical and labor forces to ensure the adequate and timely completion of planned project tasks. The Contractor Project Manager will ensure the following:

1. That a single point-of-contact with the UCAR designated Project Manager is maintained on all project-related schedule, cost, safety and technical matters including the coordination of any required communications, meetings and updates,

2. That activities of the project staff is coordinated to assure that adequate safety and radiological control plans and procedures are enforced and that project operations are conducted efficiently and in compliance with the license, regulations, and approved procedures.

3. That there is sufficient staffing to support the scheduled completion of project tasks,

4. That procurement of materials and supplies and subcontract activities in support of project goals and schedules are properly coordinated and documented,

5. That project performance and status is appropriately monitored and that any deficiencies and/or required corrective actions are identified, communicated and implemented in a timely manner,

6. That the UCAR Project Manager is provided with accurate and timely progress reports representative of actual and projected costs and schedules,

7. Timely and formal resolution of any safety, cost or schedule related discrepancies or questions,

8. That all applicable procedures, operating requirements, permits and work instructions are complied with, and

9. That the appropriate project data, documents and records are maintained such that a final report can be prepared that accurately reflects the work performed.

The minimum qualifications for the Contractor Project Manager position consists of the following:

1. A Bachelor of Science degree in the physical sciences, chemistry, biology, math or engineering and two years of experience in managing remedial projects of comparable scope and complexity, or

2. Four years of direct experience in managing radiological remediation projects of comparable scope and complexity.

2.2.3 Project Radiation Safety Officer

The Project Radiation Safety Officer (PRSO) will participate in project activities to ensure the adequacy of project plans and procedures. The PRSO will be responsible for assuring compliance with plans and procedures, assuring radiological safety considerations in the selection of processes and equipment used in the remediation activities, selection of appropriate field monitoring equipment and personal protective equipment, and maintaining radiation exposure to personnel As Low As Is Reasonably Achievable (ALARA) and within regulatory and administrative limits.

The PRSO will report to the Contractor Project Manager with a dotted line reporting authority to the contractor's corporate RSO. The PRSO has the responsibility to identify and the authority to correct any deficiencies or actions that are unsafe including work stoppage. The PRSO will perform the following duties:

1. Act as the authorized user and PRSO for the implementation of the State issued site-specific radioactive materials license for remedial activities,

2. Direct and manage the radiological information obtained during the remediation during supplemental characterization and during the Final

Radiological Status Surveys, including performing and/or confirming all calculations to demonstrate compliance with project guidelines,

3. Direct and/or prepare the Final Radiological Status Survey Report,

4. Determine the need for and/or oversee the bioassay program and to ensure that external and internal exposures are properly monitored and direct and/or assist in the training of individuals in the biological effects of radiation, as needed,

5. Prepare and/or review project-specific plans, procedures and work instructions to ensure compliance with applicable guidelines, regulations and ALARA policies,

6. Direct and/or assist the Radiological Controls Supervisor and Radiological Controls Technicians in the performance of field surveys and personnel monitoring,

7. Provide or direct the radiological calculations for dose assessment, ALARA and safety considerations, and

8. May perform designated duties of the Project Supervisor in addition to the above duties.

The minimum qualifications of the PRSO consists of the following:

1. Degree in the radiological health, nuclear physics or health physics and two years of experience as a health physicist or radiological engineer in remedial projects of comparable scope and complexity, or

2. Degree in the physical sciences, chemistry, biology, math or engineering and three years of experience in managing remedial projects of comparable scope and complexity, or

3. Degree in the radiological health, nuclear physics or health physics and four years of experience as a health physicist or radiological engineer in remedial projects of comparable scope and complexity, or

4. Degree in the physical sciences, chemistry, biology, math or engineering and five years of experience in managing remedial projects of comparable scope and complexity.

2.2.4 Project Supervisor

The Project Supervisor will report directly to the Contractor Project Manager and will be responsible for the day-to-day activities on the project. The Project Supervisor will be responsible for:

1. Ensuring that personnel are provided the correct health and safety resources, as required,

2. The coordination of daily activities with the Radiological Controls Supervisor to ensure proper planning, organizing, directing and controlling of project activities in a manner that does not conflict with the safety and health of employees performing the work activities,

3. Ensuring the safety and health of employees during all project activities and allocating the necessary resources to ensure that required health and safety activities are implemented,

4. Enforcing all applicable plans, procedures and instructions affecting health and safety, and

5. The day-to-day oversight of all subcontractor activities to ensure that those activities are being performed in a manner consistent with all health and safety requirements.

The minimum qualifications of the Project Supervisor position consists of the following:

1. Degree in the physical sciences, chemistry, biology, math or engineering and two years of experience in managing remedial projects of comparable scope and complexity, or

2. Four years of experience supervising personnel on remedial projects of comparable scope and complexity.

2.2.5 Radiological Control Supervisor

The Radiological Controls Supervisor reports directly to the PRSO, or if absent, directly to the Contractor Project Manager. The Radiological Control Supervisor receives direction from the PRSO in the administration of all project radiological controls programs, final release activities, appropriate documentation and compliance with all appropriate plans, procedures, practices and regulatory requirements. The Radiological Control Supervisor is responsible for the following:

1. Performing site characterizations, developing the Site Health and Safety Plan, implementing the specific provisions of that plan and ensuring that all site employees, subcontractors and visitors understand the requirements of the plan,

2. Functions as the site Health and Safety Supervisor with responsibility for implementing the site Health and Safety Plan,

3. Assisting the Contractor Project Manager and other project personnel in the preparation of work plans and procedures,

4. Conducting appropriate surveys and inspections while ensuring that radiological and industrial safety hazards are appropriately identified and that necessary precautions are in place prior to the initiation of work activities,

5. Specifying the appropriate safety and radiological controls for work permits and work procedures,

6. Directing the day-to-day activities of radiological controls for personnel in the performance of project operations and the selection of instrumentation and decontamination techniques appropriate for protecting personnel and reducing exposures,

7. Monitoring work in progress to ensure compliance with project plans and procedures, regulatory requirements and good radiological work practices,

8. Preventing the performance of work activities that may jeopardize the safety of personnel, violate approved plans, procedures or practices that could result in the release of contamination,

9. Reviewing and maintaining all appropriate project personnel and radiological records including survey data, training documentation, certification and qualification records, release survey records, permits, licenses and instrumentation records,

10. Maintaining first aid and radiological supplies and monitoring instruments, and

11. Inspecting and assisting in the preparation of waste materials for shipment, including appropriate radiological survey and assay activities.

The minimum qualifications for the Radiological Control Supervisor position consists of the following:

1. Two years experience as a Radiological Control Technician on remedial projects of similar scope and complexity, and

2. Certification as an Occupational Health and Safety Technician.

2.3 Training

UCAR will utilize a fully licensed, qualified contractor to implement this remediation. Contractor qualifications will include site specific safety and hazards training to assure that remediation (decommissioning) activities are carried out safely and in compliance with the license, regulations, and approved procedures and instructions.

All contractor and subcontractor personnel will be trained in accordance with the applicable requirements of 29 CFR 1910.120 before participating in remedial activities. On-site training scope and duration will be determined by the RSO or his designee and will consist of a minimum of two hours of classroom training and/or site-specific orientation. The specific radiological training requirements for this project will be determined by the Contractor's Corporate RSO and coordinated with the UCAR Health, Safety and Environmental Protection (HS&EP) Manager. Industrial Health and Safety requirements will be developed collaboratively with the UCAR HS&EP Manager. The Radiological Controls Supervisor will maintain site-specific training records.

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

The primary sources of information for the radiation protection information in this section are the Tennessee Radioactive Materials License No. S-86010 (issued to NFS), Nuclear Regulatory Commission Regulatory Guide 3.65 "Standard Format and Content for Decommissioning Plans for Licensees Under 10 CFR Parts 30, 40 and 70," Nuclear Regulatory Commission "NMSS Handbook for Decommissioning Fuel Cycle and Material Licensees," "Radiological Characterization Report by the UCAR Carbon Facility, Lawrenceburg, TN" (1995), and various other NRC guidance documents. This section describes, or provides program reference to, the methods used to ensure that remediation (decommissioning) operations are conducted in a safe and effective manner, and that occupational exposures resulting from remediation efforts are appropriately controlled. Although this remediation (decommissioning) plan specifically addresses radiological protection and control, the project Health and Safety Plan will include additional measures to ensure protection of workers from the potential hazards associated with industrial accidents and hazardous materials which will likely be encountered (e.g. asbestos).

3.1 Facility Radiological Information

3.1.1 Formerly Licensed Operations

Unit and facility operations are described in Section 1.3 Facility Description.

3.1.2 History of Operational Occurrences

Carbon monoxide is generated during the conversion of uranium oxide to uranium di-carbide. Normally, the charge containing the material has vents that allow the gas to escape as it is generated in the furnace, preventing any pressure buildup in the charging vessel. On December 6, 1964, one of the vessels ruptured causing four other vessels to be ejected from the furnace. Three vessels were ejected to the north of the furnace with no loss of material. The fourth was ejected to the south of furnaces striking the south wall of Room 133 and shattering causing a localized fire among combustible material. The fire was put out with dry chemical and CO_2 type fire extinguishers. One operator suffered second and third degree burns over his hands and lower forearms. An estimated 33.4 kg. of 93% enriched uranium was contained in the four vessels ejected from the furnace and the one vessel that ruptured inside the furnace. Approximately 22.5 Kg was recovered from the intact three vessels ejected from the furnace. The remaining 10.9 Kg of material was awaiting accountability results when the incident report was written (January 6, 1965). Preventive measures implemented included procedural changes to reduce the mass of the charge and mechanical changes which involved drilling more and larger diameter vent holes and the machining of shoulders onto all spacers between vessels so that vent holes remained unobstructed.

No other nuclear material accidents or unplanned releases were noted.

3.1.3 Current Radiological Status

As Congress tasked the NRC to review over 31,000 previously terminated radioactive materials licenses, a result of this review, NRC questions were raised concerning the radiological status of the UCAR site. Specifically, the NRC had questions regarding the following areas: (1) sampling protocols, sampling instruments, units of measurements and differentiation between pre- and post-decontamination readings, (2) status of the soil within the former restricted area associated with the Fuel Development Facility (Building 10), (3) the building roof (Building 10) and (4) the settling ponds that received discharge from the Fuel Development Facility (Building 10). At a meeting with UCAR representatives on January 13, 1994, the NRC and UCAR agreed that additional radiological characterization would be conducted in certain areas of the site. Negotiations resulted in a November 3, 1995, agreement between the NRC and UCAR as to the scope of the additional characterization required to ascertain the current radiological status of the facility and surrounding grounds. After approval by NRC, the plan was implemented. NRC observed the field sampling efforts to confirm that the survey was conducted in accordance with the approved plan and, in specific instances, collected sample splits for analytical purposes. The results of the survey are documented in Attachment A, "Radiological Characterization Report for the UCAR Carbon Facility - Lawrenceburg, TN."

NRC stated that for those facilities and grounds that did not meet the criteria for unrestricted release a decontamination plan would be submitted for approval. Correspondence between UCAR and the NRC dated July 24, 1998, clarified the specific unrestricted criteria that would apply to the soils and to the facility structures. NRC agreed that the facility would be released for unrestricted use and that the release would be final upon approval and implementation of the plan by NRC and certification by UCAR that the decontaminated areas met the criteria for unrestricted release. NRC noted that they would conduct an independent sampling and/or survey during or following UCAR's post-decontamination survey.

The characterization report (Volume 2, Attachment A) identified areas that meet the criteria for unrestricted release and require no further remediation. It also identified areas that do not meet the criteria and areas which require additional information before a determination can be made.

For those areas requiring remediation, this plan details the steps that will be taken during remediation and the documentation that will be provided.

The following sections summarize the radiological status of the:

1. Impoundment/canal soils,
2. The Building 5 Annex structure and soils,
3. The Building 10 structure and soils,
4. The Metallurgy Laboratory,
5. The soil around the incinerator pad,
6. The sanitary sewer system,
7. The storm water/process sewer system, and
8. The groundwater.

Detailed information is found in the characterization report (Attachment A).

3.1.3.1 Impoundment/Canal Soil

A total of 49 soil/sediment samples were collected from the primary and secondary settling ponds and the interconnecting canal.

Twenty-nine samples were collected from the primary pond, 17 samples from the secondary pond and three samples were collected from the interconnecting canal. The average total uranium concentration for the primary settling pond was 4.12 pCi/g. Two of the samples had total uranium concentrations of 61.33 and 15.12 pCi/g. When these two values are excluded, the average total uranium concentration is 1.59 pCi/g, nearly identical to background, indicating that uranium contamination in the primary settling pond is localized. The average total thorium concentration was 0.91 pCi/g, well below the average background concentration of 2.14 pCi/g.

Seventeen samples were collected from the secondary settling pond. The average total uranium concentration for the secondary settling pond was 0.93 pCi/g and average total thorium concentration was 1.12 pCi/g, both below the background concentrations of 1.57 and 2.14 pCi/g, respectively.

Three samples were collected from the interconnecting canal. The average total uranium concentration was 1.64 pCi/g and the average total thorium concentration was 1.59 pCi/g, both below background.

Average total uranium concentrations are well below the calculated CGL (see Section 4.2.1) of 274 pCi/g. The maximum sample concentration (61.33 pCi/g) was also well below the CGL. All total thorium average concentrations were well below background concentrations.

Based on historical liquid effluent data (Section 1.3 Facility Description) and supplemental data from the NRC approved sampling plan, no further remedial action is required for the settling ponds and interconnecting canal.

3.1.3.2 Building 5 Annex

Structure Surface Samples

The Building 5 Annex consisted of seven rooms and a hallway. A total of 249 one square meter grids were surveyed for surface and/or removable contamination in the Building 5 Annex. Of the grids surveyed, 156 grids were randomly selected from the floors, walls, ceiling and roof and 93 were biased samples with the latter focused on those areas where there was a high potential for residual contamination (e.g. vents, ducts, laboratory cabinets/drawers). Surface contamination data was collected over the entire 1m x 1m square surface. The data recorded in Attachment A are the *maximum* values recorded within the grid, not the average values.

Table 3-1 summarizes the *maximum* measurements taken from the random floor, walls, ceiling and roof grids as well as biased *maximum* measurement results for Rooms 102, 103-1, 103-2, 104/105 and 109. The first column in the column is the room number. Columns 2-7 relate to information collected from the random grids. Column 2 shows two values. The first number is the number of wall grids in that particular room. The second number is the actual number of wall grids surveyed. Column 3 also shows two values. The upper case value is the *maximum* direct (fixed and removable) alpha measurement recorded from all of the wall grids in that room. The lower case value is the *maximum* (fixed and

TABLE 3-1

BUILDING 5
Rooms Meeting Unrestricted Release Criteria
α and β/γ (dpm/100 cm²)

	RANDOM GRIDS							BIASED		
Room No.	**No. Wall**	**Max** **α** **β/γ**	**No. Floor**	**Max** **α** **β/γ**	**No. Ceiling**	**Max** **α** **β/γ**	**Max. Removable** **α**	**No. Biased**	**Max** **α** **β/γ**	**Max Removable** **α**
102	100/6	≤4 4,325	50/9	≤4 741	50/2	≤4 24	16	6 Vent	43/382	<15
103-1	119/12	298 4,325	36/7	≤4 741	36/2	≤4 741	93	1 Vent	NM/NM	<15
103-2	48/3	≤4 2,891	10/2	≤4 741	10/1	≤4 382	<15	2 Vent	NM/NM	<15
104/105	128/9	85 377	64/5	766 4,683	64/2	≤4 24	<15	4 Vent	170/382	<15
109	126/7	≤4 735	28/5	1,199 2,891	28/1	≤4 NM	<15	2 Vent	NM/NM	<15
TOTALS/ MAXIMUM VALUES	497/37	298 4,325	188/28	766 4,683	188/8	≤4 741	93	15	170/382	<15

Total Grids
(Random & Biased = 88
Maximum α and β/γ 766
4,683
Maximum Removable α Random 93
Biased <15
NM = Not Measured

removable) beta/gamma measurement recorded for all the wall grids in that room. Columns 4-7 show the same information for the floor and ceiling grids. Column 8 is the *maximum* removable alpha contamination measurement recorded from any of the wall, floor or ceiling grids. Columns 9-11 relate to information from the biased sampling, i.e., areas suspected of containing levels of contamination. Column 9 shows two pieces of information. The upper case number is the number of biased grids or areas sampled in that particular room. The low case identifies the grid or area type that had the *maximum* direct alpha and direct beta/gamma measurement. Column 10 show two values. The upper value is the *maximum* direct (fixed and removable) alpha measurement recorded from all of the biased grids measured in that room. The lower value is the *maximum* direct (fixed and removable) beta/gamma measurement recorded from all of the biased grids measured in that room. Column 11 is the *maximum* removable alpha contamination measurement recorded from all of the biased measurements.

Row 7 provides a summation of all the information for all of the rooms. For example, Column 2 indicates that there is a total of 497 wall grids in the Building 5 Annex and 37 grids were randomly surveyed. Column 3 indicates that the *maximum* direct alpha measurement (upper case number) for all the wall grids in the building was 298 dpm/100 cm^2. The lower case number indicates that the *maximum* direct beta/gamma measurement for all the wall grids in the building was 4,325 dpm/100 cm^2. Columns 4-7 show the same information but for the floor and ceiling. Column 8 is the *maximum* removable alpha contamination found in the building. Column 9 is the total number of biased grids or areas surveyed. Column 10 shows the *maximum* direct alpha and beta/gamma measurements from all of the biased grids and Column 11 shows the *maximum* removable alpha contamination. Row 8 lists the total number of grids/areas surveyed (both random and biased) and the *maximum* direct alpha and direct beta/gamma measurement for all areas as well as the *maximum* removable alpha measurements for all areas.

No direct measurements (alpha, beta/gamma) or removable alpha measurements from Rooms 102, 103-1, 103-2, 104/105 or 109 exceeded the release criteria of 1,000 dpm/100 cm^2 removable alpha or 5,000 dpm/100 cm^2 average 15,000 dpm/100 cm^2 maximum limit for direct alpha and direct beta/gamma. Based on the results from previous characterizations and the results from the NRC approved supplemental characterization plan, no further remedial action is required for those rooms.

Four rooms in the Building 5 Annex (Rooms 106, 107, 108 and 110) had one or more surfaces that exceeded an unrestricted release limit. A summary of the characterization data and proposed actions follows.

Room 106

Room 106 had contamination above unrestricted release limits on two floor grids and various counter tops, shelves and drawers. The two floor grids, N4-E4 and N6-E1, had maximum direct measurements of 2,979 and 85 dpm/100 square centimeters, respectively, for direct alpha: 41,601 and 66,690 dpm/100 square centimeters, respectively, for direct beta/gamma and 90 and <15 dpm/100 square centimeters, respectively, for removable alpha. Cabinet tops, etc. had maximum direct alpha and beta/gamma measurements of 2,979 and 428,698 dpm/100 square centimeters, respectively, and 64 for removable alpha.

In addition, scrapings were taken from counter tops as well as scrapings of thick dust from counter tops and the two samples analyzed for isotopic uranium and thorium. Total uranium concentrations were 2,506.4 and 112.1 pCi/g, respectively, and total thorium concentrations were less than background. A boring was taken through the concrete floor, gravel base and subsoil in Room 106. Total uranium concentrations were 7.1, 5.0 and 2.3 pCi/g, respectively, for the concrete floor, gravel base and subsoil samples. Total thorium concentrations were 0.27, 0.11 and 1.70 pCi/g, respectively, for the three samples (all below background). Most of the contamination in this room is restricted to fixed contamination in cabinet shelves and drawers.

Remediation proposed for this room is to survey the suspect floor grids and all contiguous grids (a total of 12 grids) and all counter tops, shelves and drawers and cleanup or remove areas of elevated contamination to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma).

Room 107

Room 107 had no wall, floor, ceiling or biased grids above unrestricted release criteria. Maximum direct measurements were 27 dpm/100 square centimeters and 3,966 dpm/100 square centimeters, respectively, for direct alpha and direct beta/gamma and background for removable alpha. Cabinet tops, etc. had a maximum direct alpha measurement of 128 dpm/100 square centimeters and 70,275 beta/gamma and all removable alpha measurements were background.

In addition, scrapings of thick dust were taken and the single sample analyzed for isotopic uranium and thorium. The total uranium concentration was 8,985.6 pCi/g and the total thorium concentration was less than background.

Remediation proposed for this room is to survey all counter tops, shelves and drawers and cleanup or remove areas of elevated contamination to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma).

Room 108

Room 108 had contamination above unrestricted release limits on one wall grid, two floor grids and three biased grids. The east wall grid, V1-H7, had maximum direct measurements of 43 and 11,135 dpm/100 square centimeter, respectively, for direct alpha and direct beta/gamma and <15 dpm/100 square centimeters for removable alpha. The two floor grids, N7-E6 and N5-E6, had maximum direct measurements of 3,404 and 7,660 dpm/100 square centimeter, respectively, for direct alpha; 20,095 and 48,769 dpm/100 square centimeters, respectively, for direct beta/gamma and <15 dpm/100 square centimeters for removable alpha. Two ceiling ledges and metal conduit in three grids had maximum direct measurements of 340 and 16,511 dpm/100 square centimeter, respectively, for direct alpha and direct beta/gamma and 59 dpm/100 square centimeters for removable alpha.

Scrapings were taken from counter tops and the single sample analyzed for isotopic uranium. The total uranium concentration was 3,487.6 pCi/g. A boring was taken through the concrete floor, gravel base and subsoil in Room 108. Total uranium concentrations were 4,320.0, 311.8 and 140.8 pCi/g, respectively, for the concrete floor, gravel base and subsoil samples. Total thorium concentrations were 0.12, 0.36 and 1.36 pCi/g, respectively, for the three samples (all below background).

Remediation proposed for this room is to survey the suspect floor grids and all contiguous grids (a total of 10 grids) and the ceiling ledges and the conduit in the affected grids and cleanup or remove areas of elevated contamination to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma).

Room 110

Room 110 had no wall, floor, ceiling or biased grids above unrestricted release criteria. Maximum direct measurements were 1,915 dpm/100 square centimeters and 4,325 dpm/100 square centimeters, respectively, for direct alpha and direct beta/gamma and 84 dpm/100 square centimeters for removable alpha. Two vents, Grids N1-E1 and N4-E5, had maximum direct measurements of 5,106 dpm/100 square centimeters and 5,106 dpm/100 square centimeters, respectively, for direct alpha, 2,891 dpm/100 square centimeters and 63,106 dpm/100 square centimeters, respectively, for direct beta/gamma and 660 dpm/100 square centimeters for removable alpha.

In addition, residue from a sink trap was collected and analyzed for isotopic uranium and isotopic thorium. The total uranium concentration was 2,088.8 pCi/g and the total thorium concentration was 9.97 pCi/g, approximately four times background.

Remediation proposed for this room is to survey the two vent areas and all sink drains and cleanup or remove areas of elevated contamination to the unrestricted release criteria in Table 4-1.

Building 5 Annex Soil

A soil core sample (Sample N23-E53 series) was collected near Manhole-249 (Attachment A). Soil sample depths were 0-6 inches, 6-12 inches, 5-10 feet and 10-15 feet. Total uranium concentrations for these four samples were 1.76 pCi/g, 1.78 pCi/g, 1.42 pCi/g, and 1.37 pCi/g, respectively. The average total uranium concentration over the profile was 1.58 pCi/g. Total thorium concentrations were 2.43 pCi/g, 2.60 pCi/g, 1.70 pCi/g, and 3.59 pCi/g, respectively. The average total thorium concentration over the profile was 2.58 pCi/g.

Three surface (0-6 inches) soil samples were collected adjacent to the exits from the Building 5 Annex (Attachment A). Total uranium concentrations ranged from 0.61 pCi/g to 4.66 pCi/g, and averaged 1.74 pCi/g. Total thorium concentrations ranged from 1.22 pCi/g to 1.45 pCi/g and averaged 1.50 pCi/g.

An asphalt sample was initially collected from a surfaced area adjacent to the building and near Manhole-249 (Attachment A). Total uranium concentrations were 7,550.6 pCi/g and the total thorium concentration was 1.22 pCi/g. A follow-up survey (10 samples) comprised of 6 asphalt and 4 soil/gravel samples was conducted. Total uranium concentrations ranged from 0.61 to 76.91 pCi/g.

The subsequent investigations indicated that the "hot spot" is confined to a small area a few square feet in size.

None of the soil samples analyzed exceeded the CGL value of 274 pCi/g; consequently, no further action is necessary for soil adjacent to Building 5 Annex except for the asphalt "hot spot". The asphalt "hot spot" will be further evaluated with direct readings as well as intrusive samples to delineate the area of contamination, and the "hot spot" will be removed.

3.1.3.3 Building 10

Structure Surface Samples

There are 36 rooms inside Building 10.

A total of 1,070 one square meter grids were surveyed for surface and/or removable contamination in Building 10. Of the grids surveyed, 924 grids were randomly selected from the floors, walls, ceilings and roof and 146 were biased samples with the latter focused on those areas where there was a high potential for residual contamination (e.g., vents, ducts, cabinets/drawers). Surface contamination data was collected over the entire one-meter square surface. The data recorded in Attachment A are the *maximum* values recorded within a grid and not the average value.

Table 3-2 summarizes the *maximum* measurements taken from the random floor, walls, ceilings as well as the biased measurements taken from Rooms 101, 102-1, 102/105, 107, 108, 109, 110, 111, 112, 113-1, 113-2, 114, 115, 116, 117, 118, 119-1, 119-2 and 123. The maximum direct measurements for all of the above grids for all of the above rooms for alpha and beta/gamma contamination, respectively, was 2,128 dpm/100 square centimeters and 4,319 dpm/100 square centimeters. The maximum removable alpha contamination was 592 dpm/100 square centimeters and 822 dpm/100 square centimeters, respectively, for the random and biased grids.

No direct measurements (alpha, beta/gamma) or removable alpha exceeded the release criteria of 1,000 dpm/100 square centimeter removable alpha or the 5,000 dpm/100 square centimeter average - 15,000 dpm/100 square centimeter maximum limit. No further action is required in the above rooms based on the results from previous characterizations (the Todd Research and Technical Division decontamination report, UCAR and AEC surveys) and results from the NRC approved supplemental characterization plan.

Twelve rooms in Building 10 (Rooms 106-1, 106-2, 120, 121, 122, 124, 126, 128-1, 129, 132, 133 and 144) either require additional information to determine whether unrestricted release criteria are met or had one or more grids that exceeded an applicable unrestricted release limit.

Rooms requiring additional information

Rooms that required additional information include 120, 121, 122, 124, 126, 129, and 132. A summary of the characterization data and proposed actions follows. Rooms where average and maximum activities do not exceed the applicable criteria for unrestricted release will not be resurveyed unless there is an indication that a significant radiological concern is present. However, if an average or maximum level is exceeded, the grid will be remediated and the remediated grid as well as contiguous grids resurveyed to document compliance.

Room 120

Room 120, Blending Room, has contamination above unrestricted release limits on one floor grid, N6-E3. The maximum direct measurement for this grid was 426 dpm/100 square centimeters and 11,488 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 19 dpm/100 square centimeters for removable alpha. The maximum direct measurements for all other measurements was 1,574 dpm/100 square centimeters and 4,319 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 209 dpm/100 square centimeters for removable alpha.

Remediation proposed for this room is to survey six floor grids (the elevated grid and the five contiguous grids) and the five wall grids (floor to ceiling) adjacent to the floor grid and cleanup or remove areas of elevated contamination to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma).

Room 121

Room 121, Vault Room, has contamination above unrestricted release limits on one wall grid, East H4-V1 where finished product was stored. The maximum direct measurement for this grid was 128 dpm/100 square centimeters and 6,112 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 19 dpm/100 square centimeters for removable alpha. The maximum direct measurements for all other measurements was 383 dpm/100 square centimeters and 1,452 dpm/100 square centimeters, respectively, for

TABLE 3-2
BUILDING 10
Rooms Meeting Unrestricted Release Criteria
α and β/γ (dpm/100 cm²)

		RANDOM GRIDS							BIASED		
Room No.	Room Description	No. Wall	Max α / β/γ	No. Floor	Max α / β/γ	No. Ceiling	Max α / β/γ	Max. Removable α	No. Biased	Max α / β/γ	Max Removable α
101	Lobby	56/2	≤4 / 735	12/2	≤4 / 1,094	12/1	≤4 / 735	<15	0	NM	NM
102-1	Office	60/3	≤4 / 377	24/5	≤4 / 377	24/1	≤4 / 377	50	1 / Vent	85 / 377	<15
102/105	Office	176/11	≤4 / 1,094	98/15	≤4 / 735	98/4	≤4 / 1,094	<15	2 / Vent	43 / 735	44
107	Laboratory	56/2	85 / 377	12/2	85 / 377	12/1	≤4 / 377	68	2 / HEPA Vent	340 / 1,452	68
108	Issue Room	72/2	≤4 / 735	18/2	≤4 / 735	18/1	≤4 / 735	19	2 / Beam/ Vent	340 / 735	243
109	Men's Locker Room	64/3	170 / 377	16/3	≤4 / 735	16/1	1,234 / 2,527	592	3 / Vent	85 / 1,810	187
110	Men's Rest Room	56/2	≤4 / 735	12/2	≤4 / 735	12/0	NM / NM	<15	1 / Vent	128 / 1,094	25
111&112	Women's Rest & Locker Rm	64/2	NM / NM	8/2	≤4 / 735	8/0	NM / NM	<15	0	NM	<15
113 -1&2	Lunch/Break Room	140/7	85 / 735	54/8	≤4 / 735	54/2	128 / 1,094	22	14 / Shelves	2,128 / 4,319	311
114	Locker/Change Room	112/4	≤4 / 1,094	48/6	85 / 1,094	48/2	≤4 / 377	22	3 / Vent	340 / 1,094	50
115	Shower Room	96/4	298 / 1,094	32/6	≤4 / 1,094	32/1	≤4 / 735	376	3 / Duct/Vent	638 / 1,094	333
116	Locker/Change Room	112/4	≤4 / 735	48/7	851 / 2,886	48/2	43 / 735	327	3 / Piping/Vent	1,054 / 1,810	822
117	Hallway	56/3	≤4 / 1,094	10/2	≤4 / 735	10/0	NM / NM	<15	0	NM	NM
118	Janitor's Storage Room	32/0	NM / NM	4/1	43 / 735	4/0	NM / NM	<15	1 / Vent	43 / 735	34
119-1	Hallway	88/3	≤4 / 735	6/4	≤4 / 1,094	6/1	≤4 / 735	19	4 / Duct	255 / 1,094	100
119-2	Hallway	48/2	≤4 / 377	8/1	≤4 / 735	8/0	NM / NM	<15	0	NM	NM
123	Maintenance Room	54/4	128 / 377	54/11	≤4 / 735	54/3	≤4 / 735	115	3 / Vent	766 / 2,169	137
TOTALS/MAXIMUM VALUES		1,342/58	298 / 1,094	464/79	851 / 2,886	464/20	1234 / 2527	592	42	2,128 / 4,319	822

TOTAL GRIDS (Random & Baised) Surveyed = 199

MAXIMUM α/β/γ = 2,128 / 4,319

MAXIMUM REMOVABLE α = Random 592
Biased 822

NM = Not Measured

alpha and beta/gamma contamination and 162 dpm/100 square centimeters for removable alpha. Remediation proposed for this room is to survey nine grids (the elevated wall grid and the eight contiguous grids), calculate the average value for each grid, and cleanup or remove areas of elevated contamination to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma).

Room 122

Room 122, Forming Room, has contamination above unrestricted release limits on one wall grid, West H3-V3, one ceiling grid, N6-E8 and three biased grids (transformer, beam and pipe). The maximum direct measurement for the wall and ceiling grid was 1,915 dpm/100 square centimeters and 31,201 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 647 dpm/100 square centimeters for removable alpha. The maximum direct measurements for the transformer, beam and pipe was 1,277 dpm/100 square centimeters and 13,280 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 1,439 dpm/100 square centimeters for removable alpha (on pipe).

Remediation proposed for this room is to survey all floor grids two grids wide from N1/E1 to N1E2 to N6E1/N6E2 (12 grids), the corresponding ceiling grids (12 grids), the corresponding west wall grids (20 grids) and the contaminated pipe along the west wall for a total of 44 grids and cleanup or remove areas of elevated contamination to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma) and less than 1,000 dpm/100 square centimeters for removable alpha.

Room 124

Room 124, Machining Room, has contamination above unrestricted release limits on one floor grid, N4-E2. The maximum direct measurement for this grid was 8,511 dpm/100 square centimeters and 31,201 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 342 dpm/100 square centimeters for removable alpha. The maximum direct measurements for all other measurements was 851 dpm/100 square centimeters and 1,810 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 87 dpm/100 square centimeters for removable alpha.

Remediation proposed for this room is to survey eight floor grids (the elevated grid and the seven contiguous grids) and cleanup or remove areas of elevated contamination to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma).

Room 126

Room 126, Hallway, has contamination above unrestricted release limits on one wall grid, West V4-H35, one floor grid, N45-E2 and one biased grid around a vent. The maximum direct measurement for the wall grid was 1,319 dpm/100 square centimeters and 6,111 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 47 dpm/100 square centimeters for removable alpha. The maximum direct measurement for the floor grid was 766 dpm/100 square centimeters and 106,469 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 16 dpm/100 square centimeters for removable alpha. The maximum direct measurement for the biased grid with the vent was 4,255 dpm/100 square centimeters and 7,904 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 909 dpm/100 square centimeters for removable alpha. The maximum direct measurements for all other measurements was 2,553 dpm/100 square centimeters and 4,319 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 573 dpm/100 square centimeters for removable alpha.

Remediation proposed for this room is to survey 12 grids (the elevated floor and five contiguous grids, five vertical wall grids and the contiguous grid associated with the vent), calculate the average value for each grid, and cleanup or remove areas of elevated contamination to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma).

Room 129 Status

Room 129, Janitorial Storage and Sink Room, has contamination above unrestricted release limits on one wall grid and two floor grids. The maximum direct measurements for the elevated grids was 851 dpm/100 square centimeters and 7,904 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 162 dpm/100 square centimeters for removable alpha.

Remediation proposed for this room is to survey the entire room (walls, floor ceiling - 78 grids) and cleanup or remove areas of elevated contamination to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma).

Room 132 Status

Room 132, Ashing Room, has contamination above unrestricted release limits on one floor grid, N10-E3. The maximum direct measurement for the elevated grid was 85 dpm/100 square centimeters and 5,395 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 22 dpm/100 square centimeters for removable alpha.

Remediation proposed for this room is to survey 17 grids (elevated and five contiguous grids, the six corresponding ceiling grids and five vertical wall grids), calculate the average value for each grid and cleanup or remove areas of elevated contamination to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma).

Rooms exceeding release criteria

Rooms that are conclusively known to exceed average or maximum action levels include rooms 106-1, 106-2, 128-1, 133 and 134. Due to the historical uses of the rooms, known locations of process equipment and areas of known elevated contamination, additional grids other than contiguous grids will be surveyed. A summary of the characterization data and proposed actions follows.

Room 106-1 and 106-2

Room 106-1 and -2, the laundry room, has contamination above unrestricted release limits on two floor grids and two biased grids (filters associated with vents). The maximum direct measurements for all other measurements was 706 dpm/100 square centimeters and 3,244 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 305 dpm/100 square centimeters for removable alpha. Maximum contamination on the two floor grids was 8,511 dpm/100 square centimeters and 38,370 dpm/100 square centimeters, respectively, for direct alpha and beta/gamma and 8,511 dpm/100 square centimeters and 34,785 dpm/100 square centimeters, respectively, for direct alpha and beta/gamma on the two vents.

A core sample was taken from Room 106-2 (Grid N2-E3E2) along with the underlying gravel and subsoil. Total uranium concentrations for the Room 106-2 core samples were 18.74 pCi/g, 0.15 pCi/g, and 1.57 pCi/g for the concrete, gravel and subsoil, respectively.

Two sediment samples were taken from the Laundry Sump in Room 106-2. Total uranium concentrations were 1.27 and 717,210 pCi/g. Associated total thorium concentrations were 19.08 and 41.75 pCi/g.

Remediation proposed for this room is to survey all 34 floor grids, the grids around the two vents, remove all filters, survey the filters and inside the vents. In addition, the steel sump will be decontaminated and removed and the concrete surfaces in the dry well surveyed. All areas of elevated contamination will be cleaned up to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma).

Room 128-1

Room 128-1, Coating Room, has contamination above unrestricted release limits on seven floor grids (N6-E1, N5-E2, N5-E1, N8-E1, N10-E7, N11-E1 and N13-E1). The maximum direct measurement for the floor grids was 6,389 dpm/100 square centimeters and 160,233 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 189 dpm/100 square centimeters for removable alpha. The maximum direct measurements for all other measurements was 1,702 dpm/100 square centimeters and 4,677 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 19 dpm/100 square centimeters for removable alpha.

A core sample was taken from Room 128 (Grid N7 - E2). Total uranium concentrations for the Room 128 core samples were 0.41 pCi/g, 0.42 pCi/g, and 1.07 pCi/g, for the concrete, gravel and subsoil, respectively.

Remediation proposed for this room is to survey a floor strip two grids wide along both the west and east walls (60 grids) and vertically along the two walls (30 grids) for a total of 90 grids, and cleanup or remove areas of elevated contamination to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma).

Room 133

Room 133, Furnace Room, has contamination above unrestricted release limits on 17 floor grids, 3 ceiling grids 3 biased grids. The maximum direct measurement for the elevated grids were 59,575 dpm/100 square centimeters and 285,681 dpm/100 square centimeters, respectively, for alpha and beta/gamma contamination and 1,338 dpm/100 square centimeters for removable alpha (only one grid had removable alpha contamination above 1,000 dpm/100 square centimeters, Ceiling N1-E7). With the exception of three floor grids (N1-E13, N24-E4 and N9-E12), two ceiling grids (N2-E12 and N21-E1) and one biased grid, a ledge, (N29-E1), all elevated readings are within a 15 meter X 10 meter grid area in the southwest quadrant of Room 133 where process furnaces and hoods were once located.

A core sample was taken from Room 133 (Grid N1 - E3/4). Total uranium concentrations for the Room 133 core samples were 824.4 pCi/g, 48.05 pCi/g, and 13.36 pCi/g, respectively.

Scrapings/cuttings were taken from an elevated beta/gamma direct measurement floor grid in the south quadrant of Room 133. The total uranium concentration was 44,688 pCi/g. The total thorium concentration was 5.15 pCi/g.

Remediation proposed for this room is to survey 157 grids in the southwest quadrant (150 floor grids, the elevated ceiling grid and five contiguous grids, the biased grid, a ledge), the three floor grids outside the quadrant and 23 contiguous grids and one biased grid, a ledge for a total of 184 grids. The contamination will be cleaned up or areas of elevated contamination removed to unrestricted release criteria (5,000 dpm/100 square centimeters average and 15,000 dpm/100 square centimeters maximum direct alpha and direct beta/gamma).

Room 134

Room 134, the Penthouse Room, houses Building 10's ventilation/filter system.

The interior of the Penthouse (Room 134) has the most extensive contamination above allowable limits for direct alpha contamination with most of the elevated contamination confined to the interior room housing the blower/fan enclosure and the filter enclosure. Conventional decontamination techniques will be employed to remove extensive areas of contamination to below allowable limits for unrestricted release. Contaminated equipment will be removed for disposal. After remediation has been completed, floor grids of Room 134 will be re-surveyed (approximately 10 meters by 15 meters) as well as the internal walls, floor and ceiling of the interior duct room including the blower/fan enclosure and the filter enclosure.

Building 10 Soil

Forty-two soil samples were collected around Building 10 (Attachment A). Nineteen samples were from random 10-meter square grids and nineteen samples were biased samples taken at exit points from the building. One soil core was taken to a depth of 15 feet and four core samples were analyzed.

Soil samples collected from the 19 10-meter square grids in the vicinity of Building 10 had total uranium concentrations that ranged from 0.69 pCi/g to 7.34 pCi/g and averaged 2.02 pCi/g. Soil samples taken from the 19 exit points around Building 10 had total uranium concentrations that ranged from 1.40 to 68.85 pCi/g and averaged 12.84 pCi/g.

A single soil core was taken from grid N24-E43. Total uranium concentrations were 2.37 pCi/g, 1.68 pCi/g, 0.90 pCi/g, and 2.33 pCi/g, for the 0-6 inch, 6-12 inch, 5-10 foot and 10-15 foot intervals, respectively, and averaged 1.82 pCi/g over the profile. Total thorium concentrations were 1.62 pCi/g, 3.60 pCi/g, 1.26 pCi/g, and 2.06 pCi/g, respectively, and averaged 2.14 pCi/g over the profile.

None of the soil samples exceeded the CGL value of 274 pCi/g; consequently, no further action is required for soil adjacent to Building 10.

Building 10 Non-contact Cooling Water and Sediments

There are two cylindrical underground tanks to the west of Building 10 which contain non-contact cooling water. These tanks have external dimensions of 10 ft. in length and 4 ft. in diameter. They are approximately 75% full (750 gallons). Total uranium concentrations for the two water samples taken were 61.44 and 4.25 pCi/liter, respectively, for the north tank and the south tank. Sediment samples taken at the same time as the water samples had total uranium concentrations of 50.18 and 2,270.42 pCi/g for the north tank and the south tank. Corresponding total thorium concentrations were 0.21 and 0.80 pCi/g, respectively.

The proposed remedial action for the two tanks is to remove the water and the sediments, separate the liquids and solids, evaporate or solidify the water, characterize the solids and transport to a licensed disposal facility.

Building 10 Roof

One hundred eight direct measurements were taken from the Building 10 Roof (29 upper terrace, 45 middle terrace, 22 lower terrace and 12 from the Penthouse).

Maximum direct measurements were 213 and 2,427 dpm/100 square centimeters for alpha and beta/gamma contamination. In addition, 12 (10 biased, 2 random) roof tar samples were taken and analyzed for uranium. Total uranium ranged from 0.11 to 41.24 pCi/g.

No direct measurements exceeded the release criteria of 5,000 dpm/100 square centimeter average - 15,000 dpm/100 square centimeters maximum and no tar sample concentration exceeded the soil CGL value of 274 pCi/g. No further action is required based on the results from previous characterization efforts and the results from the NRC approved supplemental characterization.

3.1.3.4 Metallurgy Laboratory

A total of 24 random floor grids were surveyed in the laboratory, the filing room and office. The highest direct alpha reading (fixed and removable) was 60 dpm/100 square centimeters in the laboratory and the highest direct beta/gamma measurement was 533 dpm/100 square centimeters. No removable alpha measurements were made. Eighteen measurements were taken in the laboratory focusing on counter tops, cabinets, cabinet shelves and drawers. Two areas on the counter tops had direct alpha measurements above 15,000 dpm/100 square centimeters (15,402 and 17,868 dpm/100 square centimeters). Removable alpha for the two measurements was 14 and 0 dpm/100 square centimeters, respectively. All other measurements were less than 2,844 dpm/100 square centimeters.

Four measurements each were made on the counter tops and floor grids in the filing room. The highest direct alpha reading (fixed and removable) was 42 dpm/100 square centimeters and the highest direct beta/gamma measurement was 351 dpm/100 square centimeters. Ten floor grid measurements wee taken in the office area. The maximum direct alpha reading was 36 dpm/100 square centimeters and 416 dpm/100 square centimeters maximum direct beta/gamma.

Remediation proposed for the complex is to selectively decontaminate and/or remove the counter tops in the Metallurgy Laboratory until unrestricted release criteria are met.

3.1.3.5 Incinerator Pad Soil

Two soil cores (4 samples/core) were taken near the incinerator pad, and eleven near surface (0-6") samples were taken from the four cardinal directions from the pad. In addition, three near surface soil samples were taken 100 feet away from the pad in three of the four cardinal directions.

The range for the total uranium concentrations for the three types of samples were 1.33 to 779.8 pCi/g for the core samples, 19.06 to 3,655.4 pCi/g for the near surface samples and 1.09 to 2.82 pCi/g for the three cardinal direction samples. Corresponding ranges for total thorium were 0.81 to 2.31 pCi/g, 1.37 to 4.10 pCi/g and 1.47 to 2.53 pCi/g.

Figure 3-1 is an isopleth map showing the soil concentration contour for the CGL, 274 pCi/g. The associated area for this contour interval is 500 square feet. The estimated average depth of the soil contamination is one foot resulting in a contaminated soil volume estimate of 500 cubic feet.

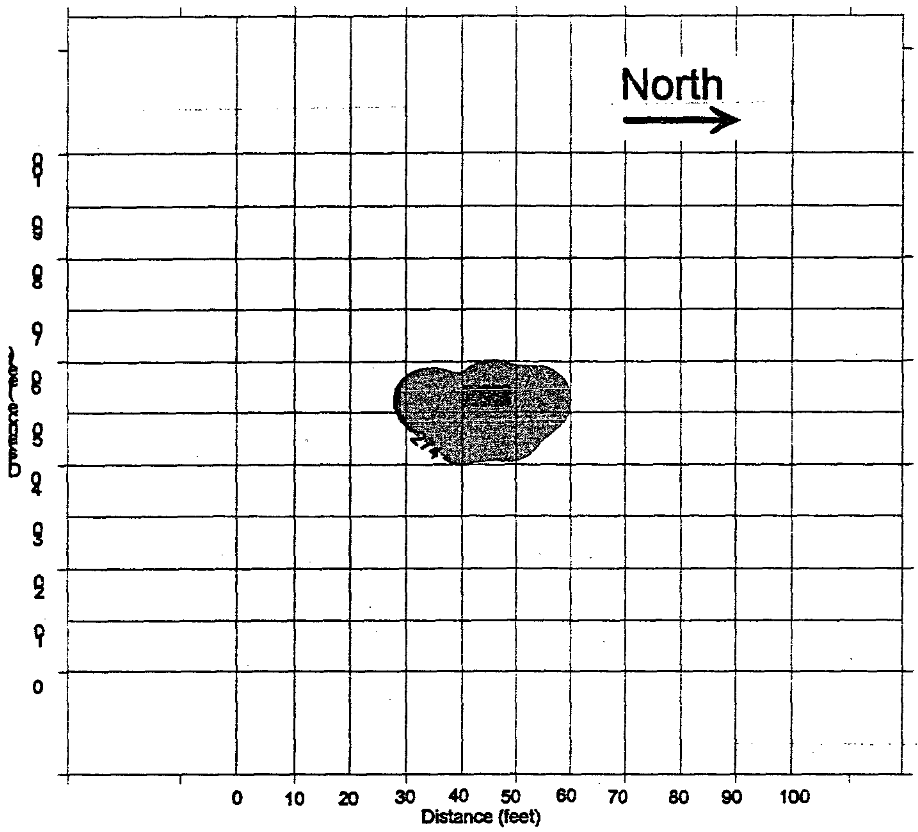
The proposed remediation for this site is to establish a 100′ x 100′ grid over the concrete pad and, employing a triangular grid system, collect an additional estimated 15 samples. Based on the sample results, area soils will be removed to a concentration limit of 274 pCi/g. Alternatively, a more sophisticated model may be employed to determine allowable soil contamination concentration levels.

3.1.3.6 Sanitary Sewer System

Samples were taken from the site's sand filter and septic tank. The former is associated with the site's current sanitary waste disposal system (west of Building 10) whereas the septic tank was associated with historical operations. Total uranium concentrations were 1.55 and 4.67 pCi/g, respectively. Total thorium concentrations were 1.79 and 1.80 pCi/g, respectively.

Results were either background or a small fraction of the CGL for total uranium (274 pCi/g). Consequently, no further action is required.

Figure 3-1: Incinerator Pad



Area Associated With
274 pCi/g U Contour
is 508 sq ft

3.1.3.7 Stormwater/Process Sewer System

Sediment samples were collected from three manholes (Attachment A) west of Building 10. Total uranium for the Building 10 manholes were 513, 2,465 and 4,287 pCi/g and for total thorium 1.70, 5.31 and 7.39 pCi/g.

The uranium sediment concentrations in the three manholes associated with Building 10 exceed the CGL of 274 pCi/g. Remediation proposed for this area includes additional sampling and/or more sophisticated modeling. Four soil cores taken from the cardinal directions around each manhole are proposed for each of the three Building 10 manholes (total of 12 cores). Cores would be completed to a depth of three feet below the manholes unless bedrock refusal occurs first.

Sediment samples were collected from the Building 5 Annex manhole, MH-249. Total uranium and thorium concentrations were 23.91 and 0.21 pCi/gm, respectively. Concentrations were below the CGL and no further action is proposed for the Building 5 Annex stormwater / process sewer system.

3.1.3.8 Groundwater Monitoring

Five perimeter groundwater monitoring wells were sampled (Attachment A). Total uranium concentrations ranged from 0.24 to 1.21 pCi/g and total thorium concentrations ranged from 0.01 to 0.43 pCi/g. All values were indicative of background concentration and were well below current and proposed drinking water standards. No further action is proposed for groundwater.

3.2 Ensuring That Occupational Radiation Exposures Are Kept As Low As Is Reasonably Achievable

3.2.1 <u>ALARA Policy</u>

The essence of a successful ALARA program is the commitment and support by management to implement a sound and effective radiation protection program. UCAR is committed to a policy of ensuring that exposure of personnel to radiation and radioactive materials is minimized to the maximum extent practical. UCAR will require that the licensed contractor responsible for site remediation has and adheres to a formal ALARA policy and program. The implementation of formal ALARA policies and programs will ensure that occupational exposures, and releases of radioactive materials to the environment, are maintained as low as reasonably achievable, commensurate with sound economics and good operating practice.

3.2.2 Operating Plans, Procedures and Controls

Operating plans, procedures and safety controls will be documented and approved by the Project Manager and the Project Radiation Safety Officer (RSO). These plans, procedures and controls will reflect good operating practices and ALARA principals.

3.2.3 Project Management

The licensed contractor has overall responsibility for assuring that occupational exposures are maintained ALARA. The contractor's project organization and the specific responsibilities of key individuals responsible for safety are described in Section 2.2.

3.2.4 Responsibilities of Individual Employees

Each worker is expected to recognize his/her individual responsibilities for ensuring safety of workers, the environment, and members of the general public, and to implement ALARA practices and philosophy as an integral part of the job. This responsibility includes adherence to approved operating and safety procedures, exercising good judgment with respect to radiological safety, and identifying to management and supervision any conditions which are perceived to be unsafe and/or not in keeping with the principals of ALARA.

3.3 Health Physics Program

Remediation (decommissioning) will be performed under the licensed contractor's health physics program, in accordance with requirements of the contractor's Tennessee Radioactive Materials License (No. S-86010-C03) and applicable NRC and State regulations. The health physics program requirements of the license were developed specifically for the UCAR site and for the specific radioactive materials present. The program incorporates guidance and requirements of the Nuclear Regulatory Commission (NRC), the Tennessee Division of Radiological Health, the National Council on Radiation Protection (NCRP), the International Commission on Radiation Protection (ICRP), and the U.S. Department of Transportation (DOT).

The health physics program addresses sources and types of radiation, occupational exposure monitoring and control, personal protection equipment, radiation and contamination monitoring and control, restricted area access control, instrumentation, effluent monitoring and control, and quality assurance. These program elements are discussed in sections that follow.

3.3.1 Sources and Types of Radiation

The radioactive materials of concern are primarily enriched uranium. Several small, isolated areas contain trace levels of thorium (Th-232) and associated daughter products; however, protection from uranium materials will provide adequate protection from Th-232 materials. Surface contamination in Building 10, Building 5 Annex, and in the Metallurgy Laboratory is primarily present as fixed contamination. Contamination in soils/sediments in small areas is also present. Residual radioactivity is not widespread.

Gamma exposure rate measurements taken at locations throughout the site confirmed that, with the exception of five locations near the incinerator pad, direct radiation levels do not exceed background levels. None of the identified areas of elevated radiation pose a significant radiological hazard. The highest radiation level detected, located adjacent to the incinerator pad, is 26 $\mu R/h$ above background.

There is no indication that radioactive material exists above release criteria beyond the former restricted area boundary or in the groundwater, settling basins, or former sanitary sewer system.

A more detailed discussion is provided in the characterization report (Attachment A) and is summarized in Section 3.1.3.

3.3.2 Occupational Exposure Monitoring

Internal and external exposure monitoring programs will be maintained to ensure accurate detection, evaluation, control and documentation of exposures resulting from radioactive materials. These programs provide quantitative and timely occupational dose information to facilitate demonstration of compliance with limits for personnel exposure as defined in 10 CFR Part 20, *Protection Against Radiation*.

Administrative action levels have been established well below regulatory limits to ensure individual exposures are maintained as low as reasonably achievable, and to ensure no individual exceeds a regulatory limit.

The primary objective of the *internal* exposure monitoring program is to assure that internal exposures to radioactive materials are detected, evaluated, and recorded. Internal exposure monitoring procedures are designed to ultimately express measurements in terms of estimated intakes (e.g., Derived Air Concentrations (DAC)-hrs). Intake estimates are based on workplace and/or worker breathing zone air sample results and individual bioassay results. Details of the internal exposure monitoring program are described in approved written procedures.

Although the potential for *external* exposure is negligible, work areas will be routinely surveyed for direct radiation (beta/gamma) whenever remediation activities are actually being performed. Results of radiation surveys will be documented and reviewed regularly by the RSO. If work area dose rates exceed 5 mrem/h, or if the RSO determines that worker exposure could exceed 10% of a regulatory limit, worker exposure will be monitored with Thermoluminescent Dosimeters (TLD). TLDs will be provided by a NAVLAP certified vender (e.g., Landauer), and will be returned to the vendor for processing at least quarterly.

Administrative action levels for internal and external exposures are established below 10 CFR 20 limits, typically at 10% of the regulatory limit. This will ensure individual exposures are maintained as far below regulatory limits as practical.

Results of internal and external exposure monitoring are recorded and reviewed by the RSO. If results indicate that administrative action levels have been exceeded, an investigation will be performed. Corrective actions will be taken as indicated by the investigation results.

3.3.3 Personal Protection Equipment

A respiratory protection program will be implemented utilizing guidance provided in NRC Regulatory Guide 8.15 "Acceptable Programs for Respiratory Protection," as applicable. Respiratory protection equipment is used for personnel protection in areas where airborne radioactivity could result in an individual exceeding action levels for occupational exposure. Respiratory protection equipment will be approved by the National Institute of Occupational Safety and Health (NIOSH). A list of typical respiratory protection equipment is provided in Table 3-3.

TABLE 3-3

Typical Respiratory Protection Equipment [1]

Type	Model	Mode [2]	Available Cartridge/Canister	Protection Factor[3]
Full-face air purifying	MSA Ultravue	NP	- Radioactive particulate matter; - Ammonia, chlorine, and organic vapors; - Acid and organic vapors	50
Full-face air purifying	Scott O Vista	NP	- Radioactive particulate matter; - Acid and organic vapors; - Acid, organic vapors, and radioactive particulate matter; - Ammonia and radioactive particulate matter.	50
Full-face air purifying	MSA PAPR RACAL	PP/CF	- Radioactive particulate matter	1,000
Full-face air purifying	Power Flow-7	PP/CF	- Radioactive particulate matter	1,000
Full-faced supplied air	MSA Constant Flo	PP/CF	- Radioactive particulate matter	2,000
Self-Contained Breathing Apparatus (SCBA)	MSA Ultravue	PD	N/A	10,000

(1) While this list is representative, it is not all-inclusive. These devices may be upgraded or replaced by other equipment having comparable or superior operating characteristics.

(2) CF - Continuous Flow; PP - Positive Pressure; NP - Negative Pressure; PD - Positive Pressure; Pressure Demand; N/A - Not Applicable

(3) Applicable only for those respirator wearers with current qualifications.

Protective clothing will be used as necessary to prevent personnel contamination and to prevent the spread of contamination to clean areas. Protective clothing may include coveralls, hoods, gloves, shoe covers, face shields, or similar equipment, depending on the nature of work being performed and the potential for release of contamination. Protective clothing requirements will be specified by the RSO and on the Radiation Work Permit (RWP).

3.3.4 Contamination Monitoring and Control

The contamination monitoring and control program is designed to detect and minimize the spread of radioactive contamination. This is accomplished through routine surveys (airborne radioactivity, removable contamination, and direct radiation), the use of access controls, the use of Radiation Work Permits (RWP), the use of personal protection equipment, and through training in good work practices.

To verify the effectiveness of contamination controls, direct and removable (smear) contamination surveys are conducted routinely in and around the work area. Survey results are evaluated against pre-determined action levels. The frequency of contamination measurements is based on the potential for spread or release of radioactive materials and/or the potential for personnel exposure. Contamination survey results are documented and reviewed by the project RSO. If action levels are exceeded, an investigation is conducted and corrective actions implemented as determined by the investigation.

Air monitoring includes the use of stationary air sampling equipment, continuous air monitors (alarming), lapel air samplers, high volume portable air samplers, or a combination of these devices.

Access controls are established for contaminated work areas to prevent inadvertent personnel access, to prevent the spread of contamination to uncontrolled areas, and to avoid or minimize personnel exposures. Unrestricted access is limited to those individuals who meet defined access requirements.

When work is required in contaminated areas with the potential for individuals to exceed 10% of the limits in 10 CFR 20, work will be performed under the provisions of a Radiation Work Permit (RWP). RWPs provide minimum personnel protection requirements for working in the area, and include other information important to limiting individual exposures. RWPs are reviewed and approved by the project RSO.

3.3.5 Instrumentation

An adequate number of radiation and contamination detection instruments are available to ensure that appropriate radiation and contamination surveys can be performed. Instrument selection criteria will be based on the type and level of radiation to be measured, maintenance requirements, ruggedness, versatility, and detection limits.

Radiation detection instrumentation may include a variety of dose rate and count rate meters. Ranges and sensitivities of instruments will vary depending on the type and model selected. Table 3-4 describes operating characteristics and ranges of instruments that will typically be used. Actual instrumentation may vary depending on specific needs. The project RSO is responsible for selection, use, calibration, and care of radiation measuring instruments.

Radiation survey and monitoring instruments are calibrated regularly and are battery and source checked prior to use.

TABLE 3-4

Examples of Typical Radiation Detection Instrumentation

PORTABLE EQUIPMENT	TYPE	RANGES
Alpha/Beta Dual Detector Scaler/Ratemeter	Ludlum 2224 with 43-89 Probe	0-500K cpm
Geiger Meuller Beta-Gamma Ratemeter	ESP-2 or Ludlum 3 with HP-210 Probe	
Alpha Scintillation Ratemeter	Ludlum AC-3-8	0-4M cpm
Gamma Ratemeter	Eberline ESP 2 with 2" NaI Detector	
Gamma Ratemeter	Bicron G-2	
Alpha/Beta Gas Flow Proportional Ratemeter (Floor Monitor)	Ludlum 239-1F	0-500K cpm
Gamma Scintillation Exposure Ratemeter	Eberline ASP-1/SPA-8 micro R meter	0-500K cpm
Alpha Scintillation Continuous Air Monitor	Alpha 6	
LABORATORY EQUIPMENT	**TYPE**	**RANGES**
Alpha Proportional Counting System	Eberline SAC-4	Variable
Alpha/Beta Planchet Counter	Ludlum 2929	

3.3.6 Environmental and Effluent Monitoring and Control

The primary pathway for potential off-site radiological exposures during site remediation is through release of airborne effluent. Remediation operations are designed to control off-site releases from this pathway. No liquid wastes have been identified and none are anticipated on this project, and there will be no liquid effluents.

Routine and special environmental monitoring will be conducted to detect, assess and limit potential airborne releases. Air monitoring will be localized and will consist of BZA filter samples and/or high volume air samples taken within a work area. Administrative action levels are established at levels well below regulatory limits. If action levels are exceeded, an investigation is conducted and corrective actions implemented as determined by the investigation.

3.3.7 Program Audits, Inspections and Reviews

The effectiveness of the health and safety program may be evaluated through periodic audits, inspections and reviews. The results of these audits, inspections and reviews are reviewed by the Project Manager and the project RSO, and corrective actions implemented as determined necessary by the RSO.

3.4 Contractor Personnel

The licensed remediation contractor is responsible for ensuring contractor personnel are provided the requisite knowledge, equipment and resources needed to safely carry out their work. This is implemented through implementation of a documented health and safety plan, access control, training, personnel protection measures, and RWPs. Prior to being allowed to start work, the contractor's employees and subcontractors will receive training commensurate with their assigned tasks. They will be informed on the specific radiological hazards associated with their work, protective measures that may be taken to minimize exposures to themselves and to others, and their rights and responsibilities under the Atomic Energy Act.

3.5 Radioactive Waste Management

The licensed remediation contractor is responsible for identifying, characterizing, segregating, processing, packaging, labeling, storing, manifesting, and shipping, as well as providing general oversight and control of all radioactive wastes. All contaminated materials recovered from the site during remediation activities will be considered waste. Secondary waste will also be generated during remediation and will include paper, plastic, rags, contaminated equipment, and the like. No liquid wastes are anticipated. Radioactive wastes may be temporarily stored/staged on-site prior to shipment to a licensed low-level waste processing and/or disposal facility.

3.5.1 Waste Characteristics

Radioactive wastes are expected to consist of dry, solid wastes including building and construction debris (wood, cinder block, concrete, steel, roofing material, piping, ductwork, etc.), equipment, soil, sediment, and secondary waste (paper, plastic, rags, small tools, sweepings, etc.) resulting from remediation activities. The radiological characteristics for wastes are the same as those described in Section 3.1.

All radioactive wastes are expected to be shipped as Low Specific Activity (LSA)/Fissile Exempt, Class A material. Wastes will be identified and characterized to permit management in accordance with applicable NRC, State, EPA, and DOT regulations, as well as disposal site requirements. Characterization and management of waste includes consideration for the possible presence of hazardous constituents regulated under RCRA. Waste characterization may be by sampling and analysis (analyses may be performed either on site or off site) or by other accepted methods.

Asbestos waste, in the form of floor tiles and/or mastic, are also expected. Asbestos containing material will be handled in accordance with applicable OSHA requirements.

3.5.2 Waste Segregation and Storage

Radioactive wastes will be physically segregated from non-radioactive and hazardous wastes. Packaged radioactive waste awaiting disposal will be stored in a clearly designated, controlled (locked or monitored) area within fenced areas.

Storage locations and storage times may vary depending on site-specific factors such as physical form and amount of waste and radionuclide content. On-site storage time is expected to be limited by the completion of waste analyses and acceptance by a licensed disposal facility, and by the economics of shipments (ensuring full or optimum shipments of waste).

Whenever possible, radioactive wastes will be either stored inside, or outside and covered, for protection against weather. Waste storage areas are subject to monitoring and control in accordance with applicable regulations, licenses, permits, and the site health and safety program. Regardless of the method and location selected, contained wastes will be stored in a manner to minimize personnel exposure and environmental impact.

Hazardous waste is not expected during remediation. In the unlikely event any waste is determined to be mixed (i.e., containing both hazardous and radioactive material), it will be segregated for further treatment, storage, management, shipment and disposal in accordance with State, EPA, and DOT regulations.

3.5.3 Waste Packaging, Shipment and Disposal

Radioactive wastes will be packaged, labeled, manifested and shipped in accordance with NRC and DOT requirements specified in 10 CFR 71, 49 CFR 173, and 10 CFR 20. In addition, waste must conform to the requirements of the licensed disposal facility.

Non-radioactive/non-hazardous wastes will be managed as solid waste for disposal in a Subtitle D, solid waste disposal facility. Prior to releasing non-radioactive wastes to a solid waste facility, the waste will be sampled and/or surveyed to demonstrate compliance with the criteria in Table 4-1.

3.5.4 Records

Records will be maintained for all radioactive waste generated, packaged, stored and shipped from the site. Records will include the waste type and form, waste volume, amount and type of radioactivity, date shipped, destination, and other relevant information.

4.0 FINAL RADIOLOGICAL STATUS SURVEY

4.1 Introduction

Section 2.1.2 Remediation (Decommissioning) Tasks stated (Task 7) building surfaces in identified affected areas will be cleaned prior to collecting supplemental radiological characterization survey data (Task 8). Cleaning efforts will include dusting, mopping, vacuuming and/or steam cleaning or high pressure water washing, as appropriate. Any wastes generated will be collected, analyzed for radioactivity, and managed accordingly.

Recent voluntary site characterization efforts were conducted for the purpose of confirming conformance with the proposed criteria for unrestricted release and identifying areas where supplemental characterization data and/or additional remediation is indicated. Those areas where the *maximum* survey reading marginally exceeded the average release criteria (direct alpha or direct beta/gamma - 5,000 dpm/100 square centimeters), but where the average direct measurement was not documented by UCAR's prior consultant (Rooms 120, 121, 122, 124, 126, 129 and 132), will be resurveyed in order to calculate the average value for the grid for comparison with the release criteria. Those areas where existing characterization data or supplemental measurements indicate that the proposed release criteria are exceeded will be decontaminated until the criteria are met.

Most areas where contamination is present at levels above the proposed release criteria are isolated and the contaminants are fixed. For example, only 3% (eight out of 249) of the grids surveyed in the Building 5 Annex and 4% (45 out of 1,070) of the grids surveyed in Building 10 had surface contamination levels that exceed the proposed release criteria.

Due to the quantity and quality of accumulated radiological data (see Volume 2, Attachment A) and the fact that elevated readings are restricted to localized hot spots (the one exception being the Room 134 penthouse in Building 10), the final status survey will be limited in scope to only include areas where measured contaminant levels exceed the average unrestricted release guidelines, as well as any other areas which may be affected by remediation activities (i.e., affected areas).

In Building 10, over half of the elevated readings came from one process area, primarily in the southwest quadrant of Room 133. This entire quadrant (a total of 184 grids) will be considered affected and resurveyed to demonstrate conformance with the proposed unrestricted release criteria. Of the 22 grids where elevated levels of contamination were detected outside of Room 133, an additional 314 grids will be considered affected and resurveyed. It is anticipated that only 24 grids in Building 5 Annex will be considered affected and be resurveyed.

4.2 Survey Design

The final status survey is designed to provide additional radiological information which, when combined with data already documented for the site, would enable the site to continue to be used in an unrestricted fashion. Specific objectives of the final status survey are to demonstrate that:

- Surface contamination levels (alpha, beta/gamma) on structures and equipment are within current established guideline levels;

- Exposure rates measured at 1 meter above the surface are less than 10 μR/hr above background; and

- Concentrations of uranium and thorium in soil/sediment are below the 25 mrem/y CGLs;

Survey efforts will include scanning surveys, surface soil sampling and analysis, exposure rate measurements, and direct and removable surface contamination surveys of structures and equipment. The survey design follows guidance provided in "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)" and/or "Manual for Conducting Radiological Surveys in Support of License Termination" (NUREG/CR-5849).

Scanning for elevated gamma emissions will be performed over 100% of the outdoor affected areas. Soil contamination levels will be determined by sampling and analysis. Surfaces of structures and equipment in affected areas will be 100% scanned using portable survey instruments. At least 30 measurements (or 1 measurement every 2 meters, whichever is greater) of direct α and β/γ radiation will be obtained from each affected area. Removable contamination will be measured only if the direct measurements exceed 1,000 dpm/100cm^2 above background. Exposure rate measurements will be made at 1 meter above the ground surface in outdoor affected areas. Groundwater will not be sampled because sufficient data exists to conclude that groundwater is unaffected by residual contamination.

4.2.1 Release Criteria

The NRC provided information for releasing structures and equipment in an August 3, 1995, letter to UCAR. Additional guidance was provided by the NRC in the Federal Register (July 1997). July 24, 1998 correspondence between UCAR and the NRC clarified that submittal of a decommissioning plan by August 20, 1998 ensures that the SDMP surface contamination criteria listed in Table 4-1 will apply to all facility structures and equipment, and that the 25 mrem / yr. exposure criteria will apply to soil contamination. For these reasons, the criteria that will be used in determining that structures and equipment meet criteria for unrestricted use will be those 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." Applicable values from that document are listed in Table 4-1. While the only contaminant of significance at the UCAR site has been identified as uranium, it was recognized that there are certain areas where the β/γ measurements exceeded the α measurements and may be indicative of significant contamination. For this reason, UCAR has elected to apply the uranium guidelines to not only the α measurements but also the β/γ measurements. As with other categories of contaminants listed in the table, the uranium guidelines will be applied separately and independently to both α and β/γ measurements.

TABLE 4-1

Surface Contamination Guidelines for Release of Facilities and Equipment

Nuclide	Average[a,b]	Maximum[a,c]	Removable[a,d]
Uranium and associated decay products	5,000 α	15,000 α	1,000 α
Natural thorium and decay products	1,000	3,000	200
Beta/Gamma Emitters	5,000 β/γ	15,000 β/γ	1,000 β/γ

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

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

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

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

Radioactivity levels in soils and sediments will be evaluated against criteria established by the NRC in 10 CFR Part 20, Subpart E, *Radiological Criteria for License Termination*. These criteria are based on limiting the dose resulting from residual radioactivity to less than 25 mrem/y to an average member of the critical group. Because multiple nuclides are present at the site, nuclide-specific Concentration Guideline Levels (CGL) were conservatively developed for evaluating compliance with the 25-mrem/y criteria. CGL values for the nuclides of concern are listed in Table 4-2 and are discussed in detail in Volume 2, Attachment C.

TABLE 4-2

CGL Values for Soil/Sediment

Contaminant	CGL (pCi/g)
Total U	274
U-234	288
U-235	50.2
U-238	161
Th-232	2.6

* Total U is estimated assuming enriched uranium. The relative activity breakdown of individual uranium isotopes is: 92.7% U-234, 4.5% U-235, and 2.7% U-238 (based on soil data obtained near the incinerator pad).

4.2.2 Background Determination

Twenty background soil/sediment samples were collected from the southwest portion of the site during the previous site characterization effort. This area is predominantly upwind and upgradient from the former radioactive material processing facilities yet close enough to be representative of actual background conditions at the site. The locations and results of background samples are presented in Volume 2, Attachment A. The data indicate that average background total uranium activity in soil is 1.57 pCi/g, with the 95% upper confidence level at 1.71 pCi/g. The average background Th-232 activity in soil is 1.04 pCi/g, with the 95% upper confidence level at 1.13 pCi/g. The background data for soil/sediment satisfy the objectives of NUREG/CR-5849 that background should ideally be defined so that the 95% confidence level is less than 20% variance from the average.

Background dose equivalent exposure rate measurements were also determined during previous characterization efforts at the same 20 locations as the background soil samples were collected. Measurements were made using a Bicron microrem tissue equivalent detector to measure dose equivalent rates (μrem/h) at ground level and at one meter above the ground. The average background dose equivalent rate at 1 meter above ground was determined to be 3.8 μrem/h.

Alpha and beta/gamma instrument background levels will be determined prior to surveying any grid by holding the instrument at least one meter away from any surface and noting the instrument reading. Significant increases in the instrument background will result in removing the instrument from service until it has been cleaned and verified to be operating properly.

4.2.3 Area Classification

Site survey data was collected from 1996 through 1998 to confirm which areas of the site meet the proposed unrestricted use criteria and where supplemental characterization data and/or remediation is indicated. Where survey data confirms the release criteria are met, the area is being classified as unaffected. Only those areas identified as affected (as defined in draft NUREG/CR-5849) will be sampled during the final status survey. Affected areas are identified and described in Section 3.1.3., and include rooms or portions of rooms inside Building 5 Annex, Building 10, the Metallurgy Laboratory, and soil in the incinerator pad area.

4.2.4 Survey Grid System

A grid system will be established for the final status survey to facilitate identification of measurement and sampling locations. A system of grids will be developed and overlaid on plan drawings for collecting surface soil samples in outside affected areas. An example of such a grid is provided as Figure 3-1 for the incinerator pad area. Building reference grids will be established in indoor affected areas using approximately the same methods as during the previous survey effort (see grid maps Volume 2, Attachment A).

4.2.5 Number of Samples

Ten surface soil samples will be obtained from the 10,000 ft^2 area surrounding the incinerator pad. This number should be sufficient to provide statistical confidence that residual contamination levels meet the proposed unrestricted release criteria. If not, additional samples will be obtained at random in this area until the desired level of statistical confidence is obtained.

Similarly, a sufficient number of samples will be obtained from any outdoor affected area for which a final status survey is deemed necessary. At least 4 samples will be obtained from any such area and additional samples may be obtained as necessary to achieve the desired level of statistical confidence.

A minimum of 30 direct α and β/γ measurements will be obtained in each indoor affected area. If the affected area is greater than 30 m^2, then direct readings of α and β/γ surface contamination will be obtained every 2 meters. Removable contamination measurements will be obtained only if the α or β/γ direct measurements exceed 1,000 dpm/100 cm^2.

4.3 Survey Methods

Surveys will be conducted using two types of measurement techniques:

1. Direct measurements using portable field instruments, and

2. Sampling and analysis by a commercially available laboratory.

This section discusses the instrumentation to be used in conducting field measurements and the methods for collecting samples to be sent to a commercial laboratory facility.

4.3.1 Gamma Radiation Surveys (Outside Areas)

Walkover gamma scanning surveys will be conducted in all affected outdoor areas to identify residual hot spots. Gamma scanning surveys will be conducted using a 2" sodium iodide scintillation detector connected to a count rate meter equipped with audible indicator. Measurements will be made as close to the surface as practical to enable detection of low levels of residual radioactivity.

One hundred percent of the outdoor affected areas will be scanned and areas where elevated readings are detected will be flagged for subsequent measurement and/or sampling. The detector will be advanced during scanning at approximately 0.5 meter per second. Audible indicators will be used to aid in detecting levels of elevated activity.

In addition to scanning surveys, gamma exposure rate measurements will be taken at 1 meter above the ground in all grids in outdoor affected areas. Exposure rate measurements will be made at the center of each grid located in an affected area and where scanning has flagged an area for subsequent measurement.

According to 6.7 in MARSSIM, a 2" NaI scanning instrument has the sensitivity to detect enriched uranium in soil at levels of approximately 132 pCi/g, which is well below the release criteria developed for the UCAR site.

4.3.2 Scans of Building Surfaces

Within affected areas of Building 10 and the Building 5 Annex, the entire surface (excluding obstructions) of wall, floor and ceiling affected areas will be scanned for alpha and beta/gamma radioactivity. Scans will be performed using a gas-filled proportional floor monitor or hand held α/β scintillation probe (or its equivalent). Scanning surveys will be conducted at a rate of approximately 1 probe width every 2-3 seconds with the probe held within a few centimeters of the surface. The audible indicator and/or digital readout will be used to identify areas of elevated alpha and beta radioactivity, which will be marked for further measurements and/or sampling. The sensitivity of these instruments are adequate to measure count rates of much less than 1,000 dpm/100 cm^2.

4.3.3 Building Surface Measurements for Alpha Contamination

Direct alpha and beta measurements will be made where the highest scanning results were obtained in each grid in affected areas. A dual alpha/beta detector with integrating scaler and audible indicator will be used to make 0.1 minute counts at each location. Additional measurements will be obtained at random from the affected area in order to obtain at least 30 measurements total from each affected area.

Because removable radioactivity is expected to be negligible and thus the probability of contaminating the probe is slight, measurements may be made with the probe held in light contact with the surface being measured.

Removable alpha and beta/gamma radioactivity will be measured in each grid where direct alpha and beta measurements exceeded 1,000 dpm/100 cm^2. Removable radioactivity will be determined by wiping an area of approximately 100 cm^2 with a dry filter paper (smear), such as a Whatman 50 or other suitable material, while applying moderate pressure. Each smear will be placed in an individual sample envelope to prevent cross-contamination, labeled with the sample location and sample date/time, and measured for gross alpha and beta using a Ludlum 2929 scintillation scaler, or comparable instrument, for comparison with the limits in Table 4-1.

The direct (total of fixed and removable) and removable (smear results) alpha and beta radioactivity levels will be recorded.

4.4 Sampling and Measurement Techniques

4.4.1 Surface/Subsurface Soil Samples

Surface soil samples will be collected from the top 15 cm of soil in the immediate vicinity of the sample location (i.e., within an approximately 2 feet radius). Samples will be collected using simple hand tools (hand auger, shovels, trowel, etc.), packaged in a plastic bag, bottle, or other suitable container, labeled with sample location and sample date, and sent to a qualified off-site laboratory for analysis. Samples will be analyzed by gamma spectroscopy, with sensitivity for U-235, U-238, Th-232, and Ra-226. U-235 values will be used as a surrogate measurement to scale other isotopes of interest. Scaling ratios will be based on data collected during the previous site characterization efforts. Sum of fraction (SOF) values will be calculated for each sample for comparison with the CGLs.

Based on characterization data, no residual radioactivity has been identified in subsurface soils below a depth of 12 inches. Therefore, no subsurface samples are necessary during the final status survey.

4.4.2 Structures

The floors in Building 10 and Building 5 Annex have been sampled during earlier characterization efforts to confirm that there is no accumulation of subsurface radioactivity. Core samples were collected from the concrete floor, subgrade, and underlying soil of Building 10 (12 samples at four locations), from corings of the concrete floor, subgrade and underlying soil of the Building 5 Annex (6 samples from two locations), from the roof of Building 10 (12 samples), and from manholes providing access to Building 10 process area floor drain collection lines (3 samples). With the possible exception of one sample location in Room 108 of Building 5 Annex, core sample results indicate that contamination levels are below the CGL levels within or below the floors. Therefore, only one additional core sample is planned in Room 108 of Building 5 Annex after remediation efforts are complete. After remediation is complete, samples will be collected from the area of highest surface contamination in each affected area. Samples of at least 2 grams will be collected by drilling, scraping, or other suitable means, and analyzed by alpha spectroscopy for uranium.

4.4.3 Equipment

Any remaining equipment that requires remediation will be surveyed for release following the guidelines in Table 4-1.

4.5 Analytical Methods

Soil and sediment samples will be sent off-site to a commercial analytical laboratory which is capable and qualified to perform the required analyses. The remediation contractor will be responsible for verifying that analyses are performed in accordance with approved written procedures and that the laboratory maintains a quality assurance/quality control program adequate for assuring the validity of analytical results.

Smear samples will be analyzed on-site. The analytical procedures and the QA/QC program that will be used will be consistent with Section 7.0 of NUREG/CR-5849.

4.6 Quality Assurance

Because the purpose of the final radiological status survey is to demonstrate that identified affected areas at the site meet the proposed unrestricted use release criteria, surveys and sampling will be conducted in a manner that provides a high degree of assurance that results reflect the actual radiological conditions at the site. The final status survey will include measures to ensure the quality of the survey including: instrumentation (selection, calibration, use), sampling and analysis (sample selection, sampling techniques, chain of custody requirements), qualifications of personnel, data validation and verification, and documentation (completeness, accuracy, consistency, reproducibility).

4.7 Interpretation of Survey Results

Dose rate and radiation level measurements will be conducted on remediated soils using survey instrumentation that reads directly in microrem per hour (μrem/h). This will enable direct comparison with background levels (approximately 3.8 μrem/h). Comparison to the release criteria (10 μR/h above background) will be accomplished by dividing the dose rate (in μrem/h above background) by 0.87 to convert the measurement into units appropriate for exposure rate in air.

Surface contamination (fixed and removable alpha radioactivity) will be measured using instruments that provide results in counts per minute (cpm). These readings must be converted to disintegrations per minute (dpm) per 100 cm^2 for comparison with release criteria. The conversion from cpm to dpm/100 cm^2 will be performed using the following formula that takes into consideration total instrument count rate, measured background level, detection efficiency of the instrument, count time, and the active surface area of the detector.

The conversion equation is:

$$\frac{dpm}{100\ cm^2} = \frac{(C\text{-}B)}{T \times E} \times \frac{(100)}{(A)}$$

Where:

C	total count rate as measured by the instrument (cpm)
B	measured background count rate (cpm)
T	time period over which the count was measured (min.)
E	detection efficiency of the instrument
A	active surface area of the detector (cm^2)

Soil/sediment radioactivity concentrations will be reported by the contract laboratory in units of picocuries per gram (pCi/g) of the submitted media. If necessary, some radioisotopes will be scaled using measured results from a surrogate. Scaling factors will be obtained from characterization data previously obtained in the area in question. A SOF value will be calculated for each sample to determine if the residual radioactivity levels are below the CGLs (i.e., less than the average background SOF + 1).

4.8 Final Radiological Status Report

The licensed remediation contractor will prepare a *Final Radiological Status Report,* following appropriate guidance in NUREG/CR-5849 and MARSSIM. This report will be submitted to the NRC for their review and agreement.

5.0 FUNDING

UCAR is committed and financially capable of implementing the supplemental site characterization, remediation and final survey work described in this proposed plan. Depending on the outcome of NRC's review of this plan, the exact scope of future site decommissioning activities and other potential contingencies, the anticipated budget and/or proposed project schedule may be impacted. These issues will be communicated to the NRC, as appropriate.

6.0 PHYSICAL SECURITY PLAN AND MATERIAL CONTROL AND ACCOUNTING PLAN PROVISIONS IN PLACE DURING REMEDIATION (DECOMMISSIONING)

The former Special Nuclear Material License for the Union Carbide Corporation Nuclear Fuels Division facility in Lawrenceburg was terminated in 1974. Since that time, there have been no physical security requirements or special nuclear material control requirements. Although residual radioactivity containing enriched uranium (up to 93% U-235) has subsequently been identified in some localized areas, the levels of radioactivity are very low and the nature of the radioactivity (present only as residual contamination in soil/sediment and on structural surfaces) makes it inaccessible from a material control and physical security standpoint. Therefore, UCAR does not anticipate that a physical security plan or a material control plan is required.

However, UCAR will select a remediation contractor that maintains Physical Security Plans and Fundamental Nuclear Material Control Plans for special nuclear material (both high- and low-enriched material), is well qualified to handle any future situation that may arise involving special nuclear material, and that will implement appropriate physical control and security measures, if they become appropriate.

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