

**Remediation Workers' Exposure Assessment
Feasibility Study At The Department Of Energy's
Rocky Flats Site**

Phase I

Study Initiated under Contract With:
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Cincinnati, OH. 45237
Contract Number 200-92-2559

Study Completed under Contract With:
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Contract Number 200-98-2006

Submitted to National Institute for Occupational Safety and Health
Surveillance Hazard Evaluation and Field Studies Division
Health-related Energy Research Branch
January, 1998

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PREFACE

The Department of Health and Human Services (DHHS), subsequent to the implementation of a Memorandum of Understanding (MOU) between the Departments of Energy (DOE) and Health and Human Services, conducts a program of independent occupational and environmental research studies with funding from DOE. Research conducted under this MOU focuses on the examination of health effects that may have resulted from past or current DOE operations. The National Institute for Occupational Safety and Health (NIOSH) within the Centers for Disease Control and Prevention, DHHS is charged with the conduct of the occupational health research component of this MOU. This document on the DOE Rocky Flats site represents the third background site document prepared for the development of the NIOSH project entitled: Exposure Assessment of Hazardous Waste (HW), Decontamination and Decommissioning and Cleanup workers at The Department Of Energy's Rocky Flats Site Phase I.

The purpose of this document is to assemble information relevant to Remediation Workers performing Hazardous Waste (HW), Deactivation (De), Dismantlement (Di), and Clean Up (CW) task activities at the DOE Rocky Flats site addressing four primary objectives. The objectives are: identification of Remediation Workers performing HW, De, Di, and CW task activities anticipated or in progress from the recent past through the next five to 10 years; demographic definition of the workforce performing these activities; identification of the technologies in use or proposed to be used (including considerations regarding health and safety impact upon the workforce); and assembly of summary information for potential chemical, mixed, and radiological contaminant exposures that may be encountered during these processes. The information is drawn predominantly from existing DOE and contractor documents or reports. Other source documents may include those assembled for compliance purposes or to define activities dictated by site Decontamination & Decommissioning, restoration, transition, and cleanup agreements with local, state, and federal authorities or as mandated by DOE. This assembly of information is to support research hypothesis development in the next phase of this project. It will also provide insight and initial data for study feasibility and planning considerations.

The depth and scope of the information assembled provides a midrange presentation of data. Grappling with the needs for substantive information while avoiding premature detail and acknowledging changes in data relevance as time elapses influenced both the character and decisions that went into the assembly of this document. The data collection process limited the need for intensive site involvement. This document is descriptive in nature. The resource documents used to assemble the information are referenced. Information that could not be obtained or which did not exist in an accessible form is also identified.

The intended application of this document is to provide an overview of Remediation Workers performing HW, De, Di, and CW task activities at the DOE Rocky Flats site. The information is presented in two ways, a text assembly of information with references and a tabular presentation. The intent of this approach is to permit disassembly of the document to facilitate combining similar information for different sites, ideally facilitating an assessment of the feasibility of involving multiple sites in a research study.

The limitations of this document should be recognized. The rate of change in organizational structure, workforce composition, and site activities at the DOE sites involving Remediation Workers performing HW, De, Di, and CW tasks appears to be increasing in frequency and complexity. This coincides with a compression of the time frame committed to cleaning up sites by DOE, resource reductions, and an increase in the use of autonomous multi tiered subcontracting. Numerical data is presented as found in the cited references. No verification of summary data provided by the sites or obtained from pre-existing documents has been performed. Obstacles that may become substantial regarding exposure characterization of workforces on site include cessation of centralized data collection systems; introduction of "just in time" contaminant characterization on an as-justified basis; modification of site programs documenting worker exposures; shifts away from a stable, long-term workforce; and changes in the structure of site management. The information presented may also constitute tangential information related to the objectives specified for this phase of the project.

DISCLAIMER

Mention of any company or product does not constitute endorsement by the National Institute for Occupational Safety and Health.

ACKNOWLEDGMENTS

The majority of this background document addressing remediation worker activities at the Department of Energy (DOE) Rocky Flats site was prepared by Dynamic Science, Inc., 1821 Summit Road, Suite 010, Cincinnati, OH 45237 under the authority of Dynamic Science, Incorporated, 8433 North Black Canyon Highway, Suite 200 Phoenix, AZ 85021, for the National Institute for Occupational Safety and Health (NIOSH) under contract no. 200-92-2559. The first draft revision and final assembly phases of this document were prepared by TRI-S Incorporated, 4960 Ridge Road, Suite 2, Cincinnati, Ohio 45209 under the authority of TRI-S Incorporated, 323 South Union Avenue, Havre de Grace, Maryland 21078, for the National Institute for Occupational Safety and Health (NIOSH) under contract no. 200-98-2006. The NIOSH project officer responsible for the management and technical direction of this document is Dr. Steven H. Ahrenholz. Assistance with document review and comment was provided by Mr. Timothy D. Taulbee, NIOSH. The Technical Information Specialists responsible for the acquisition and assembly of data into this final report were Mr. Gentry W. Stevens and Mr. David A. Back with research assistance support provided by Ms. Trudi Zimmerman, Ms. Relada Miller, Mr. Stephen Davisson, and Ms. Julie Collier. This document is the deliverable for this site for Phase I of the Hazardous Waste, Decontamination and Decommission and Cleanup Workers Exposure Assessment Study being conducted by the NIOSH Division of Surveillance, Hazard Evaluations and Field Studies - Health-Related Energy Research Branch. NIOSH conducts worker health studies at the various DOE sites through a Memorandum of Understanding executed by the DOE and the Department of Health and Human Services (DHHS) in 1990 and renewed in 1996. NIOSH is one of the Centers for Disease Control and Prevention, within DHHS.

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REMEDIATION WORKERS EXPOSURE ASSESSMENT FEASIBILITY STUDY AT THE DEPARTMENT OF ENERGY'S ROCKY FLATS SITE

1.0 ABSTRACT

The focus of this study is on Remediation Workers at the United States Department of Energy's (DOE) Rocky Flats Environmental Technology Site (RFETS) with regard to past, present and proposed future worker group activities, exposures, demographics and technologies.

Unlike most previous DOE related epidemiological studies which have focused on historical worker exposure data, this study addresses historic (July 1989 to present), present (November 1996 - November 1997) and proposed (November 1997 and beyond) Remediation Worker group exposure data. In many cases, accelerated clean up schedules are planned for DOE sites across the country with the intention of site remediation within the scope of ten years or less. These worker groups, which might encounter hazards that their predecessors (i.e., production workers) were not exposed to, may vanish upon completion of these tasks. The first phase of this study will address, identify and summarize documentation regarding this work force for use as a foundation upon which further studies will be built.

During the course of this study the partnership agreement between the DOE and the Department of Health and Human Services (DHHS), as described in the December 24, 1990 (renewed in 1996) Memorandum of Understanding (MOU) between these two agencies, has been tested in terms of gathering the necessary worker group data for this study.

2.0 PURPOSE

This study involves the assembly of background information necessary to address health hazards to Remediation Workers involved with waste streams at the RFETS. The objectives of this study are:

1. Identify and catalog historic, in progress and anticipated Remediation Worker activities at the site.
2. Define and characterize the Remediation Worker workforce demographically.
3. Identify the past, present and proposed future technology's DOE will use for the work categories.
4. Determine if exposure characterization data exists and categorize the available exposure information into the following groups: chemical, mixed and radiological.

Information assembled as a result of this study will serve as a catalyst for subsequent exposure assessment and epidemiological studies of this work force.

3.0 LIMITS

This Exposure Assessment Feasibility study focuses primarily on Remediation Workers involved with waste streams within the RFETS. The site is divided into Industrial Area and Buffer Zone Operable Units (OUs) which include the former process area and surrounding support (restricted) areas. OUs were utilized as distinct geographic areas from which the associated worker activities, demographics, exposures and technologies parameters of this study could be addressed. For the purpose of this study, off-site contamination/exposures will not be addressed. Only workers with “hands-on” or full involvement/participation will be addressed; no casual support (pre or post-job Industrial Hygiene (IH) or Radiological safety technicians which do not remain while the work is being performed), administrative support (office managers, clerical support, etc.) or bench-scale support (lab or technology research and development technicians) will be included in the defined worker group or subgroups. Site remediation operations or efforts undertaken prior to the formal conclusion of production at the RFETS are not addressed in this study. Workers that utilize buildings or structures which have been “free released” for public or private industry will not be addressed in this study.

4.0 RESEARCH APPROACH

Information Resources

Information utilized to fulfill the objectives stated earlier were collected primarily from publicly available documents and RFETS contacts.

Publicly available documents were obtained from Internet sites, the NIOSH (National Institute of Occupational Safety and Health) Health-related Energy Research Branch (HERB) Library and from the Fernald and RFETS Public Environmental Information Centers (PEIC).

The PEIC serves as a repository for the Administrative Record which was established under Section 113 (k) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The administrative record is the body of documents that “forms the basis” for the selection of a particular response (remedial response action) at a site. Section 113 (k) requires that the administrative record act as a vehicle for public participation in selecting a remedial response action. All DOE Superfund sites must maintain a PEIC. Information available at the PEIC includes documents pertaining to past, present and proposed future Remediation Worker activities and technologies. Data concerning worker activities and technologies were obtained primarily from PEIC’s, HERB Library, conversations with key RFETS staff and from Internet sites.

A NIOSH identified DOE site contact acted as a liaison between NIOSH contractor personnel and Kaiser-Hill, Inc., the RFETS operations contractor. The DOE site contact then identified key staff personnel responsible for the particular information requested. These contacts provided information not available from public information sources, i.e., documents pertaining to past, present and proposed future Remediation Worker demographics and exposures. Remediation Worker exposure and demographic data was also collected from on-site points of contact using a questionnaire format and telephone interviews.

Format considerations

Information gathered to fulfill the objectives stated earlier is presented using two complimentary approaches. These are descriptive “fact or information sheets” and “tables” which present in an overview fashion the categories and types of information necessary to address each objective.

Site Information

A general description of the site was developed to include site facts, years of operation, site activity during production, process description, current mission and future disposition of the site.

Regulatory Drivers

An overview of driving forces (legal) behind the project is presented which includes regulatory agencies and applicable legislation governing site remediation. Regulatory drivers specific to each worker group and associated activities are also presented.

RFETS Environmental Management Program

Provides an overview of management programs currently involved in oversight of environmental remediation at the RFETS.

Definition of the Remediation Worker Group

The Remediation Worker group definition was based on worker functions (i.e., Dismantlement, Deactivation, Hazardous Waste, and Cleanup Worker tasks) and the types of waste streams handled. The definitions were developed by the Authors using a combination of personal process knowledge, information gleaned from publicly available documents, and site contacts. Definition of and general management practice for each type of waste generated at the site is also presented.

Remediation Worker Group Demographics

This section provides a demographic description of the Remediation Worker group at the facility and includes, when available: overall numbers of Remediation Workers, union information, personnel records, numbers of workers per contractor, turnover rates, job titles, tasks or categories, number of workers per job task or category, indication of where workers came from [e.g., former site workers, young unskilled laborers, etc.], industry profiles, construction trades, equipment operators, health and safety support and any unconventional work groups, location of worker activity on site, tracking mechanisms/availability of past, present, and proposed future information on these workers, worker pools, primary site location of activity, generic job title groups, etc.

Identification of Historic, In-progress, and Anticipated Remediation Worker Activities and Exposures

This section presents historic, in-progress, and anticipated Remediation Worker activities and exposures which are described and defined relative to worker tasks and the physical location of those activities. Historic and current Remediation Worker exposure data, where available, was accessed, defined, and delineated into the following groups: chemical (i.e. hazardous), mixed, and radiological. Regulatory drivers specific to Remediation Worker group activities, activity duration, and number of workers per activity are also presented.

Remediation Worker Group Technologies

Provided is a listing of past, present and proposed future technologies for Remediation Workers. The list was indexed according to worker task and includes, when available, a brief description of technologies used, the number of workers required/proposed to use the technology, exposure risks (remote versus hands-on, Personal Protective Equipment (PPE) requirements, etc), and perceived advantages and disadvantages of each technology.

Exhibits

Presents, in a table format, information relative to worker group activities, demographics, technologies, and exposures. See Section 9, page 91.

Tables

The tabular presentation of the data accompanies and summarizes in an overview fashion the material presented in the written text which is written with greater detail, explanatory information, sources, limitations, etc. See Section 10, page 134.

Works Cited/References

Section 11, page 156, presents a listing of sources of information from points of contact and publicly available documents.

Points of Contact

Section 12, page 164, presents names, addresses, and phone numbers of RFETS DOE representatives and site contractor personnel that were contacted for information necessary to fulfill the objectives of this study.

Acronyms/Glossary of Terms

Section 13, page 166, presents the definitions of acronyms and terms used.

5.0 SITE INFORMATION

Overview

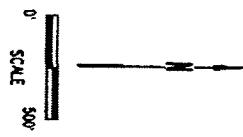
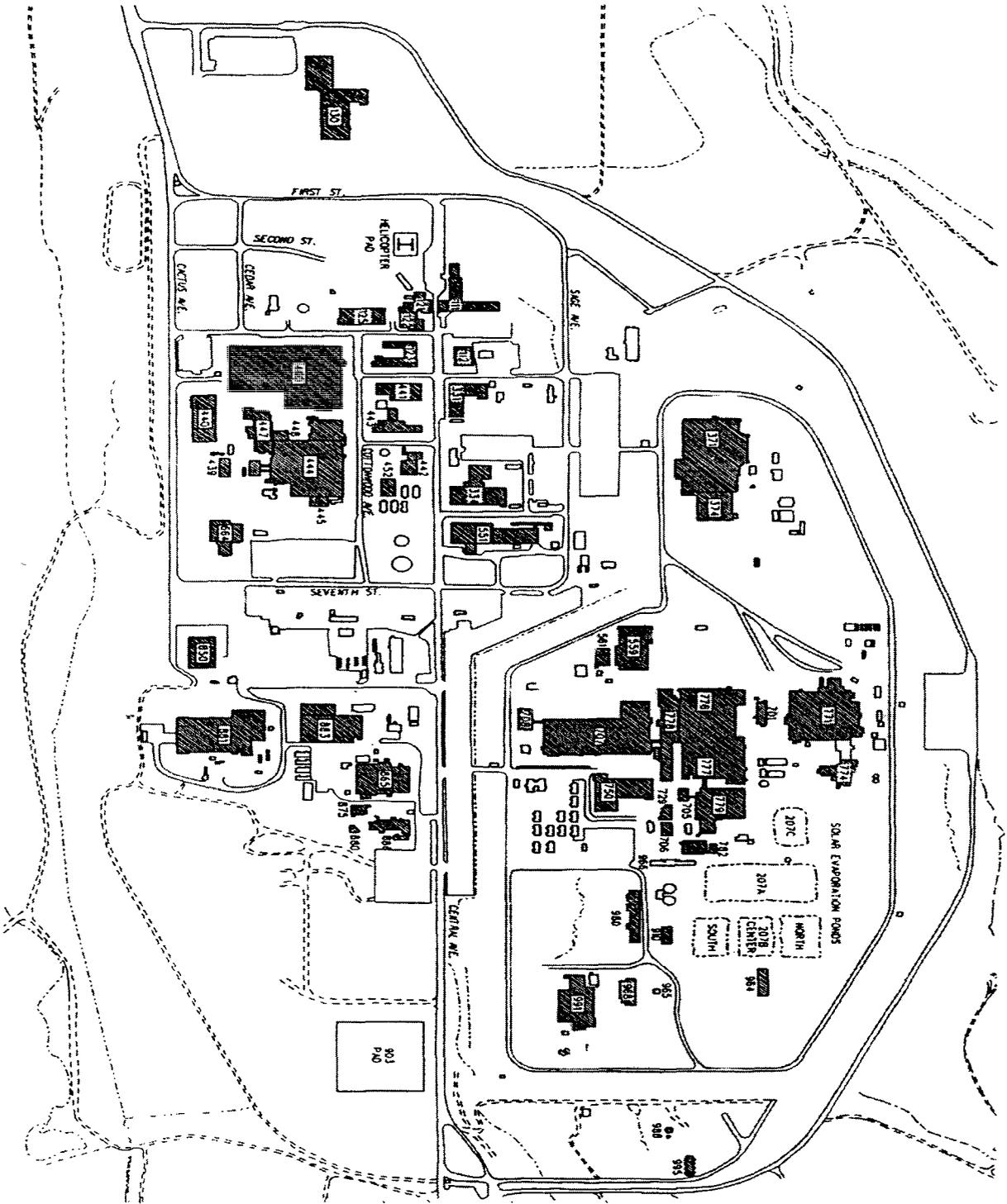
As a former contributor to our nation's defense, the RFETS is a DOE nuclear industrial facility undergoing cleanup and closure. The Plant, located near Denver, Colorado, began operations in 1952 and until 1990 was largely a manufacturing facility consolidating the production and support activities necessary for the fabrication of plutonium, uranium, and stainless steel nuclear weapon components.⁽¹⁾

The RFETS had two main historical missions during the period of operations; production of "triggers" for nuclear weapons and processing of retired weapons for plutonium recovery. The plutonium triggers, also known as "pits," are the first-stage fission bombs used to set off the second-stage fusion reaction in hydrogen bombs. Plutonium has historically been imported from the Hanford Reservation in Washington State and the Savannah River Plant in South Carolina. The RFETS also recovered materials from retired warheads and warhead manufacturing residues. Parts were formed and machined from five primary materials: plutonium, uranium, beryllium, stainless steel, aluminum, and various other materials. In general, the mission, designs, activities, and primary materials of production at the plant have remained essentially the same since plant start up until 1990 when plutonium operations were suspended.⁽²⁾

The RFETS has 500 facilities (including pads, sheds, covered areas, etc...) which supported refining, alloying, forging, machining, testing, and materials recovery operations. The recovery operations included incineration and a variety of chemical reprocessing units. Additionally, the machining operation consumed large quantities of organic lubricants and solvents. The site occupies 6,500 acres, of which 300 acres comprise the main plant area. There are 167 sites of known contamination (Individual Hazardous Substance Sites or IHSS) and more than 50,000 containers of transuranic (TRU), low-level radiological, and hazardous waste in inventory. The buildings, which comprise more than 6,000,000 square feet, contain miles of contaminated piping, hundreds of glove boxes, tanks and other process equipment.⁽³⁾ See page 8 of this document for a site map highlighting selected facilities.⁽⁶⁰⁾

Site Operator History

The RFETS Plant began operations as a Government Owned/Contractor Operated (GOCO) Facility under a Maintenance and Operation (M&O) contract. The Site was operated during the production era under two different contractors: Dow Chemical Corporation from 1952 through 1975 and the Rockwell International Corporation from 1975 through 1990. Post-production era contractors at the RFETS include Edgerton, Germeshausen and Grier (EG&G) from 1990 through mid-1995 and Kaiser-Hill from mid-1995 to present (1997). From the beginning of the post production era until mid-1995 (the beginning of the Integrated Management Contract or IMAC), the prime contractor at the RFETS employed the bulk of the workforce. The IMAC prime contractor (Kaiser-Hill) implemented a strategy of tiered subcontracting that now numbers in the double digits.



KEY TO SELECTED BUILDINGS

NO	DESCRIPTION
10	ADMINISTRATION
11	VENTILATION
12	HEAT PROTECTION
13	HEALTH SERVICES
14	STAINLESS LABORATORY
15	PRODUCTION SUPPORT
16	CHANGE AND FEE STORAGE
17	REPAIR SHOP
18	REPAIR SHOP
19	PROCESS WASTE TREATMENT
20	ROBOT HANDLING
21	PRODUCTION CENTER
22	PRODUCTION SUPPORT
23	VENTILATION
24	DEFINITE STORAGE NO
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Kaiser-Hill's First Tier Contractors Include:

- * Rocky Mountain Remediation Services (RMRS) responsible for Environmental Restoration, Waste Management and D&D Operations
- * Safe Sites of Colorado (SSOC) responsible for Nuclear Operations
- * DynCorp of Colorado, Inc. (DCI) responsible for Site Support Operations

Kaiser-Hill's Second Tier Architectural, Engineering, Construction and Construction Management (AECCM) Contractors Include:

- * Denver West Remediation Corporation (DWRC)
- * J. A. Jones ⁽⁴⁾

Addresses and points of contact for each of these and other identified contractors are provided in Section 12, page 164, Points of Contact.

Site Management Structure

Kaiser-Hill operates the RFETS for the DOE under a performance-base IMAC which began in July 1995 and is in place for the next five years. As part of contract reform, Kaiser-Hill is responsible for integrating all contractors at the RFETS. These subcontracts are assigned specific tasks for which Kaiser-Hill and the various subcontractors will share the rewards or penalties of cost and schedule underruns and overruns. The DOE expects to achieve substantial cost savings through these contract control reforms.⁽⁵⁾

Work performed by subcontractors at the RFETS includes environmental remediation, deactivation, decontamination and dismantlement. This type of work is characterized as high hazard potential from an occupational safety and health perspective. As a result a large number of subcontractor employees are presently performing highly specialized, short and long term jobs.

This work is drastically different from the DOEs' M&O contractor's who's workers were a large cadre of relatively stable, long-term employees. M&O contract workers generally had exposure monitoring for both chemical and physical agents (including ionizing radiation) and medical monitoring programs in place and the data is amenable to retrieval. Subcontractors such as those working under the IMAC at the RFETS are not always included in the sites major or prime contractor exposure monitoring/medical monitoring program. This contributing factor could lead to the potential for noncompliance, lack of worker notification, and inadequate records retention.⁽⁶⁾

Site Operational History

The RFETS was largely a manufacturing facility consolidating the production and support activities necessary for fabrication of nuclear weapon components. *Operational history can be broken down into the five following main functional areas of plant activity:*

1. *Component Manufacturing and Assembly*
 - A. *Plutonium*
 - B. *Enriched Uranium*
 - C. *Depleted Uranium*
 - D. *Beryllium*
 - E. *Stainless Steel*
 - F. *Final Product Assembly*

2. *Material Recovery and Purification*
 - A. *Plutonium*
 - B. *Uranium*
 - C. *Americium*

3. *Research and Development; Buildings*
 - A. *Building 779, "Special Orders"*
 - B. *Building 865*
 - C. *Building 886*

4. *Waste Processing*
 - A. *Liquid Process Wastes*
 - B. *Solid Wastes*
 - C. *Sanitary Wastes*

5. *Plant Support*
 - A. *Laboratories in Buildings 123, 125, 559, and 881*
 - B. *Filter Testing*
 - C. *Laundry Services*

1. Component Manufacturing and Assembly

To manufacture triggers, facilities and equipment were developed to conduct precision metalworking and assembly of fissionable and non-fissionable materials. In the case of the

RFETS, the fissionable materials have nearly always involved uranium and plutonium. Key non-fissionable components have for the most part been beryllium, aluminum, and stainless steel.

In the late 1950's, a greater emphasis was placed on the use of plutonium in the weapon design rather than the heavier amount of enriched uranium used in earlier models. This, coupled with the transfer of enriched uranium contract work to Oak Ridge Reservation in 1963, resulted in most of the enriched uranium work moving out of the RFETS by 1964. Beryllium has almost always been present at the RFETS but was not actually used in full-scale, production operations until 1958.⁽⁷⁾

Plutonium Component Manufacturing

In early years, plutonium metal was reportedly machined in a "dry" state (i.e., without any oils, using only carbon tetrachloride (CCl₄) as a coolant), with as little machining taking place as possible. Handling the dry material required extra care to prevent spontaneous combustion. Plutonium components were cast, pressed into shapes, minimally machined to "true" them, and then plated with cadmium to allow for easier handling. Cadmium was often used to coat the plutonium so that it could be handled out in the open with reduced personnel exposure to neutrons and alpha particles. The protective coating was changed to nickel within a few years time, using a process that employed nickel carbonyl. The use of nickel carbonyl lasted at least into the late 1960's, although its use in the later years was allowed for remote arming of the warhead prior to delivery.

To expedite the plutonium machining process, lubricating oil was added to the machining operations. The first significant machining of plutonium began in 1958 with the new operations in Building 776 using Shell Vitrea® cutting oil, followed by a washing with CCl₄. Building 776 housed a centralized oil collection and separation point, with the solid and liquid fractions sent separately to Building 771. In Building 771, the CCl₄ was distilled out of the oil, and the plutonium recovered from the solids. The spent organic liquids were then filtered and then solidified for disposal.⁽⁷⁾

Enriched Uranium Component Manufacturing

Enriched uranium is defined as uranium having a larger fraction of the fissile U-235 isotope than the approximate 0.7% found in naturally-occurring uranium. Enriched uranium is often called Oralloy, a term derived from Oak Ridge Alloy. The enriched uranium processed at the RFETS has typically contained about 93% U-235 by weight. Originally located in Building 881, enriched uranium operations included production chemistry, foundry operations, fabrication, and scrap material recycling. Building 881 now primarily houses support laboratories, offices, data processing, and record keeping.

When the plant first opened, Building 881 had a very heavy workload of enriched uranium component production and enriched uranium recovery. At first, the components were

solid pieces of uranium, machined to certain shapes, which were then assembled with plutonium, stainless steel, and depleted uranium components in D Plant, now known as Building 991.

Changes in the weapons concept which came about in the late 1950's resulted in a significant downturn in the amount of uranium required in the pit, but actually increased the amount of machining which went into making the new, hollow components. The basic operations for the original components involved casting and machining. The hollow design involved the same machining, but added rolling, forming, and turning operations as well. The processes used in the latter design remained basically the same throughout the life of enriched uranium operations at the RFETS. Many other components involving beryllium, stainless steel, aluminum, plutonium, and depleted uranium employed the same processes.

Enriched uranium (Oralloy) component operations left the plant in 1964, along with the uranium recovery operations. The Oak Ridge Reservation took over all enriched uranium operations, supplying the RFETS with the finished uranium components which were incorporated into the final pit assembly. After Oak Ridge took over the enriched uranium operations, the RFETS still received site returns which contained enriched uranium components. The plant processed those components with a spray leaching process to remove any external plutonium contamination, and returned the Oralloy parts back to Oak Ridge for reprocessing. Oralloy leaching operations were originally conducted in Building 881, but were relocated to Building 771 a few years after Oak Ridge acquired the enriched uranium contract. Oralloy leaching remained in Building 771 through 1989.⁽⁷⁾

Depleted Uranium Component Manufacturing

Depleted uranium is by definition uranium which has less of the fissionable U-235 isotope than the approximate 0.7 percent by weight found in natural uranium. Depleted uranium is rich in the U-238 isotope. Depleted uranium was originally received from Paducah, Kentucky in the form of derby-shaped parts. Later, feed material was received from the Feed Materials Production Center in Fernald, Ohio as ingots in sealed cans. Depleted uranium operations were a significant part of the original manufacturing performed at the plant and were located entirely within the A Plant, now Building 444. Operations included casting and machining of the components from the uranium rich in the U-238 isotope. Adoption of the implosion weapon concept brought about changes in fabrication operations that required additional processing of components. Building 883 was built to fill the need for additional rolling and forming operations. Depleted uranium was still cast in Building 444, but was shipped to 883 to be heated and rolled into sheets, from which blanks were cut and then formed to the required shape. The shaped pieces were cases and the component was coated with other materials. From there, the component was shipped on-site to final assembly. The operations remained basically the same for the last 34 years of production.

One of the changes in the depleted uranium operations came when an arc furnace was installed in the mid-1970's, providing the capability to produce uranium-niobium alloys.

Elements such as zirconium and niobium could be melted more effectively than was possible with the induction casting furnaces, thereby creating a more homogenous alloy casting. Prior to use of the arc furnace, research and development of depleted uranium-niobium alloys involved an electron beam furnace. This alloying work began in 1966, although full-scale production didn't occur until the early 1970's.⁽⁷⁾

Beryllium Component Manufacturing

Originally, beryllium material was received from Brush Industries in the shape of bowls which had been "chevron-cut" from "logs" of pressed-powder beryllium. These bowls were heat-treated and then machined to the required dimensions in the southeast corner of Building 444, in a room only big enough for six to eight lathes. For some time, the plant experimented with casting beryllium components into "near-net-shapes" which went directly from the foundry to the machine shop for finish machining. When beryllium operations became part of the primary production line in 1958, the process had changed to eliminate the near-net-shape casting, and components were shaped from blanks that were supplied by an outside vendor. These blanks were pressed into shapes and then machined into final forms. The plant soon thereafter began conducting its own casting of beryllium ingots for economic reasons. These ingots were cut up into puck-like billets around which an airtight steel casing was welded. The "canned" billet could then be heated and rolled to the desired thickness, the can cut away, and the remaining blank machined as before. Machining operations include milling, turning, drilling, and polishing.

During the mid 1970's, the design agencies (Lawrence Livermore and Los Alamos National Laboratories) made the decision to change over from the wrought process described above to molding of parts from sintered (pressed powder) blanks. The plant then began receiving blanks from outside suppliers, and beryllium foundry operations ceased in 1975. By 1980, the foundry had been cleaned up of all beryllium and only depleted uranium casting was being conducted in Building 444.⁽⁷⁾

Stainless Steel Component Manufacturing

Stainless steel component work came to the RFETS in 1964 from the American Car and Foundry Company in Albuquerque. Stainless Steel operations (known as the "J Line") began in Building 881 and were there until 1984, when they were moved into Building 460, which was newly constructed to house those operations and some from Building 444. These "consolidated manufacturing" operations remain in Building 460 today. A RFETS representative stated that the Building 460 was a non-radiological metal working facility where stainless steel and titanium was machined.⁽⁶⁰⁾

Final Product Assembly

The original final assembly building was the "D Plant," now known as Building 991. The final assembly operations included using small amounts of solvents for one last wipe-down of

components and finished products for solid core devices. When hollow core devices became more popular, more intensive final assembly operations were required which included: drilling, welding, brazing, turning and polishing. This work was performed in Building 777 until the fire of 1969 when it was moved into Building 707 where it remained until production ended. Prior to the fire of 1969, Building 707 was involved in the earlier phases of weapons development.⁽⁷⁾

2. Material Recovery and Purification

Plutonium

Originally, plutonium at the RFETS came from Hanford as plutonium nitrate in small, stainless steel Florence flasks packaged in cylindrical steel canning cases shaped like small telephone cable reels. The nitrate was vacuum-transferred into a vessel where plutonium dioxide was precipitated by the addition of hydrogen peroxide. The dioxide was converted to fluoride, which was converted to a metal button by calcium-iodine reduction. Later, plutonium also came in the form of buttons from Hanford. Occasionally, plutonium nitrate feed was also received from the Oak Ridge Reservation. Around 1959, these shipments dropped off, and the majority of the plutonium feed to recovery and purification operations was recycled material, either from site returns, the foundry, or the waste products from the recovery operation itself. Site returns are weapon components that have been retired and returned to the RFETS for disassembly and recovery of materials. Some of the plutonium which went through the system at this time came from outside sources in the form of plutonium dioxide.⁽⁷⁾

The plutonium recovery process is often described in terms of functional divisions: "fast" and "slow" recovery operations. The basic fast cycle recovery operations involve an aqueous dissolution process, followed by precipitation, calcination, hydrofluorination, and reduction steps to return the solute back into metallic form. Nitric acid is the primary chemical used in the dissolution steps, although the operation also involves aluminum nitrate, calcium fluoride, and water. After dissolution, the nitrate mixture undergoes a peroxide precipitation step which converts the plutonium to solid plutonium peroxide, which in turn is heated (calcined) to change it to plutonium dioxide, a powder that is often called "green cake." The plutonium dioxide is then reacted with anhydrous hydrogen fluoride vapor in a rotary tube to convert it to plutonium tetrafluoride, "pink cake." The PuF_4 is then reduced by reaction with calcium to convert it to plutonium metal. The final product "button" was washed and moved to storage until needed for production feedstock. Liquid wastes which were generated by fast cycle recovery were either transferred over to slow cycle recovery or sent to Building 774 for treatment, provided that duplicate sampling demonstrated that residual radioactivity concentrations were within acceptable levels.

Slow recovery operations involve different types of processes, depending upon the nature of the wastes to be handled. For example, combustible residues, such as plastic bags and Kimwipes®, were incinerated to reduce the bulk of the materials and convert the plutonium to an oxide form. The slow side also receives effluents from the fast cycle for further recovery of any

plutonium in those streams. Other processes were designed to recover plutonium from lab wastes, molten salt process residues, and other solutions by various methods including dissolution and cation or anion exchange. The resulting nitrate solutions from the slow cycle processes were then introduced into fast systems operations prior to the peroxide precipitation step.

There were three primary recovery processes in slow recovery: anion exchange, dissolution, and cation exchange. The most significant of these is probably the anion exchange process, which received effluents from the other two. Anion exchange primarily received effluents from the fast cycle precipitation operation, with the dissolution and cation exchange operations contributing to a lesser degree. Dissolution received its feed, in part, in the form of incinerator ash. The feed may also have been made up of plutonium dioxide from oxidation operations in Building 771 and other buildings. The resulting effluent went to anion exchange. Cation exchange feed came from lab wastes and the chloride salt processes. The main reason for the cation exchange operation was to remove chlorides which can create severe corrosion problems for the anion exchange equipment from plutonium bearing materials that contain them. Once these materials went through the cation exchange, they could then be transferred to anion exchange without complications.

Prior to 1960, dissolution was followed by a solvent extraction step which used tributylphosphate as the solvent and dodecane as the diluent. The solvent extraction was followed by cation exchange. Around 1960, solvent extraction was eliminated from the recovery process line because the materials going through the recovery process were becoming more and more varied. A new process was required which could handle the variety of feed materials. The solvent extraction process was replaced by anion exchange. This was made possible by raising the molarity of the solution following dissolution by adding higher molarity nitric acid. The resulting solution could then be sent directly onto anion exchange.⁽⁷⁾

Uranium

Building 881 was utilized for the uranium recovery process and was similar to the 1950's plutonium recovery process that included solvent extraction. Uranium recovery had fast and slow sides and involved similar chemistry, but dibutylethylcarbutol was used as the solvent instead of the tributyl phosphate and dodecane used as the solvent and diluent in plutonium recovery. Overall, the basic plutonium and uranium recovery operations were similar in almost all respects. Building 881 operated solvent stills to enable the plant to discard spent solvents, oils, and mixtures of the two. The discarded oil/spent solvents was drummed and sent to an area known as the "Mound" and later moved to the Building 903 drum storage area.

For some time, the Building 881 chemical recovery operations included an "Oralloy leaching" operation, in which returned or rejected enriched uranium weapons parts were subjected to a spraying of hot nitric acid to remove residual plutonium surface contamination. Some uranium would also be removed by the acid leaching. Associated solutions were

evaporated, and the concentrate precipitated with ammonia gas, calcined to a dry oxide form, and analyzed for plutonium content.

When the Department of Defense decided to eliminate the redundancy in the weapons manufacturing facilities, enriched uranium operations were given entirely to the Oak Ridge Reservation. Consequently, uranium operations in Building 881 were shut down in 1962 and subsequently decontaminated and decommissioned. The building was "completely idle" from approximately 1964 to 1966, at which time stainless steel operations became operational after relocation from Albuquerque, New Mexico.⁽⁷⁾

Americium

One fissionable material which was a product of the metals production process was americium. Americium recovery began in 1957 (Putzier, 1982) and until the americium market demand fell off in the 1980's was widely used in smoke detectors, batteries, and medical diagnostic tracers. In 1986, DOE declared americium a waste product and the material has since been discarded in associated waste streams.⁽⁷⁾

3. Research and Development

Research and development has always been a part of the activities at the plant. The focus of the work, however, has not been in the area of weapons design or development. Rather, it has been directed toward three areas: 1.) basic understanding of the materials handled at the plant (for example, metallurgy of plutonium and uranium), 2.) improving the recovery and purification of those materials, and 3.) improving the manufacturing operations and assembly techniques.

Many research and development activities have also focused on understanding the causes of accidents, thereby reducing the potential for future injuries and liability. One example of this was the 1964 plutonium/carbon tetrachloride explosion in Building 776, which initiated a number of research and development projects that examined the interaction of plutonium with a variety of solvents.⁽⁷⁾

At the RFETS, some activities that were actually research and development in nature were incorporated as an extension of production engineering. Examples of research and development activities as an extension of production engineering include plutonium and beryllium work.⁽⁷⁾

Buildings Associated With Research and Development

Rolling of enriched uranium foil was conducted in 1964 in the northeast corner of the plant garage, Building 331. This area was used for the development of depleted uranium and uranium alloy casting techniques, using electron beam energy, and uranium coating studies. The area was later converted for the development of remote handling techniques such as robotics

and remote manipulator arms after Building 865 came on-line in 1970. Areas of study included metallurgy, coatings development, joining of materials, machining and gauging, non-destructive and destructive testing, chemistry-related concerns such as corrosion and surface chemistry, effects of radiation on materials, actinide recovery and purification, waste treatment, and environmental detection systems.

Building 779, “Special Orders”

The primary activities conducted in Building 779 include:

- * Product physical chemistry, which involves testing of various material compatibilities, stockpile reliability, and plutonium aging under various environmental conditions.*
- * Physical metallurgy, which includes tensile testing, study of casting dynamics, electron microscopy, X-ray analysis, hardness testing, and dimensional dynamics.*
- * Joining, which involves methods such as welding and brazing.*
- * Pyrochemistry, the study of molten salt extraction and electro-refining processes.*
- * Hydriding, the nondestructive recovery of plutonium from substrates using hydrogen.*
- * Chemical technology, which is concerned with improvement of aqueous material recovery techniques.*
- * Coatings, which involves various methods to coat substrates, such as vapor deposition.*
- * Machining and gauging, which involves manufacturing of special order parts, tools, and test components.⁽⁷⁾*

Building 865

Building 865 began operations in 1970 and included alloying and metalworking operations. Some of the metals employed in the alloying development include aluminum, copper, magnesium, molybdenum, niobium, platinum, stainless steel, tantalum, and vanadium. Metalworking operations include melting and casting, forging, press forming, extrusion, drawing, rolling, diffusion bonding, hydrospinning, swaging, cutting and shearing, and heat treating.⁽⁷⁾

Building 886

Building 886 was used to perform criticality safety experiments. These “in situ” experiments conducted outside of Building 886 were always subcritical; neutron count rates were observed as criticality was approached. In 1965, the Nuclear Safety Group conducted about 1600 critical mass experiments using uranium and plutonium in solutions (800 tests), compacted powder (300), and metallic forms (500). Building 886 laboratory space includes a “test cell” area where experiments are conducted and two rooms for storage of radioactive materials. One of the radioactive material storage rooms houses nine tanks which contain the solutions of uranyl nitrate in dilute nitric acid that are used for criticality experiments. These tanks contains borosilicate-glass raschig rings that absorb neutrons and prevent criticality events. Approximately half of the 1600 criticality experiments conducted in Building 886 actually achieved criticality.⁽⁷⁾

4. Waste Processing

Waste processing, to varying degrees, has always been a part of the activities at the plant. The waste processing practices have varied over time as scientists’ understanding of radiation improved, knowledge in the area of waste technology progressed, and tighter regulatory requirements were enacted. Because of its size and location, the plant has always had its own sanitary waste treatment facilities in addition to those handling industrial wastes. Waste processing at the RFETS has included liquid, sanitary waste and solid process waste.

Liquid Process Wastes

The general mission of the waste operations at the RFETS was to reduce the volume of liquid process wastes and put them into a form acceptable for transportation to off-site burial grounds. The processing of liquid wastes has involved relatively consistent technology over the years, with some refinements to achieve greater treatment capacity and eliminate off-site discharges.

Building 774, built in 1952, treats radioactive aqueous waste generated by Building 771. Liquids transferred to Building 774 are subjected to any necessary pH adjustment and then go through a precipitation step to remove radionuclides. The resulting slurry is sent to vacuum filters. The solids removed from the filters are combined with cement or another solidifying agent and then shipped to long term storage as TRU mixed (chemically and radioactively hazardous) waste. The aqueous waste from this first stage goes through a second stage, which is essentially a repeat of the first. Prior to establishment in 1973 of the policy that the RFETS would attempt to discharge no process waste to off-site surface waters (a “zero discharge” policy), the aqueous wastes from this process went to either the solar evaporation ponds or to the “B” series of holding ponds, depending upon the concentrations of radioactivity present. Below a specified level, waste water could be discharged to the ponds. The water in the “B” ponds went on to Great Western Reservoir.⁽⁷⁾

An evaporator was installed in Building 774 to treat the liquids that had accumulated in the solar evaporation ponds. Its limited capacity was not able to eliminate the need for the solar ponds. Water and any volatiles evolved from the evaporation process were untreated and discharged to the atmosphere. The concentrate from the evaporator was fed to a double drum dryer, on which the salt solution dried and was removed by a scrubber and demister before venting to the stack, with the liquids from the scrubber and demister returning to the aqueous treatment process. The evaporator was taken out in 1979, and the liquids from the second stage of treatment and the solar ponds have since been transferred to Building 374.

Building 774 also processes organic liquid wastes. When Building 776 went into service in 1957, the plant experimented unsuccessfully with a centrifuge in an attempt to process the plutonium-contaminated organic liquids from machining operations. In 1958, Building 776 became the central collection point for the oils where the liquids and solids were separated and sent on to Building 771. In Building 771, carbon tetrachloride was distilled out of the oil, and plutonium was recovered from the solids. The still bottoms then became a problem. The spent oil and carbon tetrachloride were put into drums for storage until a satisfactory method of treatment of the contaminated material could be found. Those drums were at first buried, and then later were stored at a location now known as the 903 Pad. The drums that were buried were later unearthed and disposed of under the observation of the Colorado Department of Health.

There was a considerable effort over several years to find an effective method to treat the oil so that it could be re-used or disposed of as non-radioactive waste. Attempts to separate the carbon tetrachloride from the oil for re-use were unsuccessful and, eventually, the organic liquids were simply treated by filtration and solidification and sent on to long term storage as TRU mixed wastes.

The method finally developed involved filtering the spent liquids to remove particulate matter larger than one micron and then mixing it with calcium silicate to create a gel. In addition, the oil coolant and carbon tetrachloride were continuously recirculated at the point of use through 30 micron filters. When the liquids are no longer suitable for continuous use, they are filtered through a one micron filter and then mixed with the solidifying agent. The mixer-extruder operation was sometimes referred to as the "Jelly Factory" or the "Grease Plant." The process is essentially the same today, a one-step process in which the organic liquids are mixed with Envirostone ® and allowed to set up before shipment.

Two other small waste streams are treated by Building 774. One is silver recovery from spent photo solutions and the other is a variety of miscellaneous wastes, primarily from laboratory operations. The latter is simply mixed with cement to solidify it for long-term storage.

The chemicals used in liquid waste treatment processes are primarily caustics for pH adjustment, reagents such as ferric and magnesium sulfate, and flocculating agents. They are typically mixed with water and then added to the wastes. No organic solvents are used, but they do treat organic liquid waste streams.

Depending upon the amount of contamination in the waste product, the resulting sludge or solids are packaged in drums or large wooden boxes and shipped as TRU waste or low specific activity (LSA) wastes to approved national storage sites.⁽⁷⁾

Solid Wastes

Radioactive solid wastes generated at the RFETS can be placed into two categories; retrievable and non-retrievable. The retrievable wastes are those which contain greater than 10 nanocuries of radioactivity per gram of material. These wastes are packaged and stored to enable them to be repackaged if necessary, or if technology warrants, to enable their retrieval and the subsequent recovery or treatment of the contained radioactive and/or chemical toxins. The kinds of waste which typically fall into this category are the solidified sludge and salts generated by the liquid waste treatment operations, line-generated wastes such as gloves, clothing, and other small items, and plutonium-contaminated wastes such as decommissioned glove-boxes, high efficiency particulate air (HEPA) filters, or machine tools.

Line generated wastes were placed into a drum until it was full. It was then assayed to determine the amount of radioactivity within the drum. If the drum content exceeds preestablished criteria, the drum was unpacked, the items with recoverable plutonium removed, and then the drum was re-packed with waste of a lower radioactivity. Plutonium-contaminated wastes first go through the size reduction facilities in Building 776, where attempts are made to remove surface contamination, and the waste is then cut up or crushed to reduce its volume and packaged in sealed, reinforced boxes which are about four feet square.

Non-retrievable wastes are non-line-generated wastes which have less than 10 nanocuries per gram contamination, and can include chairs, tables, and cabinets. These items are also reduced in volume in the size reduction facilities and packaged in 55-gallon drums or wooden boxes.

In almost every case, radioactive solid wastes have been shipped off-site to a federally approved storage or disposal facility. Up until 1970, sanitary waste sludge were buried on-site, usually in the plant landfill. Since then, sanitary sludge has been shipped to a federally approved facility for disposal as solid waste.

Non-radioactive solid wastes generated at the RFETS include the typical types of materials found in municipal garbage: paper, food items, office waste, lumber, and so on. This material is disposed in the plant's on-site landfill. The original plant landfill, located on the south side of the plant, opened in 1952 and closed in August 1968. An incinerator was also in operation at that time, in Facility 219 on the west access road. With a few exceptions, non-radioactive combustible waste was burned in the incinerator and the resultant ashes were dumped on the ground adjacent to it and covered with dirt. It has been estimated that less than 100 grams of slightly radioactive depleted uranium contaminated combustibles were burned

along with the general plant waste during the period from 1952 to 1968.

The second landfill, which is in operation today, opened in August, 1968, and is on the north side of the plant. In 1971, the plant instituted a program which required that all ordinary wastes originating in plutonium areas be monitored for radioactivity prior to placement in the dumpsters destined for the landfill.⁽⁷⁾

Sanitary Wastes

Liquid sanitary wastes at the RFETS are comprised of the sewage resulting from treatment of wastes from rest rooms, showers and sinks, food service areas, and cooling tower blowdown. The liquid sanitary waste operations are kept separate from the liquid process waste operations to prevent contamination of the sanitary waste streams. In addition, the sanitary wastes which originate from plutonium areas are kept separate from those from other areas until they reach two holding tanks upstream from the treatment plant. At that point, they can be retained and sampled to check for contamination. From those holding tanks, the sewage is processed as in many other municipal wastewater treatment facilities, through a series of clarifiers, aerators, and digesters, with the sludge becoming a waste and the liquids going through a final disinfection step before release. This basic process has remained essentially the same throughout the operation of the plant.

In the early years, the sanitary sludge were disposed on-site in trenches constructed for their disposal. These were trenches T-2 through T-8. At that time, some of the floor drains in the manufacturing buildings were not isolated from the sewage treatment plant, and the sanitary sludge became contaminated with uranium and plutonium. From 1954 to 1968, trench T-2 through T-8 received approximately 100 tons of sewage sludge. When the second landfill opened in 1968, it began receiving the sludge, and continued to receive them until 1969. At that time, the sludge were declared to be low-level radioactive waste (LLRW) and have since been shipped off-site for disposal at federally approved disposal sites.⁽⁷⁾

The final disposition of treated sanitary liquid effluent has also undergone some changes since the plant first opened. In the early years of plant operation, LLRW process waste water, specifically laundry waste water, was discharged directly to Walnut Creek. While the waste water released was reported as not exceeding applicable radioactivity concentration guides, it did contain some LLRW concentrations of plutonium and uranium. The Building 771 outfall became contaminated from this practice. Later, it was decided to send laundry waste to the sewage treatment plant. As a result, sewage treatment sludge became contaminated. On December 21, 1973, the release of laundry waste water into Walnut Creek was stopped. The plant has attempted to comply with a "zero-discharge" policy, wherein all liquids are evaporated or solidified for off-site disposal.⁽⁷⁾

5. Plant Support

The plant has a number of support groups which are typical to many large manufacturing facilities, such as administrative and financial organizations, utilities and facilities management groups, and health and safety personnel. The plant has some support organizations which are unique because the plant handles a large amount of radioactive materials in various forms. One is the Criticality Lab, or Nuclear Safety Group, which is dedicated to identifying and directing control of the potential for spontaneous nuclear fission chain reactions (criticalities) in the conduct of plant activities. Another unique support function has been provided by the Filter Test group, which provides pre- and post-installation testing of the HEPA filters used in ventilation exhaust systems and performs testing of personnel respirators. Plant Support activities of potential relevance to off-site exposures include Criticality Safety, the various service Laboratories, Filter Testing, and Laundry Services.⁽⁷⁾

Laboratories in Buildings 123, 125, 559, and 881

There are four service laboratories at the RFETS; the Health Physics Laboratory, the Standards Laboratory, the Plutonium Laboratory, and the General Laboratories.

The Health Physics Laboratories are located in Building 123. They performed analysis of personnel dosimeters and all airborne sample analysis on radiological sources for quality assurance/quality control purposes. It also performs calibration and standardization experiments to assure operation in accordance with the manufacturer's specifications. One section of the Standards Lab certifies dimensional measurements such as length, angles, and roundness.

The Building 559 Lab is the Plutonium Analysis Laboratory. The lab conducts analysis to determine the purity of plutonium, what the impurities are and their concentrations, and the concentrations of plutonium alloys, whether in metal, liquid, or oxide form. The lab can also analyze gases and organics. The primary purpose of the lab is to sample incoming plutonium site returns and feed material, and that which is recovered/purified and cast at the plant site for the production of weapons.

The Building 881 Labs are also called the General Labs. They were installed as part of initial construction of the building in 1952. A number of analysis on a variety of materials are performed here. Waste water and National Pollutant Discharge Elimination System (NPDES) permit sample analysis are performed here, as well as sludge, surface water, and groundwater sample analysis. Production control samples from Building 460 and 444 were analyzed by the General Labs. When the enriched uranium processes were in operation in Building 881, the laboratories also performed analysis of the materials generated on that line.⁽⁷⁾

Filter Testing

Filter Testing was formed in 1979 after an audit identified the need for a group to perform in-place leak testing of HEPA filters; a group separate from the group that installs the filters. In-place testing of the filters reportedly has always been conducted at the plant site, but prior to formation of the Filter Testing Group, in-place leak testing of filters was performed by the same group that installed the filters.

Laundry Services

Laundry services provides cleaning, sorting, and distributions of the coveralls and other reusable garments that are required in the manufacturing areas containing potential contamination. The clothing includes coveralls, shirts, shorts, undergarments, socks, caps, and booties. Laundry services also launders respirators and bath towels. Exhaust air from the dryers and washers is vented through HEPA filter plenums. Laundry services is to become privatized in the near future.⁽⁷⁾

Site Current Mission: The RFETS Vision

The RFETS vision provides a broad statement for the future of the site. All activities, agreements, planning documents and other legal arrangements are guided by the vision and preserve, to the maximum extent possible, the full range of options and opportunities necessary to help accomplish and attain the vision. Specific and day-to-day activities at the site are governed by relevant agreements and other legal arrangements. The vision also accommodates changing priorities, activities and strategies to reflect community values

Below is an elaboration of the RFETS vision and a discussion of its adaptability to meet future technological, safety concerns and community preferences. Local elected officials, local government managers, the RFETS Local Impacts Initiative (RFLII), Citizens Advisory Board (CAB), other groups and citizens will be fully involved in making decisions and addressing issues in all of the topics that follow:

1. Removal of Plutonium, Transuranic Wastes and Other Special Nuclear Material

The highest priority of the vision is to make the RFETS safe. This principally involves the collection; stabilization; and safe, secure, retrievable, and monitored storage of plutonium, TRU wastes and other special nuclear materials (SNM) for as long as they remain at the RFETS. Presently, there is no off-site facility available to receive these materials from the RFETS. As a result, this material may remain at the site in a safe configuration for years. However, the agencies are committed to help secure the availability of off-site locations to receive these materials. These materials must be removed from the RFETS as soon as a location is found to receive them and it is safe to do so. The DOE is committed to begin removing the plutonium and SNMs that are weapons useable fissile materials as soon as possible with a target set to begin

removal no later than the year 2010 with final removal completed by the year 2015. In the year 2000, these dates will be evaluated to determine if these time frames need to be adjusted and then established as enforceable commitments from that date forward. The Waste Isolation Pilot Plant (WIPP) in New Mexico may be available sooner than the year 2010 to receive TRU wastes. The DOE is committed to begin removing TRU wastes to the WIPP or, if necessary, to another off-site location, as soon as it is available.

2. On-Site Disposal of Wastes and Materials

Efforts will be made to remove wastes, building debris and other materials from the RFETS to off-site disposal locations. However, budgetary, technological, safety and other considerations may require that some of these wastes be disposed of in-place or stored on-site in a safe, retrievable, and monitored manner for many years. At some point in the future, it may be necessary after consultation with local elected officials, local government managers, RFLII, CAB, other groups and citizens, from a risk reduction, budgetary, technological, safety and environmental standpoint, to dispose of some of these stored wastes and materials on-site. If so, every effort will be made to minimize the amount of material that must be disposed of on-site.

Future retrieval of wastes disposed of onsite will not be precluded if and when technological development, budgetary availability, and location of an off-site disposal facility permits such activity. Should any wastes or contamination remain on-site, the federal government will be responsible for effective monitoring, maintenance of facilities, and maintenance of institutional controls adequate to prevent exposure from, and any release of, other chemical or radiological contamination.

3. Buildings

The cleanup of buildings, the consolidation of wastes and materials within them and the safe demolition of buildings will occur to reduce risks and reduce site operating costs. All radioactive and hazardous wastes stored in buildings and much of the equipment and hardware within them such as duct-work, piping and equipment, some of which may be contaminated with radioactive and hazardous components - will be removed or decontaminated before the buildings are reused or demolished. The contaminated equipment and hardware removed from the buildings will be stored in a retrievable and monitored manner. Some on-site disposal of this material, including building debris, may be necessary. Those buildings that may have value for other economic uses will be identified and the option of converting and transferring these buildings to other appropriate uses once cleanup and closure work has been completed will be preserved.

4. Level of Cleanup

While cleaning up the site to average background levels for the Front Range of Colorado is a desire of many in the community, it is beyond the reach of today's technology, budgetary resources, and legal requirements. As a result, the site will be cleaned up to allow open space

and other appropriate uses given current technology and fiscal resources. Further cleanup efforts will be made where feasible as fiscal resources and cost effective technology allow. The DOE is committed to assuring ongoing monitoring and maintenance of any wastes or contamination remaining on-site, the containment of contamination, and allowing for the further treatment of wastes as new and emerging cost effective technologies become available. In addition, the RFETS contains a unique ecological habitat that cannot be easily replaced. Its ecological values will be preserved and protected to the maximum extent possible during cleanup and closure activities.

5. Land Use

All land use decisions pertaining to the RFETS will be made with the active involvement of local governmental authorities and the public. This vision anticipates that the RFETS will be cleaned up so that it can be used as open space or converted to other appropriate uses consistent with community preferences, although opportunities for residential use will be restricted. There will be a need to restrict access to certain areas of the site while cleanup and closure activities are conducted and while plutonium, TRU wastes, and SNMs remain on-site. Access and use restrictions also may need to be applied where residual contamination may be present and constitute a risk to the public and for areas that house storage facilities or possible landfills. However, most of the land should be able to accommodate a wide range of appropriate future uses and economic opportunities.

6. Technological Development

Every effort will be made to develop and apply new and emerging cost effective technologies to address waste treatment, cleanup and closure needs at the site. However, recognizing the urgent need to reduce risks, promote safety and advance activities to accomplish the vision; treatment, cleanup and closure activities may need to be accomplished using the best technology presently available. The agencies are committed to investigating and applying new and emerging cost effective technologies to treat and further cleanup any wastes or contamination remaining on-site, including wastes in storage and possible disposal facilities. New and emerging cost effective technologies will be explored on an ongoing basis as long as waste or contamination remain at the RFETS. Activities to accomplish the vision should not wait for the development of new technologies. However, permanent and irretrievable cleanup decisions will be kept to a minimum to take advantage of possible new and emerging cost effective technologies.⁽¹⁾

6.0 RFETS REGULATORY DRIVERS

The DOE manages the government-owned, contractor-operated facility at the RFETS in the State of Colorado that formerly played a major role in the production of nuclear weapons. Weapons production has ceased and the mission has changed primarily to decommissioning. Most remaining operations are dedicated to stabilization, treatment, safe storage, and containment of SNM and waste at the site. Activities at the RFETS range from interim storage of plutonium pits awaiting final disposition off-site to removal and remediation activities at designated OUs under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), and the Colorado Hazardous Waste Act (CHWA).

CERCLA

The CERCLA (42 U.S.C. 9601-9675) was originally enacted in 1980 and was amended in 1986. CERCLA provides requirements for the cleanup of sites at which the presence of hazardous substances poses a threat or potential threat to human health or the environment. This federal law was primarily enacted to address sites where hazardous substances threaten the environment or the surrounding population because of hazardous substance releases (40 CFR Parts 300-311). As such, CERCLA generally differs from RCRA in that it addresses past management sites (pre-1980), for example, tanks that stored hazardous wastes but were closed prior to 1980. RCRA generally deals with more recent or active management sites (post-1980). Hazardous substances are listed in Table 302.4 of 40 CFR Part 300; a material is identified as a hazardous substance by being included on this table, and the term specifically excludes petroleum or any petroleum fractions.

RCRA

The RCRA of 1976 (42 U.S.C. 6901-6992) is the most complex and far-reaching regulatory statute. RCRA Subtitle C., commonly referred to as RCRA, provides requirements for the management of hazardous wastes, as defined in 40 Code of Federal Regulations (CFR) Part 261 Subparts C and D. These requirements include standards for collection and storage of hazardous wastes (40 CFR Parts 260 to 265).

In order to become subject to RCRA hazardous waste regulations, a site must first have been determined to contain hazardous wastes. Hazardous wastes may be identified by first establishing that the materials in question are solid wastes. Materials exempt from solid wastes are domestic sewage, CWA point source discharges, irrigation return flow, in-situ mining wastes, and SNM, source material, and product material, defined under the AEA (40 CFR 260 Appendix 1). Once a waste has been identified, it must be evaluated by reviewing the lists of hazardous wastes presented in 40 CFR Part 261 Subpart D. If the waste is determined not to be a “listed hazardous waste,” it must then be assessed to determine if it exhibits what the EPA has defined as qualities or “characteristics” of a hazardous waste, as set forth in 40 CFR Part 261 Subpart C.

Except where a waste is specifically excluded by the EPA, if it is found to be “listed” or “characteristic,” it must be managed in accordance with RCRA hazardous waste management regulations. Conversely, if a waste is determined not to be a hazardous waste, it is not subject to the hazardous waste management regulations, nor is the unit containing it (such as a tank) subject to hazardous waste management regulations. ⁽⁸⁾

Independent Regulatory Entities

Three independent entities currently oversee and regulate environmental, health, and safety aspects of DOE activities at the RFETS. These entities are the U. S. Environmental Protection Agency (USEPA), the Defense Nuclear Facilities Safety Board (DNFSB or Board), and the Colorado Department of Public Health and Environment (CDPHE). In some circumstances, these entities exercise concurrent jurisdiction over facilities or materials as the result of overlap in applicable statutory provisions. For example, the cleanup of a facility contaminated with mixed radioactive waste is subject to regulation by USEPA and Colorado, pursuant to CERCLA, RCRA, and CHWA (depending on the nature of the cleanup action), as well as by DOE and the Board pursuant to the Atomic Energy Act (AEA) of 1954, as amended. Plutonium and other nuclear materials mixed with hazardous waste are subject to RCRA permits governing treatment, storage, and disposal of the hazardous component of “mixed” waste, and are also subject to Board safety oversight of nuclear waste storage. DOE regulates activities related to SNM, subject to DNFSB oversight, under the AEA. For detailed information concerning the oversight roles of the various regulatory entities at the RFETS, see “Final Rocky Flats Cleanup Agreement (RFCA), Appendix 1, July 19, 1996, Page I-1 and I. ⁽⁸⁾

7.0 RFETS WASTE MANAGEMENT PROGRAM

The goal of the RFETS Waste Management program is to reduce, eliminate, or mitigate environmental liabilities by managing waste safely and effectively. The sources of waste are inventories from past production, as well as current and future facility stabilization/deactivation activities. The Environmental Restoration section addresses all treatment, storage, and disposal costs and associated activities for waste generated by remedial action and decommissioning.

The management of waste involves a four-step process: characterization, treatment, storage, and disposal. This process is not necessarily sequential for all waste streams. For example, some waste requires treatment before and after storage, other waste may be sent directly to disposal. Six types of waste are generated and/or stored at the RFETS: TRU mixed waste, TRU waste, low-level mixed waste, LLRW, hazardous waste, and sanitary waste.

This assessment includes compliance with federal, state, and local environmental laws, DOE Orders, various agreements, and consent decrees that protect the environment and public health. *Site-specific agreements include the Interagency Agreement and the 1995 Compliance Order resulting from the Site Treatment Plan process under the Federal Facility Compliance Act.*

Waste characterization encompasses sampling and analyzing waste, developing analytical methods, and documenting and verifying waste streams. Much of the waste generated in the past was characterized solely by process knowledge (i.e., personal judgment based on experience with a particular process or operation). For this reason, laboratory analysis is vital to waste characterization.

Existing waste treatment systems at the RFETS focus on reducing the volume of liquid and solid waste forms and stabilizing other waste to produce a waste form suitable for storage or disposal. Certain existing systems use technologies that were initiated many years ago and were not designed to produce final waste forms to meet current waste acceptance criteria. Treatment systems are being developed and are described in the Site Treatment Plan for TRU mixed and low-level mixed waste.

Residue management at the RFETS is unique because the Nuclear Material and Facility Stabilization program is responsible for treatment and the Waste Management program is responsible for storage and disposal. This waste management assessment classifies residues as TRU mixed and TRU waste because of the way in which materials will be managed for disposal.

Most of the waste must be kept in interim storage pending the availability of onsite or offsite disposal. Site plans call for the identification and provision of timely interim waste storage capacity, particularly for contaminated media and low-level mixed waste, sufficient to support remediation and other scheduled mission activities. The RFETS will not be used as a storage facility for materials imported from other sites in the weapons complex.

This assessment assumes that waste shipment/disposal rates are equivalent to waste generation rates after the year 2020. The waste will be shipped, packaged and certified by the generator without treatment, precluding the need for additional storage capacity.

Sanitary solid waste is currently the only waste disposed of onsite. However, this assessment assumes that environmental restoration-generated waste will be disposed of in an onsite Corrective Action Management Unit and pondcrete will be disposed of in an adjacent RCRA Subtitle C disposal cell. This estimate assumes that non-environmental restoration generated low-level mixed waste and LLRW will be disposed of at the Nevada Test Site. Some forms of low-level mixed waste are currently being disposed of at Envirocare of Utah. Exhibit 9.1, page 91, presents Major Waste Management Activity Milestones.⁽⁹⁾

Transuranic Mixed Waste

Generation and Handling:

TRU mixed waste is TRU waste with a hazardous waste constituent or characteristic. This waste must be managed in accordance with appropriate radioactive waste regulations and hazardous waste regulations. It is generated from routine operations, residue stabilization, and RCRA closure activities. Characterization of this waste is based largely on process knowledge and limited sampling and analysis.⁽⁹⁾

Treatment:

Existing liquid processing treatment systems for volume reduction of TRU mixed liquid waste are Building 774, miscellaneous aqueous waste handling and immobilization and the Building 374 liquid waste treatment facility. The primary planned treatment methods for solid TRU mixed waste are immobilization of free liquids and particulate, neutralization and oxidation, and repackaging to meet the WIPP waste acceptance criteria.

Storage:

TRU mixed waste must be stored in permitted RCRA storage units. The available storage capacity for TRU mixed waste is expected to increase in the future as residues are processed and residue storage space is transferred to TRU mixed storage capacity. TRU mixed and TRU waste will be certified, staged, and shipped out of Building 664.

Disposal:

TRU mixed waste is assumed to be disposed of at the WIPP. Increased certification capacity for the RFETS is assumed to support this disposal. Approximately 5,000 cubic meters (6,600 cubic yards) of waste will be shipped for disposal at the WIPP between FY 1999 and FY 2039.⁽¹⁰⁾

TRU Waste

TRU waste is waste that contains alpha-emitting TRU elements with half-lives greater than 20 years whose combined activity level is at least 100 nanocuries per gram of waste at the time of assay. Like high-level waste, TRU waste is formally defined in DOE Order 5820.2A. TRU waste is further categorized according to its external surface radiation dose rates. Waste with dose rates exceeding 200 mRem per hour requires special handling and is classified as remote-handled TRU waste. TRU waste below this level is called contact-handled TRU waste. Because of the long half-lives of many TRU isotopes, TRU waste can remain radioactive for hundreds of thousands of years. Some of the common TRU radionuclides present in TRU waste include plutonium-239, -240, -241, -238, and -242; americium-241; and curium-244. Other important radionuclides that can be present in TRU waste, primarily remote handled TRU waste, are fission products, reactor activation products, and their resulting daughter products, including strontium-90, yttrium-90, cesium-137, barium-137, cobalt-60, and europium-152, -154, and -155.

Most TRU waste is the result of the weapons production process and contains plutonium. TRU waste from weapons production results almost exclusively from fabrication of plutonium weapons components, recycling plutonium from production scrap, residues, or retired weapons, and chemical separation of plutonium. Considerable amounts of TRU waste also contains hazardous constituents subject to regulation under RCRA (mixed TRU waste), and some contains polychlorinated biphenyls (PCBs) subject to the Toxic Substances Control Act.⁽¹⁰⁾

TRU waste includes aqueous and organic solutions, glass, filters, sludges, salts, resins, incinerator ash, leaded rubber gloves, combustibles, ceramics, low-grade oxides (low-assay uranium oxides), sand, slag, crucibles, alloys, miscellaneous compounds, scrub alloy, and anode heels. Some TRU waste does include organic and halogenated organic solvents, toxic metals, PCBs, acids, and caustics; although, a large portion of TRU waste does not contain chemically hazardous constituents.

Some TRU waste requires special management because it was not produced from weapons production activities or because it cannot be certified for disposal at the planned repository. Nonweapons TRU waste includes filters, resins, neutron sources, reactor vessels, demineralizer systems, and waste from fuel fabrication facilities. Uncertifiable TRU waste, which is TRU waste that is classified through process knowledge, but not through analysis, includes materials from decontamination and decommissioning of hot cells, waste from nuclear weapons accidents, DOD waste, certain sludges, large metal parts, and remotely-handled items.

Generation and Handling:

At the RFETS, TRU waste is primarily contaminated with plutonium. Contaminated media include combustibles, plastics, light metals (primarily Beryllium); and sludges. Characterization of this waste has been based largely on available process knowledge.

Treatment:

Treatment systems are divided into primary and in-process systems. In-process systems focus on volume reduction and stabilization in preparation for safe storage rather than on treating waste for final disposal. The primary existing solid waste treatment system for TRU waste is the Building 776 solid waste reprocessing and repackaging system. Existing liquid processing treatment systems for TRU liquid waste are Building 371 caustic waste treatment, Building 774 aqueous waste treatment, Building 774 miscellaneous aqueous waste treatment, Building 374 liquid waste treatment facility, and Building 771 oxalate and hydroxide precipitation. The primary planned treatment for TRU waste includes immobilizing free liquids and particulate, neutralizing and oxidating them, and repackaging the waste to meet the WIPP Waste Acceptance Criteria (WAC).

Storage:

DOE Orders govern the storage of TRU waste. Some waste is currently stored in regulated TRU mixed storage areas because very few areas at the RFETS have been formally designated as storage areas for non-RCRA-regulated waste. Commingling of nonregulated waste containers with RCRA-regulated waste containers is a legally acceptable practice but it increases overall storage costs. Historically, TRU waste was stored in areas that are permitted for TRU mixed and mixed residue waste because these areas satisfied concerns for radiological safety and container management. Also, the site lacks sufficient storage space overall to allow for total segregation of TRU waste. TRU mixed and TRU waste will be certified, staged, and shipped out of Building 664.⁽⁹⁾

Disposal:

TRU waste will be disposed of at the WIPP in New Mexico, which this report assumes will open in FY 1998. The site also assumes that disposal of approximately 3,300 cubic meters (4,300 cubic yards) of TRU waste at the WIPP will begin in FY 1999 and continue through FY 2039.

Transportation of TRU mixed and TRU waste by truck to the WIPP will require using the Transuranic Package Transporter (TRUPACT II) shipping vessel. Each shipping vessel can contain 14 0.2- cubic meter (55-gallon) drums or two standard metal boxes, and each truck trailer can carry three vessels.⁽⁹⁾

Low-level Mixed Waste

Mixed waste is waste that contains both hazardous waste subject to RCRA, and source, special nuclear, or byproduct material subject to the AEA. Low-level mixed waste is considered separately from other LLRW because the presence of RCRA-regulated constituents is a major factor in determining how it is managed. In contrast, decisions for treatment and disposal of

high-level and TRU wastes are based primarily on radiological rather than chemically hazardous characteristics. Although mixed waste was formally defined by statute in 1992, regulators recognized that it required special management many years earlier. The DOE first started managing low-level mixed waste as a separate waste type in the 1980's.

The radioactive component of low-level mixed waste is similar to the component in LLRW. This waste is generally much less radioactive than high-level and TRU waste and can contain a broad spectrum of radionuclides, depending on the source of the waste. Based on the radioactive content of low-level waste managed at the same sites where low-level mixed waste is managed, it is likely that fewer than 2.4 million curies are present in DOE low-level mixed waste. Although DOE sites generally maintain more detailed data on the radioactive content of the low-level mixed waste inventory, this data has not been compiled at a nationwide level.⁽¹⁰⁾

Hazardous constituents present in mixed LLRW include toxic heavy metals, organic and halogenated organic chemicals, cyanides, inorganic chemicals and elements, explosive compounds, and corrosive chemicals and solutions. Some low-level mixed waste contains both RCRA-regulated hazardous constituents and PCBs regulated under TSCA.

The storage, treatment, and disposal of low-level mixed waste is subject to state and federal RCRA regulations. Low-level mixed waste generally is not disposed of at DOE sites long term. Instead, the DOE stores (short term) low-level mixed waste at its sites, and the waste is treated either at DOE or commercial sites. Some mixed low level waste has been disposed of commercially. Decisions for the future disposal of low-level mixed waste at DOE sites have not yet been made.⁽¹⁰⁾

Low-level mixed waste is generated during a broad spectrum of processes and activities including equipment maintenance, materials production, cleaning, environmental restoration, facility deactivation and decommissioning, and the treatment or handling of LLRW and other waste types.

Generation and Handling:

Low-level mixed waste includes combustibles, plastics, light metals (those metals in group 1A and 2A of periodic table including Beryllium which is the primary light metal at the site), soils, and liquids as well as treated waste such as cemented solar pond sludge (pondcrete) and cemented aqueous process waste salts (saltcrete).⁽⁵⁹⁾

Treatment:

The primary existing treatment system for low-level mixed waste is the Building 374 liquid waste treatment facility. Planned treatment for low-level mixed waste includes Diversified Scientific Services, Inc., the Advanced Mixed Waste Treatment Project in Idaho, and several onsite treatment systems. All waste will be treated to meet land disposal restrictions.

Storage:

A RCRA Permit regulates the storage of low-level mixed waste at the RFETS. Current projections indicate that the addition of Building 440 storage will provide sufficient storage capacity for future needs until onsite treatment begins.

Disposal:

Low-level mixed waste must meet land disposal restriction standards prior to disposal. This site assumes that 9,700 cubic meters (12,800 cubic yards) of saltcrete will continue to be shipped to Envirocare of Utah until FY 2021. This estimate also assumes that 12,000 cubic meters (16,000 cubic yards) of pondcrete will be placed in the proposed onsite RCRA Subtitle C disposal cell from FY 1999 through 2000, which will close in FY 2003. Approximately 700 cubic meters (900 cubic yards) of low-level mixed waste will be disposed of at commercial facilities between FY 1999 and 2046, and between FY 1999 and 2044, an additional 28,000 cubic meters (37,000 cubic yards) will be shipped to the NTS.⁽⁹⁾

Low-level Radioactive Waste

LLRW is composed of all radioactive waste not classified as high-level waste, TRU waste, spent nuclear fuel, or natural uranium and thorium byproduct material defined under the AEA.

Like high-level waste and TRU waste, LLRW is defined in DOE Order 5820.2A. It is also defined in the Energy Policy Act of 1992. DOE LLRW is segregated into remote-handled and contact handled categories. Some LLRW contains alpha-emitting TRU radionuclides in concentrations below the 100 nanocurie per gram minimum concentration established in the TRU waste definition. LLRW containing hazardous waste or PCBs is categorized as mixed LLRW. In addition, the DOE manages some naturally-occurring or accelerator-produced radioactive material as LLRW.

LLRW comes from many sources and is present at many DOE sites. The facilities that process, create, or otherwise handle radioactive materials, perform chemical conversions or separations, and fabricate nuclear components, all generate LLRW. LLRW is generated from many of the support activities (e.g., wastewater treatment and equipment maintenance) associated with both weapons production and nonweapons activities. Some LLRW is also derived from the pretreatment of high-level waste and the management of chemical separation facilities. Finally, LLRW can be generated from environmental restoration, facility deactivation and decommissioning, and the treatment and handling of TRU waste and mixed LLRW.⁽¹⁰⁾

The radioactive content of disposed LLRW is composed of the following six distinct types of radionuclides that indicate how the radioactivity originated or the level of radioactive hazard: fission products, tritium, internal activation products, alpha radioactivity, uranium and thorium,

and uncategorized radioactivity. By curie content, more than 99 percent of the tritium, internal activation products, and alpha radioactivity, 90 percent of the fission products, and 92 percent of the uranium and thorium come from weapons production.

LLRW is composed of a wide variety of materials generally similar to those in TRU waste. Recently generated LLRW (except for LLRW from environmental restoration activities) is classified into 18 physical forms. LLRW resulting from environmental restoration activities is classified into categories similar to non-environmental restoration LLRW.

Certain LLRW, known as special case waste, requires special handling and is not suitable for disposal in shallow land burial facilities because of its high radioactive content. This waste includes certain resins, sludges, filter media, radioisotope thermoelectric generators by products, equipment, demineralizer systems, gauges and dials, waste from hot cells, and other materials.

Hazardous constituents as generally are not present in waste identified in this assessment as LLRW since any LLRW containing RCRA- or TSCA-regulated substances above regulatory levels is classified in this assessment as mixed LLRW or radioactive PCB waste, respectively. Radioactive asbestos waste has also been classified separately. LLRW containing these hazardous constituents has been separated from other LLRW in this analysis because the presence of RCRA- or TSCA-regulated chemical constituents in the waste is a major factor affecting how the waste will be managed.

The DOE disposes of most solid LLRW in shallow-land burial facilities. While the DOE currently disposes of LLRW at six sites (Hanford, Idaho National Engineering Laboratory, Los Alamos National Laboratory, Nevada Test Site, Oak Ridge National Laboratory, and the Savannah River Site), buried LLRW is present at eight other sites that have either conducted onsite disposal in the past or have experienced past radioactive releases resulting in buried LLRW.

Much LLRW is treated prior to disposal to either stabilize the waste form (e.g., by solidifying LLRW containing free liquid or particulates) or reduce the disposal volume (e.g., by incineration or compaction). Treatment is usually conducted onsite but in some cases waste is transported offsite for treatment and then returned to the DOE. The waste is then stored onsite until it is either disposed onsite or transported to another DOE site for disposal. Nineteen sites involved in nuclear weapons production currently store LLRW, typically in metal drums or metal or plywood boxes. Larger items are wrapped in plastic. Prior to disposal, the waste is certified to ensure that no mixed LLRW or other prohibited materials (e.g., free liquids that could leak out) are present.

LLRW emitting high levels of gamma radiation is stored in heavily shielded containers prior to disposal. Low level waste containing alpha-emitting radionuclides at levels at or above 10 nanocuries per gram are sometimes managed separately from LLRW containing lower

concentrations of alpha-emitters. Because of the potential inhalation hazard, high-alpha LLRW require special procedures to limit possible inhalation hazards to workers. ⁽¹⁰⁾

Generation and Handling:

LLRW includes combustibles, plastics, light metals (primarily Beryllium), soils, and liquids, as well as treated waste such as sewage sludge. Characterization of this waste is based largely on process knowledge; however, laboratory analysis to supplement process knowledge has been included in the assessment for waste characterization.

Treatment:

Primary existing treatment systems for LLRW are LLRW Sewage Sludge Treatment, and Building 374 Liquid Waste Treatment Facility. The primary planned treatments include drying, segregating, and repackaging to meet waste acceptance criteria.

Storage:

LLRW is stored in compliance with requirements set forth in DOE Orders. Some of this waste is currently stored in regulated low-level mixed waste storage areas. Building 440 will be converted to store LLRW and will also provide the capability to stage and ship the waste.

The RFETS currently stages and ships LLRW out of Building 664. The site has the capability to ship waste directly from the Centralized Waste Storage Facility (Building 906) and 750 and 904 pads.

Disposal:

LLRW handled by the Waste Management program will be transferred to the Nevada Test Site (NTS) for disposal. Low-level sewage sludge will also be shipped to the Nevada Test Site. Waste transferred to the NTS is estimated at approximately 36,000 cubic meters (47,000 cubic yards) and will take place between FY 1996 and FY 2046. An additional 3,400 cubic meters (4,500 cubic yards) will be disposed of at a commercial facility between FY 1997 and FY 2044.

Currently, 46 cubic meters (60 cubic yards) of asbestos-containing material are stored in Building 666 and several other locations at the RFETS. Of the total, 31 cubic meters (41 cubic yards) of asbestos-containing material are contaminated with low levels of radioactive materials. Radioactive asbestos-containing material is shipped to the DOE's Hanford Facility for landfill disposal. The remainder is shipped to an appropriate offsite commercial facility. ⁽⁹⁾

Hazardous Waste

Hazardous waste is defined under RCRA, its implementing regulations in 40 CFR Parts 260 to 279, and corresponding state regulations. A material is a hazardous waste under RCRA only if it meets the definition of a solid waste. A solid waste is considered to be hazardous if it is either listed in the regulations as a hazardous waste or exhibits a characteristic of corrosivity,

ignitability, reactivity, or toxicity.

Hazardous waste is managed differently from other waste types handled by DOE. Because hazardous waste does not contain a radioactive component, the DOE can more easily release it for private sector treatment and disposal. After release by DOE, this waste is treated, if necessary, by incineration and other technologies, and the residues, which sometimes are no longer hazardous, are disposed of in landfills. Some DOE hazardous waste is also recycled. This waste is not considered a legacy from nuclear weapons production because no long-term monitoring or management of the waste by the DOE is expected.

Prior to offsite release, the DOE stores and characterizes hazardous waste to comply with RCRA regulations and to verify that it does not contain radioactive material. The DOE also recycles some hazardous waste into usable products. In either case, DOE generally does not store hazardous waste for a long time.

The DOE began handling hazardous waste as a distinct waste type in the 1980s. Prior to the regulation of hazardous waste, DOE disposed of some waste at its production sites. ⁽¹⁰⁾

Hazardous waste management requirements are based on RCRA regulations and Colorado Hazardous Waste Regulations. Hazardous waste must be stored in permitted RCRA storage units. Current projections indicate that existing storage capacity will be sufficient for future needs.

The site assumes that the current practice of shipping nonenvironmental restoration hazardous waste to commercial treatment, storage, and disposal facilities will continue. The site also assumes that 3,000 cubic meters (3,900 cubic yards) will be transferred to commercial facilities between FY 1996 and 2046.

Sanitary Waste

Treatment:

The Sanitary Waste Program involves operating the Waste Water Treatment Plant and the sanitary landfill. Sanitary waste is primarily generated by routine operations, decontamination, and decommissioning activities. Liquid sanitary waste is treated in a two-phase process. Resulting liquids are treated in an activated carbon bed filtration system and resulting solids are handled as LLRW.

Disposal:

Solid sanitary waste is not stored or treated prior to being recycled commercially or disposed of at the site landfill. The volume of solid sanitary waste to be disposed at the site landfill is currently estimated at 6,500 cubic meters (8,500 cubic yards) per year. Construction of the first cell of a new sanitary landfill to replace the existing sanitary landfill began in FY 1994. This new landfill will consist of three individual cells and will have a capacity of approximately 456,000 cubic meters (600,000 cubic yards) to meet solid sanitary waste disposal requirements for the life cycle of the landfill. Each cell will be equipped with a double-liner system, a leachate collection system, a leak detection system, a methane gas collection system,

and a baler system to enhance waste volume reduction and recycling. This site assumes that the new landfill will operate until FY 2049. In addition, approximately 7,500 cubic meters (9,800 cubic yards) of sanitary waste will be shipped to a commercial facility for disposal.

Direct Program Management/Support

The purpose of direct program management support provided to waste management activities is to ensure compliance with existing agreements and to reduce the risk and costs associated with managing the RFETS's inventory of waste. Program management activities include assessing and responding to regulatory changes, exploring regulatory flexibility, developing strategies, planning baselines, developing tracking, and reporting on budgets and performance. Waste strategies include optimizing TRU waste shipments and minimizing waste through recycling.

Landlord Activities

Landlord responsibility for the RFETS was transferred from the Office of Defense Programs to the Office of Environmental Management in FY 1994. This responsibility, which has been assumed by the Nuclear Material and Facility Stabilization program, covers certain site-wide activities that are not assigned to direct site programs. The landlord activities support the direct programs and cover a wide range of site functions required for maintaining the infrastructure at the RFETS. These functions include environmental monitoring, infrastructure maintenance, safeguards and security, fire/security system replacement, and health and safety.

Environmental monitoring includes monitoring and assessing air quality, chemical tracking and reporting; surface water monitoring, assessment, and operations; groundwater monitoring and geologic monitoring; ecology and National Environmental Policy Act (NEPA) requirements for biological flora and fauna assessment and protection; and environmental impact mitigation planning and documentation. Numerous ongoing reporting activities maintain compliance with environmental regulations.

Maintaining the infrastructure requires many types of refurbishment, replacements, and upgrades. Because the facilities are aging, projects must be completed to replace electrical, mechanical, or other infrastructure systems. The decision to proceed with infrastructure replacement projects is made when the cost of maintaining the system exceeds the cost of replacing it. Projects at the RFETS include replacing the main site electrical substation, which is expected to be completed in FY 1998, and replacing specific portions of the plutonium heating, ventilation, and air conditioning (HVAC) system. A project also is under way to upgrade, replace, or close underground storage tanks to meet current regulations and performance standards. This project will be completed in FY 1999.

Another important landlord responsibility involves safeguards and security to protect SNM and site personnel. Several projects are scheduled to ensure continuing success in this area. A replacement of the plant communications system will ensure worker safety through the site-wide sounding of alarms and dissemination of information. This replacement will be completed in FY 2000. The Master Safeguards and Security Agreement requires the completion

of various projects to protect SNM. These projects include upgrading perimeter intrusion equipment and adding a glovebox line to consolidate plutonium.

The fire/security system will be replaced by FY 2000. It will provide a new security alarm and fire alarm, upgrade the central and secondary alarm stations, and reduce the size of the Protected Area, and the personnel access control systems. This project is necessary to meet National Fire Protection Association requirements, protect government-owned assets, and ensure the safety and security of the public, workers, and the environment. This project is phased so that its scope can be adjusted as fire and security requirements change in response to the RFETS' new mission.

Health and safety encompasses nuclear safety, emergency management, industrial hygiene, occupational safety, and radiation protection. The DOE plans several capital projects to upgrade the RFETS. They include new equipment, air monitoring improvements, and health physics improvements. New equipment such as an alpha spectroscopy analysis system and an emergency body counter are needed to ensure the ongoing success of radiological protection. Air monitoring improvements include a representative effluent sampler system and ambient air particulate sampler system, both of which are required to comply with current standards for radionuclide air monitoring. In addition, replacing two alarm/monitoring systems in plutonium processing and support buildings will meet current requirements for airborne alpha radiation monitoring.⁽⁹⁾

Other Waste

Some DOE waste does not fit into one of the previously defined categories because of its chemical and radiological composition. The following waste has been included in this category:

- * *PCBs and PCBs mixed with radioactive waste that are subject to TSCA but are not also subject to RCRA. (Some of this waste is classified as mixed LLRW if it contains other RCRA-regulated hazardous constituents or because it is managed in a state where PCBs are subject to state RCRA programs.)⁽¹⁰⁾*
- * *Asbestos and LLRW asbestos that is not subject to RCRA. (Some of this waste is classified as mixed LLRW if it contains other RCRA-regulated hazardous constituents or because it is managed in a state where asbestos is subject to state RCRA programs.)*
- * *Byproduct material that has been mixed with a hazardous waste subject to RCRA (known as mixed byproduct material).*

DOE manages about 79,000 cubic meters of these types of waste at about 30 sites, including 19 sites involved in weapons production. This includes 14,000 cubic meters of radioactive asbestos, 22,000 cubic meters of radioactive PCBs, and 44,000 cubic meters of mixed byproduct material. A small amount (40 cubic meters) of nonradioactive asbestos and PCBs also is included in this category. All of the nonradioactive waste and mixed byproduct material is the result of weapons production. The mixed byproduct material is attributed entirely to uranium mining, milling, and refining.

About 94 percent of the radioactive asbestos and 67 percent of the radioactive PCBs also are the result of nuclear weapons production. When combined, about 16 percent of this waste is the result of enrichment, 66 percent from uranium mining, milling, and refining, eight percent from RD&T, two percent from activities supporting the NNPP Non Nuclear Production Programs, and eight percent from other nonweapons activities.⁽¹⁰⁾ The majority of RFETS radiological PCB waste (20,000 gallons) has been shipped to Oak Ridge National Laboratory (ORNL) for incineration. The resulting four, 55- gallon drums of ash will be shipped to a disposal site.⁽¹¹⁾

RFETS Contaminants of Concern

The greatest liability at the RFETS is the potential health and safety risks posed by the presence of large amounts of SNM in its various forms. SNM consists of plutonium metal and oxides, as well as enriched uranium metal and oxides. The RFETS has 12.9 metric tons (14.2 tons) of plutonium (nearly 15,000 items) and 6.7 metric tons (7.4 tons) of highly enriched uranium in nuclear weapons parts, materials, process residues, and wastes. Much of this material has been stored in temporary packaging since 1989, when production operations involving radioactive materials were suspended.

Approximately 30,000 liters (7,800 gallons) of plutonium solutions and 2,700 liters (700 gallons) of highly enriched uranium acid solution are stored in tanks that were not designed for long-term storage. Also, numerous former production process buildings contain gloveboxes, instruments, machine tools, walls, floors, tanks, pipes, and ducts contaminated with radioactive and hazardous materials. Exhibit 9.2, page 92, presents RFETS contaminants of concern by building.

The site's waste inventory includes approximately 3,200 kilograms (7,100 pounds) of plutonium in residues, 600 cubic meters (800 cubic yards) each of TRU mixed and TRU waste, 18,000 cubic meters (24,000 cubic yards) of low-level mixed waste, 5,500 cubic meters (7,200 cubic yards) of LLRW, and 230 cubic meters (300 cubic yards) of hazardous waste. Exhibit 9.3, page 93, presents RFETS waste types and volumes.⁽¹²⁾

Volatile Organic Compounds (VOC)

VOCs released from RFETS were mainly solvents. The three major VOCs used at the plant were carbon tetrachloride, 1, 1, 1 -trichloroethane and methylene chloride. The VOCs most commonly found during monitoring have been by-products of combustion from automobiles except for carbon disulfide which has been periodically detected. Carbon disulfide has not been used at the plant but has been used by other processes in the industrial park to the southeast of the RFETS. All levels of VOCs detected have so far been very low. Exhibit 9.4, page 94, presents additional chemical contaminants of concern at the RFETS.⁽¹³⁾

8.0 THE RFETS REMEDIATION WORKER GROUP

8.0.1 Overview

Due to the large number of personnel at the RFETS and the ability of workers to change positions and work locations frequently, the facility provides a minimum amount of RCRA training to facility personnel, including DOE, contractors and subcontractors to ensure full compliance with Colorado Hazardous Waste Regulations 100.41 (a)(12) and 264.16. Those personnel not involved in hazardous waste management (i.e., personnel involved with facilities maintenance and upkeep and the transportation, storage and disposal of radioactive and radioactive mixed waste) will receive certain basic RCRA training, while those personnel who are involved in hazardous waste management will receive more extensive training. Hazardous waste management personnel are those workers involved with the sampling, surveying, containerization, treatment, transportation, storage, and disposal of hazardous waste associated with IHSS's, Solid Waste Management Units (SWMU's), and HWMU's. Also affected by these regulations are those workers who perform tasks relative to the removal of fuel, draining and/or de-energizing of non-essential systems that contain hazardous waste. Hazardous waste management training consists of both classroom and on the job training (OJT).⁽¹⁴⁾

The RCRA personnel training program has been implemented to ensure that facility personnel involved with sampling, surveying, containerization, treatment, transportation, storage, and disposal of hazardous waste associated with IHSS's, Solid Waste Management Units (SWMU's), and HWMU's perform their work in full compliance with the Colorado Hazardous Waste Regulations 100.41 (a)(12) and 264.16. Also affected by these regulations are those workers who perform tasks relative to the removal of fuel, draining and/or de-energizing of non-essential systems that contain hazardous waste.

Remediation workers associated with final large-scale (superstructure) dismantlement, disassembly and/or demolition of the facility subsequent to facility deactivation receive additional training identified by their supervisors.

Therefore, Remediation Workers at the RFETS are defined as that portion of the RFETS wage workforce that perform the following tasks:

8.0.2 HAZARDOUS WASTE TASKS

Hazardous waste tasks include sampling, surveying, containerization, treatment, transportation, storage, and disposal of hazardous waste (i.e., chemically contaminated wood, metal, concrete, asphalt, debris, process residues, discarded product, contact waste, etc.) associated with IHSS's, Solid Waste Management Units (SWMU's), and HWMU's. SWMUs are defined areas associated with production processes at facilities which have become contaminated as a result of routine, systematic, and deliberate release of wastes or constituents, noting that a product could become a waste if it is discarded or abandoned (50 Federal Register 28702).

HWMU's encompass a contiguous area of land on or in which hazardous waste has been placed, or the largest area in which there is significant likelihood of mixing hazardous waste constituents in the same area. Examples of HWMU's include surface impoundments, waste piles,

land treatment areas, landfill cells, incinerators, tanks and associated piping and container storage areas (40 CFR, Part 260.10, Subpart B definitions).

Hazardous waste tasks may also involve hazardous waste with a radiological component. If a radiological component exists above the DOE action level the waste will be construed as mixed waste (most RFETS wastes are mixed waste). In this case, efforts are made to remove or treat either the radiological or hazardous component to allow for disposal options (most mixed waste at this time is stored on-site due to a lack of approved storage facilities). If the radiological component is removed successfully then the hazardous waste that remains can be safely treated on or off-site to render it non-hazardous. Conversely, if the hazardous component can be treated on-site the remaining radiological waste can be shipped to the LLRW storage facility.

8.0.3 DEACTIVATION TASKS

Deactivation tasks involve placing a facility in a safe and stable condition to minimize the long-term cost of a surveillance and maintenance program that is protective of workers, the public, and the environment until decommissioning is complete. Tasks include the removal of fuel, draining and/or de-energizing of non-essential systems, removal of stored radioactive, mixed, and hazardous waste materials, and related actions. As a bridge between operations and decommissioning, based on facility-specific conditions and final disposition plans, deactivation can accomplish operations such as final process runs and decontamination activities aimed at placing the facility in a safe and stable condition. Decommissioning takes place after deactivation and includes surveillance and maintenance, decontamination, and/or small-scale dismantlement of process lines, tanks, and equipment. These tasks are taken at the end of the life of the facility to retire it from service with adequate regard for the health and safety of the workers, the public, and protection of the environment. The ultimate goal of decommissioning is the unrestricted release or restricted use of the site.

8.0.4 CLEANUP TASKS

Cleanup tasks involve systems operation and maintenance (treatment, transportation, storage and disposal of LLRW generated during day-to-day activities at the RFETS). Workers involved with Cleanup tasks will identify, weigh, sample, survey, containerize, store, and prepare LLRW for shipment to the NTS and the Envirocare facility in Clive, Utah.

8.0.5 DISMANTLEMENT TASKS

Dismantlement tasks involve the disassembly or demolition and removal of any structure, system, or component, and satisfactory interim or long-term disposal of the residue from all portions of the facility. Dismantlement tasks also involve final large-scale (superstructure) dismantlement, disassembly and/or demolition of the facility subsequent to facility deactivation.

Unlike hazardous waste, deactivation and cleanup tasks, which are performed by Kaiser-Hill sub-tier contractors, dismantlement tasks are performed by workers who are pulled from local Colorado Building Construction Trades (CBCT) union labor halls and are dedicated exclusively to dismantlement tasks.

8.0.6 Examples of Tasks performed by Remediation workers

Under a Removal Action (RA) or closure action, Remediation workers performing HW tasks will remediate any HWMUs within a building prior to facility deactivation. Removal actions, authorized by CERCLA Section 104 d (2), are designed to address immediate threats to human health and the environment. A removal action may be conducted during any point in the CERCLA response process. Typical removal actions include dismantling and decontaminating a building, stabilizing of structures, preventing migration of hazardous substances, or removing of barrels, drums, tanks, or other contaminated materials. Upon completion of this task and disposition of the removed hazardous waste, Remediation workers performing De tasks will enter the building to be deactivated and remove any salvageable equipment, loose radiological gross contamination, or “holdup material” (material left in process lines, machinery, equipment etc.) and perform general cleanup activities. At this point a contract is let to a dismantlement company for the final phase of the process. Remediation workers performing Di tasks perform activities such as removing asbestos and Asbestos Containing Material (ACM), encapsulation of fixed radiologically contaminated surfaces using latex paint, removal and staging for proper disposal of structural components, and containerization of materials for shipment to the proper storage/disposal area.

8.1 IDENTIFICATION OF HISTORIC, IN-PROGRESS, AND ANTICIPATED REMEDIATION WORKER GROUP DEMOGRAPHICS AT THE RFETS

8.1.1 Current Personnel Composition

Current staffing requirements represent a site-wide mix of federal and contractor personnel. The federal work force consists primarily of managers, administrators, professionals, engineers, and scientists. This mix supports the oversight of site operations and management of the interface between regulators, headquarters, and other organizations required to accomplish the mission and vision at the RFETS.⁽⁹⁾

The contractor work force is primarily a mix of the tiered subcontractor labor personnel and professional staff who conduct the day-to-day site operations and plan and perform the remediation of the site. As discussed previously on page 7, Kaiser-Hill is the management and organization (M&O) prime contractor at the RFETS and sub-contractors are responsible for specific site projects. Exhibit 9.5, page 96, presents a composition of contractor full-time equivalents.

8.1.2 RFETS Special Worker Group

A Cooperative Agreement (grant based) contract between DOE-Rocky Flats Field Office (RFFO) and Manufacturing Science Corporation (MSC) was let to refurbish and recycle RFETS Buildings 883 and 865 for re-use by private industry. MSC (804 Kerr Hollow Road, Oak Ridge, Tennessee 37830), is a major metal recycling operation that focuses on recycling materials from former weapons complex facilities. This work began on April 1, 1994 and will end December 31, 1997. Building 883 was a manufacturing plant and Building 865 was a research and development plant used during the production era. Originally four buildings (865, 883, 444, and 447) were to be completed but funding was cut resulting in only partial completion. The four buildings involved are metal machining and fabrication facilities. Materials utilized in these buildings included uranium, beryllium and stainless steel. There were no plutonium operations in any of the buildings. Activities performed by employees of MSC included hazardous waste, deactivation, and cleanup tasks involved in the refurbishing of these buildings. This work was done totally outside the authority of Kaiser-Hill, except for minor radiological control support.

About 60 hands-on workers performed work under this agreement. Ninety percent of this group were former RFETS production workers. Management and supervisory support was also provided by BNFL, Inc. totaling about 14 people.⁽¹⁵⁾

A wealth of IH and radiological data exists on this work, including over 10,000 personnel air monitoring samples specifically for Beryllium (Be). Sixty percent of these samples were recorded with detectable levels of Be, and over 200 of these sample results exceeded the OSHA Permissible Exposure Limits (PEL). Ten of these samples greatly exceeded the OSHA PEL, however the TWA (Time Weighted Average) was within acceptable limits.^(15, 59)

MSC has finished the decontamination and decommissioning work. The DOE has hired an outside firm to provide independent verification that any remaining level of contamination

meets relevant health standards. After this verification has been completed, the DOE will allow a private sector company to begin manufacturing operations.

8.1.3 Union Information

There are two separate labor bargaining agreements currently in place at the RFETS. The Colorado Building Construction Trades Contract/Agreement (CBCTC) which governs construction projects (this includes some environmental restoration and dismantlement work) and the United Steel Workers of America (USWA), AFL-CIO-CLC (Colorado Labor Council) agreement which governs the remainder of the union work on site. Table 10.1, page 134, presents Contacts and Demographic Description of Prime and Subcontractor Remediation Workers at the RFETS.

Building Trades workers (18 different crafts) are drawn from local union halls and as of November 5, 1997, numbered around 400. These workers are utilized by the site's two AECCM contractors, DWRC and J.A. Jones, and-or their subcontractors.

Workers represented under the USWA are all Kaiser-Hill employees who are "leased" to various subcontractors (Dyncorp, SSOC, RMRS, etc.). These workers are utilized on an as-needed basis and as of November 5, 1997, numbered around 1400.⁽¹⁶⁾ The majority of this group were former production workers. From post-production until the fall of 1996 this group contained 45 different job titles/descriptions. In the fall of 1996 the "true cleanup workforce" was redefined utilizing 25 different job titles/descriptions.⁽¹⁷⁾

8.1.3.1 USWA Bargaining Agreement

The union information presented below was selected from the October 13, 1996 bargaining agreement between Kaiser-Hill Company, its subcontractors, their subcontractors, its/their successors (referred to in the bargaining agreement as the "Company"), and the USWA. This agreement recognizes the USWA as the sole collective, non-construction bargaining agency with respect to wages, hours and other conditions of employment for all hourly paid employees.

The bargaining agreement defines a set of employment terms and conditions deemed most equitable in view of each of the various interests involved, namely: Government, Company, Union, Employee, and Public.

This bargaining unit includes D&D employees and crew leaders and excludes all salaried personnel, office clerical employees, guards, watchmen, professional personnel, and supervisors. Exhibit 9.6, page 97, lists the classifications of hourly paid employees affected by the Kaiser-Hill/USWA bargaining agreement and number of workers/yr, 1989-1996. Only hourly paid employee worker classifications relevant to this study are included in this exhibit.

Site Management:

- * *The Company has all rights, functions, and authorities for the management of the Site and the direction of the working force, except as those rights are abridged by the terms of*

the bargaining agreement.

- * *The Company has the right to contract with outside independent contractors for maintenance, construction, and repair work when in the judgment of the Company such services are required. In exercising its right to contract with outside firms for production and support work, it is the intent of the Company to make every reasonable effort to utilize the resources and capabilities of the Site.*
- * *All provisions of this labor agreement will be interpreted and applied to permit maximum flexibility and utilization of the represented workforce. As work functions either diminish or are identified for outsourcing, the Company will discuss with Union leadership options for redeploying existing personnel. The intent would be that while some work scope may decline, the overall represented workforce would remain at the site.*
- * *The Union recognizes other rights and responsibilities belonging solely to the Company, prominent among which are, but not limited to: the right to determine the nature and extent of the work and operations to be performed; the right to hire; promote; demote; determine minimum qualifications; assign work; decide the number and location of Site units; number, size, and makeup of departments and groups; the products to be manufactured; the schedules and rates of production; and the processes of manufacturing together with all designing, engineering, and control of raw materials.*

Supervisory and Salaried Technical Personnel

Except as provided in the bargaining agreement, supervisory personnel do not perform routine production, maintenance, or service work assigned to hourly workers in the bargaining unit. However, it is recognized that supervisory and salaried technical personnel must do manual work to effectively perform their jobs, and therefore, may perform the following items of work.⁽¹⁸⁾

1. *Perform necessary instruction and training.*
2. *Determine operating characteristics of equipment or processes. The employee normally assigned to the equipment or process shall be present during such determination.*
3. *Any work necessary during an emergency such as a fire, explosion, flood, storm, line rupture, power failure, or any other condition which endangers life or property.*
4. *Work connected with accountability and security regulations.*
5. *For experimental purposes, an hourly employee normally assigned to existing/new equipment and/or processes shall be present.⁽¹⁸⁾*

Restriction Due to Toxic, Radiological, and/or Hazardous Material Exposure

When it has been determined by Industrial Hygiene and Health and Safety that an employee must be reassigned due to the employee approaching or exceeding Company or DOE standards for exposure to toxic, radiological, or hazardous materials, the employee will be assigned to another available job within his/her classification and department upon approval of Industrial Hygiene and Health and Safety. A recognized competent independent medical authority mutually agreed upon by the USWA, Department of Health and Safety, and Kaiser-Hill Rocky Flats will be used to verify the exposure level on a case-by-case basis.⁽²⁰⁾

Hours of Work

Day Shift: 7:30 a.m. to 4:00 p.m. with one-half hour non-paid lunch period, or 7:45 a.m. to 3:45 p.m. with a twenty minute paid lunch period.

P.M. Shift: 3:45 p.m. to 11:45 p.m., or 3:30 p.m. to 11:30 p.m. with a twenty minute paid lunch period.⁽¹⁹⁾

Midnight Shift: 11:30 p.m. to 7:30 a.m., or 11:45 p.m. to 7:45 a.m. with a twenty minute paid lunch period.⁽²⁰⁾

Four Day Work Week Schedule

A four (4) day work week consisting of four (4) consecutive days of ten (10) hour shifts. The ten (10) hour shifts will be exclusive of a ½ hour unpaid meal period. On a four (4) day work week all hours worked in excess of ten (10) hours will be paid at 1 ½ times the rate of pay, and all hours worked on the first or second scheduled day off will be paid at 1 ½ times the rate of pay. All hours worked on the third scheduled day off during a four (4) day schedule will be paid at two (2) times the rate of pay.⁽²⁰⁾

9/80 Work Week Schedule

With this schedule, employees work a total of eighty (80) hours in a two (2) week period. During week one, employees work four nine-hour days and one eight-hour day (44 hrs). During week two, employees work four (4) nine (9) hour days (36 hrs) with one (1) day off (totaling 52 hours per 2 weeks period). Hours worked on a daily basis in excess of these hours will be paid at 1 ½ the rate of pay, and all hours worked on the first or second scheduled day off will be paid at 1 ½ times the rate of pay. All hours worked on the third scheduled day off will be paid at two (2) times the rate of pay. These hours are exclusive of a ½ hour lunch period.⁽²⁰⁾

Protective Clothing and Equipment

When in the judgment of the Company protective clothing and equipment are necessary in certain areas of the Site for the health and safety of employees or for the protection of equipment or product, the Company will provide such protective clothing and equipment to be worn in areas designated by the Company.⁽²⁰⁾

Medical Examinations

An applicant for employment, before being hired, must meet certain minimum standards of health and physical fitness as determined by medical examination. The examination will be given by a licensed physician designated by the Company. Periodic medical examinations may be offered or required to aid an employee to improve his/her health or to enable the Company to guard the health of its employees.⁽²⁰⁾

Radiation Records

In accordance with the DOE's Radiation Protection Standards, the Company will:

- 1. Advise an employee, upon his/her written request, of his/her occupational radiation exposure as indicated in the exposure record.*
- 2. Notify an employee immediately of any radiation exposure he/she has received which exceeds the limits specified by DOE's standards.*
- 3. Provide an employee or retiree upon his/her request or within twenty (20) days after termination, at no cost, a written summary of his/her cumulative recorded occupational radiation exposures received during the period of his/her employment with the Company.*

Hazardous and Toxic Materials Records Training

As standards are developed and implemented, and the technology for measurement becomes accessible, the Company will notify an employee at such time as it becomes aware of any hazardous and/or toxic material exposure the employee has received which exceeds the limits specified by DOE standards. Additionally, the Company will provide training to employees whose job assignment and responsibilities are directly related to hazardous/toxic materials.⁽²⁰⁾

8.1.4 D&D Agreement: March 5, 1996 as amended October 13, 1996

This agreement pertains to Remediation workers performing De tasks and shall apply to all D&D work performed by employees represented by the United Steelworkers of America at the RFETS and to all off site D&D work which they are assigned by the Company. It is the parties' intention to make every effort to assign tasks relating to closing the facility and reclaiming the Site to "site employees" unless "construction work" or provisions of the collective bargaining agreement apply.⁽²⁰⁾

Overall Site Work

D&D activity may be performed through a number of projects which generally have a beginning and completion date. It is agreed that the Company or the DOE may declare any building or area D&D in nature.⁽²⁰⁾

In accordance with the Company integrating contractor arrangement, employees may be supervised by Kaiser-Hill Company, a subcontractor or lower tier contractor. Employees may also be assigned to work with a contractor if work is subcontracted out.

D&D crew members will perform all D&D work, within their D&D classification, which they are qualified and trained to perform safely regardless of jurisdiction. If support is needed, the Company may assign support personnel per the collective bargaining agreement to perform work covered by their classification to support a project. Support personnel shall return to their regularly assigned area (classification and shift) after their part of the project is complete.⁽²⁰⁾

D&D Classifications

The Company has established the following D&D jobs:

1. *D&D Skilled Trade Worker*
2. *D&D Hazard Reduction*
3. *D&D Utility Worker⁽²⁰⁾*

D&D Training

The parties agree that job specific and safety training are needed and the Company will provide the necessary training prior to assignment to a specific task where training is needed. The Company shall provide necessary Worker Health and Safety Education and training for Union members as needed to perform D&D work.⁽²⁰⁾

8.1.5 Future Full-Time Equivalent Personnel Needs at the RFETS

Based on the current site mission and the future scope of work assumed, future personnel needs at the site will include an increase in project managers, cost estimators, and engineers, and a decrease in administrative and clerical personnel.

8.1.6. Discussion of RFETS Demographics

The majority of the RFETS post-production remediation workforce (1655 non-construction related workers as of November, 1997), is represented by the United Steelworkers of America (USWA), AFL-CIO-CLC. In late 1992, Remediation workers underwent Hazardous Waste Operations and Emergency Response (HAZWOPER) training. HAZWOPER training is health and safety training imposed by regulation 29 CFR 1910.120e. At this time 78% of Remediation workers at the RFETS were HAZWOPER trained. The normal operating shift of these workers is 4 days a week, 10 hours a days (start times are adjusted for prevailing weather conditions, i.e., a 2 A.M. start time during the heat of the summer). Only those personnel involved with wastewater treatment, power plant operation, and emergency response perform second and third shift activities. Remediation workers are required to change into company issued clothing prior to reporting to their work station and must doff company issued clothing

and shower prior to exiting. Due to potential contact with chemical and radiological contaminants, the donning of PPE specified by the Industrial Hygiene and Radiological Engineering departments is required prior to entry into the areas of chemical, mixed or radiological contamination where work is being performed. Exhibit 9.7, page 98, presents PPE Selection Criteria at the RFETS as of December 1997.

In November 1997, Kaiser-Hill employed or subcontracted the services of approximately 1342 Remediation workers applicable to this study.⁽²¹⁾ Exhibit 9.8, page 99, presents Hourly-Paid Employees Represented by the Kaiser-Hill/USWA Bargaining Agreement Depicting the Number of Workers/First Tier Contractor, 1997. The function of this worker group involves the removal, decontamination, treatment, storage, transportation and disposal of hazardous, mixed, and LLRW waste, demolition, asbestos abatement, and systems maintenance and operation. The top five job titles associated with these worker group activities are Radiological Control Technicians (298 workers), Process Specialists (214 workers), Stationary Operating Engineers (111 workers), Maintenance Technologists (100 workers), and Risk Reduction Technicians (76 workers). Industry profiles (comparable worker groups in the private sector) include, but are not limited to: solid, hazardous and mixed waste treatment storage and disposal workers; nuclear power plant maintenance personnel; demolition workers; asbestos abatement personnel; and power and wastewater treatment plant operators.

Turnover rates for the Remediation worker group are as follows: no rate is available for 1989-1995, 1996 = 8.6%, the first half of 1997 = 7.1% (reduction in force and downsizing are confounders).⁽²²⁾ Turnover rates for 1997 apply to the numbers of workers in Exhibit 9.8 on page 99.

Historically, demographic information has been difficult to obtain for NIOSH feasibility studies due to the linkage of personal identifiers, whether it be social security number or site ID, to the demographic data in need. In the case of RFETS, specific demographic information including age, gender, ethnicity etc. is available through the site human resources contact listed in this document and can be obtained through personal ID at a later point of this study.

8.2 IDENTIFICATION OF HISTORIC, IN-PROGRESS AND ANTICIPATED REMEDIATION WORKER ACTIVITIES AND EXPOSURES AT THE RFETS

This section presents historic, in-progress, and anticipated Remediation Worker activities and exposures which are described and defined relative to the production area SNM facilities remediation project, cluster removal phased worker activities and the physical location of those activities.

Remediation worker activities 1 through 43 described below are those activities which have either been completed, are in progress, or are scheduled to be undertaken in the near future.

The activities are described in relationship to the types of tasks performed by Remediation workers during the activity. For example, an activity performed by Remediation workers that involves HW tasks will be defined as a HW task. Table 10.2, page 136, presents Remediation Worker Contacts, Activity Descriptions and Exposure Types.

Overview:

8.2.1 Production Area SNM Facilities Remediation Project

The former nuclear production area includes the 126 acres within the Protected Area, where plutonium processing and fabrication was conducted in support of the nuclear weapons program. Also included in the nuclear production area is the 800 complex, which processed enriched uranium, depleted uranium, and beryllium to support the defense programs. There are 225 structures, including cooling towers within the production area. Additionally, there are 134 other facilities, such as process waste systems and waste tanks, within the production area.⁽²³⁾

These 359 facilities are grouped into 20 Clusters for purposes of planning and management. Generally these clusters are comprised of a major facility such as Building 707, which fabricated plutonium components, and associated support structures. The Clusters within the production area include but are not limited:

- | | | | |
|-----|-----------------|-----|-----------------------------|
| 1. | 207 Cluster | 11. | 774 Cluster |
| 2. | 371/374 Cluster | 12. | 790 Cluster |
| 3. | 559 Cluster | 13. | 800A Cluster |
| 4. | 566 Cluster | 14. | 881 Cluster |
| 5. | 569 Cluster | 15. | 865/883 Cluster |
| 6. | 707/750 Cluster | 16. | 886 Cluster |
| 7. | 771/774 Cluster | 17. | 910 Cluster |
| 8. | 776/777 Cluster | 18. | 964 Cluster |
| 9. | 778 Cluster | 19. | 980 Cluster |
| 10. | 779 Cluster | 20. | 991 Cluster ⁽²³⁾ |

When all nuclear production was halted in 1989, SNMs were left in place without any handling or repackaging pending resumption of nuclear operations. When the RFETS production mission was formally terminated in 1992, it was possible to begin processing, stabilizing and repackaging the SNM to make it safe to store, handle and ship. This effort will continue through approximately 2002. As the effort to stabilize material progresses, and as buildings are no longer required to process and store SNM, it is necessary to decommission these nuclear and support facilities to further minimize risk, reduce mortgage costs and to fulfill the site closure mission.

It is anticipated that by FY 97, significant nuclear facilities will no longer be required to support SNM missions. By FY 2006, all of these buildings will be deactivated, decontaminated, dismantled and/or demolished. When demolished, cleanup of soils beneath buildings will be undertaken.

8.2.1.2 Cluster Removal Phased Activities

During this status transition from an operating SNM facility to a vacant remediated site, there are six phased activities associated with the removal of each cluster:

1. Facility Landlord Functions:

The purpose of this activity is to ensure that buildings within Cluster Facilities are maintained in a safe, secure, and environmentally compliant status. Appropriate controls are maintained, and verification inspections are performed to demonstrate compliance to applicable State, Federal, and regulatory requirements. Maintenance and calibration activities are performed to a level that ensures Vital Safety System operation. Building availability will be maintained at the level necessary to support the achievement of SNM and deactivation operations and performance measures. ⁽²³⁾

2. SNM Removal Operations:

This deactivation operation removes SNM, in numerous forms, from buildings to support the elimination of individual storage areas and the Material Access Areas, and transitions buildings to deactivation. Materials include all SNM stored in vaults and vault type rooms, specific items in glove boxes or other process areas (such as residues), and SNM remaining in equipment and glove boxes. These materials will be transferred to Building 371 for interim storage. Once the new Pu Storage Facility is completed, all stored materials in Building 371 will be relocated to that facility.

- * Building 779 work will be substantially completed by the close of FY 96 except removal of the remaining SNM holdup necessary to eliminate nuclear and criticality safety issues.*
- * Building 771 has 3 secure storage areas, several residue storage areas, and a large quantity of SNM in glove boxes and equipment. All must be removed.*
- * Building 776/777 has the largest storage of SNM besides Building 371, with 7*

secure storage areas, along with several residue storage areas, and a large quantity of SNM in glove boxes and equipment. All must be removed.

- * Building 371 will be the receiver of the rest of the Site's SNM until placed in a new storage facility or shipped offsite. Only after the new interim SNM storage facility is complete will SNM removal operations involve this building. All the SNM (which will be packaged in DOE-STD-3013 containers, or similar) will be transferred to the new facility when available, then, the SNM in glove boxes and equipment in Building 371 will be collected, packaged, and transferred. ⁽²³⁾*

3. Facility Deactivation

Administrative deactivation- This includes establishing immediate administrative changes in the building operating requirements. Also, equipment calibrations, glove box glove surveys and classified document removal is accomplished. Additional work scope includes the removal of combustibles from glove boxes.

Initial Physical Deactivation- Activities include emptying storage cabinets, reducing the fire load by removing paper and other combustibles, relocating classified tooling and parts, preparing equipment for removal, removing miscellaneous and equipment deemed excess, removing tooling from each building, removing excess chemicals, removing radiological check sources, completing housekeeping cleanup for each building, releasing excess equipment and material to property utilization and disposal (PU&D), labeling contaminants prior to disposal, preparing and packaging waste as necessary for onsite disposal, disposing of hazardous chemicals and materials and completing RCRA closure certification.

Final Physical Deactivation- Preliminary decontamination for each building is included. Other contamination will be fixed using ALARA paint. Other activities include de-energizing glove box electrical and other energized systems connected to the glove box, removal of gloves and cap glove ports, remediate the ducts, equipment and glove boxes to allow for the reduction of the building hazard category, isolate and remove auxiliary power equipment, depressurize, drain flush and cap utility piping system; this includes water, steam, hydraulic, air, and oil systems, identify and label contaminants prior to disposal, package and store waste for onsite disposal, replace fire suppression system, de-energize and secure HVAC unit not needed for D&D, disabling the lighting system, and downgrading the building hazard classification. ⁽²³⁾

4. Decommissioning

Decommissioning activities at the RFETS will be conducted under CERCLA as removal actions (RA).

Before the formal decommissioning process begins, the facility will have gone through certain defined activities that set the stage for decommissioning. Such activities center around the transition process as management of the facility transfers from deactivating the facility and establishing a Surveillance and Maintenance (S&M) program to care for the facility until decommissioning can be accomplished. In order to determine appropriate features of the S&M

program, information must be obtained about the general nature and extent of contamination (termed preliminary characterization); and information must be available about the specific hazards present in the facility to ensure that they are properly addressed in the S&M program (termed preliminary hazards analysis).⁽²³⁾

4A. Performance of Decommissioning Operations: The Decommissioning Operations Plan (DOP).

When the necessary documents are completed and approved and the performing organization has demonstrated its readiness, the decommissioning action will proceed. The DOP and Health and Safety Plan (HASP) will provide for the appropriate safety measures to protect people and the environment. When the specified end condition criteria have been achieved and independently verified, the action is concluded. While the actual decommissioning work is proceeding, the S&M program is phased out in a planned manner as areas and systems are completed, dismantled or otherwise closed out.⁽²³⁾

5. Decontamination

Decontamination activities are performed to remove loose and fixed radioactive contaminants from surfaces (both external and internal) of nuclear facilities and from the equipment items and systems contained therein. Decontamination activities may be either remedial or preventive in nature. They are considered remedial where decontamination is required to reduce existing radiation levels so that necessary operation, inspection, maintenance, dismantlement, disposal, or similar activities can be performed within acceptable guidelines for personnel occupational radiation exposure. The activities are considered preventive where decontamination is performed routinely to control radiation levels so that conditions mandating remedial decontamination do not occur or are significantly retarded.

Removal of radioactive contaminants from surfaces (i.e., decontamination) regularly necessitates simultaneous removal of much larger amounts of non-radioactive materials also present on the contaminated surfaces. The composition and properties of these non-radioactive materials frequently differ considerably from those of the radioactive contaminants. Thus, considerable information is required to characterize the nature and amounts of all materials present on surfaces to be decontaminated.

Decontamination activities result in transfer of radioactive and non-radioactive contaminants from the surfaces treated into secondary mediums which then become byproduct radioactive wastes from the decontamination process. Production of these wastes contribute to the waste management scope and cost. Thus, selection and use of decontamination methods and equipment will include careful consideration of the effects on compliance with radioactive waste management requirements and on subsequent activities to be performed within the facility.

A wide variety of both chemical and physical methods (and combinations thereof) are used to achieve desired decontamination results in various application. Operations range from simple janitorial-type functions (e.g., vacuuming, wiping, and mop-and-bucket scrubbing) to sophisticated chemical processes capable of dissolving adherent corrosion product oxides from

the internal surfaces of reactor cooling system piping. Each method and item of equipment used for decontamination work has inherent capabilities and limitation. For this reason, and because of the wide variation in the nature and function of the surfaces to be decontaminated (in addition to the aforementioned variations in the nature and compositions of the contaminants on these surfaces), judicious selection and careful deployment of decontamination methods, equipment, and personnel is crucial to achievement of successful decontamination results. ⁽²³⁾

6. Dismantlement and Demolition

Facility process equipment generally is not salvaged for reuse because of contamination levels. Consequently, the dismantlement objectives exclude reassembly concerns and include only efficiency of decontamination, volume reduction, and final handling based on considerations of safety and cost-effectiveness.

In some cases, because of its size or weight, equipment dismantlement will require special handling equipment in conjunction with proper training to assure its proper use. Generally, equipment dismantlement will require standard disassembly and segmenting methods which include powered and manual tools. Pneumatically operated tools and flame-operating tools are both used and require contamination control measures.

Highly radioactive heavy-walled metal structures, including vessels, and heavy walled piping, may require remote cutting and handling.

After the majority of the process and support equipment have been removed, the remaining interior structures are evaluated for compliance with release criteria. The contaminated interior structures are subjected to volume reduction measures and prepared for final packaging/transportation as radioactive waste.

External structures (e.g., roof, walls, floor) are removed using standard demolition techniques only after all contamination has been removed from the facility. If the external structures are themselves contaminated, additional measures must be taken to prevent the spread of radiological contamination during removal.

Decontamination operations and the disassembly of radioactively contaminated items will require the application of contamination control devices and methods.

Existing facility High Efficiency Particulate Air (HEPA) filtered systems, if they exist and are operational, are maintained to provide contamination control coverage. When the facility system is no longer needed, it is dismantled, using its own filtering capability to control the spread of contamination during its dismantlement.

Existing facility HEPA systems may not always provide adequate contamination control for localized uses. Portable HEPA-filtered ventilation units are then used to provide additional contamination-control and ventilation, either in conjunction with the facility systems or as independent systems. Unless monitored for contamination in their exhausts, these units are exhausted into the existing facility HEPA - filtered ventilation system to ensure against the

release of contamination to the building interior. High efficiency HEPA-filtered vacuum cleaners will also be utilized for small volume contamination control, as well as for loose surface decontamination operations. These units normally exhaust to the building interior without monitoring of their exhaust.

Surface decontamination operations are a major part of the overall decommissioning effort. Aggressive decontamination methods will be required to remove existing surface coatings, such as paints, varnishes and similar fixatives, as well as base layers of the surface material, which may also contain embedded contamination.

Segmentation of large metal pieces, including process equipment, will be accomplished with plasma arc cutting equipment. If remediation or removal is required, it can be efficiently accomplished by utilizing powered equipment.

Good radiological control practices require the containment of loose contamination. During decommissioning, certain work evolutions will require the segmentation of components, the demolition of concrete, and the opening of process systems, which may disturb residual contamination. Typical contamination control measures include, but are not limited to building containment envelopes, applying surfaces fixatives, and installing localized ventilation systems.
(23)

7. Cluster Closure and IHSS's

This activity includes all environmental restoration activities relating to site closure within the nuclear remediation facility. (23) IHSS's are placed into 2 categories: High and Low. High ranked IHSS's will be remediated and low ranked IHSS's will undergo administrative close-out called the No Further Action process. Exhibit 9.9, page 100, presents Rocky Flats Historical OUs, IHSS's and Contaminants of Concern as of November, 1994.

8.2.2 Technologies/Approach:

The approach to decommissioning nuclear facilities will be to utilize available practices and technologies as a baseline. However, as new technologies become available from private or DOE funded research and development, the new technologies will be evaluated for upgrading the baseline. It is expected that improvements will be made in areas such as contamination measurements and waste characterization, which will both improve the quality and decrease the cost of the activities.

8.2.3 Milestone/Schedule

De Tasks:

1. All holdup removed from Building 779 in FY 1997
2. Remove MAA from Building 771 in FY 1997
3. All Holdup removed from Building 771 in FY 1999
4. Remove MAA from Building 776/777 in FY 2000

5. All holdup removed from Building 776/777 in FY 2001
6. MAA from Building 707 in FY 2001
7. All holdup removed from Building 707 in FY 2002
8. Close 371/374 Cluster in FY 2005
9. Close 559 Cluster in FY 2006
10. Close 707 Cluster in FY 2005
11. Close 771/774 Cluster in FY 2003
12. Close 776/777 Cluster in FY 2003
13. Close 779 Cluster in FY 2000
14. Close 886 Cluster in FY 2002⁽²³⁾

CW/HW Tasks:

1. Remediate High Risk IHSS's in FY 2006⁽²³⁾

8.2.4 HAZARDOUS WASTE TASKS

HW tasks at the RFETS involves the sampling, surveying, containerization, treatment, transportation, storage and disposal of hazardous and or mixed waste (i.e., chemically contaminated wood, metal, concrete, soil, asphalt, debris, process residues, discarded product, contact waste, etc.) associated with IHSS's and HWMU's. In some cases, Remediation Workers will deal with radiological waste streams as a function of these activities.

This section will define HW tasks, waste categories, contacts, exposure types, regulatory drivers and time line. Also, a qualitative indicator of the number of workers per category of activity (LOW: <10; MED: 11-75, HIGH: >75), is presented. Tasks are described in association with select IHSS's. Examples of activities associated with the HW tasks presented below include:

1. *Draining of pipes, tanks, or other containers.*
2. *On-site transportation of hazardous/mixed waste/materials.*
3. *Sorting, packaging, or re-packaging of hazardous/mixed waste -materials.*
4. *Waste (hazardous/mixed) treatment (e.g. thermal desorption, oxidation).*
5. *Waste (hazardous/mixed) storage operations (draining; venting; aspirating of any type of container, including tanks, drums, pipes, etc.)*
6. *Handling wet combustibles (high solvent content).*
7. *Hazardous waste/material leak/spill response or follow-up (environmental or indoors).*
8. *Collection of samples or use of Direct Reading Instruments (e.g. Draeger® Tube, Organic Vapor Meter).*
9. *House-keeping (e.g. mopping, sweeping, trash removal).*
10. *Production (hazardous/mixed), usually limited, done for purposes of verifying Transportation, Storage and Disposal (TSD) processes or techniques.⁽²⁴⁾*

Former OU1 (Buffer Zone); 881 Hillside

The 881 Hillside Area is located north of Woman Creek in the southeast section of the RFETS and includes 11 IHSS's. Contamination includes soil and ground water contaminated with uranium, VOC's, PAH's and plutonium. On-site treatment of soil and groundwater will be employed to allow for final on-site disposal. It is anticipated that it will take two years to complete remediation of this former OU which is scheduled to take place between fiscal years 1997-1999. The number of workers involved is projected to be medium at between 11 and 75. CERCLA is the regulatory driver behind the following activities. Examples of IHSS's to undergo remediation are listed below.⁽¹²⁾

Activity 1: IHSS 102, Oil Sludge Pit #2

IHSS 102, the Oil Sludge Pit #2, was a former below ground waste disposal pit into which 30 to 50 drums containing (non-radiological) oil sludge from a storage tank clean out were emptied. Excavation of oil contaminated soil is expected to occur between 1997 and 1999, a duration of two years. On-site treatment will be employed to allow for final on-site disposal.⁽²⁵⁾

Activity 2: IHSS 103, Chemical Burial Area

IHSS 103, the Chemical Burial Area (a portion of the "Hillside Area"), was used to store chemicals, solvent drums and fire damaged refuse resulting in soil and groundwater contaminated with carbon tetrachloride, TCE, PCE, 111-TCE, uranium and chloroform. Removal of these drums (disposal) and excavation of contaminated soil occurred in 1997. On-site treatment of soil and groundwater was employed to allow for final on-site disposal.⁽²⁵⁾

Activity 3: IHSS 113, Mound Area

The Mound Area was a former above ground waste disposal area that was used to store drums containing uranium, plutonium, hydraulic oil and volatile organic chemicals (primarily carbon tetrachloride). Removal of these drums and a limited amount of underlying soils occurred in the 1970's. Further remediation is planned which will include excavation of 400 to 1000 cubic yards of soil which will require thermal desorption treatment allowing final on-site disposal. This mixed waste stream under went remediation between 3/97-8/97, which was a duration of 5 months.⁽²⁶⁾

Former OU 3: Offsite Areas

This area is located beyond the RFETS Buffer Zone Area and is outside the scope of this study. Includes 4 IHSS's.⁽¹²⁾

Former OU 4 (Industrial Area): Solar Ponds

The Solar Ponds are located in the Industrial Area of the RFETS and includes one HWMU/IHSS comprised of five solar ponds. On-site treatment of soil and groundwater will be employed to allow for final off-site/on-site disposal. This former OU will be remediated under

the CERCLA regulatory driver. It is anticipated to take two years to complete remediation of this former OU which is scheduled to take place between fiscal years 1998-2000. The number of workers involved is expected to be medium; between 11 and 75. Examples of IHSS's to undergo remediation and contaminants of concern are listed below.⁽¹²⁾

Activity 4: IHSS 101 (HWMU #38), Solar Ponds

The Solar Ponds were part of the site's process waste water treatment system. These evaporation ponds contained lithium and aluminum scrap, nitrates, treated acidic wastes and low levels of radioactivity. The Solar Ponds underwent a remedial action in July 1994. This mixed waste site will undergo remediation between Fiscal Years 1998-2000, a duration of 2 years.⁽²⁷⁾

Former OU5 (Industrial/Buffer Zone Area): Woman Creek

The Woman Creek Drainage is located on the south side of the site in both the Industrial and Buffer Zone Area of the RFETS and includes 11 IHSS's. Contamination includes PAHs, PCBs, oil, beryllium, solvents, paint thinner, pesticides, radiological (depleted uranium and radium) and non-radioactive chemical wastes. On-site treatment of soil and groundwater will be employed to allow for final off-site/on-site disposal. This former OU will undergo remediation under CERCLA and will be completed between Fiscal Years 2002-2014, a duration of 12 years. The number of workers involved is projected to be medium at between 11 and 75. Examples of IHSS's to undergo remediation and contaminants of concern are listed below.⁽¹²⁾

Activity 5: IHSS 115, Original Landfill (Industrial Area)

The Original Landfill was used at the RFETS from 1952 to 1968. Some depleted uranium ash was buried along with normal plant waste which may have included chemicals (i.e., solvents, beryllium and uranium). Removal of this mixed waste and excavation of any radiologically contaminated soil is to occur after 2006. On-site treatment will likely be employed to allow for final on-site disposal.⁽²⁵⁾

Activity 6: IHSS's 133.1, 2, 3 and 4, Ash Pit I-1 (Buffer Zone Area)

Ash Pit I-1 was a former below ground waste disposal area that was used for the disposal of incinerator ash containing uranium and other metals which was covered with soil. Removal of this waste and excavation of any contaminated soil is to occur after 2006. On-site treatment will likely be employed to allow for final on-site disposal.⁽²⁵⁾

Former OU6 (Industrial/Buffer Zone Area): Walnut Creek

The Walnut Creek drainage on the north side of the site is located in both the Industrial Buffer Zone Area of the RFETS and includes 19 IHSS's. Contamination includes metals, PCBs, VOCs, radiological (Pu, U, Am and Sr), and nitrate wastes. On-site treatment of landfill gasses and wastes, sediments, soil and groundwater will be employed to allow for final offsite/on-site disposal. This former OU will undergo remediation under CERCLA. Planned activities are to occur from 1997-1999, a 2 year duration.⁽¹²⁾

Former OU 7 (Buffer Zone) Present Landfill

The Present Landfill is located on the north side of the site in the Buffer Zone of the RFETS and includes 4 IHSS's. Contamination includes tritium, metals, VOCs, Semi-VOC's, asbestos and radiological (Pu). On-site treatment of landfill gasses and wastes, sediments, soil and groundwater will be employed to allow for final offsite/on-site disposal. This former OU will undergo remediation under CERCLA. It is anticipated to take nine years to complete remediation, which is scheduled to take place between fiscal years 1997-2006. The number of workers involved will be medium; between 11 and 75. Examples of IHSS's to undergo remediation and contaminants of concern are listed below.⁽¹²⁾

Activity 7: IHSS 114 Present Landfill

The Present Landfill was a former below ground waste disposal area that began accepting material in 1968 and was used to store waste containing uranium and/or plutonium which exhibited less than the minimal detectable amount of radioactivity when surveyed. One thousand kgs. of contaminated sanitary sewage sludge were also buried. Removal of this waste and excavation of any radiologically contaminated soil is to occur after 1997. On-site treatment will be employed to allow for final on-site disposal.⁽²⁵⁾

Former OU 8 (Industrial Area): 700 Area

The 700 Area is located in the center of the Industrial Area of the RFETS and includes 24 IHSS's. Contamination includes VOCs, radiological (Pu, U and Am), solvents (carbon tetrachloride and benzene), oils, metals, nitrates, acids and bases. On-site treatment of wastes, soil and groundwater will be employed to allow for final off-site/on-site disposal. CERCLA is the regulatory driver for the remediation activities. It is anticipated to take three years to complete remediation of this former OU which is scheduled to take place between fiscal years 1998-2001. The number of workers involved will be medium; between 11 and 75. An example of an IHSS's to undergo remediation and contaminants of concern are listed below.⁽¹²⁾

Activity 8: IHSS 135, Cooling Tower Blowdown

Hexavalent chromium and small quantities of lithium were reported to have been present in small ponds which were used to contain water from cooling towers. The ponds were covered with fill and small amounts of depleted uranium may also have been buried at that time. Excavation of any radiologically contaminated soil is expected to occur after 1998. On-site treatment will be employed to allow for final on-site disposal.⁽²⁵⁾

Former OU 9 (Industrial Area): The Original Process Waste Lines

The Original Process Waste Lines are located in the center of the Industrial Area of the RFETS and includes 1 IHSS. Contamination includes nitrates, acids, caustics, and radiological. On-site treatment of soil will be employed to allow for final off-site/on-site disposal. This former OU will undergo remediation under CERCLA. It is anticipated to take three years to complete remediation, which is scheduled to take place between fiscal years 1998-2001. The number of

workers involved will be medium; between 11 and 75. The only example of an IHSS to undergo remediation and contaminants of concern is listed below.⁽¹²⁾

Activity 9: IHSS 121, Original Process Waste Lines Soils

Soils within this area may have been affected by leaking pipes or tanks that were used to transport various types of process waste. Possible contaminants of concern include nitrates, acids, caustics and radionuclides. This mixed waste site will undergo remediation under RCRA. Excavation of any radiologically contaminated soil is expected to occur after 1998.

This area includes 20 IHSS's scattered throughout the Industrial Area and two IHSS's within the Buffer Zone near Former OU 7. Contamination includes VOCs, radiological (Pu and U), metals, acids, halogenated and non halogenated solvents, cyanide, and petroleum products. Treatment options for the identified environmental media affected have not yet been identified. This former OU will undergo remediation under CERCLA. It is anticipated to take three years to complete remediation, which is scheduled to take place between fiscal years 1998-2001. The number of workers involved will be medium; between 11 and 75.⁽¹²⁾

Former OU 11 (Buffer Zone): West Spray Field

The West Spray Field is located on the west side of the site, in the Buffer Zone of the RFETS and contains one IHSS. Contamination includes nitrates and other wastes associated with OUs 4 and 5. Treatment options for the identified environmental media affected has not yet been identified. This former OU will be remediated under CERCLA. It is anticipated to take two years to complete remediation, which is scheduled to take place between fiscal years 1997-1999. The number of workers involved will be medium; between 11 and 75.⁽¹²⁾

Former OU 12 (Industrial Area): The 400/800 Area

The 400/800 Area is located in the center of the site, in the Industrial Area of the RFETS and includes 12 IHSS's. Contamination includes radiological (U and Pu), VOCs, other organics nitrates, sulfates, metals, acids, beryllium, lithium, hydrogen peroxide and chlorinated solvents associated with process leaks, spills, and outdoor support activities. Treatment options for the identified environmental media affected has not yet be identified. This former OU will be remediated under CERCLA. It is anticipated to take two years to complete remediation, which is scheduled to take place between fiscal years 1998-2000. The number of workers involved will be medium; between 11 and 75.⁽¹²⁾

Former OU 13 (Industrial Area): The 100 Area

The 100 Area is located in the center of the site, in the Industrial Area of the RFETS and includes 15 IHSS. Contamination includes organics, radiological (U and Pu), lithium, oils, nitrates, fuel oil, acids, caustics, and metals associated with process leaks, spills, and outdoor support activities. Treatment options for the identified environmental media affected has not yet been identified. This former OU will be remediated under CERCLA. It is anticipated to take two

years to complete remediation, which is scheduled to take place between fiscal years 1998-2000. The number of workers involved will be medium; between 11 and 75. Examples of IHSS's to undergo remediation and contaminants of concern are listed below.⁽¹²⁾

Activity 10: IHSS 128, Oil Burn Pit No. 1

Oil Burn Pit No. 1 was a former below ground waste disposal pit into which 10 drums containing oil with depleted uranium were burned; then buried. Building 335 was then built on this site. Excavation of any oil/depleted uranium contaminated residue and soil is expected to occur after 1998 after the removal of Building 335. On-site treatment will be employed to allow for final on-site disposal.⁽²⁵⁾

Activity 11: IHSS 134, Metal Disposal Site North Area (IAG Name: Lithium Metal Destruction Site) and Reactive Metal Destruction Site South Area

The Metal Disposal Site North Area and Reactive Metal Destruction Site South Area was a potentially radiologically contaminated area on which 400-500 pounds of metallic lithium (small quantities of sodium, calcium and magnesium) and some solvents were destroyed over a nearly twenty year period. Certain residues including lithium carbonate were buried as well. Removal of this waste and excavation of any contaminated soil is expected to occur after 1998. On-site treatment will be employed to allow for final on-site or offsite disposal.⁽²⁵⁾

Activity 12: IHSS 171, Solvent Burning Ground

The Solvent Burning Ground was a potentially radiologically contaminated area utilized for training fire department personnel as well as experiments concerning the effect of heat and water on various materials including filter plenums. Fire training included the burning of diesel fuel, gasoline, magnesium chips and waste solvents. Excavation of any contaminated soil is expected to occur in 1998. On-site and offsite treatment will be employed to allow for final on-site and offsite disposal.⁽²⁵⁾

Former OU 14 (Industrial Area): The Radioactive Sites

The Radioactive Sites are located in the center of the site, in the Industrial Area of the RFETS and include 8 IHSS's. Contamination includes VOCs, radiological and metals associated with process leaks, spills, and construction support activities. Treatment options for the identified environmental media affected have not yet been identified. CERCLA is the regulatory driver behind the activities. It is anticipated to take two years to complete remediation of this former OU which is scheduled to take place between fiscal years 1998-2000. The number of workers involved will be medium; between 11 and 75.⁽¹²⁾

Former OU 15 (Industrial Area): Inside Building Closures

These activities will be conducted in the south side of the site, in the Industrial Area of the RFETS and will include 6 IHSS's. Contamination (potential hazardous materials) include;

waste oil, 1,1,1-trichloroethane, chlorinated solvents, VOCs, beryllium and radiological (Pu, U and Ra) contaminants associated with former process and subsequent TSD support activities. It is anticipated to take two years to complete remediation of this former OU which is scheduled to take place between fiscal years 1998-2000. This mixed waste will be remediated under the CERCLA regulatory driver. The number of workers involved will be medium; between 11 and 75.⁽¹²⁾

Former OU 16 (Buffer Zone): Low-Priority Sites or No Further Action (NFA) sites

These sites are located in the south side of the site, in the Buffer Zone of the RFETS and include 7 IHSS's. Contamination includes metals, semi-VOC's, VOCs, radiological. These IHSS's have been designated as administrative closure only (NFA). CERCLA is the regulatory driver behind the activities. It is anticipated to take two years to complete remediation of this former OU which is scheduled to take place between fiscal years 1997-1999.⁽¹²⁾

8.2.5 DEACTIVATION TASKS

As stated previously, De workers are that portion of the RFETS wage workforce responsible for placing a facility in a safe and stable condition to minimize the long-term cost of a surveillance and maintenance program that is protective of workers, the public, and the environment until decommissioning is complete. Actions include pre-dismantlement/ reuse activities such as the removal of fuel, draining and/or de-energizing of non-essential systems, removal of stored radioactive, mixed, and hazardous waste materials, and related actions.

This section will define De worker activities, waste categories, contacts, exposure types, regulatory drivers and time line. Also, a qualitative indicator of the number of workers per category of activity (LOW: <10; MED: 11-75, HIGH: >75), are presented. Activities are described in association with select HWMUs. Examples of activities associated with the De tasks presented below include:

1. *Use of hand tools for size reduction disassembly, etc..*
2. *Use of powered tools (e.g. Sawzall) for size reduction, disassembly, etc..*
3. *Hot cutting or welding.*
4. *Decontamination Wet Methods using washing, scrubbing, water blasting.*
5. *Decontamination Mechanical Methods dry wiping, sweeping.*
6. *Decontamination L Abrasive Methods sanding, scabbling, grinding, CO₂ blasting. Coating (paint, adhesives, etc.) removal.*
7. *HEPA vacuuming.*
8. *Draining of pipe, tank, or other containers.*
9. *Asbestos removal/abatement.*
10. *Housekeeping (e.g. mopping, sweeping, trash removal).*
11. *Refurbishment of equipment and building.⁽²⁴⁾*

Activity 13: HWMU 4, Acid Dumpsters

HWMU 4, the Acid Dumpsters, are located in Building 444. Contaminants of concern

include: beryllium, nitric acid and uranium. Decontamination, safe shutdown and post-operations closure are the anticipated activities. RCRA is the regulatory driver behind these activities. Low-Level Mixed Waste is the waste type. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 2002-2003. The number of workers will likely be low at 1-10.⁽²⁸⁾

Activity 14: HWMU 18.02, Granular Activated Carbon Treatment: Building 374

Contaminants of concern associated with this HWMU include: Beryllium, chloroform, methylene chloride, nitric acid, 1,1,1-TCE, TCE, PCE, plutonium, americium and uranium. Decontamination, safe shutdown and post operations closure are the anticipated activities. RCRA is the regulatory driver behind these activities. Hazardous Waste and Low-Level Mixed Waste are the waste types. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 2001-2003. Number of workers will likely be low between 1-10.⁽²⁸⁾

Activity 15: HWMU 30, Chip Cementation: Building 447

Contaminants of concern include: Beryllium, methylene chloride and uranium. Decontamination, safe shutdown and post operations closure are the anticipated activities. RCRA is the regulatory driver behind these activities. Low-Level Mixed Waste is the waste type. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 2006-2007. Number of workers will likely be low between 1-10.⁽²⁸⁾

Activity 16: HWMU 39, Fabric Filtration: Buildings 444, 447, and 460

Contaminants of concern include: Beryllium, chloroform, methylene chloride, nitric acid, 1,1,1-TCE carbon tetrachloride and uranium. Decontamination, safe shutdown and post operations closure are the anticipated activities. RCRA is the regulatory driver behind these activities. Hazardous Waste and Low-Level Mixed Waste are the waste types. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 2001-2008. Number of workers will likely be low between 1-10.⁽²⁸⁾

Activity 17: HWMU 41, Process Waste Storage Tanks: Building 774

Contaminants of concern include: 1,1,1-TCE, plutonium, americium and uranium. Decontamination, safe shutdown and post operations closure are the anticipated activities. RCRA is the regulatory driver behind these activities. Low-Level Mixed Waste is the waste type. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 1998-2001. Number of workers will likely be low between 1-10.⁽²⁸⁾

Activity 18: HWMU 42, Process Waste Treatment Facility: Building 374

Contaminants of concern include: Beryllium, chloroform, methylene chloride, nitric acid,

1,1,1-TCE, TCE, PCE, plutonium, americium and uranium. Decontamination, safe shutdown/post operations closure are anticipated activities. RCRA is the regulatory driver for these activities. TRU Mixed Waste\ Residues and LLMW are the waste types. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 1996-1997. Number of worker will likely be low between 1-10.⁽²⁸⁾

Activity 19: HWMU 44, Oil Storage Tanks: Building 776

Contaminants of concern include: Beryllium, carbon tetrachloride, methylene chloride, 1,1,1-TCE, plutonium, americium, tritium and uranium. Decontamination, safe shutdown and post operations closure are the anticipated activities. RCRA is the regulatory driver behind these activities. Low-Level Mixed Waste is the waste type. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 1999-2001. Number of workers will likely be low between 1-10.⁽²⁸⁾

Activity 20: HWMU 49, Fluidized Bed Units (FBUs): Building 776

Contaminants of concern include: Beryllium, carbon tetrachloride, methylene chloride, 1,1,1-TCE, plutonium, americium, tritium and uranium. Decontamination, safe shutdown and post operations closure are the anticipated activities. RCRA is the regulatory driver behind these activities. Hazardous Waste and Low-Level Mixed Waste are the waste types. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 1999-2001. Number of workers will likely be low between 1-10.⁽²⁸⁾

Activity 21: HWMU 53, Miscellaneous Cementation: Buildings 371 and 771

Contaminants of concern include: Beryllium, methylene chloride, nitric acid, plutonium, americium, tritium and uranium. Decontamination, safe shutdown and post operations closure are the anticipated activities. RCRA is the regulatory driver behind these activities. Low-Level Mixed Waste is the waste type. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 1998-2001. Number of workers will likely be low between 1-10.⁽²⁸⁾

Activity 22: HWMU 55, Aqueous Process Waste Treatment: Building 774

Contaminants of concern include: 1,1,1-TCE, plutonium, americium and uranium. Decontamination, safe shutdown and post operations closure are the anticipated activities. RCRA is the regulatory driver behind these activities. TRU Mixed Waste/Residues and Low-Level Mixed Waste are the waste types. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 1999-2001. Number of workers will likely be low between 1-10.⁽²⁸⁾

Activity 23: HWMU 56, Organic Waste Immobilization: Building 774

Contaminants of concern include: 1,1,1-TCE, plutonium, americium and uranium. Decontamination, safe shutdown and post operations closure are the anticipated activities. RCRA

is the regulatory driver behind these activities. TRU Mixed Waste/Residues and Low-Level Mixed Waste are the waste types. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 1996-1997. Number of workers will likely be low between 1-10.⁽²⁸⁾

Activity 24: HWMU 80.1, Reactive Cyanide Treatment Unit: Building 881

Contaminants of concern include cyanide. Decontamination, safe shutdown and post operations closure are the anticipated activities. RCRA is the regulatory driver behind these activities. Hazardous Waste and Low-Level Mixed Waste are the waste types. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 2002-2003. Number of workers will likely be low between 1-10.⁽²⁸⁾

Activity 25: HWMU 90.37, 90.39 and 90.43: Container Storage Area: Building 779, Room 131; Glove boxes: 131A, 131B, 131D, 131E, 106-3, 4 and 5 and 860

Decontamination, safe shutdown and post operations closure were the activities. CERCLA was the regulatory driver behind these activities. TRU Mixed Waste/Residues were the waste types. It took one year to complete remediation of this HWMU and occurred between fiscal years 1997-1998. Number of workers will likely be low between 1-10.⁽²⁸⁾

Activity 26: HWMU's 90.115, 116, 117, 119, 120-122, Container Storage Area: Building 771: Glove boxes.

Contaminants of concern include: Beryllium, methylene chloride, nitric acid, plutonium, americium, tritium, and uranium. Decontamination, safe shutdown and post operations closure are the anticipated activities. RCRA is the regulatory driver behind these activities. TRU Mixed Waste/Residues are the waste types. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 1999-2000. Number of workers will likely be low between 1-10.⁽²⁸⁾

Activity 27: HWMU 90.129, Container Storage Area: Building 771, Room 183

Contaminants of concern include: Beryllium, methylene chloride, nitric acid, plutonium, americium, tritium, and uranium. Decontamination, safe shutdown and post operations closure are the anticipated activities. RCRA is the regulatory driver behind these activities. TRU Mixed Waste/Residues are the waste types. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 1998-2001. Number of worker will likely be low between 1-10.⁽²⁸⁾

Activity 28: HWMU 90.142: Container Storage Area: Building 371, Room 3408 Glove boxes 72B and 72C

Contaminants of concern include: Beryllium, nitric acid, plutonium, americium and uranium. Decontamination, safe shutdown and post operations closure are the anticipated

activities. RCRA is the regulatory driver behind these activities. TRU Mixed Waste/Residues are the waste types. It is anticipated that it will take one year to complete remediation of this HWMU which is scheduled to take place between fiscal years 2001-2002. Number of worker will likely be low between 1-10.⁽²⁸⁾

8.2.6 DISMANTLEMENT TASKS

Di tasks at the RFETS involve the demolition and disassembly of structures and associated equipment primarily located in the Industrial Area OU. Di workers remove asbestos, process equipment (where applicable), and internal and external building components (after encapsulation of loose radiological material), and then transfer this LLRW to workers performing CW tasks for shipping, storage, etc. Since Di tasks are primarily associated with the disposition of LLRW, the contaminant of concern associated with each historic, in-progress and anticipated Di worker activity listed below will be primarily radiological.

Exposures for these workers will be determined by the particular demolition and disassembly technology utilized, i.e., removing metal with a cutting torch, hand removal of asbestos panels, removal of lead based paint, etc.

All of the site's 500 facilities (of which 50 are radioactively contaminated with plutonium or uranium) will be demolished with the exception of the new plutonium, TRU and low-level waste storage facilities or any facilities deemed to be commercially valuable which would undergo decontamination.

This section will define Di Worker activities, waste categories, contacts, exposure types, regulatory drivers and time line. Also, a qualitative indicator of the number of workers per category of activity (LOW: <10; MED: 11-75, HIGH: >75), is presented where available. Activities are described in association with select Clusters. Examples of activities associated with the Di tasks presented below include:

1. *Use of hand tools for size reduction, disassembly, etc..*
2. *Use of powered tools (e.g. Sawzall®, loader mounted shears) for equipment and/or building component size reduction and disassembly.*
3. *Hot cutting or welding.*
4. *Asbestos removal/abatement.*
5. *Demolition of buildings or other large structures by backhoe ram, hydraulic shears, wrecking ball, or other devices.⁽²⁴⁾*

8.2.6.1 Di Worker Key Accomplishments

Since July 10, 1989, four buildings and associated structures/tanks located within the various former OUs have undergone dismantlement by Di workers. At the time of this study several buildings were in the process of being placed in a safe configuration (by De workers) in anticipation of the final demolition or reuse. Exhibit 9.10, page 103, presents Kaiser-Hill/DOE-RFFO Ten Year Plan Activities Schedule: Remediation Worker Present/Future Activities.

Activity 29: Dismantlement of Above Ground Fuel Oil Storage Tanks

The activities consisted of decontamination and demolition of two tanks (one 840,000 gallon and one 1.9 million gallon) which were drained, decontaminated, and cut up for final disposal. Mixed waste/residues were the waste types. CERCLA and RCRA were the regulatory drivers behind these activities. The number of workers (estimated) necessary to complete this task was low: 1-10. The time line was 7/95-9/96, a duration of 14 months (estimated).

Activity 30: Dismantlement of Building 889

The activities consisted of decontamination and demolition of building 889, size reduction of building components and containerization of waste for final disposal. The contaminants of concern were radiological. CERCLA was the regulatory driver behind this activity. The number of workers (estimated) necessary to complete this task was medium: 11-75. The time line was 7/95-9/96, a duration of 14 months (estimated).

Activity 31: Dismantlement of Seven Guard Posts (400 area)

The activities consisted of the removal of seven guard posts and containerization/shipment of waste for final disposal. The contaminants of concern were radiological. CERCLA was the regulatory driver behind these activities. The number of workers (estimated) necessary to complete these tasks were low: 1-10. The time line was 7/95-9/96, a duration of 14 months (estimated).

Activity 32: Dismantlement of an Electrical Substation

The activity consisted of decontamination of substation components in anticipation of demolition and containerization/shipment of all wastes generated for final disposal. TSCA-Mixed waste/residues were the waste types. CERCLA/TSCA were the regulatory drivers behind this activity. The number of workers (estimated) necessary to complete this task was low: 1-10. The time line was 7/95-9/96, a duration of 14 months (estimated).

8.2.7 CLEANUP TASKS

As stated previously, CW's are responsible for the day-to-day activities associated with the maintenance and operation of facilities located within the various former OU's and treatment, storage and shipment of radiological materials and wastes generated by HW, De and Di worker tasks. Examples of CW tasks include routine facilities maintenance (painting, utilities, structural integrity, sanitation, etc.).

Certain former OU's are comprised primarily of smaller out-buildings and storage sheds. The removal of these structures is relatively simple and does not require the manpower and equipment resources associated with the dismantling and demolition of the much larger structures found in the Industrial Area. Therefore, the final disposition of these structures is considered more of a clean-up activity and falls under the domain of CW tasks.

This section will define CW task activities, waste categories, contacts, exposure types, regulatory drivers, time line and number of workers per activity. Examples of activities associated with the CW tasks presented below include:

1. *Use of hand tools for size reduction, disassembly, etc.*
2. *Use of powered tools, (e.g. Sawzall) for size reduction, disassembly, etc.*
3. *Decontamination: Wet methods (e.g. washing, scrubbing, water blasting).*
4. *Decontamination: Mechanical methods (e.g. dry wiping, sweeping).*
5. *Decontamination: Abrasive methods (e.g. sanding, grinding, CO₂ blasting).*
6. *Coating removal (paint, adhesives, etc.).*
7. *HEPA Vacuuming.*
8. *On-site transportation of LLR waste/radiological materials.*
9. *Materials consolidation.*
10. *Sorting, packaging, or re-packaging waste materials.*
11. *Radiological waste treatment (e.g. vitrification).*
12. *Radiological waste storage operations (draining, venting, aspirating of any type of container, including tanks, drums, pipes, etc.).*
13. *Radiological leak/spill response or follow-up (environmental or indoors).*
14. *Collection of samples or use of Direct Reading Instruments (e.g. Geiger Counter).*
15. *Housekeeping (e.g. mopping, sweeping, trash removal).*
16. *General maintenance of equipment or building (e.g. building repairs, bulb replacement).*
17. *Ventilation system maintenance.*
18. *Production (radiological), usually limited, done for purposes of verifying TSD processes or techniques.⁽²⁴⁾*

Former OU1 (Buffer Zone): 800 Area CW Activities

Activity 33: IHSS 130, Radioactive Site - 800 Area Site No. 1

The Radioactive Site - 800 Area Site No. 1 (a portion of the "Hillside Area"), was used to store fire damaged refuse resulting in soils contaminated with uranium and plutonium. Removal of this waste (disposal) and excavation of any radiologically contaminated soil is to occur 1997-1999. On-site treatment of soil and groundwater will be employed to allow for final on-site disposal. CERCLA is the regulatory driver behind this activity. The number of workers necessary to perform this activity is projected to be medium; 11-75. ⁽²⁵⁾

Former OU2 (Buffer Zone): CW Activities

Activity 34: IHSS 108, Trench T-1

Trench T-1 was a former below ground waste disposal area that was used to store 125 drums containing 25,000 kg of depleted uranium chips. Removal of these drums and excavation of any radiologically contaminated soil is to occur 1997-1999. On-site treatment will be employed to allow for final on-site disposal. CERCLA is the regulatory driver behind this activity. The number of workers necessary to perform this activity is projected to be medium; 11-

Activity 35: IHSS 110, Trench T-3

Trench T-3 was a former below ground waste disposal area that was used to store drums containing uranium and plutonium contaminated sanitary sewage sludge. Removal of these drums and excavating of 2240 cubic yards of underlying soil occurred in 1996. On-site treatment was employed to allow for final on-site disposal. This mixed waste stream was remediated under CERCLA and was completed between 3/96-6/96, a duration of three months. The number of workers involved was medium; 11 - 75.⁽²⁶⁾

Former OU 6 (Buffer Zone): CW Activities**Activity 36: IHSS 167.1, Spray Field North Area**

The Spray Field North Area was used as a land-surface disposal area onto which landfill effluent and local surface runoff were sprayed beginning in 1986. Effluents were sprayed on the ground to enhance evaporation. These effluents were subsequently found to contain tritium, strontium and uranium. Excavation of any radiologically contaminated soil is to occur 1997-1999. On-site treatment will be employed to allow for final on-site disposal. CERCLA is the regulatory driver behind this activity. The number of workers necessary to perform this activity is medium; 11-75.⁽²⁵⁾

Former OU 9 (Industrial Area): Radioactive Site 700 Area CW Activities**Activity 37: IHSS 163.2, Site No. 3 Buried Slab**

Site No. 3 was an area which was used for the storage of a radiologically contaminated (non-removable americium) concrete slab. The slab was excavated and the contaminated area was removed and shipped to an offsite disposal facility. The number of workers that performed this activity was medium; 11-75.⁽²⁵⁾

Former OU 14 (Industrial Area): CW Activities**Activity 38: IHSS 156.1, Building 334 Parking Lot**

The Building 334 Parking Lot was used as a storage area for soil containing low levels of plutonium excavated near Building 774. The volume of soil involved is not known. Fifty to seventy-five dump truck loads of soil were removed and placed in IHSS 156.2 during the construction of Parking Lot 334. Excavation of any radiologically contaminated soil is to occur 1998-2001. On-site treatment will be employed to allow for final on-site disposal. The waste stream is radiological. CERCLA is the regulatory driver the following activities. The number of workers necessary to perform this activity is medium; 11-75.⁽²⁵⁾

Activity 39: IHSS 164.1, Radioactive Site 800 Area Site No. 2 Concrete Slab

Site No. 2 was an area which was utilized to store a radiologically contaminated concrete slab in 1958. The slab was broken up, removed, disposed of offsite and the area cleaned up. The waste stream was radiological. CERCLA was the regulatory driver behind this activity. Time line is 1998 -2001, a duration of 3 years. The number of workers necessary to perform this activity was medium; 11-75. ⁽²⁵⁾

8.2.8 SPECIAL WORKER (MSC) GROUP TASKS

Activity 40: Removal of Storage Tanks, Building 883.

These MSC HW activities consisted of decontamination of 14 Tanks (9 of which contained Pu). Five tanks were remediated utilizing draining and triple rinsing techniques for clean closure and the remaining 9 tanks were drained, decontaminated, and cut up for final disposal. Mixed waste is the waste stream. CERCLA and RCRA are the regulatory drivers behind this activity. The number of workers necessary to perform this activity is medium; 11-75. Time line is 11/28/97 to 01/15/98, a duration of 1.5 months.

Activity 41: Beryllium (Be) Processing Equipment Removal, Buildings 883 and 865.

These MSC De activities consisted of decontamination and removal of process equipment, size reduction of equipment and containerization of waste for final disposal/reuse/recycling. Mixed waste is the waste stream. CERCLA is the regulatory driver behind this activity. The number of workers necessary to perform this activity is medium; 11-75. Time line was 9/95 to 11/97, a duration of 2.2 years.

Activity 42: Uranium Processing Equipment Removal, Buildings 883 and 865.

These MSC De activities consisted of decontamination and removal of large pieces of machinery such as furnaces, hydraulic presses and large rolling mills, size reduction of equipment and containerization of waste for final disposal/reuse/recycling. The contaminant of concern is radiological. CERCLA is the regulatory driver behind this activity. The number of workers necessary to perform this activity is medium; 11-75. Time line was 9/95 to 11/97, a duration of 2.2 years.

Activity 43: Building Decontamination, Buildings 883 and 865.

These MSC De activities consisted of decontamination of duct work, walls, floors, and work surfaces within both buildings in anticipation of building reuse and containerization of all wastes generated for final disposal/reuse/recycling. The contaminant of concern is radiological. CERCLA is the regulatory driver behind this activity. The number of workers necessary to perform this activity is medium; 11-75. Time line was 9/95 to 11/97, a duration of 2.2 years.

8.2.9 Description of DOE/RFETS Industrial Hygiene, Occupational Safety and Health, and Radiological Control Programs

Industrial Hygiene Program

The purpose of the RFETS Industrial Hygiene (IH) Program is to ensure that physical, biological and chemical hazards to employees are recognized, evaluated and controlled.

RFETS manages its IH Program through formal policies and procedures, which are contained in the RFETS Safety and Hygiene (H&S) Manual. The RFETS Safety and Hygiene Manual designates the Safety and Hygiene requirements that shall be adhered to for all work performed at the RFETS. Information related to the following topics is included in this manual: safety program, PPE, industrial hygiene, fire protection, HAZWOPER, pressure safety, loss prevention, inspections, reports and investigations. Each and every task at the site requires a Health and Safety Plan (HASP) for designated scopes of work identified in the RFETS H&S Manual. A task-specific HASP addresses the following, as applicable: safety documentation requirements, interface with the different safety organizations, safety evaluation of job scheduling, hazard analysis, preventive measures, employee selection and training, as well as ongoing safety evaluation and close-out procedures.⁽²⁹⁾

The DOE's Environmental Safety and Health (ES&H) Technical Information Service (TIS) Internet Resource Directory Performance Data-DOE-Industrial Hygiene Website⁽⁵⁶⁾ contains information on a variety of methods and systems. The DOE and site offices use these databases to track industrial hygiene/health physics performance and individual site data. Those methods and systems which are relevant to the RFETS site include: Comprehensive Epidemiologic Data Resource (CEDR)⁽⁵⁴⁾, DOE Lessons Learned Program⁽⁵²⁾, Facility Profile Information Management System (FPIMS)⁽⁵¹⁾, Occupational Injury and Property Damage Summary Reports (OIPDS)⁽⁵³⁾, Computerized Accident/Incident Reporting System (CAIRS)⁽⁵⁵⁾, Occurrence Reporting and Processing System (ORPS)⁽⁵⁰⁾, and the Radiation Exposure Monitoring System (REMS)⁽⁴⁹⁾.

Occupational Safety and Health (OS&H) Program

The ES&H Environmental Restoration and Waste Management (ER&WM) Branches of Kaiser-Hill provides first and subsequent tier contractors' line management with day-to-day support of site wide occupational safety and health matters.

An effective occupational safety and health management program includes provisions for the systematic identification, evaluation, and prevention or control of general workplace hazards, specific job hazards, and potential hazards that may arise from foreseeable conditions. An effective program addresses not only specific regulations but goes beyond specific requirements of law to consider all hazards. It will seek to prevent injuries and illnesses, whether or not compliance is an issue. As the size of a work site or the complexity of a hazardous operation increases, the need for written guidance increases to ensure clear communication of policies and priorities and consistent and fair application of rules.

Success of the overall site occupational safety and health programs hinges on active employee involvement in the total safety process, such as participation in walk around inspections of their work areas.

Radiological Control (RadCon) Program

It is the policy of the RFETS to conduct its radiological operations in a manner that ensures the health and safety of all employees, contractors and the general public. In achieving this objective, The RFETS shall insure that radiation exposure to workers and the public and releases of radioactivity to the environment are maintained below regulatory limits. Deliberate efforts are taken to further reduce exposures and releases in accordance with a process that seeks to make any such exposures or releases As Low As Reasonably Achievable (ALARA). The RFETS is fully committed to implementing a radiological control program that consistently reflects this policy.

The RFETS Radiological Control Manual (RCM) establishes the fundamental requirements and procedures to meet this policy and commitment. It contains the requirements of the DOE Radiological Control Manual (DOE-RCM) with the text reformatted to emphasize and highlight the incorporation of 10 CFR Part 835 requirements.

The policies and procedures of this manual are applicable to all the RFETS operations. The Site RCM program requirements established in this manual take precedence over all other contractor policies, procedures, manuals, or practices for radiological protection.⁽³⁰⁾

Areas of focus in radiological safety include: applications of As Low As Reasonably Achievable (ALARA) practices and principles; radiological engineering work controls; controlling the spread of contamination; decontamination techniques; ventilation usage and controls; radioactive material handling, storage and control; external and internal exposure controls; respiratory protection usage; radiological worker training; radiological worker training for special applications; radiological performance indicator goals and standards; and personnel contamination control.

It is the intent of the RFETS to establish and maintain radiological protection operations that are technically defensible, consistent throughout the site, and compliant with the requirements of this manual. Where full compliance with any requirement of this manual is not immediately achievable in any program element, approved interim compensatory measures shall be implemented to provide equivalent protection and an implementation plan shall be developed and initiated to bring the program into full compliance. Requests for exceptions to any requirements or recommendation for change to the manual (which require DOE Headquarters approval) will be approved by the Radiological Control Manager and Senior Site Executive prior to forwarding to DOE-RFFO and/or the appropriate Program Office.

Examples of Monitoring in the Workplace requirements (10 CFR 835 Appendix A, Subpart E) include individual and area monitoring, verification of the effectiveness of engineering and process controls, instrumentation, contamination and access control, and PPE.

All personnel working in radiologically controlled work areas will be trained in the appropriate procedures for proper monitoring, correct work techniques and the proper usage of PPE while working in these areas. In some cases a hazardous material or chemical environment might be located in a radiologically controlled area. If this occurs, the most protective PPE will

be utilized for personnel protection.⁽³¹⁾

8.2.10 Task Exposures

Hazardous Waste workers are the most likely to experience radiological and chemical exposures or a combination of both due to the frequency of job specific activities involving mixed waste. Many of the mixed wastes encountered by HW workers are liquids, residues, dusts, and gases which may be absorbed through the skin or inhaled into the lungs..

Radiological Exposures Affecting Task Workers

According to the RFETS Radiological Control Program, HW workers receiving possible radiological exposures are continuously monitored and managed under radiological oversight, which is aimed at overall upgrading of radiological protection, safety and health physics performance within DOE. Radiological Control Evaluations identifying strengths and weaknesses of site-specific radiation programs and Annual Radiation Doses affecting all workers and visitors at each site are documented for public access via Internet sites and DOE reports. Exhibit 9.11, page 117, provides a listing of radiological reports available for public review pertaining to the RFETS.

Science Applications International Corporation (SAIC) has been contracted by DOE to keep record of all nuclear site employee and visitor radiation exposures ranging from no measurable dose to 10 rem. In 1994, SAIC reported that 3,660 employees out of 5,308 at the RFETS received measurable TEDEs (total effective dose equivalents). Exhibits 9.12a through 9.12g, page 120, provide radiological dose information for monitored DOE and DOE contractor employees and visitors at the RFETS. Exhibit 9.13, page 121, provides 1990 through 1995 RFETS Dosimetry Rates among HW, De, Di, and Cleanup Workers, as Reported April, 1997.

More specific radiological exposure data resides in records maintained by the RFETS and DOE. The volumes, entitled "A Guide to Record Series Useful for Health-Related Research," were developed by Radiological Assessments Corporation (RAC) and presents a listing of the records readily available at the site and those that are kept as archives at other locations. The record series relating to post-production workers (1989 through the present) and possible radiological exposures are entitled: 1) "Body and Lung Burden Data Cards," 2) "Body Counter Schedule Logs," 3) "Demographic and Dosimeter Results Correction Records," 4) "Therapy Records," 5) "Dosimeter Location Records," 6) "Dosimeter Results Records," 7) "Exposure History Records," 8) "Incident and Occurrence Records," 9) "Internal Exposure Logs," 10) "Medical Case Files," and 11) "Radiological Deficiency Reports." The preceding record series do not identify a summary of exposures directly pertaining to HW workers, however the data is available and can be filtered for health-related studies. These public available document can be obtained through the RF PEIC.

8.2.11 Radiological Dose Exposure

Internal Dosimetry:

From the beginning of the post production era until 1995 (the inception of the Integrated Management Contract or “IMAC”), the prime contractor at the RFETS employed the bulk of the workforce. The prime contractor implemented an internal dosimetry monitoring program. This program included routine bioassay sampling of urine, feces, and lung burden. All employees qualified as Radiation Worker II are subject to the above mentioned sampling on a six month alternating schedule based on their jobs’ exposure potential. Another important part of the RFETS internal dosimetry program is the use of “workplace indicators.” Nasal swab samples are taken on any employee after exits from areas where full-face respirators or supplied air is required. Other examples of workplace indicators include: facial, head/neck, hand/forearm and clothing swipe samples as well as positive Select Alpha Air Monitor (SAAM) alarms. During 1993 there were nine confirmed radionuclide intakes, detected primarily by workplace indicators. Estimated committed effective dose equivalents (CEDEs) from these intakes ranged from less than 0.5 mRem to approximately 380 mRem. One case was detected during 1993 with a preliminary CEDE of approximately 89 rem; however, this intake was attributed to an incident that occurred in 1989 prior to plutonium operation curtailment. In addition to the internal dosimetry monitoring program, internal exposure ALARA goals are set annually. These goals are based on the number of confirmed internal intakes which occur. In 1993 a total of nine internal intakes occurred (eight inhalations and one puncture wound intake).

External Dosimetry:

Radiological Control Manual 1994, Revision 1 and 10 CFR 835 Implementation:
The RFETS’s two primary regulatory drivers with regard to radiological concerns are the DOE’s Radiological Control Manual, dated 1994, Revision 1 and 10 CFR 835. Implementation of these two programs is in place as of this writing.⁽³²⁾

Engineering and Administrative Controls

The RFETS defines an engineering control as those controls which eliminate hazards by mechanical means or by process design, including apparatus and mechanisms which physically prevent entry, minimize hazards, or create some kind of physical barrier.

The RFETS defines an administrative control as those controls which eliminate hazards by altering work habits such as Standard Operating Procedures (SOP’s), management directives, exposure tracking, and limitations on actual exposure.

Both engineering and administrative controls are in place with regard to the work at the RFETS. In most cases regarding chemical and radiological exposures, the administrative controls utilized by the RFETS contractor are more restrictive than exposure limits implemented by the DOE. Because of these controls, actual personal exposures are expected to be conservative relative to general area survey results.

8.2.12 Description of RFETS Chemical and Radiological Exposure Records Systems

Chemical and radiological exposure data for Remediation Workers is task-specific and is reported on an individual basis. No summary data for any particular worker group or task is

available at the this time, with the exception of the MSC/DOE contract work which should be issued in a final report on or about January 1998.

A. RFETS Employee Radiological/Medical Records Program

The RFETS employee medical records program is responsible for the collection and maintenance of personnel medical records. The site has an occupation-specific program in which a Surveillance Nurse reviews the employee's job title and decides which type of occupational medical monitoring is required. Occupational physicals include: hearing and vision testing, pulmonary function testing, EKG (age dependent), physical examination, chest X-ray, complete blood and urinalysis lab profile and hemocult analysis. Entry, annual and exit (if not covered by a recent annual) physicals may or may not be required depending upon the person's job title and work location. Since 1996, the site has maintained medical/radiological records in an ORACLE® database format entitled "Radiological Health System" (RHS).⁽³⁰⁾

Employee medical records are retained at the site until an employee is terminated, dies or leaves the site at which time the site sends that person's records to the Federal Records Center in Denver, CO. Employee records available at the Federal Records are maintained by the employees' names, the RFETS identification number and social security number.⁽³³⁾

B. Beryllium Health Surveillance Program:

The DOE has conducted a voluntary Beryllium Health Surveillance Program (BHSP) for current and former employees of the RFETS. This program was initiated to detect possible long term health effects of exposure to beryllium. The study is now entering a retesting phase for individuals previously tested.⁽³⁴⁾

C. Personnel Training Records

Since 1996, the RFETS has maintained personnel training records in an ORACLE® database format entitled "Training, Scheduling, and Records (TSR). The information contained in this database includes site and job specific training as identified in applicable DOE, Occupational Safety and Health Administration (OSHA), Department of Transportation (DOT), and EPA regulations. Examples include Radiological Worker, HAZWOPER, Building Orientation, Waste Management, and heavy equipment certification training records. Prior to 1996, Supervisors maintained personnel training records in individual file folders tested).⁽³⁵⁾

D. Industrial Hygiene Records

The RFETS Industrial Hygiene Department operated by Kaiser-Hill maintains chemical and physical agent monitoring/exposure records in (hard copy) paper file folders by program and project. These industrial hygiene records include information concerning asbestos, nuisance dust, PCB's, and various chemicals used on-site.

If personal exposure event occurs, notice is given to the RFETS Medical Department for addition to the employees medical record and/or action in terms of administrative control

implementation.⁽³⁶⁾

Note: Recent correspondence with RFETS employees have indicated that the site has developed an industrial hygiene exposure Access® database.⁽⁶¹⁾

Work is in progress under a grant-based contract (R01/CCR812933-01) between NIOSH/Tri-County Health Department/University of Colorado, Health Services Center/New England Research Institute involving the development of an occupational exposure database and surveillance system at the RFETS. This exposure database and surveillance system is designed to provide a simple mechanism for the health and safety personnel to manage their data and identify potential exposure determinants associated with high exposures. The goal of this project is to help practicing health and safety professionals at DOE Cleanup sites in the collection, management, and analysis of site specific data.⁽²⁴⁾

In response to legal and civic concerns, E.G.&G. Records Management developed databases to provide and track information about Rocky Flats. HAI has evaluated the following databases and determined that they are of particular interest to health researchers: the 706 Technical Library database and the United States v. Rockwell Litigation Support System database.

The 706 Technical Library database may be used to search for classified and unclassified site publications maintained by the Library since 1952. These publications include technical, scientific, and process reports either written by Industrial Hygiene personnel or directly relating to Industrial Hygiene issues. The software supporting the database, called ADSEP, is approximately twenty-five years old and is searched on an IBM 3190. Hardcopy printouts from the database are available for review within the Library. Data relating to classified records were last updated in 1992; unclassified record were updated in 1991.

The United States v. Rockwell Litigation Support System Database is located in T334 C. It may be used to search for classified and unclassified records which were seized during the 1989 FBI raid. Researchers should be aware that the database does not contain copies of all of the documents seized by the FBI. The software supporting the system is a copyrighted program designed by the LSI Corporation, located in Golden, Colorado, and is accessed through an IVUE Workstation. The system is not updated.

HAI staff searched for relevant record titles in these two databases by combining keywords with Boolean search terms. The keywords were taken from HAI's records selection criteria (see Appendix B). The databases provided the following number of "hits," or indications that document title(s) with the following term(s) exist in the record collections. Each hit had at least one of the words in the combination of terms. For example, a successful search resulting from the first combination of terms had either "environment" or "environmental monitoring" in the document titles. The 706 Technical Library database can be searched with forms of words. For example, "radioact" can be used to find titles with radioactive and radioactivity. The United States v. Rockwell Litigation Support Service, however, does not have this capability. The first column of numbers are the hits for the 706 Technical Library, the second are the hits for the United States v. Rockwell Litigation Support System Database:

<i>Environment</i>	<i>568</i>	<i>1377</i>
<i>Incidents/Occurrences/Accidents/Safety</i>	<i>906</i>	<i>2310</i>

<i>Medicine/Health</i>	98	3135
<i>Alarm/Body Counter/Dose/Dosage/Dosimet/Film Badge</i>	230	862
<i>Waste/Drum/Tank/Hazardous Material/Materials Handling</i>	1445	3138
<i>Detect/Radioact/Radiat/Beta/Neutron/Gamma/Alpha</i>	214	616

Due to the nature of database search techniques, researchers should not consider HAI's search of the databases to be exhaustive. This is intended to provide an idea of the volume of material available on these particular topics. In addition, the use of the databases are restricted to personnel with specialized training.⁽⁶²⁾

E. Site wide Records Department

The RFETS has a site wide records department which is operated by Kaiser-Hill. The sites' records center is located in Building 441, Room 142, which houses several fire-proof safes where the sites records are stored (approximately 6,000 ft³ .) These records are stored by building or location name, and/or employee name or identification number.

RFETS records are managed in accordance with National Archives Record Administration (NARA) retention schedules. The RFETS Records Management Department ships records to two offsite records storage locations: The first is the Denver Federal Records Center, National Archives and Records Administration, (P.O. Box 25307) Building 48, 5th Street, North Avenue, Denver, CO 80225 which currently stores approximately 10,000 ft³ of the RFETS records. This record center's points of contacts are Mark Ferguson and/or Joel Baker, phone number (303) 236-0804, fax number (303) 236-9297. The second record storage location is the Department of Veterans (VA) Affairs Records Center and Vault (P.O. Box 141), Business Highway 60 North, 11923 Lime Kiln Drive, Neosho, Missouri which currently stores approximately 2,000 ft³ of the RFETS records. The VA point of contact is Ray McClland, Phone number (417) 451-2744, fax number (417) 451-7317.

The records stored at the RFETS in Building 441 today cover all post production work and some production era work as well. The Records Department maintains an ORACLE® database known as Records Management Data Base (RMDB) which covers all site federal records generated by any contractor performing work at the site.

Most of the RFETS departments which supply the records listed below maintain some form of database, with the exception of IH which is still in the process of developing a working database.

Records available at the RFETS Records Center include, but are not limited to:

1. *General Administrative files*
2. *Acquisition and Controller files*
3. *Personnel, Medical and Training files*
4. *Health and Safety Department records*
5. *Security records*
6. *Industrial Hygiene and Radiological Department records*
7. *Fire and Safety Department records*
8. *Standard Operating Procedures (SOP's)*
9. *Production records⁽³⁶⁾*

8.2.13 Discussion of RFETS Exposure Information

Exposure data has typically been difficult to provide for previous NIOSH feasibility studies. All of the 'systems' described in this document constitute the exposure information necessary for further NIOSH studies. It has been found that RFETS chemical and radiological exposure data is available, but summary data is not available for chemical exposures. Summary radiological exposure data is available through the REMS provided by the DOE. For clarification, Kaiser-Hill is the reporting organization of radiological exposures and responsible for forwarding site data to the REMS operated by SAIC. SAIC is the contractor responsible for analysis and reporting of radiological information submitted to the DOE. Unlike radiological information, DOE does not require summary annual reports of chemical exposures and IH routine monitoring.

Kaiser-Hill's Industrial Hygiene Department is the keeper of data and responsible for instituting site IH monitoring. Sub-contractors may develop their own organizational systems (i.e. Safe Sites of Colorado has developed a computerized system), however, Kaiser must ensure all that all monitoring is completed and data is kept. RFETS IH information is available through paper copies and project/facility Industrial Hygienists (POC's are noted at the end of this document). Recently, many DOE sites including RFETS are in the process of converting chemical exposure data to computerized database systems (i.e. Safe Sites of Colorado). The installment of such systems will greatly extend the availability of summary chemical exposure data.

8.3 IDENTIFICATION OF HISTORIC, IN-PROGRESS, AND ANTICIPATED REMEDIATION WORKER GROUP TECHNOLOGIES AT THE RFETS

The basis for the use of advancing technologies at the RFETS is to reduce or eliminate worker radiological and chemical exposure, as well as facilitating the proper disposition of waste from the site. The RFETS is driven by the DOE to develop and utilize a Site Treatment Plan (STP). This living document is designed to identify developing technologies and allow them to be assessed in terms of applicability for the accelerated site clean-up.⁽³⁷⁾

In April 1995, the Proposed Site Treatment Plan (PSTP) was submitted to the CDPHE by the U.S. DOE at the RFETS. This document described the Site's strategy for treating waste. The PSTP was required by the Federal Facility Compliance Act of 1992 (FFC Act) for each DOE site that stores or generates waste. A Compliance Order requiring that the Site implement the PSTP as amended (now referred to as the STP) was signed by DOE and CDPHE in October 1995. This document describes the proposed changes and revisions to the STP LLMW strategy that have resulted from recent developments at the Site and presents a new baseline for achieving the objectives of the Federal Facilities Compliance Agreement (FFCA).

The STP Re-baseline integrates the STP strategy with the overall Site priorities and aligns with the new vision of accelerated site closure. The activities outlined in the approved STP were in many cases inconsistent with the new Site priorities outlined in the RFCA, the Rocky Flats Vision, Integrated Site Baseline (ISB), Rocky Flats Ten-Year Plan, and Accelerated Site Action

Project (ASAP). The STP Re-baseline makes STP implementation activities consistent with the new Site priorities while achieving the goals of reducing treatment and disposal costs and accelerating scheduled completion. The STP Re-baseline will also provide equal degrees of control and protection of human health and the environment.

Closure of the RFETS will involve application of numerous technologies for waste management (WM), environmental restoration (ER), decontamination and decommissioning (D&D), and special nuclear materials (SNM) management. RFETS will monitor ongoing cleanup technology development activities in both the commercial and governmental sectors. As successful demonstrations of technologies are identified, RFETS personnel will evaluate the technology for cost savings or risk reduction at the Site. If the evaluations are favorable, implementation via commercial service contractors or direct site application will be encouraged. High risk activities, largely focused on SNM stabilization and treatment, will be the primary thrust prior to 2006. As that mortgage cost is reduced, ER, WM, and D&D programs will receive additional emphasis. Therefore, SNM stabilization, monitoring, and waste treatment for disposal will have the most near term value. Beyond 2006, the ER program expects to install landfill caps over several disposal sites and ongoing development of advanced landfill covers is expected to provide a substantial risk reduction over conventional technologies. Improved surveying and assay systems will be needed for all D&D activities, but will be especially important to reduce risk to workers and facilitate least cost disposal options.

Improved decontamination technologies will also be important to minimize generated waste. Available technologies are planned for essentially all cleanup activities. However, the opportunity for considerable cost savings and risk reduction is recognized by the Site. RFETS personnel are cognizant of numerous technologies that are under development in commercial and government laboratories. All of these technologies are represented as improvements over conventional methods. RFETS intends to monitor progress in these programs. When successfully demonstrated, their application at the RFETS will be encouraged and facilitated. Table 10.3, page 148, presents technologies for Remediation Workers at the RFETS.⁽³⁸⁾

8.3.1 Programs which identify technology needs:

A. Robotics Crosscutting and Advanced Technology Program

The Robotics Crosscutting and Advanced Technology (CC&AT) program element is designed to address the generic, long-term technology development needs identified within DOE's environmental management efforts. The primary goal of CC&AT is the development of robotics technologies broadly applicable to the EM needs of DOE. All of the technologies and techniques of waste remediation being developed by the CC&AT team are directed at faster, safer, and cheaper ways of performing these tasks.

CC&AT addresses environmental problems severe enough to cause human beings significant risk to their health and safety. These problems are typical at highly contaminated radioactive material processing facilities such as those located at the RFETS and the Savannah River Site. These retired material processing facilities must be cleaned and dismantled to eliminate the high maintenance and monitoring costs that continue, even though the facilities are

no longer operating.

The CC&AT team within the Robotics Technology Development Program (RTDP) develops technologies that are used to support all tank waste retrieval, chemical analysis automation and decontamination and dismantlement task areas.

Common technology needs within RTDP influence the effectiveness of all of the program's technical areas. Responses to long-term technology, research, and development efforts (while interfacing with representatives from industry, universities, and other federal agencies) are essential to CC&AT's continued growth and to the effective dissemination of technology developed under RTDP to the commercial sector.⁽³⁹⁾

B. Research and Development Requirements “Gap” Analysis

Gap analysis supports both near-term (3 to 8 years) and long-term waste stabilization technologies by focusing effort and funding on the research areas that are needed most. By identifying preferred end states and by developing preferred processes which focus on specific requirements, dilution of research effort and funding will be minimized. The gap analysis will result in a single list of research requirements and activities called the Baseline Research and Development Technical Requirements Document.⁽⁴⁰⁾

C. Trade Study on End State of Ash Residues (ESAR)

The Trade Study is intended to identify the best possible technologies for the ash residues issue based on technical considerations. This effort seeks the most desirable pathways(s) to an acceptable end-state, using efficiency, cost, waste, facility capabilities, worker safety and public safety as elements of the preference ranking criteria.

The task is conducted by the Trade Study Group, comprised of members from sites impacted by the study and those persons having interest in its outcome.

The task requires, for each alternative assessed, identification of a process description, facility requirements, equipment requirements, throughput capability, storage location and capacity, surveillance and monitoring activities, transportation requirements, and NEPA requirements.⁽⁴⁰⁾

8.3.2 HW TASK TECHNOLOGIES:

Technology 1: Electrochemical Chlorination

A bench-scale LLMW treatment project utilized to eliminate the cyanide from cyanide-contaminated liquids. After treatment the waste remains LLRW but can now be disposed of at an offsite TSD facility. The electrochemical chlorination technology utilizes 2 workers; a chemical operator and a supervisor outside the area. The electrochemical chlorination project occurred in two parts. Part 1 began on 6/94 and ended on 6/95 and treated 3 drums of waste during a one year duration. Part 2 began on 6/96 and ended on 11/96 and treated 8 drums of waste during a five

month duration. Total number of drums treated over the course of the project were 11 drums in 17 months. PPE utilized for this project included smocks, rubber gloves and eye protection within a HEPA filtered containment area. No advantages or disadvantages with this technology in terms of worker exposure are noted.⁽⁴¹⁾

Technology 2: Mercury Recovery

A bench-scale Mixed Waste treatment project which involves the retort and collection of mercury through various methods, some of which are proprietary. This technology utilizes 2 workers. No time or duration was given for this treatment technology. PPE for this work is smock and gloves under a lab fume hood. No advantages or disadvantages with this technology in terms of worker exposure are noted.⁽⁴¹⁾

Technology 3: Poly Encapsulation

Involves the unpacking and repacking of LLMW drums while adding a binding agent known as Permacon®. This technology will utilize 4 workers; 3 chemical operators and a support operator located outside the work area supplying drums. A one month feasibility study was performed in FY 96 and three months of full scale work are to begin in April of 1997. The PPE utilized included Level B within a HEPA filtered Stainless Steel containment area.

This LLMW has Uranium and Beryllium dusts and fines as it's primary constituents. The bench scale part of this operation was performed by KH employees. A subcontractor, Advanced Intermediate Management Services (AIMS), performed the FY 97 work. No advantages or disadvantages with this technology in terms of worker exposure are noted.⁽⁴¹⁾

Technology 4: Cementation, Organic Treatment and UV Oxidation

Other treatment technologies utilized on the site's reactive excess chemicals include cementation, organic treatment and UV oxidation of Mixed Wastes. These technologies are bench scale and utilize 2 workers; a chemist and a chemist helper. These treatment technologies are employed about one to six times a month, one days worth of work apiece. PPE for these work events varies according to the reactive excess chemical being treated, ranging from a "bomb suit" (Level A-PPE) to smock and gloves under a lab fume hood. No advantages or disadvantages with this technology in terms of worker exposure are noted.⁽⁴¹⁾

Technology 5: Super Critical CO₂ Extraction

Involves driving off VOC's from LLMW drums through dissolving organic contaminants with CO₂ at moderate temperature and high temperature. SCDE is a process that employs a flowing, noncombustible, nontoxic, environmentally safe fluid as a solvent. This technology will utilize 2 workers; 1 chemical operator and a support operator located outside the work area supplying drums. The PPE utilized included Level B within a HEPA filtered Stainless Steel containment area. Full scale operations of this technology are expected if manpower and funding issues are resolved.⁽⁴¹⁾ No advantages are noted, however there may be a potential new hazard to workers: plutonium high fired oxide. Note: As noted by a Rocky Flats representative, the potential for plutonium high fired oxide exposure for this technology is a greater concern than

others listed in this document. High fired oxide becomes a greater concern when the technology runs above 800 degrees C. Most high temperature technologies run between 600 and 800 degrees C. ⁽⁵⁹⁾

Technology 6: Catalytic Chemical Separation

Involves the acid digestion of LLMW, primarily combustibles. This technology will utilize 6 workers; 5 chemical operators and a support operator located outside the work area supplying drums. Feasibility study scale only to date. The PPE utilized included Level B within a HEPA filtered Stainless Steel containment. No advantages or disadvantages with this technology in terms of worker exposure are noted.⁽⁴¹⁾

Technology 7: Burial and Storage of Certain LLMW and LLRW.

Burial and interim storage are the primary past (production era) and present (1997, interim storage only) mixed and low level radiological waste technologies at the RFETS. The numbers of workers necessary to accomplish these technologies is medium at 11 - 75. Descriptive exposure potential involves contact, PPE required, airborne and indoor/outdoor. No advantages with this technology in terms of worker exposure are noted. Disadvantages include continuous surveillance and maintenance and the technology is labor intensive.

Technology 8: High-Temperature Vacuum Distillation Separation of Plutonium Waste Salts.

High-Temperature Vacuum Distillation Separation is a proposed Mixed Waste treatment technology for plutonium-bearing waste salts.

This technology is based on the large difference in vapor pressures at high temperature between most chloride salts that constitute pyrochemical residues and the actinide oxides. However, the plutonium content in these salts is usually a form of plutonium trichloride. Vapor pressure differences between alkali and alkaline earth chlorides and plutonium trichloride are too small to effect a good separation, therefore PuCl_3 must be converted to an oxide through an oxidation process. The number of workers necessary to utilize this technology is not noted. No advantages are noted, however there maybe a potential new hazard: plutonium high fired oxide.⁽⁵⁷⁾ Note: As noted by a Rocky Flats representative, the potential for plutonium high fired oxide exposure for this technology is a greater concern than others listed in this document. High fired oxide becomes a greater concern when the technology runs above 800 degrees C. Most high temperature technologies run between 600 and 800 degrees C. ⁽⁵⁹⁾

Technology 9: Water-Soluble Chelating Polymers For Removal Of Plutonium and Americium From Waste Water

Polymer filtration is a proposed Mixed Waste treatment technology being developed to recover valuable or regulated metal ions selectively from process or waste waters. Water-soluble chelating polymers are specially designed to bind selectively with metal ions in aqueous solutions.

The basis for metal ion separation involves the retention of metal ions bound to the chelating groups of the water-soluble polymer while smaller unbound species and water pass freely through the ultra filtration membrane. The polymer filtration process allows for the selective concentration of dilute solutions of metal ion contaminants. The reduced volume containing the polymer/metal ion complex can go directly to disposal or the metal ions can be recovered by a stripping reaction and the polymer can be recycled for further metal ion recovery. No advantages or disadvantages with this technology in terms of worker exposure are noted. The number of workers necessary to utilize this technology are also not noted.⁽⁴³⁾

Technology 10: Catalytic Chemical Oxidation (Delphi DetoxSM)

The Catalytic Chemical Oxidation (CCO) system is a proposed Hazardous Waste treatment technology that uses the reaction of oxygen, or an alternate oxidizing agent, to destroy the organic constituents of a waste in an aqueous solution. In CCO, one or more chemical species are added to increase the rate at which the oxidation reactions proceed. The CCO system uses both an iron catalyst and co-catalysts to degrade the organics in a strong acid solution. Both solid and liquid wastes can be treated, and most metals are dissolved and concentrated in the reaction solution.

In a Department of Energy (DOE) project sponsored by the Morgantown Energy Technology Center (METC), the application of a CCO technology for soil remediation has been evaluated. Additional studies with other surrogates (non-radioactive) for RFETS wastes, including solid combustibles, are also being conducted. METC is currently sponsoring the development of a field-scale system to be tested at the Savannah River Site. This test will be shakedown testing on hazardous waste and will not be conducted on actual mixed waste. No advantages or disadvantages with this technology in terms of worker exposure are noted. The number of workers necessary to utilize this technology are also not noted.⁽⁴⁴⁾

Technology 11: Low Temperature Thermal Desorption

The Low Temperature Thermal Desorption (LTTD) system is a proposed Mixed Waste treatment technology that will be utilized for treating small volume, solvent contaminated waste streams.

The objectives of the RFETS LTTD effort is to desorb and separate the hazardous contaminants, which are separated from the mixed wastes by heating the materials to temperatures from 100°C to 287°C, depending on the waste matrix. Further pilot to full-scale development and demonstration efforts took place FY 96 and FY 97 in support of the RFETS Treatment Plan. The RFETS became part of this development process when the RFETS conducted treatability studies on Rocky Flats RCRA waste in October 1993. No advantages or disadvantages associated with the use of this technology in terms of worker exposure are noted. The number of workers necessary to utilize this technology are also not noted.⁽⁴⁴⁾

Technology 12: Transient Infrared Spectroscopy (TIRS)

Transient Infrared Spectroscopy (TIRS) is a proposed noncontact, on-line analysis technique for process streams of solid or viscous-liquid Mixed Waste material. TIRS provides a real-time chemical (molecular) analysis of the process stream produced by the polyethylene microencapsulation process. Polyethylene microencapsulation is an alternative promising waste immobilization technology being actively developed at the RFETS. Polyethylene microencapsulation can produce a stable waste form containing up to 65% (by weight) waste. The monitor provides data that will guide the waste process operators in their control of the encapsulation, will document the processed waste composition for certification purposes, and will provide a record of the processed waste should questions or problems later arise. The monitor works automatically, without contacting the waste stream (except with air), so there is no secondary waste, no worker exposure, and little worker time required. Advantages relative to worker exposures include limited contact. No disadvantages associated with the use of this technology in terms of worker exposure are noted. The number of workers necessary to utilize this technology are not noted. ⁽⁴⁵⁾

Technology 13: Ceramification For Stabilization and Immobilization of Plutonium-Containing Compounds

Ceramification, a proposed Mixed Waste treatment technology, is a new plutonium stabilization/immobilization process under development at the RFETS. Ceramification, which is based on a coating process proven in weapons applications, is appropriate for the stabilization and immobilization of plutonium solutions, plutonium oxides, and some other respirable and dispersible plutonium compounds (i.e., residues). In the process, these plutonium compounds are converted into solid plutonium oxide articles appropriate for low-risk, interim storage requiring minimal surveillance. Portions of this process are proprietary and are not presented in detail.

Ceramification eliminates or reduces the dispersion of plutonium compounds and significantly reduces safety requirements and risks of interim storage and transport. A non dispersible product reduces potential contamination of facilities, equipment, and personnel during material handling. Ceramification produces articles with high waste loading and little or no volume increase. Achievable plutonium loadings in the solid article are estimated at more than 80% plutonium oxide. Final articles are homogeneous. Ceramification is carried out at low process temperatures (300^o to 600^oC). Full-scale processing times have ranged from one to three hours in batch tests. As a disadvantage, there may be a potential new hazard to workers: plutonium high fired oxide, however there was no available documentation on this disadvantage. The number of workers necessary to utilize this technology are not noted. ⁽⁴⁰⁾

Technology 14: Salt Distillation

Distillation separation is a proposed Mixed Waste treatment technology which is based on the large difference in vapor pressures at high temperature between chloride salts, which constitute most pyrochemical residues, and the actinide oxides. The 16 metric tons (MT) of pyrochemical salts at the RFETS contain about 1 MT of plutonium. Eleven MT of these salts are composed of a sodium chloride-potassium chloride matrix. The remainder consists of a calcium

chloride matrix. DOE has committed to mitigate the problems associated with 6 MT of high-hazard pyrochemical salts at the RFETS by May 1997, and an additional 4 MT by December 1997. These residues may pose a safety risk if the reactive metals in the residues come into contact with water, creating hydrogen gas that could cause container pressurization. Even if no hazard from reactive metals is present, these salts can adsorb moisture from the atmosphere, resulting in corrosion and breach of containment. The full 16 MT inventory is to be made safe by May 2002. In addition to mitigation of hazards, these residues must also be made acceptable for eventual disposal. An additional 2 tons of these salt residues exist at Los Alamos and require stabilization by May 2002. No advantages are noted, however there may be a potential new hazard to workers: plutonium high fired oxide. The number of workers necessary to utilize this technology are not noted. ⁽⁴⁰⁾ Note: As noted by a Rocky Flats representative, the potential for plutonium high fired oxide exposure for this technology is a greater concern than others listed in this document. High fired oxide becomes a greater concern when the technology runs above 800 degrees C. Most high temperature technologies run between 600 and 800 degrees C. ⁽⁵⁹⁾

Technology 15: Pyrochemical Salt Oxidation

Pyrochemical Salt Oxidation is a proposed Mixed Waste treatment technology utilized to treat spent pyrochemical salts in order to mitigate all safety concerns regarding interim on-site storage. Another goal of this project will be to develop a process to chemically oxidize and to stabilize crucibles for safe, interim storage. No advantages or disadvantages associated with the use of this technology in terms of worker exposure are noted. The number of workers necessary to utilize this technology are not noted. ^(40, 42)

Technology 16: Pyrolysis

Pyrolysis, a proposed Mixed Waste treatment technology, is a pyrochemical technique that uses a high-temperature, chemically inert environment to break down and volatilize polymeric materials. The pyrolysis system will destroy the matrix of the polymer, allowing its decomposition products to be removed as a gas. The remaining material containing the radionuclides will be reduced significantly in both mass and volume, and will be in a form suitable for long-term storage, cementation, or subsequent actinide recovery. The pyrolysis system will be tailored specifically for the glove box environment and will be designed to minimize the formation of organic liquids. The pyrolysis system will also incorporate a series of downstream technologies to treat the off-gas decomposition products, allowing the process to operate in compliance with environmental regulations. Advantages in terms of worker exposures associated with this technology include the minimization of the formation of organic liquids, and consistency with air quality concerns. As a disadvantage, there may be a potential new hazard: plutonium high fired oxide, however no documentation was available on this disadvantage. The number of workers necessary to utilize this technology are not noted. ^(40, 42)

Technology 17: Mediated Electrochemical Oxidation (MEO)

A proposed Mixed Waste treatment technology for the treatment of combustible waste

and for the removal of surface contamination from selected matrices. This technology has the capability of destroying the organic component and recovering the radioactive component of selected mixed wastes. For example, it has been shown that chlorinated hydrocarbons, such as tetrachloroethylene, carbon tetrachloride, and chloroform, can be converted very efficiently to carbon dioxide at room temperature. However, other organic materials like polypropylene and polyethylene are fairly inert. MEO, as a room-temperature process, would be an ideal technology for the treatment of a waste such as the full-flow filters that are contaminated with carbon tetrachloride and plutonium. Treatment with the MEO process would convert the carbon tetrachloride to carbon dioxide, dissolve the plutonium for subsequent recovery by standard recovery procedures, and leave the filters free of both organic and radioactive contamination - in other words, suitable for compaction and disposal. No advantages or disadvantages associated with the use of this technology in terms of worker exposure are noted. The number of workers necessary to utilize this technology are not noted.⁽⁴²⁾

Technology 18: Microwave Vitrification of Mixed Wastes And Residues

Currently, many metric tons of high activity residue materials are being stored at the RFETS in sub-standard forms. The list of stored residues include sludge, sand/slag/crucible from foundry operations, incinerator ash, oxides, pyrochemical salts, and a variety of other inorganic materials. These materials are found throughout the DOE complex, making the problem common to numerous sites and programs.

Microwave Vitrification is a proposed Mixed Waste treatment technology that would be appropriate for many residue waste forms. Preliminary scoping studies indicate that this technology could successfully treat 80% of the residue inventory at the RFETS. The process uses microwave energy to heat and vitrify waste materials. Microwave vitrification is an innovative technology for the vitrification of inorganic mixed and high activity wastes. It produces a durable, leach-resistant final form that meets DOT requirements and is ideal for interim storage. The microwave vitrification system is a flexible heat source that is readily adaptable to other applications such as drying and calcination.

The final waste form produced by microwave vitrification is a glass or mineral-like monolith that does not contain free-liquid or release able particulate, and is highly leach resistant. It is extremely robust and is especially suited for hazardous and mixed wastes. The microwave vitrified waste form meets all criteria for shipment and disposal at either the NTS or the WIPP. Advantages of this technology in terms of worker exposure include lowered radiation exposures to workers due to remote treatment processing. No disadvantages associated with the use of this technology in terms of worker exposure are noted. The number of workers necessary to utilize this technology are not noted.⁽⁴²⁾

Technology 19: Polymer Microencapsulation

The RFETS has several low-level mixed waste streams containing high concentrations of salts (primarily chlorides, nitrates, sulfates, and fluorides). These wastes need to be stabilized to meet EPA, DOT, and disposal site requirements prior to shallow land burial. The need to stabilize low-level mixed salts to meet regulatory requirements is a problem that is common to

many DOE sites throughout the complex. Over the last several years, the RFETS has demonstrated that encapsulation of high salt and ash wastes in a polymer matrix produces durable, leach resistant waste forms with relatively high waste loadings (30 to 80 percent).

Polymer Microencapsulation is a Mixed Waste treatment technology that utilizes two classes of polymers, thermosetting and thermoplastic, to treat a variety of mixed waste streams, including evaporator concentrate salts, sludge, incinerator ash, ion exchange resins, blowdown solutions, and molten salt oxidation residuals.

Thermoplastic polymers such as polyethylene (a commonly-used plastic that is resistant to chemicals and moisture) are combined with dried waste in a commercially available twin screw extruder, which melts the polyethylene and mixes it with the waste. The waste encapsulated in polyethylene is extruded into a drum, where it solidifies upon cooling. The process operates at a low temperature, requires no off gas treatment, and generates no secondary waste. Since high loadings of waste may be incorporated into the polymer, a substantial reduction in volume may be possible relative to cementation, which is the baseline technology. Production scale use of this technology is scheduled to begin in FY 2003 and end in FY 2019, processing approximately 1,500 cubic meters of waste. Advantages of this technology in terms of worker exposure include less worker exposure due to the fact that no secondary waste stream is generated. No disadvantages associated with the use of this technology in terms of worker exposure are noted. The number of workers necessary to utilize this technology are not noted. ⁽⁴⁶⁾

Technology 20: Extraction Chromatography

Plutonium purification and processing operations produce aqueous effluent streams containing americium-241 and a small fraction of plutonium.

The Extraction Chromatography processes is a proposed Mixed Waste treatment technology that will treat aqueous effluent streams at the source, in order to selectively extract actinide elements. Chromatographic treatment of these effluents offers actinide extraction advantages, including chemical specificity, moderately high loading capacity, multistage character, and rapid kinetics. Successful implementation will effect a separation of the effluent stream into a small volume of high-actinide concentration and the original aqueous effluent stream, now decontaminated of most alpha activity. The concentrated actinides will be recovered in relatively pure form suitable for vault storage, additional recovery operations, or disposition. Downstream treatment operations on the aqueous effluents will be simplified and made less hazardous due to the reduction of radioactivity. Advantages associated with the use of this technology in terms of worker exposures include reduction in activity levels, hazards, and exposures associated with storage and handling of the final solid waste types generated. No disadvantages are noted. The number of workers necessary to utilize this technology are not noted. ⁽⁴⁰⁾

8.3.3 DE TASK TECHNOLOGIES:

Technology 21: Multisensor Inspection and Characterization Robot for Small Pipes (MICROSPI)

Multisensor Inspection and Characterization Robot for Small Pipes (MICROSPI) is a proposed Mixed Waste technology capable of inspecting pipes for radiation (alpha, beta, gamma), organics (solvents and PCBs), and metals (mercury, lead, arsenic, etc.), and capable of determining and mapping the locations of unknown pipes. This system is in an early stage of development. The product of this effort will be a semi-autonomous device with onboard miniature sensors and a remote operator interface with integrated data system. This system will operate in both a moving, survey mode and a stationary, detailed-analysis mode. Advantages in terms of worker exposures associated with the utilization of this technology include:

1. Reduced time to perform overall D&D, both during characterization and remediation
2. Improved waste segregation since accurate characterization allows appropriate level of planned work effort for different types of contamination
3. Minimized airborne and localized spread of contaminants released by opening pipes and sampling
4. Eliminates the need for D&D, if no contamination is detected

No disadvantages in terms of worker exposures associated with the utilization of this technology are noted. The number of workers necessary to utilize this technology are estimated to be low, less than 10. ⁽⁵⁸⁾

Technology 22: Baseline decontamination technologies

Baseline decontamination technologies are past and present Mixed and Hazardous Waste decontamination technologies that include chemical or electrochemical technique, thermal technique and mechanical cleaning and washing. Advantages in terms of worker exposures associated with the use of these technologies are that they are versatile and easy to control. Disadvantages in terms of worker exposures associated with the use of these technologies include:

1. Generation of airborne contaminants and/or secondary wastes
2. Inefficiencies and expense of labor intensive, time consuming, and costly operations
3. High risk of worker exposure
4. Inability to efficiently decontaminate components having complex geometries or surface irregularities (e.g., welds in steel and concrete cracks and crevices)

The number of workers necessary to utilize these technologies are estimated to be medium at 11 to 75. ⁽⁴⁷⁾

Technology 23: CORPEX™ Nuclear Decontamination Process for the decontamination of plutonium-contaminated facilities and equipment

The CORPEX™ is a proposed Mixed and Hazardous waste nondestructive

decontamination technology that removes only the contaminant and the matrix that fixes the contaminant to the surface; it does not damage the substrate. The chemistry of the cleaning agent is destroyed by the addition of proprietary oxidizers, leaving only water, carbon dioxide, nitrogen gases, and the secondary waste sludge. Advantages in terms of worker exposures associated with the utilization of this technology include reduction of personnel exposure; waste minimization; and the possible free-release of decontaminated components. No disadvantages in terms of worker exposures associated with the utilization of this technology are noted. The number of workers necessary to utilize this technology are estimated to be low, less than 10.⁽⁴⁷⁾

Technology 24: Decontamination of nickel Recyclable Scrap Metal(RSM).

Decontamination of nickel RSM is a proposed Mixed and Hazardous waste decontamination technology. The objective of this task is to develop and successfully demonstrate a technically effective and cost-efficient process to remove and/or reduce the radioactive contamination of nickel. Advantages in terms of worker exposures associated with the utilization of this technology include an alternative to storage and disposal. This technology includes four phases. Phase I involves lab-scale investigation, II includes removing technetium from nickel by bulk and/or surface decontamination techniques, III includes testing the process, and IV involves full scale evaluation of the technology for decontamination. and conversion of RSM to high-value product using a rolling mill for fabrication of recycled metal. Disadvantages in terms of worker exposures associated with the utilization of this technology include a potential IH concern with nickel.⁽⁴⁷⁾ However, RFETS IH due to the mechanical cold cutting methods utilized anticipates no exposure potential above the identified regulatory level.⁽⁶¹⁾ The number of workers necessary to utilize this technology are not noted.

8.3.4 DI TASK TECHNOLOGIES:

Technology 25: Baseline Technologies for Dismantlement.

Baseline Technologies for Dismantlement is a past/present Radioactive Waste treatment technology which utilizes manual and hydraulic tools to cut, shear, lift, and move structural materials and process equipment. These tools include overhead cranes, high-pressure water jets, saws, laser cutters, and plasma and acetylene torches. Advantages of utilizing these technologies in terms of worker exposures include versatility and ease of control. Disadvantages of utilizing these technologies in terms of worker exposures include:

1. Generation of secondary wastes.
2. Require manual intervention/operation.
3. Expose workers to industrial and radiological safety hazards and contaminant.

The numbers of workers necessary to utilize these technologies are estimated to be low to medium.⁽⁴⁷⁾

8.3.5 CW TASK TECHNOLOGIES:

Technology 26: Electrolytic Decontamination

Repackaged containers must be contamination-free for “out-of-line” non production interim storage, and container weld ends must remain hermetically sealed after cleaning. Electrolytic decontamination is designed to decontaminate material containers so that these containers can be released into the laboratory room for handling outside the glove box environment.

Electrolytic decontamination is a proposed Radioactive Waste treatment technology under development for several applications. The original purpose of the technology was to decontaminate equipment and uranium weapons parts for disposal at the RFETS, and it has been successfully demonstrated for these applications. Its potential for providing contamination-free containers as part of an automated system led to the integration of electrolytic decontamination with the Sandia can-out system, a robotic-assisted method for removing filled containers from the glove box. It is also being applied as the means of container decontamination in other projects. Advantages associated with the use of this technology in terms of worker exposures include limited handling by operators during the decontamination process and the minimization of waste generation. This minimizes radiation exposure to personnel. No disadvantages are noted. The number of workers necessary to utilize this technology are not noted.⁽⁴⁰⁾

Technology 27: Plutonium Stabilization and Packaging System Specification Development (PuSPS)

The plutonium Stabilization and Packaging System (PuSPS) is a proposed Radioactive Waste treatment project that is driven by the need for a complex-wide plutonium (Pu) technology for inspecting, disassembling, stabilizing, repacking, and labeling failed Pu product containers. The resulting system will be obtained from one design effort and one procurement package, and yet will meet the needs of each site. This will provide necessary standardization of stabilized materials and reduce the duplication of efforts and costs that would be incurred if individual sites continued development. The standardized stabilizing packaging, labeling and transfer system will simplify handling, accountability, inspection, identification, and transportation. Advantages associated with the use of this technology in terms of worker exposures include ease of inspection and some automated support features will increase safety and reduce personnel exposure. The equipment must be operable under glove box conditions and must stabilize and package material to acceptable standards. No disadvantages are noted. The number of workers necessary to utilize this technology are not noted.⁽⁴⁸⁾

Exhibit 9.1: Major Waste Management Activity Milestones.

ACTIVITY/MILESTONES	
Treatment	Completion Date (Fiscal Year)
Transuranic Mixed and Transuranic Waste	2028
Low-Level Mixed Waste	2025
Disposal	Completion Date (Fiscal Year)
Transuranic Mixed and Transuranic Waste to Waste Isolation Pilot Plant	2039
Pondcrete to Proposed Resource Conservation and Recovery Act Disposal Cell	2003
Low-Level Mixed Saltcrete to Envirocare	2021
Low-Level Mixed and Low-Level Waste to Nevada Test Site	2046
Sanitary Waste to New Sanitary Landfill	2050

Exhibit 9.2: RFETS Contaminantes of Concern by Building*.

Building Number	Main Sources/Operation	Contaminantes of Concern
991/985	UST Air Handling System, Vaults 996, 997 and 999 and Non-Destructive Testing	Beryllium, Plutonium, Americium and Uranium
875	Equipment Decontamination, Nitrate Storage Tanks and Filter Plenum	Benzene, Beryllium, Carbon Tetrachloride, Chloroform, Methylene Chloride, Nitric Acid, 1,1,1- Trichloroethane, Plutonium, Americium and Uranium
883/879	Former Uranium Rolling, Shearing, Blanking/Trepanning and Forming Processes	Beryllium and Uranium
865 and 866	Beryllium Powder work, R&D (Metalworking), Metalography Lab and Grit Blasting	Benzene, Beryllium, Carbon Tetrachloride, Chloroform, Methylene Chloride, Nitric Acid, 1,1,1-Trichloroethane, Plutonium, Americium, Tritium and Uranium
729 and 782	Filter Plenums (No Processes Named)	Plutonium, Americium, Tritium and Uranium
778	Laundry Services	Plutonium, Americium and Uranium
777/776	Machining, Foundry, Special Weapons Projects, Disassembly/Assembly, Cleaning, Solvent Recovery and Radiography	Beryllium, Carbon Tetrachloride, Methylene Chloride, 1,1,1-Trichloroethane, Plutonium, Americium, Tritium and Uranium
774	Organic and Sludge Immobilization System (OASIS)	1,1,1- Trichloroethane, Plutonium, Americium and Uranium
771	Paint Stripping/Application, Shipping/Counting, Plutonium Recovery	Beryllium, Methylene Chloride, Nitric Acid, Plutonium, Americium, Tritium and Uranium
707	Plutonium Casting, Oxidation, Rolling, Briquetting, Storage and Machining, Parts Brazing, Degreasing, Testing and Inspection	Beryllium, Carbon Tetrachloride, 1,1,1-Trichloroethane and Plutonium
561 (559)	Gallium Determination, Emissions Spectroscopy, Uranium Analysis and Plutonium Oxidation	Beryllium, Chloroform, Nitric Acid, Tritium, Plutonium, Americium and Uranium
460	Product Inspection, Parts Cleaning, Non-destructive Testing and Radiography	Carbon Tetrachloride, 1,1,1- Trichloroethane and Chloroform
447/441	Maintenance Operations, Welding, Arc Melt Furnace and Chip Roasting	Beryllium, Methylene Chloride and Uranium
444	Beryllium Machining, Product Plating Lab, Foundry, Uranium Machining, Titanium Stripping, Assembly, Brazing, Welding, Etching and Coating	Beryllium, Nitric Acid and Uranium
374	Waste Receiving and Neutralization	Beryllium, Chloroform, Methylene Chloride, Nitric Acid, 1,1,1- Trichloroethane, PCE, Plutonium, Americium and Uranium
371	Plutonium Operations, Chemical, Standards and Support Labs and Maintenance Operations	Beryllium, Nitric Acid, Plutonium, Americium and Uranium

Exhibit 9.3: RFETS Waste Types and Volume

Waste Type	Volume
Transuranic Waste: Without regard to source or form, waste that is contaminated with alpha-emitting TRU radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay.	1,449 m ³
Low-Level Mixed: Waste that contains both hazardous waste subject to RCRA and source, special nuclear, or byproduct material subject to the Atomic Energy Act of 1954, as amended (42 U.S.C. § 2011 et seq.).	16,439 m ³
Low-Level Radioactive waste: Waste that is not high level waste, spent nuclear fuel, or byproduct material. LLRW is further defined in the Low Level Radioactive Waste Policy Act, codified in 42 U.S.C.A. §§ 2021b (9), and its attendant regulations.	10,672 m ³
Hazardous Waste: is defined under RCRA, its implementing regulations in 40 CFR Parts 260 to 279, and corresponding state regulations. A material is a hazardous waste under RCRA only if it meets the definition of a solid waste. A solid waste is considered to be hazardous if it is either listed in the regulations as a hazardous waste or exhibits a characteristic of corrosivity, ignitability, reactivity, or toxicity.	1,338 m ³
Sanitary Waste : meets the definition of a solid waste and is not hazardous waste under RCRA	240,480 m ³
Low-Level Radioactive Asbestos waste: Low level radiological waste, as defined above, where TSCA regulated asbestos exists as a primary component.	41 m ³
Low-Level Radioactive PCB waste: Low level radiological waste, as defined above, where TSCA regulated PCB's exists as a primary component.	71 m ³
Special Nuclear Material: Plutonium, uranium enriched in the isotope 233 or in the isotope 235, any other material artificially enriched by these materials, and any other materials identified by DOE or the NRC, as stated in AEA § 2014 (aa).	12.9 metric tons of plutonium and 6.7 metric tons of highly enriched uranium
TRU Materials: Elements that have an atomic number greater than 92 (uranium), including neptunium, plutonium, americium, and curium.	Not Reported
Transuranic Mixed: RCRA mixed waste, as defined above, where the radioactive component is TRU waste, also as defined above.	1,468 m ³

Exhibit 9.4: Additional Chemical Contaminants of Concern at the RFETS.

Chemical Name	1988-89 Inventory Quantity (kg)
Acetic Acid	138
Acetone	508
Carbon tetrachloride	7,058
Caustic potash	1,315
Caustic soda	1,066
Chlorine	*NR
Chromium acid	2
Chromium	1
Chromium oxide	4
Chromium oxide	*NR
Cyclohexane	108
Ethylene glycol	692
Freon 113	2,006
Freon 12	1,312
Freon 22	*NR
Freon 502	358
Hydrochloric acid	1,272
Hydrofluoric acid	41
Hydrogen peroxide	1,836
Isopropanol	693
Mercury	4
Methanol	333
Nitric acid	52,624
Nitrous oxide	10
Phosphoric acid	2,443

Exhibit 9.4 (Continued): Additional Chemical Contaminants of Concern at the RFETS.

Chemical Name	1988-89 Inventory Quantity (kg)
Sodium chromate	47
Sodium hydroxide	14,511
Sodium nitrate	2,472
Sodium nitrite	46
Sulfuric acid	7,043
Toluene	93
1 1 1-Trichloroethane	1,749
Trichloroethylene	140
Xylene	98

*NR denotes Not Reported

Exhibit 9.5: Contractor Full-time Equivalent (FTE) Composition at the RFETS*

LABOR CATEGORY	CONTRACTOR FTEs						TOTAL FTEs		
	DIRECT			INDIRECT					
	1996	1997	1998	1996	1997	1998	1996	1997	1998
Crafts	150	178	178	149	119	119	299	297	297
Laborers and Other General Workers	117	139	139	115	91	91	232	230	230
Operators	154	185	185	154	124	124	308	309	309
TOTAL	421	502	502	418	334	334	839	836	836

* The projections for Full-time Equivalent employees are based on FY 1996 planning baselines
 Direct denotes: First tier contractors's Indirect denotes: Second and subsequent tier contractors's

Exhibit 9.6: Hourly-Paid Employees Affected by the Kaiser-Hill/USWA Bargaining Agreement and Number of Workers/Yr: 1990-1996.

Classification	Number of Workers/Yr. 1990-1996						
	'90	'91	'92	'93	'94	'95	'96**
Carpenters	61	55	51	41	33	36	34
D&D Skilled Trade Worker	These are newly created classifications for 1996 Labor Relations Agreement						32
D&D Hazardous Reduction Technician							12
D&D Utility Worker							0
Electricians	117	161	179	101	86	85	80
Engineering Technicians	168	20				27	100
Equip Operators	6	5	7		3	5	
Handlers/Laborers/Helper	4		2	127	60	69	8
Machinists & Machine Setup/ Operators	237+	255	256	210	78	60	38
Mechanics/Repairers	1	55	59	21	1		
Misc. Technicians	323	240	276	276	354	247	98
Misc. Precision Production	517&	123	134&	23	9	2	214
Operators, Plant/System Utilities	243&	412	445	27	4	3	130
Painters*	61	53	58	45	35	28	23
Pipe Fitters*	144	117	117	100	81	80	63
Radiation Monitors/Techs	284	280	1	313	365	311	
Mission Support Specialist I*	These are newly created classifications for 1996 Labor Relations Agreement						64
Mission Support Specialist II*							41
Mission Support Specialist III*							34
Science Technicians	138	132	156	244	233	218	
Sheet Metal Workers	96+	93	90	36	25	26	
Truck Drivers	41	38	44	40	27	28	
Welders and Solders	36	26	25	20	6	2	

* Falls under the classification of Mission Support Specialist. These include the jobs of Filter Technologist, Facility Remediation and Waste Technologist and Waste Certification Inspector

** The entries for 1996 were compiled from “Exhibit 9.8: Horly-Paid Employees Represented by the Kaiser-Hill/USWA Bargaining Agreement Depicting the Number of Workers/First Tier Contractors, 1997”. Following is a listing of the classifications from this document and the classifications which were combined thought best match criteria. In some cases were two or more of these classifications combined into one. Classifications with exact matches will be listed separately.

Exhibit 9.8	Exhibit 9.6
D&D Utility Worker and Utility Worker	to D&D Utility Worker
Lineman Electician and Electrician	to Electricians
Stationary Operating Engineer	to Engineer
Maintenance Filter Technologist	to Engineering Technician
General Laborer	to Handlers/Laborers/Helper
Maintenance Machinist	to Machinist
Risk Reduction Technician and Non Destructive Testing (Lab) Technologist	to Misc. Technicians
Process Specialist	to Misc. Precision Production
Experimental Operator, Waste Water Treatment Operator and Stationary Operating Engineer	to Operators, Plant/System, Utilities

The **Carpenter, Painter and Pipefitter** classifications directly relate to one another

+ Combined EG&G and Precision Forge numbers as presented in DOE REM Database.

& Combined EG&G and RMM Group as presented in DOE REM Database.

Exhibit 9.7: PPE Selection Criteria at the RFETS as of December 1997

LEVEL	EQUIPMENT RECOMMENDED:	EQUIPMENT OPTIONAL:	PROTECTION PROVIDED:	SHOULD BE USED WHEN:	LIMITING CRITERIA
A	<ul style="list-style-type: none"> - Self-contained breathing apparatus (SCBA). - Chemical suit. - Chem-resistant gloves. - Chem-resistant boots. 	<ul style="list-style-type: none"> - Cooling Unit. - Coveralls. - Long cotton underwear. - Disposable gloves and boot covers. 	<ul style="list-style-type: none"> - Highest available level of protection. 	<ul style="list-style-type: none"> In presence of - Chemicals - Atmospheric vapors, gases, or particulates. - Poorly ventilated areas. 	<ul style="list-style-type: none"> - Suit materials must be compatible to substances involved.
B	<ul style="list-style-type: none"> - SCBA. - Chemical resistant clothing (coveralls, jacket). - Chem-resistant gloves. - Chem-resistant boots. - Hard hat. - Two-way radio. 	<ul style="list-style-type: none"> - Coveralls. - Disposable gloves and boots. - Face shield. - Long-cotton underwear. 	<ul style="list-style-type: none"> - Same as A, but with less skin protection. It is the minimum level recommended for initial entries until hazards have been further identified. 	<ul style="list-style-type: none"> - In atmospheres identified requiring high respiratory protection, but less skin protection. 	<ul style="list-style-type: none"> - Use only when atmosphere is not suspected of containing high concentrations of vapors or gases. - Not to be used where contact with gases or particulates may affect the skin, or where chemical splashes may occur.
C	<ul style="list-style-type: none"> - Full face mask with air-purifying canister. - Chemical resistant clothing (coveralls, jacket). - Chem-resistant gloves. - Chem-resistant boots. - Hard hat. - Two-way radio. 	<ul style="list-style-type: none"> - Coveralls. - Disposable gloves and boots. - Face shield. - Long-cotton underwear. - Escape mask. 	<ul style="list-style-type: none"> - The same skin protection as B, but less respiratory protection. 	<ul style="list-style-type: none"> - In atmospheres where air contaminants have been identified, concentrations measured, and a canister is capable of removing the contaminant. - Also, that air contaminants or splashes will not adversely affect exposed skin. 	<ul style="list-style-type: none"> - Atmospheric chemicals must not exceed IDLH levels. - The atmosphere must contain at least 19.5% oxygen.
D	<ul style="list-style-type: none"> - Coveralls. - Safety boots and shoes. - Safety glasses. or chemical splash goggles. - Hard hat. 	<ul style="list-style-type: none"> - Gloves. - Escape mask. - Face shield. 	<ul style="list-style-type: none"> - No respiratory protection. - Minimal skin protection. 	<ul style="list-style-type: none"> - The atmosphere contains no known hazards. - Work functions preclude splashes, immersions, and potential for unsuspected inhalation or contact with hazardous chemicals. 	<ul style="list-style-type: none"> - This level should not be worn in the Exclusion Zone. - The atmosphere must contain at least 19.5% oxygen.

Exhibit 9.9 A: Rocky Flats Historical Operable Units, IHSS's and Contaminants of Concern as of November, 1994^①

OU Number (Name)	IHSS #'s	Contaminants of Concern (C of C's)
OU1 (Hill side 881)	102, 103, 104, 105.1-.2, 106, 107, 119.1-.2, 130 and 145	VOCs, PCBs, PAHs, and RAD (Pu)
OU2 (903 Pad, Mound, and East Trenches Area)	108, 109, 110, 111.1-.8, 112, 113, 140, 153, 154, 155, 183 and 216.2 and .3	VOCs, Metals, Sanitary Waste (sewage sludge and effluent), and RAD (Pu, U and Am)
OU4 (Solar Evaporation Ponds)	101	Nitrates, metals, solvents, and RAD (Pu and U)
OU5 (Woman Creek Drainage: including surface water, stream sediments, soil)	115, 133.1-.6, 142.10, 142.11, 196 and 209	PAHs, PCBs, oil, beryllium, solvents, paint thinner, pesticides, RAD (DU and Ra) and nonradioactive chemical wastes.
OU6 (Walnut Creek)	141, 142.1-.9, 142.12, 143, 165, 166.1-.3, 167.1-.3 and 216.1	Metals, PCBs, VOCs, RAD (Pu, U, Am and Sr) and nitrates
OU7 (Landfill)	114 and 203	Tritium, Metals, VOCs, Semi-VOC's, asbestos, RAD (Pu)
OU8 (700 Area)	118.1,118.2, 123.1, 123.2, 125, 126.1, 126.2, 127, 132, 135, 137, 138, 139.1, 139.2, 144, 146.1-.6, 149, 150.1-.8, 1551, 159, 163.1-.2, 172, 173, 184 and 188	VOCs,RAD (Pu, U and Am), solvents including carbon tetrachloride and benzene,oils, metals, nitrates, acids and bases
OU9 (Original Process Waste Lines)	121	Nitrates, acids, caustics, RAD
OU10 (Outside Closures)	124.1-.3, 129, 170, 174a and b, 175, 176, 177, 181, 182, 205, 206, 207, 208, 210, 213 and 214	VOCs, RAD (Pu and U), metals, acids,halogenated and non halogenated solvents, cyanide, petroleum products
OU11 West Spray Field	168	Nitrates, other wastes
OU12 (400/800 Area)	116.1-.2,120.1-.2, 136.1-136.3, 147.1-.2, 157.2, 187 and 189	RAD (U and Pu), VOCs, other organics nitrates, sulfates, metals, acids, beryllium, lithium, hydrogen peroxide and chlorinated solvents
OU13 (100 Area)	117.1-.3, 122, 128, 134, 148, 152, 157.1, 158, 169, 171,186, 190 and 191	Organics, RAD (U and Pu), lithium, oils, nitrates, fuel oil, acids, caustics, and metals
OU14 (Radioactive Sites)	131, 156.1-.2, 160, 161, 162 and 164.1-3	VOCs, RAD and metals
OU15 (Inside Building Closures)	178, 179, 180, 204, 211, 212, 215 and 217	Potential Hazardous Materials included: waste oil, 1,1,1- trichloroethane, chlorinated solvents, VOCs, beryllium and RAD (Pu, U and Ra)
OU16 (Low -Priority Sites or NFA sites)	185, 192, 193, 194, 195, 196 and 197	Metals, Semi-VOC's, VOCs, RAD

^① From U.S. DOE Fact Sheet, Operable Units at Rocky Flats, November 1994

Exhibit 9.8: Hourly-Paid Employees Represented by the Kaiser-Hill/USWA Bargaining Agreement Depicting the Number of Workers/First Tier Contractors, 1997.

Classification	Number of Workers/Contractor, 1997				
	RMRS	SSOC	DynCorp	Kaiser-Hill	Total
Carpenter	9	12	12	1	34
Risk Reduction Technician	1	56	4	15	76
Electrician	6	43	21	0	70
General Laborer	1	1	6	0	8
Non-Destructive Testing(Lab)Technologist	0	0	22	0	22
Sheetmetal Worker	4	13	7	0	24
Waste Water Treatment Operator	5	0	0	0	5
Utility Worker	2	15	31	1	49
D&D Skilled Trade Worker	31	1	0	0	32
D&D Hazardous Reduction Technician	11	0	0	1	12
D&D Utility Worker	0	0	0	0	0
Primary Operating Engineer	12	73	26	0	111
Experimental Operator	0	14	0	0	14
Lineman Electrician	0	0	9	1	10
Maintenance (Filter) Technologist	1	4	93	2	100
Maintenance Machinist	1	27	10	0	38
Mission Support Specialist I	0	13	43	8	64
Mission Support Specialist II	24	3	14	0	41
Mission Support Specialist III	0	0	34	0	34
Process Specialist	76	133	4	1	214
Painter	3	11	9	0	23
Pipefitter	7	29	26	1	63
Radiological Control Technician	71	177	12	38	298
Totals	265	625	383	69	1342

Information Provided by Chris Keese of Kaiser- Hill Human Resources Department (303) 966- 3485 this information is reported monthly to the contractors listed on this table.

Exhibit 9.9 B: Rocky Flats, Buffer Zone Operable Unit^②, IHSS's and Contaminants of Concern as of July 19, 1996

OU Number (Name)	IHSS #'s	Contaminants of Concern (C of C's)
Former OU1 (Hill side 881)	102, 103, 104, 105.1-2, 106, 107, 119.1-2, 130 and 145	VOCs, PCBs, PAHs, and RAD (Pu)
Former OU2 (903 Pad, Mound, and East Trenches Area)	108, 109, 110, 111.1-8, 112, 113, 140, 153, 154, 155, 183 and 216.2 and .3	VOCs, Metals, Sanitary Waste (sewage sludge and effluent), and RAD (Pu, U and Am)
Former OU5 (Woman Creek Drainage: including surface water, stream sediments, soil) except IHSS's #'s 115 and 196	133.1-6, 142.10, 142.11 and 209	PAHs, PCBs, oil, beryllium, solvents, paint thinner, pesticides, RAD (U and Ra) and nonradioactive chemical wastes.
Former OU6 (Walnut Creek) except IHSS's #'s 143 and 165	141, 142.1-9, 142.12, 166.1-3, 167.1-3 and 216.1	Metals, PCBs, VOCs, RAD (Pu, U, Am and Sr) and nitrates
Former OU7 (Landfill)	114 and 203	Tritium, Metals, VOCs, Semi-VOC's, asbestos, RAD (Pu)
Former OU10 (Outside Closures) Except IHSS's #'s 170 and 174a and b.	124.1-3, 129, 175, 176, 177, 181, 182, 205, 206, 207, 208, 210, 213 and 214	VOCs, RAD (Pu and U), metals, acids,,halogenated and non halogenated solvents, cyanide, petroleum products
Former OU11 West Spray Field	168	Nitrates, other wastes
Former OU16 (Low -Priority Sites or NFA sites)	185, 192, 193, 194, 195, 196 and 197	Metals, Semi-VOC's, VOCs, RAD

② Final Rocky Flats Cleanup Agreement, 7/19/1996, Attachment 1, pp. 1-2

Exhibit 9.9 C Rocky Flats, Industrial Area Operable Unit², IHSS's and Contaminants of Concern as of 7/19/1996

OU Number (Name)	IHSS #'s	Contaminants of Concern (C of C's)
Former OU4 (Solar Evaporation Ponds)	101	Nitrates, metals, solvents, and RAD (Pu and U)
Former OU5 (Woman Creek Drainage: including surface water, stream sediments, soil) except IHSS's #'s 133.1-.6, 142.10, 142.11 and 209	115 and 196	PAHs, PCBs, oil, beryllium, solvents, paint thinner, pesticides, RAD (U and Ra) and nonradioactive chemical wastes.
Former OU6 (Walnut Creek) except IHSS's #'s 141, 142.1-.9, 142.12, 166.1-.3, 167.1-.3 and 216.1	143 and 165	Metals, PCBs, VOCs, RAD (Pu, U, Am and Sr) and nitrates
Former OU8 (700 Area)	118.1, 118.2, 123.1, 123.2, 125, 126.1, 126.2, 127, 132, 135, 137, 138, 139.1, 139.2, 144, 146.1-.6, 149, 150.1-.8, 155.1, 159, 163.1-.2, 172, 173, 184 and 188	VOCs, RAD (Pu, U and Am), solvents including carbon tetrachloride and benzene, oils, metals, nitrates, acids and bases
Former OU9 (Original Process Waste Lines)	121	Nitrates, acids, caustics, RAD
Former OU10 (Outside Closures) except IHSS's #'s 124.1-.3, 129, 175, 176, 177, 181, 182, 205, 206, 207, 208, 210, 213 and 214	170 and 174a and b	VOCs, RAD (Pu and U), metals, acids, halogenated and non halogenated solvents, cyanide, petroleum products
Former OU12 (400/800 Area)	116.1-.2, 120.1-.2, 136.1-136.3, 147.1-.2, 157.2, 187 and 189	RAD (U and Pu), VOCs, other organics nitrates, sulfates, metals, acids, beryllium, lithium, hydrogen peroxide and chlorinated solvents
Former OU13 (100 Area)	117.1-.3, 122, 128, 134, 148, 152, 157.1, 158, 169, 171, 186, 190 and 191	Organics, RAD (U and Pu), lithium, oils, nitrates, fuel oil, acids, caustics, and metals
Former OU14 (Radioactive Sites)	131, 156.1-.2, 160, 161, 162 and 164.1-.3	VOCs, RAD and metals
Former OU15 (Inside Building Closures)	178, 179, 180, 204, 211, 212, 215 and 217	Potential Hazardous Materials included: waste oil, 1,1,1, trichloroethane, chlorinated solvents, VOCs, beryllium and RAD (Pu, U and Ra)

²Final Rocky Flats Cleanup Agreement, 7/19/1996, Attachment 1, pp. 1-2

Exhibit 9.10: Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule: Remediation Worker Present/Future Activities

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration	
Rocky Flats	Information obtained from reference material	Cluster 130			
		Deactivation Worker Present/Future Activities	130 Trailer Facilities Deactivation	2003 - 2004	1 yr
			Building 130 Deactivation	2015 - 2016	1 yr
		Dismantlement Worker Present/Future Activities	130 Trailer Facilities Decommissioning	2003 - 2004	1 yr
			Building 130 Decommissioning	2015 - 2016	1 yr
			Cluster 130 Closure	2015 - 2016	1 yr
		Remediate/Contain Inner Buffer Zone			
		Hazardous Waste Worker Present/Future Activities	Remediate/Contain Inner Buffer Zone IHSSs	1997 - 1999	2 yrs
		Infrastructure/Old Landfill (219)			
		Hazardous Waste Worker Present/Future Activities	Close Old Sanitary Landfill (OU5)	2002 - 2014	12 yrs
		Develop/Operate Sanitary Waste Landfill			
		Cleanup Worker Present/Future Activities	Closure New Sanitary Landfill	2005 - 2006	1 yr
			OU7 Landfill Operations	1997 - 2001	4 yrs
			Solid Wastes Landfill Closure	1999 - 2001	2 yrs
		Operate and Maintain LEW/LLMW Storage			
		Cleanup Worker Present/Future Activities	LL/LLM Storage Operations	1997 - 2005	8 yrs
			Storage Facility Operations	1998 - 2006	8 yrs

**Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:
Remediation Worker Present/Future Activities**

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration			
Rocky Flats	Information obtained from reference material	Develop/Operate TRU Waste Storage					
		Hazardous Waste Worker Present/Future Activities	Operate and Maintain Site TRU/TRM Storage	1997 - 2000	3 yrs		
			Develop New TRU Capacity	1997 - 2000	3 yrs		
			TRU Waste Staging/Shipping Facility D&D	2006 - 2007	1 yr		
			Operate TRU Waste Staging/Shipping Facility	1997 - 2003	6 yrs		
			Assay and Characterize TRU/TRUM Waste	1998 - 2007	9 yrs		
		Provide Offsite Waste Disposal					
		Hazardous Waste Worker Present/Future Activities	Provide Waste Disposal Ops Mgmt and Support	1997 - 2007	10 yrs		
			Utilize Offsite Disposal	1997 - 2008	11 yrs		
			Chemical Mgmt, Treatment, Disposal	1997 - 2007	10 yrs		
		Operate and Maintain Waste Treatment					
		Cleanup Worker Present/Future Activities	Operate Waste Water Treatment Process	1997 - 2007	10 yrs		
		Hazardous Waste, Cleanup Worker Present/Future Activities	Operate Residue Treatment Process	1997 - 2003	6 yrs		
		Hazardous Waste Worker Present/Future Activities	Operate LLMW Treatment Process	1997 - 2007	10 yrs		
			Operate TRU Waste Treatment Process	2003 - 2007	4 yrs		

**Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:
Remediation Worker Present/Future Activities**

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration		
Rocky Flats	Information obtained from reference material	Develop Waste Management Projects				
		Hazardous Waste Worker Present/Future Activities	Alternative Liquid Waste Treatment Project	1997 - 2000	3 yrs	
			Misc. Waste Immobilization Capital Project	1997 - 2002	5 yrs	
			Misc. Waste Immobilization System D&D	2007 - 2008	1 yr	
		Develop and Operate Pu Storage Facility				
		Cleanup Worker Present/Future Activities	Upgrade Existing PU Storage Facility	1997 - 2000	3 yrs	
			Operate Existing PU Storage Facility	1997 - 2001	4 yrs	
			Develop/Implement New Pu Storage Facility	1997 - 2001	4 yrs	
			Operate Interim SNM Storage Facility	2001 - 2014	13 yrs	
		Develop Stabilization Capability				
		Cleanup Worker Present/Future Activities	Develop and Implement Process Procedures	1997 - 1998	1.75 yrs	
			Develop PASS Project	1997 - 1998	1.75 yrs	
			Develop SNM Solid Residue Elimination Project	1997 - 1999	2 yrs	
			Develop Liquid Stabilization Process	1997 - 2000	3 yrs	

**Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:
Remediation Worker Present/Future Activities**

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration				
Rocky Flats	Information obtained from reference material	Operate and Maintain SNM Treatment						
		Deactivation Worker Present/Future Activities	Operate Enriched Uranium Decontamination Process	1997 - 1998	2 yrs			
		Cleanup Worker Present/Future Activities	Operate HEUN Process		1998 - 1999	1 yr		
			Operate SNM Liquid Stabilization Process		1997 - 2000	3 yrs		
			Operate SNM Solid Residue Elimination Process		1997 - 2004	7 yrs		
			Operate PU Metal/Oxide Stabilization Process		1997 - 2003	6 yrs		
			Operate PU Processing and Packaging		1997 - 2003	6 yrs		
		Provide SNM Offsite Shipment						
		Cleanup Worker Present/Future Activities	Shipment of U and Pu Pits		1998 - 2002	4 yrs		
			Shipments of SNM		2010 - 2014	4 yrs		
		Cluster 111						
		Deactivation Worker Present/Future Activities	111 Cluster Deactivation		2004 - 2005	1 yr		
		Dismantlement Worker Present/Future Activities	111 Cluster Decommissioning		2004 - 2006	2 yrs		
			Cluster 111 Closure		2006 - 2007	1 yr		
		Cluster 125/441						
		Deactivation Worker Present/Future Activities	125/441 Cluster Deactivation		2004 - 2005	1 yr		
		Dismantlement Worker Present/Future Activities	125/441 Cluster Decommissioning		2004 - 2005	1 yr		
			Cluster 125/441 Closure		2005 - 2006	1 yr		

**Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:
Remediation Worker Present/Future Activities**

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration		
Rocky Flats	Information obtained from reference material	Cluster 221/224				
		Deactivation Worker Present/Future Activities	221/224 Cluster Closure	1997 - 1998	1 yr	
		Hazardous Waste/Cleanup Worker Present/Future Activities	Remediate/Contain 221/224 High Risk IHSS's	2002 - 2003	1 yr	
		Cluster 223				
		Dismantlement Worker Present/Future Activities	223 Cluster Decommissioning	2003 - 2004	1 yr	
			Cluster 223 Closure	2004 - 2005	1 yr	
		Cluster 300/500				
		Deactivation Worker Present/Future Activities	300/500 Cluster Deactivation	2007 - 2008	1 yr	
		Dismantlement Worker Present/Future Activities	300/500 Cluster Decommissioning	2007 - 2008	1 yr	
			Cluster 300/500 Closure	2008 - 2009	1 yr	
		Cluster 331				
		Deactivation Worker Present/Future Activities	331 Cluster Deactivation	2007 - 2008	1 yr	
		Dismantlement Worker Present/Future Activities	331 Cluster Decommissioning	2007 - 2008	1 yr	
			331 Cluster Closure	2008 - 2009	1 yr	
		Cluster 371T				
		Dismantlement Worker Present/Future Activities	371T Cluster Decommissioning	2001 - 2002	1 yr	
			371T Cluster Closure	2001 - 2002	0.2 yrs	

**Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:
Remediation Worker Present/Future Activities**

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration			
Rocky Flats	Information obtained from reference material	Cluster 440					
		Deactivation Worker Present/Future Activities	440 Cluster Deactivation	2006 - 2007	1 yr		
		Dismantlement Worker Present/Future Activities	440 Cluster Decommissioning	2006 - 2007	1 yr		
			440 Cluster Closure	2006 - 2007	1 yr		
		Cluster 442/452					
		Deactivation Worker Present/Future Activities	442/452 Cluster Deactivation	2004 - 2005	1 yr		
		Dismantlement Worker Present/Future Activities	442/452 Cluster Decommissioning	2004 - 2005	1 yr		
			442/452 Cluster Closure	2004 - 2005	1 yr		
		Cluster 444					
		Deactivation Worker Present/Future Activities	444 Cluster Deactivation	2001 - 2003	2 yrs		
		Dismantlement Worker Present/Future Activities	444 Cluster Decommissioning	2002 - 2004	2 yrs		
			444 Cluster Closure	2004 - 2005	1 yr		
		Cluster 460					
		Deactivation Worker Present/Future Activities	460 Cluster Deactivation	2005 - 2006	1 yr		
		Dismantlement Worker Present/Future Activities	460 Cluster Decommissioning	2005 - 2007	2 yr		
			460 Cluster Closure	2007 - 2008	1 yr		

**Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:
Remediation Worker Present/Future Activities**

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration			
Rocky Flats	Information obtained from reference material	Cluster 664					
		Deactivation Worker Present/Future Activities	664 Cluster Deactivation	2007 - 2008	1 yr		
		Dismantlement Worker Present/Future Activities	664 Cluster Decommissioning	2007 - 2008	1 yr		
			664 Cluster Closure	2008 - 2009	1 yr		
		Cluster 690T					
		Dismantlement Worker Present/Future Activities	690T Cluster Decommissioning	2000 - 2001	1 yr		
			690T Cluster Closure	2000 - 2001	1 yr		
		Cluster 750 HAZ					
		Dismantlement Worker Present/Future Activities	750 HAZ Cluster Decommissioning	2007 - 2008	1 yr		
			750 HAZ Cluster Closure	2007 - 2008	1 yr		
		Cluster 850					
		Deactivation/Cleanup Worker Present/Future Activities	B850 Offices and Cafeteria Deactivation	2007 - 2008	1 yr		
		Dismantlement Worker Present/Future Activities	B850 Offices and Cafeteria Decommissioning	2007 - 2008	1 yr		
			850 Cluster Closure	2008 - 2009	1 yr		
		Cluster 891T					
		Dismantlement Worker Present/Future Activities	891T Cluster Decommissioning	1999 - 2000	1 yr		
			891T Cluster Closure	2000 - 2001	1 yr		

**Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:
Remediation Worker Present/Future Activities**

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration			
Rocky Flats	Information obtained from reference material	Cluster 903/905					
		Dismantlement Worker Present/Future Activities	903/905 Cluster Decommissioning	2007 - 2008	1 yr		
			903/905 Cluster Closure	2008 - 2009	1 yr		
		Cluster 904/906					
		Dismantlement Worker Present/Future Activities	904/906 Cluster Decommissioning	2007 - 2008	1 yr		
			904/906 Cluster Closure	2008 - 2009	1 yr		
		Infrastructure/Water/Industrial Zone					
		Dismantlement Worker Present/Future Activities	INFWTI Cluster Decommissioning	2006 - 2007	1 yr		
			INFWTI Cluster Closure	2006 - 2007	1 yr		
		Process Waste Transfer System/Industry					
		Dismantlement Worker Present/Future Activities	PWTS Cluster Decommissioning	2008 - 2009	1 yr		
			PWTS Cluster Closure	2009 - 2010	1 yr		
		Remediate/Contain High Risk IHSSs					
		Hazardous Waste/Deactivation/Cleanup Worker Present/Future Activities	High Rank IHSSs Remediate - Industrial Zone	1998 - 2000	2 yrs		
Remediate Contain Low Risk IHSSs							
Hazardous Waste/Deactivation/Cleanup Worker Present/Future Activities	NA/NFA Justification Low Risk IHSSs Industrial Zone	1998 - 2001	3 yrs				

**Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:
Remediation Worker Present/Future Activities**

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration			
Rocky Flats	Information obtained from reference material	Cluster 207					
		Deactivation/Cleanup Worker Present/Future Activities	207 Cluster Deactivation	2000 - 2001	0.2 yrs		
		Dismantlement Worker Present/Future Activities	207 Cluster Decommissioning	2001 - 2003	0.2 yrs		
			207 Cluster Closure	2001 - 2002	0.2 yrs		
		Cluster 371/374					
		Cleanup Worker Present/Future Activities	Bldg 371/374 SNM Removal	2000 - 2004	4 yrs		
		Deactivation Worker Present/Future Activities	Cluster 371/374 Deactivation	2001 - 2003	2 yrs		
		Dismantlement Worker Present/Future Activities	Cluster 371 - 374 Decommissioning	2002 - 2005	3 yrs		
			Cluster 371/374 Closure	2005 - 2006	1 yr		
		Cluster 371A					
		Dismantlement Worker Present/Future Activities	371A Cluster Decommissioning	1998 - 1999	0.7 yrs		
			371A Cluster Closure	1999	0.2 yrs		
		Cluster 559					
		Deactivation Worker Present/Future Activities	Bldg 559 Deactivation	2003 - 2005	2 yrs		
		Dismantlement Worker Present/Future Activities	Cluster 559 Decommissioning	2004 - 2006	2 yrs		
			559 Cluster Closure	2006 - 2007	1 yr		

**Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:
Remediation Worker Present/Future Activities**

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration			
Rocky Flats	Information obtained from reference material	Cluster 566					
		Deactivation Worker Present/Future Activities	566 Cluster Deactivation	1998 - 1999	0.2 yrs		
		Dismantlement Worker Present/Future Activities	566 Cluster Decommissioning	1999 - 2000	1 yr		
			566 Cluster Closure	2005 - 2006	0.2 yrs		
		Cluster 569					
		Deactivation Worker Present/Future Activities	569 Cluster Deactivation	2005	0.2 yrs		
		Dismantlement Worker Present/Future Activities	569 Cluster Decommissioning	2005	0.7 yrs		
			569 Cluster Closure	2005 - 2006	0.2 yrs		
		Cluster 707					
		Cleanup Worker Present/Future Activities	SNM Removal of B707	1999 - 2003	4 yrs		
		Deactivation Worker Present/Future Activities	Cluster 707 Deactivation	2000 - 2004	4 yrs		
		Dismantlement Worker Present/Future Activities	Cluster 707 Decommissioning	2002 - 2005	3 yrs		
			707 Cluster Closure	2005 - 2006	1 yr		
		Cluster 750					
		Deactivation Worker Present/Future Activities	750 Cluster Deactivation	1997 - 2000	3 yrs		
		Dismantlement Worker Present/Future Activities	750 Cluster Decommissioning	1999 - 2000	0.1 yrs		
			750 Cluster Closure	2000 - 2001	0.2 yrs		

**Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:
Remediation Worker Present/Future Activities**

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration		
Rocky Flats	Information obtained from reference material	Cluster 750 Pad				
		Dismantlement Worker Present/Future Activities	750 PAD Cluster Decommissioning	2000 - 2001	1 yr	
			750P Cluster Closure	2000 - 2001	0.2 yrs	
		Cluster 771/774				
		Cleanup Worker Present/Future Activities	SNM Removal for B771	1999 - 2000	1 yr	
		Deactivation Worker Present/Future Activities	Cluster 771 Deactivation	1998 - 2001	3 yrs	
		Dismantlement Worker Present/Future Activities	Cluster 771 Decommissioning	2000 - 2002	2 yrs	
			771/774 Cluster Closure	2002 - 2004	2 yrs	
		Cluster 771A				
		Deactivation Worker Present/Future Activities	771A Cluster Deactivation	2000 - 2001	0.2 yrs	
		Dismantlement Worker Present/Future Activities	771A Cluster Decommissioning	2001 - 2002	1 yr	
			771A Cluster Closure	2000 - 2001	0.3 yrs	
		Cluster 776/777				
		Cleanup Worker Present/Future Activities	SNM Removal for B776/777	1998 - 2000	2 yrs	
		Deactivation Worker Present/Future Activities	Cluster 776/777 Deactivation	1999 - 2001	2 yrs	
		Dismantlement Worker Present/Future Activities	Cluster 776/777 Decommissioning	2000 - 2003	3 yrs	
			776/777 Cluster Closure	2003 - 2004	1 yr	

**Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:
Remediation Worker Present/Future Activities**

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration	
Rocky Flats	Information obtained from reference material	Cluster 778			
		Deactivation Worker Present/Future Activities	778 Cluster Deactivation	2002 - 2003	0.2 yrs
		Dismantlement Worker Present/Future Activities	778 Cluster Decommissioning	2003	1 yr
			778 Cluster Closure	2003 - 2004	0.2 yrs
		Cluster 779			
		Hazardous Waste/Cleanup Worker Present/Future Activities	Bldg 779 SNM and Hazmat Removal Operations	1997 - 1998	1 yr
		Deactivation Worker Present/Future Activities	Cluster 779 Deactivation	1997 - 1999	2 yrs
		Dismantlement Worker Present/Future Activities	Cluster 779 Decommissioning	1998 - 2001	3 yrs
			779 Cluster Closure	2000 - 2001	0.3 yrs
		Cluster 790			
		Deactivation Worker Present/Future Activities	Radiation Calibration Lab Physical Deactivation	2001 - 2002	0.2 yrs
		Dismantlement Worker Present/Future Activities	Radiation Calibration Lab Decommissioning	2002	0.2 yrs
			790 Cluster Closure	2002 - 2003	1 yr
		Cluster 800A			
		Deactivation Worker Present/Future Activities	Cluster 800A Deactivation	1999 - 2000	0.6 yrs
		Dismantlement Worker Present/Future Activities	800A Cluster Decommissioning	2000 - 2001	1 yr
			800A Cluster Closure	2000 - 2001	0.3 yrs

**Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:
Remediation Worker Present/Future Activities**

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration	
Rocky Flats	Information obtained from reference material	Cluster 881			
		Deactivation Worker Present/Future Activities	Cluster 881 Deactivation	2002 - 2003	1 yr
		Dismantlement Worker Present/Future Activities	Cluster 881 Decommissioning	2003 - 2005	2 yrs
			881 Cluster Closure	2005 - 2007	2 yrs
		Cluster 865/883			
		Deactivation Worker Present/Future Activities	Bldg 865 Deactivation	1998 - 2000	2 yrs
		Dismantlement Worker Present/Future Activities	Bldg 865 Decommissioning	1999 - 2001	2 yrs
			Cluster 865/883 Closure	2001 - 2002	1 yr
		Cluster 886			
		Deactivation Worker Present/Future Activities	Cluster 886 Physical Deactivation	1999 - 2000	1 yr
		Dismantlement Worker Present/Future Activities	Cluster 886 Decommissioning 1999 - 2001, - 2 yrs	1999 - 2001	2 yrs
			886 Cluster Closure	2001 - 2003	2 yrs
		Cluster 910			
		Deactivation Worker Present/Future Activities	910 Cluster Deactivation	2006	0.2 yrs
		Dismantlement Worker Present/Future Activities	910 Cluster Decommissioning 2006, - 0.833 yrs	2006	1 yr
			910 Cluster Closure 2006, - approx. 0.25 yrs	2006	0.3 yrs

Exhibit 9.10 (Continued): Kaiser-Hill/DOE RFFO Ten Year Plan Activities Schedule:

Remediation Worker Present/Future Activities

Facility:	Contact(s)	Category:	Activity Title	Timeline and Duration	
Rocky Flats	Information obtained from reference material	Cluster 964			
		Dismantlement Worker Present/Future Activities	Cluster 964 Decommissioning	2000	1 yr
			Cluster 964 Closure	2000	0.3 yrs
		Cluster 980			
		Dismantlement Worker Present/Future Activities	980 Cluster Decommissioning	2001 - 2002	1 yr
			980 Cluster Closure	2002 - 2003	1 yr
		Cluster 991			
		Cleanup Worker Present/Future Activities	Cluster 991 SNM Removal	1999 - 2000	0.3 yrs
		Deactivation Worker Present/Future Activities	Cluster 991 Deactivation	2000	0.3 yrs
		Dismantlement Worker Present/Future Activities	Cluster 991 Decommissioning	2000 - 2001	1 yr
			Cluster 991 Closure	2001	1 yr
		Process Waste Transfer System Nuclear (PWTSN)			
		Dismantlement Worker Present/Future Activities	PWTSN Cluster Decommissioning	2005 - 2006	1 yr
			PWTSN Cluster Closure	2006 - 2007	1 yr
		Security/Nuclear Production Zone (SECNPZ)			
		Deactivation Worker Present/Future Activities	SECNPZ Cluster Deactivation	2002 - 2003	0.3 yrs
		Dismantlement Worker Present/Future Activities	SECNPZ Cluster Decommissioning	2003 - 2004	1 yr
			SECNPZ Cluster Closure	2003 - 2004	0.5 yrs

Exhibit 9.11: Radiological Reports Available for Public Review Pertaining to the RFETS

Reports	Date
Radiological Control Evaluation, RF Office	August 16 - 20, 1993
Radiological Control Evaluation, RF Field Office	August 22 - 26, 1994
Annual Radiation Doses - Total Effective Dose	1990-1994
Annual Radiation Doses - Deep Dose	1990-1994

① As noted in RFETS EXPOSURE SURVEILLANCE PROJECT, Data Dictionary for Exposure Database. Ref. [C:\rflats\expsurv\ssoc\ssocdb.doc, last revised 14, October, 1997].

Exhibit 9.12a: Collective Deep Dose Equivalent for Monitored DOE and DOE Contractor Employees and Visitors in 1994 at The Rocky Flats Site

Numbers of Monitored Individuals	Numbers of Individuals with Measurable Doses	Collective Dose-Equivalent (Person-rem)	Average Dose Equivalent (mrem) per Individual	Average Dose-Equivalent(mrem) per Individual w/Measurable Doses
5,308	3,657	229	43	63

Exhibit 9.12b: Collective Deep Dose Equivalent (person-rem) for Monitored DOE and DOE Contractor Employees and Visitors from 1989 through 1993 at the Rocky Flats Site

1989	1990	1991	1992	1993
412	145	313	297	250

Exhibit 9.12c: Distribution of Annual Deep Dose Equivalent (person-rem) for Monitored DOE and DOE Contractor Employees and Visitors in 1994 at the Rocky Flats Site - Deep Dose Equivalent (rem)

	No Measurable	meas. <0.10	0.10-0.25	0.25-0.50	0.50-075	Total Persons
Workers	1,646	3,077	456	65	6	5,250
Visitors	5	53	0	0	0	58
Total Persons	1,651	3,130	456	65	9	5,308
Total Person-rem	ND	138	66	21	4	

Exhibit 9.12d Distribution of Annual Deep Dose Equivalent, by Contractor in 1994 at the Rocky Flats Site

Contractor	No Measurable	meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	Total Persons
EG&G Workers	992	2,488	402	65	6	3,953
EG&G Subs Workers	21	31	1			53
J.A. Jones Workers	67	52	26			145
DOE Field Office Subs	93	47				140
Rocky Mountain Management Group	273	105	7			385
Total Persons	1,446	2,723	436	65	6	4,676

1994 Annual Radiation Doses-TEDE (Total Effective Dose Equivalent)

Exhibit 9.12e Collective Total Effective Dose Equivalent for Monitored DOE/DOE Contractor Employees and Visitors

Field Organization	Number of Monitored Individuals	Number of Monitored Individuals with Measurable Doses	Collective Dose-Equivalent (Person-rem)	Average Dose Equivalent (mrem) per Individual	Average Dose-Equivalent(mrem) per Individual w/Measurable Doses
Rocky Flats Office	5,308	3,660	232	44	63
Total DOE	120,754	28,374	1,835	15	65

Exhibit 9.12f Distribution of Annual Total Effective Dose Equivalent by DOE Facility Type in 1994

Facility Type	<Meas.	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1-2	Total Persons
Weapons Fabrications & Testing	1,643	3,073	460	66	6	1	1	5,250
Total in Person -rem	0	138	67	21	4	1	1	0

Rocky Flats ≈ Weapons Fabrications & Testing facility

Exhibit 9.12g Distribution of Annual Total Effective Dose Equivalent by Contractor at Rocky Flat in 1994

Contractor	<Meas.	meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1-2	Total Persons
EG&G Workers	992	2,481	406	66	6	1	1	3,953
EG&G Subs Workers	21	31	1	0	0	0	0	53
J.A. Jones Workers	66	53	26	0	0	0	0	145
DOE Field Office Subs	93	47	0	0	0	0	0	140
Rocky Mountain Management Group	271	107	7	0	0	0	0	385
Total Persons	1,443	2,719	440	66	6	1	1	5,068

Exhibit 9.13: 1990 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-10	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)	
EG&G	370	Engineering Technicians	12	84	24	17	7	9	8	4	1	1	-	1	156	69,569	446	
	0380	Science Technicians	8	77	30	10	8	3	2	-	-	-	-	-	130	22,407	172	
	0383	Radiation Monitors/Techs	50	107	67	33	15	5	4	1	-	1	1	-	234	58,514	250	
	0390	Misc. Technicians	57	175	56	22	7	3	1	1	1	-	-	-	266	36,528	137	
	0610	Mechanics/Repairers	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0642	Carpenters	4	44	11	1	-	-	1	-	-	-	-	-	57	4,694	87	
	0643	Electricians	18	79	14	6	-	-	-	-	-	-	-	-	99	6,725	68	
	0644	Painters	8	43	4	4	-	1	1	-	-	-	-	-	53	5,886	111	
	0645	Pipe Fitter	13	100	24	3	1	1	1	-	-	1	-	-	131	15,870	121	
	0660	Misc. Rep/Const.	-	6	-	1	-	-	-	-	-	-	-	-	7	496	71	
	0681	Machinists	5	127	74	6	3	1	-	-	-	-	-	-	211	21,530	102	
	0682	Sheet Metal Workers	2	66	15	9	2	1	-	-	-	-	-	-	93	10,064	108	

Exhibit 9.13(Continued): 1990 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-10	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)
EG&G	0690	Operators, Plant/System Utilities	18	48	26	7	1	1	-	-	-	-	-	-	83	9,894	119
	0710	Machine Setup/Oper's	2	18	-	-	-	-	-	-	-	-	-	-	18	834	46
	0771	Welders and Solders	3	20	11	2	-	-	-	-	-	-	-	-	33	3,009	91
	0780	Misc. Precision/Production	56	205	120	45	14	6	6	4	1	1	1	-	403	89,596	222
	0820	Truck Drivers	17	21	3	-	-	-	-	-	-	-	-	-	24	1,006	42
	0830	Equip Operators	-	5	1	-	-	-	-	-	-	-	-	-	6	421	70
	0840	Misc. Transport	21	35	5	3	-	-	-	-	-	-	-	-	43	2,945	68
	0850	Laborers/Helper	-	4	-	-	-	-	-	-	-	-	-	-	4	52	13
Precision Forge	0681	Machinists	1	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A
	0682	Sheet Metal Workers	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Exhibit 9.13 (Continued): 1990 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-1	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)
RMM Group	0525	Misc. Service	30	65	5	6	-	-	-	-	-	-	-	-	76	4,670	61
	0690	Oper/Plant/Sys/Utilities	88	50	2	-	-	-	-	-	-	-	-	-	54	1,627	30
	0780	Misc. Precis/Prod.	5	33	14	4	-	2	-	-	-	-	-	-	53	6,362	120
	0524	Janitors	2	2	-	-	-	-	-	-	-	-	-	-	2	64	32

Exhibit 9.13 (Continued): 1991 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-10	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)
EG&G	0110	Manager-Administrator	39	571	193	79	20	14	13	5	1	1	-	-	897	142,509	159
	0160	Engineer	79	487	65	19	4	6	3	-	1	-	-	-	585	48,734	83
	0200	Misc. Professional	48	732	183	89	28	11	18	4	1	-	-	-	1,066	150,930	142
	0370	Engineering Technicians	-	13	5	2	-	-	-	-	-	-	-	-	20	2,211	111
	0380	Science Technicians	1	65	44	10	7	3	2	-	-	-	-	-	131	23,179	177
	0383	Radiation Monitors/Techs	-	126	86	42	13	4	7	-	-	1	1	-	280	66,040	236
	0390	Misc. Technicians	7	155	53	18	5	2	-	-	-	-	-	-	233	25,887	111
	0525	Misc. Service	5	134	27	9	-	1	1	-	-	-	-	-	172	14,101	82
	0610	Mechanics/Repairers	-	47	6	2	-	-	-	-	-	-	-	-	55	3,107	56
	0642	Carpenters	-	43	10	1	-	-	1	-	-	-	-	-	55	5,265	96
	0643	Electricians	2	111	33	11	1	-	2	-	1	-	-	-	159	19,198	121
	0644	Painters	-	35	13	4	-	1	-	-	-	-	-	-	53	5,426	102
0645	Pipe Fitter	-	63	44	7	1	-	1	-	-	1	-	-	117	19,272	165	

Exhibit 9.13 (Continued): 1991 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-10	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)
EG&G	0681	Machinists	-	146	91	11	6	1	-	-	-	-	-	-	255	28,768	113
	0682	Sheet Metal Workers	-	49	30	10	2	2	-	-	-	-	-	-	93	13,299	143
	0690	Oper. Plant/System/Utilities	2	174	117	69	17	9	14	4	3	1	1	-	410	135,978	332
	0771	Welders and Solders	-	13	12	1	-	-	-	-	-	-	-	-	26	2,967	114
	0780	Misc. Precision/Production	3	73	29	15	2	1	-	-	-	-	-	-	120	14,892	124
	0820	Truck Drivers	-	31	6	1	-	-	-	-	-	-	-	-	38	2,776	73
	0830	Equip Operators	-	2	2	1	-	-	-	-	-	-	-	-	5	665	133
	0643	Electricians	2	111	33	11	1	-	2	-	1	-	-	-	159	19,198	121
	0644	Painters	-	35	13	4	-	1	-	-	-	-	-	-	53	5,426	102

Exhibit 9.13 (Continued): 1992 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-1	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)
EG&G	0110	Manager-Admin	82	505	157	61	16	16	7	13	3	-	-	-	762	108,485	142
	0160	Engineer	151	557	64	14	6	4	3	1	1	-	-	-	650	49,872	77
	0200	Misc. Professional	174	816	195	88	23	18	13	3	-	-	-	-	271	32,080	118
	0380	Science Technicians	3	67	59	15	8	2	2	-	-	-	-	-	153	26,884	176
	0383	Radiation Monitors/Techs	-	115	122	45	19	7	8	-	-	1	1	-	318	79,645	250
	0390	Misc. Technicians	5	177	68	19	4	1	1	1	-	-	-	-	271	32,080	118
	0525	Misc. Service	18	135	30	10	-	2	-	-	-	-	-	-	177	14,480	82
	0610	Mechanics/Repairers	11	40	7	1	-	-	-	-	-	-	-	-	48	3,218	67
	0642	Carpenters	4	28	15	3	-	-	1	-	-	-	-	-	47	5,873	125
	0643	Electricians	3	127	31	12	3	-	2	-	1	-	-	-	176	22,179	126
	0644	Painters	2	36	12	7	-	1	-	-	-	-	-	-	56	6,585	118
	0645	Pipe Fitter	1	77	30	6	1	1	-	-	-	1	-	-	116	17,728	153
	0681	Machinists	10	129	94	18	4	1	-	-	-	-	-	-	246	30,381	124
0682	Sheet Metal Workers	4	44	30	8	3	1	-	-	-	-	-	-	86	12,692	148	

Exhibit 9.13 (Continued): 1992 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-10	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)
EG&G	0690	Operators Plant/Sys/ Utilities	4	188	140	60	21	8	14	4	3	1	1	-	441	138,445	314
	0771	Welders and Solderers	-	11	13	1	-	-	-	-	-	-	-	-	25	2,972	119
	0780	Misc. Precision/Prod.	13	70	37	11	1	1	-	-	-	-	-	-	120	13,995	117
	0820	Truck Drivers	-	37	6	1	-	-	-	-	-	-	-	-	44	3,278	75
	0830	Equipment Operators	-	4	2	1	-	-	-	-	-	-	-	-	7	843	120
	0840	Misc. Transport	1	4	-	-	-	-	-	-	-	-	-	-	4	177	44
	0850	Handlers/ Laborers/ Helpers	-	2	-	-	-	-	-	-	-	-	-	-	2	45	23
	0990	Miscellaneous	98	333	49	13	6	4	4	7	1	1	1	-	415	48,341	116
RMM Group	0780	Misc. Precision/Prod.	-	1	-	-	-	-	-	-	-	-	-	-	1	21	21

Exhibit 9.13 (Continued): 1993 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-10	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)
EG&G	0380	Science Technicians	18	155	39	19	12	-	-	-	-	-	-	-	226	31,295	138
	0383	Radiation Monitors/Techs	9	204	76	22	2	-	-	-	-	-	-	-	304	29,126	96
	0390	Misc. Technicians	25	224	25	2	-	-	-	-	-	-	-	-	251	13,557	54
	0610	Mechanics/Repairers	16	5	-	-	-	-	-	-	-	-	-	-	5	198	40
	0642	Carpenters	8	28	5	-	-	-	-	-	-	-	-	-	33	1,852	56
	0643	Electricians	8	90	3	-	-	-	-	-	-	-	-	-	93	3,565	38
	0644	Painters	10	25	9	1	-	-	-	-	-	-	-	-	35	2,829	81
	0645	Pipe Fitter	8	86	5	1	-	-	-	-	-	-	-	-	92	3,985	43
	0660	Misc. Repair/Const.	20	22	3	-	-	-	-	-	-	-	-	-	25	1,076	43
	0681	Machinists	76	97	4	-	-	-	-	-	-	-	-	-	101	4,277	42
0682	Sheet Metal Workers	3	32	1	-	-	-	-	-	-	-	-	-	33	1,512	46	

Exhibit 9.13 (Continued): 1993 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-10	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)
EG&G	0690	Oper/Plant/Sys/Utilities	5	22	-	-	-	-	-	-	-	-	-	-	22	754	34
	0710	Machine Setup/Oper.	1	26	6	-	-	-	-	-	-	-	-	-	32	2,094	65
	0771	Welders & Solderers	3	17	-	-	-	-	-	-	-	-	-	-	17	678	40
	0780	Misc. Precision/Prod	9	14	-	-	-	-	-	-	-	-	-	-	14	498	36
	0820	Truck Drivers	3	36	1	-	-	-	-	-	-	-	-	-	37	1,520	41
	0840	Misc. Transport	1	3	1	-	-	-	-	-	-	-	-	-	4	257	64
	0850	Handlers/Laborers/Helper	12	98	10	6	1	-	-	-	-	-	-	-	115	7,231	63
	0990	Miscellaneous	554	1,015	68	16	3	-	-	-	-	-	-	-	1,103	58,778	53
RMM Group	0990	Miscellaneous	190	359	1	1	-	-	-	-	-	-	-	361	4,077	11	

Exhibit 9.13 (Continued): 1994 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-10	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)
EG&G	0380	Science Technicians	27	117	61	23	4	-	1	-	-	-	-	-	206	27,226	132
	0383	Radiation Monitors/Techn	20	213	116	16	-	-	-	-	-	-	-	-	345	34,602	100
	0390	Misc. Technicians	49	253	47	5	-	-	-	-	-	-	-	-	305	19,400	64
	0525	Misc. Service	1	17	-	-	-	-	-	-	-	-	-	-	17	854	50
	0610	Mechcs/Repairers	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0642	Carpenters	4	24	5	-	-	-	-	-	-	-	-	-	29	1,736	60
	0643	Electricians	22	56	8	-	-	-	-	-	-	-	-	-	64	3,924	61
	0644	Painters	3	21	9	2	-	-	-	-	-	-	-	-	32	3,170	99
	0645	Pipe fitter	8	58	15	-	-	-	-	-	-	-	-	-	73	4,628	63
	0660	Misc. Repair/Const.	18	48	1	-	-	-	-	-	-	-	-	-	49	2,147	44
	0681	Machinists	12	46	2	-	-	-	-	-	-	-	-	-	48	2,255	47
	0682	Sheet Metal Workers	1	22	2	-	-	-	-	-	-	-	-	-	24	1,366	57
0690	Oper/Plant/Sys/Utilities	-	4	-	-	-	-	-	-	-	-	-	-	4	234	59	

Exhibit 9.13 (Continued): 1994 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-10	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)
EG&G	0710	Machine Setup/Oper.	1	15	2	-	-	-	-	-	-	-	-	-	17	1,067	63
	0771	Welders and Solders	2	4	-	-	-	-	-	-	-	-	-	-	4	141	35
	0780	Misc. Presc/Prod	3	6	-	-	-	-	-	-	-	-	-	-	6	294	49
	0820	Truck Drivers	5	21	1	-	-	-	-	-	-	-	-	-	22	1,311	60
	0830	Equip. Operators	-	3	-	-	-	-	-	-	-	-	-	-	3	157	52
	0840	Misc. Transport	1	3	-	-	-	-	-	-	-	-	-	-	3	127	42
	0850	Handlers/Laborers/Helper	25	52	3	-	-	-	-	-	-	-	-	-	55	2,835	52
EG&G Sub-contractors	0990	Miscellaneous	28	20	1	1	-	-	-	-	-	-	-	20	441	22	

Exhibit 9.13 (Continued): 1995 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-10	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)
EG&G	0370	Engineering Technicians	8	19	-	-	-	-	-	-	-	-	-	-	19	462	24
	0380	Science Technicians	23	73	68	31	19	4	-	-	-	-	-	-	195	39,880	205
	0383	Radiation Monitors/Techn	10	122	154	23	2	-	-	-	-	-	-	-	301	40,307	134
	0390	Misc. Technicians	33	164	37	11	2	-	-	-	-	-	-	-	214	18,190	85
	0525	Misc. Service	1	10	1	-	-	-	-	-	-	-	-	-	11	600	55
	0642	Carpenters	3	26	7	-	-	-	-	-	-	-	-	-	33	2,148	65
	0643	Electricians	14	52	19	-	-	-	-	-	-	-	-	-	71	5,117	72
	0644	Painters	1	20	7	-	-	-	-	-	-	-	-	-	27	2,050	76
	0644	Painters	1	20	7	-	-	-	-	-	-	-	-	-	27	2,050	76
	0645	Pipe fitter	7	57	15	1	-	-	-	-	-	-	-	-	73	5,087	70
	0660	Misc. Repair/Const.	10	9	-	-	-	-	-	-	-	-	-	-	9	303	34
0681	Machinists	4	30	9	-	-	-	-	-	-	-	-	-	39	2,632	67	

Exhibit 9.13 (Continued): 1995 RFETS Dosimetry Rates Among HW, De, Di, and Cleanup Workers. As Reported April, 1997

Name	Occ. Code	Occupation	No. Meas. Dose	Meas. <0.1 (rem)	0.1-0.25 (rem)	0.25-0.5 (rem)	0.5-0.75 (rem)	0.75-1.0	1-2	2-3	3-4	4-5	5-10	>10	No. with Meas. TEDE	Collective TEDE (person-mrem)	Avg. Meas. TEDE (mrem)
EG&G	0682	Sheet Metal Workers	-	24	2	-	-	-	-	-	-	-	-	-	26	1,557	60
	0690	Oper/Plant/Sys/Utilities	1	2	-	-	-	-	-	-	-	-	-	-	2	90	45
	0710	Machine Setup/Oper.	2	12	3	-	-	-	-	-	-	-	-	-	15	1,118	75
	0771	Welders and Solders	1	1	-	-	-	-	-	-	-	-	-	-	1	14	14
	0780	Misc. Presc/Prod	1	1	-	-	-	-	-	-	-	-	-	-	1	11	11
	0820	Truck Drivers	1	26	1	-	-	-	-	-	-	-	-	-	27	1,430	53
	0830	Equip Operators	1	3	-	1	-	-	-	-	-	-	-	-	4	615	154
	0840	Misc. Transport		3	-	-	-	-	-	-	-	-	-	-	3	171	57
	0850	Handlers/Laborers/Helpers	7	40	19	3	-	-	-	-	-	-	-	-	62	5,854	94
0990	Miscellaneous	422	855	84	13	9	1	-	-	-	-	-	-	962	60,320	63	
EG&G Subcontr.	0990	Miscellaneous	220	35	5	-	-	-	-	-	-	-	-	40	1,354	34	

Note: Occ. Code # 0990 indicates that the site provided the information to DOE-HQ but the information did not fit the standardized coding system) Per Derek A. Hagemeyer 4/21/97. Workers outside the defined study populations were excluded from this report even though they may have been reported as receiving moderated to high TEDE's when compared to the reported worker groups.

Table 1: Contacts and Demographic Description of Prime and Subcontractor Remediation Workers at the RFETS.

Facility	Task Category	Contractor	# Workers	Industry Profile	Primary Activity Titles	Top 5 Job Titles	No. Workers
RFETS	HW, CW, De and Di	Kaiser Hill (K-H) , L. L. C. Rocky Flats Environmental Technology Site (RFETS) Point of Contact (POC): Chris Keese, Labor Relations Department P. O. Box 464, Building 334, Golden, CO 80402-0464 Ph: (303) 966-3485	72 ①	1. Solid, Hazardous and Mixed Waste TSD facility Workers 2. Construction & Demolition Workers 3. Nuclear Power Plant Maintenance Workers 4. Power and WWT plant operators	HW/MW/LLRW Treatment, Storage, Disposal, and Transportation Systems Maintenance and Operations Equipment and Internal and External Bldg. Component Decontamination, Removal, Encapsulation and Demolition④	1. Radiological Control Technicians 2. Risk Reduction Technicians 3. Mission Support Specialists I 4. Experimental Machinist 5. Maintenance Technologist	1. 37 2. 15 3. 8 4. 3 5. 2 ②
		DyneCorp of Colorado (DCI) RFETS POC: P. O. Box 464, T-130D, Golden, CO 80402-0464 Ph: (303) 966-9855	390 ①	1. Solid, Hazardous and Mixed Waste TSD facility Workers 2. Construction /Demolition Workers 3. Nuclear Power Plant Maintenance Workers 4. Power and WWT plant operators	HW/MW/LLRW Treatment, Storage, Disposal, and Transportation Systems Maintenance and Operations Equipment and Internal and External Bldg. Component Decontamination, Removal, Encapsulation and Demolition④	1. Maintenance Technologist 2. Mission Support Specialists I 3. Mission Support Specialists II 4. Utility Worker 5. Pipefitter	1. 93 2. 43 3. 34 4. 31 5. 26②
		Rocky Mountain Remediation Services, L. L. C. (RMRS) RFETS POC: Building 080, P. O. Box 464 Golden, CO 80402-0464 Ph: (303) 966-8786	265 ①	1. Solid, Hazardous and Mixed Waste TSD facility Workers 2. Construction /Demolition Workers 3. Nuclear Power Plant Maintenance Workers 4. Power and WWT plant operators	HW/MW/LLRW Treatment, Storage, Disposal, and Transportation Systems Maintenance and Operations Equipment and Internal and External Bldg. Component Decontamination, Removal, Encapsulation and Demolition④	1. Process Specialists 2. Radiological Control Technicians 3. D&D Skilled Trades 4. Mission Support Specialists II 5. Stationary Operating Engineers	1. 76 2. 71 3. 31 4. 24 5. 12②
	CW and De	Colorado Building Construction Trades Contract/Agreement (CBTCC) POC: Bob Mc Cormick Building 080, P. O. Box 464 Golden, CO 80402-0464 Ph: (303) 966-9832	300 ⑤	1. Solid, Hazardous and Mixed Waste TSD facility Workers 2. Construction /Demolition Workers 3. Nuclear Power Plant Maintenance Workers	18 different construction crafts are drawn from local union halls and at the present time numbered around 300.④	1. D&D Skilled Trades 2. Pipefitter 3. Electricians 4. Heavy Equipment Operator 5. Laborer	1. N/A 2. N/A 3. N/A 4. N/A 5. N/A

Table 1 (Continued): Contacts and Demographic Description of Prime and Subcontractor Remediation Workers at the RFETS.

Facility	Task Category	Contractor	# Workers	Industry Profile	Primary Activity Titles	Top 5 Job Titles	No. Workers
RFETS	HW, CW, De and Di	Safe Sites of Colorado, L. L. C. (SSOC) RFETS POC: Building 080, P. O. Box 464 Golden, CO 80402-0464 Ph:(303) 966-7491	628 ①	1. Solid, Hazardous and Mixed Waste TSD facility Workers 2. Construction/Demolition Workers 3. Nuclear Power Plant Maintenance Workers 4. Power and WWT plant operators	HW/MW/LLRW Treatment, Storage, Disposal, and Transportation Systems Maintenance and Operations Equipment and Internal and External Bldg. Component Decontamination, Removal, Encapsulation and Demolition④	1. Radiological Control Technicians 2. Process Specialists 3. Utility Workers 4. Risk Reduction Technicians 5. Electricians	1. 177 2. 133 3. 73 4. 56 5. 43②
	HW, CW and De	Manufacturing Science Corporation(MSC) Attn: Dennis Floyd 3000 Youngfield Street, Suite 364 Denver, CO 80215 Headquartered at 804 Kerr Hollow Road, Oak Ridge, Tennessee 37830 Ph: (303) 237-8576	60③	1. Construction Workers 2. Asbestos and Lead Abatement Workers 3. Nuclear Power Plant Maintenance Workers	HW/MW/LLRW Treatment Equipment and Internal Bldg. Component Removal, Decontamination and Encapsulation ④	1. Asbestos and Lead Abatement Workers 2. Construction Workers 3. Laborers 4. Trades: Pipe fitters, Electricians, etc.	1. N/A 2. N/A 3. N/A 4. N/A
	HW, De, Di and CW First Tier Contractors Sitewide	All of Above 1989-1996	Total: 1355 ② 300 ⑤ <u>60</u> ③ 1715			First Tier Contractors Sitewide: 1. Radiological Control Technicians 2. Process Specialists 3. Stationary Operating Engineers 4. Maintenance Tech's 5. Risk Reduction Technicians	First Tier Contractors Sitewide: 1. 298 2. 214 3. 111 4. 100 5. 76

① Information provided by Chris Keese, Labor Relations Department (303) 966-3485, from a Report entitled Hourly Staffing Allocation dated 12/16/97.

② Personnel are matrixed from Kaiser-Hill to the various first and subsequent tier subcontractors.

③ Information provided by Dennis Floyd, MSC Project Manager see conversation report dated 11/19/97.

④ See the list of detailed activities by task on the following page.

⑤ Information provided by Robert McCormick (Kaiser-Hill) see conversation report dated 7/21/97.

Table 10.2: Rocky Flats Site Remediation Worker Contacts, Activity Descriptions and Exposure Types As Reported January, 1998

Facility: Rocky Flats	Category:	Contact(s)	Activities Title and Brief Description	Exposure Type	Driver	Time line and Duration		Workers per Activity
Former OU1 Buffer Zone	Hazardous Waste Task	Information obtained from reference material	<p>Activity 1: IHSS 102, Oil Sludge Pit #2</p> <p>Oil Sludge Pit #2 was a former below ground waste disposal pit into which 30 to 50 drums containing (non-radiological) oil sludge from a storage tank cleanout were emptied. On-site treatment will be employed to allow for final on-site disposal subsequent to excavation of oil contaminated soil.</p>	Hazardous	CERCLA	1997- 1999	2 yrs	MED: 11 - 75
			<p>Activity 2: IHSS 103, Chemical Burial Area</p> <p>IHSS 103, the Chemical Burial Area (a portion of the "Hillside Area"), was used to store chemicals, solvent drums and fire damaged refuse resulting in soil and groundwater contaminated with carbon tetrachloride, PCE, 111-Trichloroethane, uranium and chloroform. On-site treatment of soil and groundwater will be employed to allow for final on-site disposal subsequent to removal of these drums (disposal) and excavation of any contaminated soil.</p>	Mixed	CERCLA	1997	1 yr	MED: 11 - 75
Former OU 2 Buffer Zone		<p>Name: Ken Korkia</p> <p>Title: RFCAB Staff Coordinator</p> <p>Phone: (303) 420-7855</p>	<p>Activity 3: IHSS 113, Mound Area</p> <p>The Mound Area was a former above ground waste disposal area that was used to store drums containing uranium, plutonium, hydraulic oil and volatile organic chemicals (primarily carbon tetrachloride). Removal of these drums and a limited amount of underlying soils occurred in the 1970's. Further remediation is planned which will include excavation of 400 to 1000 cubic yards of soil which will require thermal desorption treatment allowing final on-site disposal.</p>	Mixed	CERCLA	3/97 - 8/97	3 mos.	MED: 11 - 75

Table 10.2 (Continued): Rocky Flats Site Remediation Work Contacts, Activity Descriptions and Exposure Types As Reported 1/98

Facility: Rocky Flats	Category:	Contact(s)	Activities Title and Brief Description	Exposure Type	Driver	Time line and Duration		Workers per Activity
Former OU 4 Industrial Area	Hazardous Waste Task	Information obtained from reference material	<p>Activity 4: IHSS 101 (HWMU#38), Solar Ponds</p> <p>The Solar Ponds were part of the sites' process waste water treatment system. These evaporation ponds contained lithium and aluminum scrap, nitrates, treated acidic wastes and low levels of radioactivity.</p>	Mixed	CERCLA	1998- 2000	2 yrs.	MED: 11 - 75
Former OU5 Industrial/ Buffer Zone Area			<p>Activity 5: IHSS 115, Original Landfill (Industrial Area)</p> <p>The Original Landfill was used at RFETS from 1952 to 1968. Some depleted uranium ash was buried along with normal plant waste which may have included chemicals (i.e., solvents, beryllium and uranium). On-site treatment will likely be employed to allow for final on-site disposal subsequent to removal of this waste and excavation of any radiologically contaminated soil.</p>	Mixed	CERCLA	2002- 2014	N/A	MED: 11 - 75
			<p>Activity 6: IHSS's 133.1, 2, 3 and 4, Ash Pit I-1 (Buffer Zone Area)</p> <p>Ash Pit I-1 was a former below ground waste disposal area that was used for the disposal of incinerator ash containing uranium and other metals which was covered with soil. On-site treatment will likely be employed to allow for final on-site disposal subsequent to removal of this waste and excavation of any contaminated soil.</p>	Radiological	CERCLA	2002- 2014	N/A	MED: 11 - 75

Table 10.2 (Continued): Rocky Flats Site Remediation Work Contacts, Activity Descriptions and Exposure Types As Reported 1/98

Facility: Rocky Flats	Category:	Contact(s)	Activities Title and Brief Description	Exposure Type	Driver	Time line and Duration		Workers per Activity
Former OU 7 Buffer Zone Area	Hazardous Waste Task	Information obtained from reference material	<p>Activity 7: IHSS 114 Present Landfill</p> <p>The Present Landfill was a former below ground waste disposal area that began accepting material in 1968 and was used to store waste containing uranium and/or plutonium which exhibited less than the minimal detectable amount of radioactivity when surveyed. 1000 kgs. of contaminated sanitary sewage sludge were also buried. On-site treatment will be employed to allow for final on-site disposal subsequent to removal of this waste and excavation of any radiologically contaminated soil.</p>	Radiological	CERCLA	1997- 2006	N/A	MED: 11 - 75
Former OU 8 Industrial Area			<p>Activity 8: IHSS 135, Cooling Tower Blowdown</p> <p>Hexavalent chromium and small quantities of lithium were reported to have been present in small ponds which were used to contain water from cooling towers. The ponds were covered with fill and small amounts of depleted uranium may also have been buried at that time. On-site treatment will be employed to allow for final on-site disposal subsequent to excavation of any radiologically contaminated soil.</p>	Mixed	CERCLA	1998- 2001	N/A	MED: 11 - 75
Former OU 9 Industrial Area			<p>Activity 9: IHSS 121, Original Process Waste Lines Soils</p> <p>Soils within this area may have been affected by leaking pipes or tanks that were used to transport various types of process waste. Possible COC's include nitrates, acids, caustics and radionuclides.</p>	Mixed	RCRA	1998- 2001	N/A	MED: 11 - 75

Table 10.2 (Continued): Rocky Flats Site Remediation Work Contacts, Activity Descriptions and Exposure Types As Reported 1/98

Facility: Rocky Flats	Category:	Contact(s)	Activities Title and Brief Description	Exposure Type	Driver	Time line and Duration		Workers per Activity
Former OU 13 Industrial Area	Hazardous Waste Task	Information obtained from reference material	<p>Activity 10: IHSS 128, Oil Burn Pit No. 1</p> <p>Oil Burn Pit No. 1 was a former below ground waste disposal pit into which 10 drums containing oil with depleted uranium were burned; then buried. Building 335 was then built on this site. Excavation of any oil/depleted uranium contaminated residue and soil is expected to occur subsequent to the removal of Building 335. On-site treatment will be employed to allow for final on-site disposal.</p>	Mixed	CERCLA	1998- 2000	N/A	MED: 11 - 75
			<p>Activity 11: IHSS 134, Metal Disposal Site North Area (IAG Name: Lithium Metal Destruction Site) and Reactive Metal Destruction Site South Area</p> <p>The Metal Disposal Site North Area and Reactive Metal Destruction Site South Area was a potentially radiologically contaminated area on which 400-500 pounds of metallic lithium (small quantities of sodium, calcium and magnesium) and some solvents were destroyed over a nearly twenty year period. Certain residues including lithium carbonate were buried as well. On-site treatment will be employed to allow for final on-site or offsite disposal subsequent to removal and excavation of this waste.</p>	Mixed	CERCLA	1998- 2000	N/A	MED: 11 - 75
			<p>Activity 12: IHSS 171, Solvent Burning Ground</p> <p>This site was a potentially radiologically contaminated area utilized for training fire department personnel as well as experiments concerning the effect of heat and water on various materials including filter plenums. Fire training included the burning of diesel fuel, gasoline, magnesium chips and waste solvents. On-site and offsite treatment will be employed to allow for final on-site and offsite disposal subsequent to excavation of any contaminated soil.</p>	Mixed	CERCLA	1998- 2000	N/A	MED: 11 - 75

Table 10.2 (Continued): Rocky Flats Site Remediation Worker Contacts, Activity Descriptions and Exposure Types As Reported 1/98

Facility: Rocky Flats	Category:	Contact(s)	Activities Title and Brief Description	Exposure Type	Driver	Time line and Duration		Workers per Activity
Industrial Area OU	Deactivation Worker Tasks	Name: Carl Spring Title: Hazardous Waste Specialist Phone: (303) 692-3358	<p align="center">Activity 13:</p> <p align="center">HWMU 4: Acid Dumpsters. Building 444</p> <p align="center">Decontamination, Safe Shut Down and Post Operations Closure</p>	Low-Level Mixed Waste	RCRA	2002 - 2003	1 yr.	Low: < 10
			<p align="center">Activity 14:</p> <p align="center">HWMU 18.02: Granular Activated Carbon Treatment. Building 374</p> <p align="center">Decontamination, Safe Shut Down and Post Operations Closure</p>	Hazardous Waste. Low-Level Mixed Waste.	RCRA	2001 - 2003	2 yrs.	Low: < 10
			<p align="center">Activity 15:</p> <p align="center">HWMU 30: Chip Cementation. Building 447</p> <p align="center">Decontamination, Safe Shut Down and Post Operations Closure</p>	Low-Level Mixed Waste.	RCRA	2006- 2007	1 yr.	Low: < 10
			<p align="center">Activity 16:</p> <p align="center">HWMU 39: Fabric Filtration. Buildings 444, 447, and 460</p> <p align="center">Decontamination, Safe Shut Down and Post Operations Closure</p>	Hazardous Waste. Low-Level Mixed Waste.	RCRA	2001- 2008	7 yrs.	Low: < 10

Table 10.2 (Continued): Rocky Flats Site Remediation Worker Contacts, Activity Descriptions and Exposure Types As Reported 1/98

Facility: Rocky Flats	Category:	Contact(s)	Activities Title and Brief Description	Exposure Type	Driver	Time line and Duration		Workers per Activity
Industrial Area OU	Deactivation Worker Tasks	Name: Carl Spring Title: Hazardous Waste Specialist Phone: (303) 692-3358	<p align="center">Activity 17:</p> <p align="center">HWMU 41: Process Waste Storage Tanks. Building 774</p> <p align="center">Decontamination, Safe Shut Down and Post Operations Closure</p>	Low-Level Mixed Waste.	RCRA	1998 - 2001	3 yrs.	Low: < 10
			<p align="center">Activity 18:</p> <p align="center">HWMU 42: Process Waste Treatment Facility. Building 374</p> <p align="center">Decontamination, Safe Shut Down and Post Operations Closure</p>	Hazardous Waste. Low-Level Mixed Waste. TRU Mixed Waste. Residues	RCRA	1996 - 1997	1 yr.	Low: < 10
			<p align="center">Activity 19:</p> <p align="center">HWMU 44: Oil Storage Tanks. Building 776</p> <p align="center">Decontamination, Safe Shut Down and Post Operations Closure</p>	Low-Level Mixed Waste.	RCRA	1999 - 2001	2 yrs.	Low: < 10
			<p align="center">Activity 20:</p> <p align="center">HWMU 49: Fluidized Bed Units (FBUs). Building 776</p> <p align="center">Decontamination, Safe Shut Down and Post Operations Closure</p>	Hazardous Waste. Low-Level Mixed Waste.	RCRA	1999 - 2001	2 yrs.	Low: < 10

Table 0.2 (Continued): Rocky Flats Site Remediation Worker Contacts, Activity Descriptions and Exposure Types As Reported 1/98

Facility: Rocky Flats	Category:	Contact(s)	Activities Title and Brief Description	Exposure Type	Driver	Time line and Duration		Workers per Activity
Industrial Area OU	Deactivation Worker Tasks	Name: Carl Spring Title: Hazardous Waste Specialist Phone: (303) 692-3358	<p align="center">Activity 21:</p> HWMU 53: Miscellaneous Cementation. Buildings 371 and 771 Decontamination, Safe Shut Down and Post Operations Closure	Low-Level Mixed Waste.	RCRA	1998 - 2001	3 yrs.	Low: < 10
			<p align="center">Activity 22:</p> HWMU 55: Aqueous Process Waste Treatment. Building 774 Decontamination, Safe Shut Down and Post Operations Closure	Low-Level Mixed Waste. TRU Mixed Waste. Mixed Residues	RCRA	1999 - 2001	2 yrs.	Low: < 10
			<p align="center">Activity 23:</p> HWMU 56: Organic Waste Immobilization Building 774 Decontamination, Safe Shut Down and Post Operations Closure	Low-Level Mixed Waste. TRU Mixed Waste. Mixed Residues	RCRA	1996 - 1997	1 yr.	Low: < 10
			<p align="center">Activity 24:</p> HWMU 80.1: Reactive Cyanide Treatment Unit: Building 881 Decontamination, Safe Shut Down and Post Operations Closure	Hazardous Waste. Low-Level Mixed Waste.	RCRA	2002- 2003	1 yr.	Low: < 10

Table 0.2 (Continued): Rocky Flats Site Remediation Worker Contacts, Activity Descriptions and Exposure Types As Reported 1/98

Facility: Rocky Flats	Category:	Contact(s)	Activities Title and Brief Description	Exposure Type	Driver	Time line and Duration		Workers per Activity
Industrial Area OU	Deactivation Worker Tasks	Name: Carl Spring Title: Hazardous Waste Specialist Phone: (303) 692-3358	<p align="center">Activity 25:</p> HWMU 90.37, 90.39 and 90.43: Container Storage Area. Building 779, Room 131. Gloveboxes: 131A, 131B, 131D, 131E, 106-3, 4, 5, and 860 Decontamination, Safe Shut Down and Post Operations Closure	Low-Level Mixed Waste. TRU Mixed Waste. Mixed Residues	CERCLA	1997 - 1998	1 yr.	Low: < 10
			<p align="center">Activity 26:</p> HWMU 90.115, 116, 117, 119, 120-122 Container Storage Area: Building 771 Gloveboxes Decontamination, Safe Shut Down and Post Operations Closure	Low-Level Mixed Waste. TRU Mixed Waste. Mixed Residues	RCRA	1999 - 2000	1 yr.	Low: < 10
			<p align="center">Activity 27:</p> HWMU 90.129: Container Storage Area. Building 771, Room 183 Decontamination, Safe Shut Down and Post Operations Closure	TRU Mixed Waste. Mixed Residues	RCRA	1998 - 2001	3 yrs.	Low: < 10
			<p align="center">Activity 28:</p> HWMU 90.142: Container Storage Area: Building 371, Room 3408 Gloveboxes 72B and 72C Decontamination, Safe Shut Down and Post Operations Closure	Low-Level Mixed Waste. TRU Mixed Waste. Mixed Residues	RCRA	2001 - 2002	1 yr.	Low: < 10

Table 10.2 (Continued): Rocky Flats Site Remediation Worker Contacts, Activity Descriptions and Exposure Types As Reported 1/98

Facility: Rocky Flats	Category:	Contact(s)	Activities Title and Brief Description	Exposure Type	Driver	Time line and Duration		Workers per Activity
Above Ground Fuel Oil Tank Removal	Di Task	Conversation report w/Ben Evans, Kaiser- Hill project manager; 12/31/97	<p>Activity 29: Dismantment of Above Ground Fuel Oil Storage Tanks</p> <p>The activities consisted of decontamination and demolition of 2 Tanks (one 840,000 gallon and a 1.9 million gallon) which were drained, deconed, and cutup for final disposal.</p>	Mixed	CERCLA and RCRA	7/95- 9/96	14 months	Low 1-10
Building 889			<p>Activity 30: Dismantment of Building 889</p> <p>The activities consisted of decontamination and demolition of building 889 , size reduction of building components and containerization of waste for final disposal.</p>	Radiological	CERCLA	7/95- 9/96	14 months	Med 11-75
Seven Abandoned Guard Posts in the 400 area			<p>Activity 31: Dismantment of Seven Guard Posts (400 area)</p> <p>The activities consisted of removal of 7 guard posts, and containerization/shipment of waste for final disposal.</p>	Radiological	CERCLA	7/95- 9/96	14 months	Low 1-10
Electrical Substation			<p>Activity 32: Dismantment of an Electrical Substation</p> <p>The activities consisted of decontamination of substation components in anticipation of demolition. containerization/shipment of all wastes generated for final disposal.</p>	TSCA- Mixed	CERCLA /TSCA	7/95- 9/96	"hands- on" work: 6 weeks	Low 1-10

Table 0.2 (Continued): Rocky Flats Site Remediation Worker Contacts, Activity Descriptions and Exposure Types As Reported 1/98

Facility: Rocky Flats	Category:	Contact(s)	Activities Title and Brief Description	Exposure Type	Driver	Time line and Duration		Workers per Activity
Former OU1 (Buffer Zone): 800 Area	Cleanup Worker Tasks	Information obtained from reference material	<p>Activity 33: IHSS 130, Radioactive Site - 800 Area Site No. 1</p> <p>The Radioactive Site - 800 Area Site No. 1 (a portion of the "Hillside Area"), was used to store fire damaged refuse resulting in soils contaminated with uranium and plutonium. Activities include removal of this waste (disposal) and excavation of any radiologically contaminated soil. On-site treatment of soil and groundwater will be employed to allow for final on-site disposal.</p>	Radiological	CERCLA	1997- 1999	2 yrs.	Med: 11-75
Former OU2 (Buffer Zone)			<p>Activity 34: IHSS 108, Trench T-1</p> <p>Trench T-1 was a former below ground waste disposal area that was used to store 125 drums containing 25,000 kg of depleted uranium chips. Activities include removal of these drums and excavation of any radiologically contaminated soil. On-site treatment will be employed to allow for final on-site disposal.</p>	Radiological	CERCLA	1997- 1999	2 yrs.	Med: 11-75
			<p>Activity 35: IHSS 110, Trench T-3</p> <p>Trench T-3 was a former below ground waste disposal area that was used to store drums containing uranium and plutonium contaminated sanitary sewage sludge. Activities included removal of these drums and excavating of 2240 cubic yards of underlying soil. On-site treatment was employed to allow for final on-site disposal.</p>	Mixed	CERCLA	3/96-6/96	3 mos	Med: 11-75

Table 0.2 (Continued): Rocky Flats Site Remediation Worker Contacts, Activity Descriptions and Exposure Types As Reported 1/98

Facility: Rocky Flats	Category:	Contact(s)	Activities Title and Brief Description	Exposure Type	Driver	Time line and Duration		Workers per Activity
Former OU 6 (Buffer Zone)	Cleanup Worker Tasks	Information obtained from reference material	Activity 36: IHSS 167.1, Spray Field North Area The Spray Field North Area was used as a land-surface disposal area onto which landfill effluent and local surface runoff were sprayed beginning in 1986. Effluents were sprayed on the ground to enhance evaporation. These effluents were subsequently found to contain tritium, strontium and uranium. Activities include excavation of any radiologically contaminated soil. On-site treatment will be employed to allow for final on-site disposal.	Radiological	CERCLA	1997- 1999	2 yrs.	Med: 11-75
Former OU 9 (Industrial Area): Radioactive Site 700 Area			Activity 37: IHSS 163.2, Site No. 3 Buried Slab Site No. 3 was an area which was used for the storage of a radiologically contaminated (non-removable americium) concrete slab. The slab was excavated and the contaminated area was removed and shipped to an offsite disposal facility.	Radiological	CERCLA	1997- 1999	2 yrs.	Med: 11-75
Former OU 14 (Industrial Area)			Activity 38: IHSS 156.1, Building 334 Parking Lot The Building 334 Parking Lot was used as a storage area for soil containing low levels of plutonium excavated near Building 774. The volume of soil involved is not known. Fifty to seventy-five dump truck loads of soil were removed and placed in IHSS 156.2 during the construction of Parking Lot 334. Activities include excavation of any radiologically contaminated soil. On-site treatment will be employed to allow for final on-site disposal.	Radiological	CERCLA	1998- 2001	3 yrs.	Med: 11-75
			Activity 39: IHSS 164.1, Radioactive Site 800 Area Site No. 2 Concrete Slab Site No. 2 was an area which was utilized to store a radiologically contaminated concrete slab in 1958. The slab was broken up, removed, disposed of offsite and the area cleaned up.	Radiological	CERCLA	1999- 2001	3 yrs.	Med: 11-75

Table 0.2 (Continued): Rocky Flats Site Remediation Worker Contacts, Activity Descriptions and Exposure Types As Reported 1/98: (MSC) Special Worker Group

Facility: Rocky Flats	Category:	Contact(s)	Activities Title and Brief Description	Exposure Type	Driver	Time line and Duration		Workers per Activity
Building 883 Perimeter	Hazardous Waste Task (MSC) Special Worker Group	Name: Dennis Floyd Manufacturing Sciences Corporation (MSC), 3000 Youngfield Street, Suite 364, Denver, CO 80215	Activity 40: Removal of Storage Tanks The activities consisted of decontamination of 14 Tanks (9 of which contained Pu). Five tanks were remediated utilizing draining and triple rinsing techniques for clean closure and the remaining 9 tanks were drained, decontaminated, and cut up for final disposal.	Mixed	CERCLA and RCRA	11/28/97 to 01/15/98	1.5 Months	Med 11-75
Buildings 883 and 865	Deactivation Task (MSC) Special Worker Group	Title: Project Manager Phone: (303)237-8576	Activity 41: Beryllium (Be) Processing Equipment Removal The activities consisted of decontamination and removal of process equipment, size reduction of equipment and containerization of waste for final disposal/reuse/recycling.	Mixed	CERCLA	9/95 to 11/97①	2.2 years	Med 11-75
Buildings 883 and 865			Activity 42: Uranium Processing Equipment Removal The activities consisted of decontamination and removal of large pieces of machinery such as furnaces, hydraulic presses and large rolling mills, size reduction of equipment this and containerization of waste for final disposal/reuse/recycling.	Radiological	CERCLA	9/95 to 11/97①	2.2 years	Med 11-75
Buildings 883 and 865			Activity 43: Building Decontamination The activities consisted of decontamination of ductwork, walls, floors, & work surfaces within both buildings in anticipation of building reuse. containerization of all wastes generated for final disposal/reuse/recycling	Radiological	CERCLA	9/95 to 11/97①	2.2 years	Med 11-75

Table 10.3: Past, Present and Future Technologies for Remediation Workers at the Rocky Flats Site

Facility Rocky Flats	Category	Activity Title	Technology and Brief Description	# Workers per Technology	Descriptive Exposure Potential	Advantages	Disadvantages
Industrial Area OU	Hazardous Waste Task Proposed	Treatment of LLMW	Technology 1: Electrochemical Chlorination Electrochemical Chlorination is used to eliminate the cyanide from cyanide- contaminated liquids. After treatment the waste remains LLRW but can now be disposed of at an offsite TSDF.	LOW: < 10	1. PPE required	None noted	None noted
		Treatment of MW	Technology 2: Mercury Recovery Involves the retort and collection of mercury through various methods, some of which are proprietary.	LOW: < 10	1. PPE required	None noted	None noted
	Hazardous Waste Task Past, Present and Proposed	Treatment of LLMW	Technology 3: Poly Encapsulation Involves the unpacking and repacking of LLMW drums while adding a binding agent known as Permacon®. This LLMW has Uranium and Beryllium dusts and fines as it's primary constituents.	LOW: < 10	1. PPE required	None noted	None noted
		Treatment of MW	Technology 4: Cementation: Organic Treatment and UV Oxidation Treatment technologies utilized on the sites' reactive excess chemicals	LOW: < 10	1. PPE required	None noted	None noted

Table 10.3: Past, Present and Future Technologies for Remediation Workers at the Rocky Flats Site

Facility Rocky Flats	Category	Technology Title	Technology and Brief Description	# Workers per Technology	Descriptive Exposure Potential	Advantages	Disadvantages
Industrial Area OU	Hazardous Waste Task Proposed	Treatment of LLMW	Technology 5: Super Critical CO2 Extraction Involves driving off VOC's from LLMW drums through dissolving organic contaminants with CO2 at moderate temperature and high pressure. Feasibility study scale only to date. Full scale operations of this technology are expected if manpower and funding issues are resolved.	LOW: < 10	1. PPE utilized included Level B within a HEPA filtered Stainless Steel containment area.	1. Removal would simplify disposal of treated waste forms and result in cost savings.	1. Potential new hazard: Plutonium High Fired Oxide. Greater risk than other high temperature technologies.
			Technology 6: Catalytic Chemical Separation Involves the acid digestion of LLMW, primarily combustibles. Feasibility study scale only to date.	LOW: < 10	1. PPE utilized included Level B within a HEPA filtered Stainless Steel containment.	None noted	None noted
	Hazardous Waste Task Past/ Present	Interim Storage and Disposal of Mixed and Hazardous Waste	Technology 7: Burial and Storage	MED: 11 - 75	1. Contact 2. PPE required 3. Airborne 4. Indoor/outdoor	None noted	1. Both methods require continuous surveillance and maintenance 2. Labor intensive
	Hazardous Waste Task Proposed	Treatment of Mixed Waste	Technology 8: High-Temperature Vacuum Distillation Separation of Plutonium Waste Salts Utilizes the large difference in vapor pressures at high temperature between most chloride salts and actinide oxides to separate plutonium from the waste salts.	Not Available	None noted	1. Reduction in the cost of disposal.	1. Potential new hazard: Plutonium High Fired Oxide. Greater risk than other high temperature technologies.

Figure 10.3: Past, Present and Future Technologies for Remediation Workers at the Rocky Flats Site

Facility Rocky Flats	Category	Technology Title	Technology and Brief Description	# Workers per Technology	Descriptive Exposure Potential	Advantages	Disadvantages
Industrial Area OU	Hazardous Waste Task Proposed	Treatment of Mixed Waste	<p>Technology 9: Water-Soluble chelating Polymers For Removal Of Plutonium and Americium From Waste Water</p> <p>Water-soluble chelating polymers are specially designed to bind selectively with metal ions in aqueous solutions (process or waste waters). Polymer filtration then selectively recovers the valuable or regulated metal.</p>	Not Available	None noted	None noted	None noted
		Treatment of Hazardous Waste	<p>Technology 10: Catalytic Chemical Oxidation (CCO)</p> <p>The CCO system uses the reaction of oxygen, or an alternate oxidizing agent, to destroy the organic constituents of a waste in an aqueous solution.</p>	Not Available	None noted	None Noted	None noted
		Treatment of Mixed Waste	<p>Technology 11: Low Temperature Thermal Desorption (LTTD)</p> <p>Treats organically contaminated soils, sludge, and other solid matrices by desorbing and separating the hazardous contaminants.</p>	Not Available	None Noted	None Noted	None noted
		Treatment of Mixed Waste	<p>Technology 12: Transient Infrared Spectroscopy (TIRS)</p> <p>An on-line, real-time composition monitor of the molten waste stream produced by the polyethylene microencapsulation process.</p>	Not Available	1. Limited contact.	1. Monitor works automatically, without contacting the waste stream (except with air), so there is no secondary waste, no worker exposure, and little worker time required.	None noted

Figure 10.3: Past, Present and Future Technologies for Remediation Workers at the Rocky Flats Site

Facility Rocky Flats	Category	Technology Title	Technology and Brief Description	# Workers per Technology	Descriptive Exposure Potential	Advantages	Disadvantages
Industrial Area OU	Hazardous Waste Task Proposed	Treatment of Mixed Waste	Technology 13: Ceramification A coating process for the stabilization and immobilization of plutonium-containing compounds.	Not Available	1. Limited Contact	1. Reduces potential contamination of facilities, equipment, and personnel during material handling.	1. Potential new hazard: Plutonium High Fired Oxide.
			Technology 14: Salt Distillation Distillation separation of plutonium from plutonium-bearing waste salts.	Not Available	None noted	None noted	1. Potential new hazard: Plutonium High Fired Oxide. Greater risk than other high temperature technologies.
			Technology 15: Pyrochemical Salt Oxidation Treatment of spent pyrochemical salts in order to mitigate all safety concerns regarding interim on-site storage.	Not Available	None noted	None noted	None noted
			Technology 16: Pyrolysis A pyrochemical technique that uses a high-temperature, chemically inert environment to break down and volatilize polymeric materials.	Not Available	1. Limited Contact	1. Technology minimizes the formation of organic liquids. 2. Process is consistent with air quality concerns.	1. Potential new hazard: Plutonium High Fired Oxide.

Table 10.3: Past, Present and Future Technologies for Remediation Workers at the Rocky Flats Site

Facility Rocky Flats	Category	Technology Title	Technology and Brief Description	# Workers per Technology	Descriptive Exposure Potential	Advantages	Disadvantages
Industrial Area OU	Hazardous Waste Task Proposed	Treatment of Mixed Waste	<p>Technology 17: Mediated Electrochemical Oxidation (MEO)</p> <p>This technology converts contaminated chlorinated hydrocarbons into carbon dioxide and then dissolves the plutonium for subsequent recovery by standard recovery procedures.</p>	Not Available	None noted	None noted	None noted
			<p>Technology 18: Microwave Vitrification</p> <p>This process uses microwave energy to heat and vitrify waste materials.</p>	Not Available	1. Limited Contact	1. Radioactive exposures to workers are lowered due to remote treatment processing.	None noted
		Treatment of LLMW	<p>Technology 19: Polymer Microencapsulation</p> <p>Stabilizes low-level mixed salts to meet regulatory requirements.</p>	Not Available	1. Limited Contact	1. No secondary waste stream is generated.	None noted
		Treatment of Mixed Waste	<p>Technology 20: Extraction Chromatography</p> <p>This technology will treat aqueous effluent streams to selectively extract actinide elements.</p>	Not Available	1. Limited Contact	1. Reduction in Technology levels, hazards, and exposures associated with storage and handling of the final solid waste types generated.	None noted

Table 10.3: Past, Present and Future Technologies for Remediation Workers at the Rocky Flats Site

Facility: Rocky Flats	Category	Technology Title	Technology and Brief Description	# Workers per Technology	Descriptive Exposure Potential	Advantages	Disadvantages
Industrial Area OU	Deactivation Tasks Proposed	Mixed and Hazardous Waste Inspection Technology	<p>Technology 21: Multisensor Inspection and Characterization Robot for Small Pipes (MICROSPI)</p> <p>Inspects pipes for radiation (alpha, beta, gamma), organics (solvents and PCBs), and metals (mercury, lead, arsenic, etc.), and is capable of determining and mapping the locations of unknown pipes.</p>	LOW: < 10	<ol style="list-style-type: none"> 1. Non-contact 2. Indoors 	1. Reduced time to perform overall D&D, both during characterization and remediation.	None Noted
	Deactivation Tasks Past/ Present	Mixed and Hazardous Waste Decontamin- ation Technologies	<p>Technology 22: Baseline Decontamination Technologies</p> <p>Chemical or electrochemical technique, thermal technique and mechanical cleaning and washing.</p>	MED: 11 - 75	<ol style="list-style-type: none"> 1. Contact 2. PPE required 3. Airborne 4. Indoor/Outdoor 	<ol style="list-style-type: none"> 1. Versatile and easy to control. 2. Improved waste segregation since accurate characterization allows appropriate level of planned work effort for different types of contamination. 3. Minimized airborne and localized spread of contaminants released by opening pipes and sampling. 4. Eliminates the need for D&D, if no contamination is detected. 	<ol style="list-style-type: none"> 1. Generation of airborne contaminants and/or secondary wastes. 2. Inefficiencies and expense of labor intensive, time consuming, and costly operations. 3. High risk of worker exposure. 4. Inability to efficiently decontaminate components having complex geometries or surface irregularities (e.g., welds in steel and concrete cracks and crevices).

Table 10.3: Past, Present and Future Technologies for Remediation Workers at the Rocky Flats Site

Facility: Rocky Flats	Category	Technology Title	Technology and Brief Description	# Workers per Technology	Descriptive Exposure Potential	Advantages	Disadvantages
Industrial Area OU	Deactivation Tasks Proposed	Mixed and Hazardous Waste Decon. Technology	<p>Technology 23: CORPEX™ Nuclear Decontamination Process</p> <p>Nondestructive cleaning method for the decontamination of plutonium-contaminated facilities and equipment.</p> <p>Removes only the contaminant and the matrix that fixes the contaminant to the surface; it does not damage the substrate. The chemistry of the cleaning agent is destroyed by the addition of proprietary oxidizers, leaving only water, carbon dioxide, nitrogen gases, and the secondary waste sludge.</p>	LOW: < 10	<ol style="list-style-type: none"> 1. Indoor/Outdoor 2. Limited Contact 	<ol style="list-style-type: none"> 1. Reduction of personnel exposure; waste minimization; and the possible free-release of decontaminated components. 	None Noted
			<p>Technology 24: Decontamination of Nickel Recyclable Scrap Material (RSM)</p> <p>This technology includes four phases. Phase I involves lab-scale investigation, II includes removing technetium from nickel by bulk and/or surface decontamination techniques, III includes testing the process, and IV involves full scale evaluation of the technology for decon. and conversion of RSM to high-value product using a rolling mill for fabrication of recycled metal.</p>	Not Available	<ol style="list-style-type: none"> 1. Indoor/Outdoor 2. Limited Contact 	<ol style="list-style-type: none"> 1. Environmental sound alternative to storage and disposal. 2. Economical. 	<ol style="list-style-type: none"> 1. Nickel is a potential IH concern.

Table 10.3: Past, Present and Future Technologies for Remediation Workers at the Rocky Flats Site

Facility: Rocky Flats	Category	Technology Title	Technology and Brief Description	# Workers per Technology	Descriptive Exposure Potential	Advantages	Disadvantages
Industrial Area OU	Dismantl e-ment Tasks Past/ Present	Radioactive Waste Treatment Technology	<p>Technology 25: Baseline technologies for dismantlement</p> <p>Manual and hydraulic tools used to cut, shear, lift, and move structural materials and process equipment. These tools include overhead cranes, high-pressure water jets, saws, laser cutters, and plasma and acetylene torches.</p>	HIGH: 75 <	<ol style="list-style-type: none"> 1. Contact 2. PPE required 3. Airborne 4. Indoor/outdoor 	1. Versatile and easy to control.	<ol style="list-style-type: none"> 1. Generates secondary wastes. 2. Requires manual intervention/operation. 3. Exposes workers to construction and radiological safety hazards.
	Cleanup Tasks Proposed	Treatment of Radioactive Waste	<p>Technology 26: Electrolytic Decontamination</p> <p>Designed to decontaminate radioactive material containers using electrolytes so that these containers can be released for handling outside the glove box environment.</p>	Not Available	1. Limited contact	<ol style="list-style-type: none"> 1. Automated to reduce personnel exposure. 2. Minimization of secondary wastes 	None noted
			<p>Technology 27: Plutonium Stabilization and Packaging System (PuSPS)</p> <p>Inspecting, Disassembling, stabilizing, repacking, and labeling failed Pu product containers.</p>	Not Available	1. Limited contact	1. Automated to reduce personnel exposure.	None noted

11.0 WORKS CITED/ REFERENCES

1. Final Rocky Flats Cleanup Agreement, CERCLA VIII-96-21, Appendix 10. U.S. Department of Energy, Rocky Flats Environmental Technology Site. pg 10-1, 10-4. July 19, 1996.
2. Reconstruction of Historical Rocky Flats & Identification of Release Points, Project Task 3 & 4. ChemRisk. pg. 43. August 1992.
3. "The Rocky Flats Closure Project." Rocky Flats Environmental Technology Site. U.S. Department of Energy. 5 Aug. 1998 <<http://www.rfets.gov/rfclosre.htm>>.
4. Ryan, Kevin. Telephone Interview. Safe Sites of Colorado (SSOC), Nuclear Operations. Back, Dave. December 9, 1997.
5. Rocky Flats First Annual Report. Kaiser-Hill Company. pg. I. June 30, 1996.
6. Enhanced Work Planning: A Team Approach to Worker Protection. U.S. Department of Energy, Office of Environmental Management, Office of Strategic Planning and Analysis. pg. 4. December 13, 1995.
7. Reconstruction of Historical Rocky Flats Operations and Identification of Release points, Project Tasks 3 & 4. ChemRisk. pgs. 59-91. August 1992.
8. Final Rocky Flats Cleanup Agreement, CERCLA VIII-96-21, Appendix 10. U.S. Department of Energy. Rocky Flats Environmental Technology Site. pg. 1-1, 1-2. July 19, 1996.
9. The 1996 Baseline Environmental Management Report, Vol. II, Alaska-New Jersey. U.S. Department of Energy and Office of Environmental Management. DOE/EM-0290. pgs. 42-51. June 1996.
10. Linking Legacies. U.S. Department of Energy and Office of Environmental Management, DOE/EM-0319. pgs. 40-59. January 1997.
11. Rocky Flats Crossroads, Connecting People, Information & Ideas. Rocky Flats Bimonthly Employee Newspaper, Vol. 2, Number 21. pg. 5. October 14, 1996.
12. The 1996 Baseline Environmental Management Report, Vol. II, Alaska-New Jersey. U.S. Department of Energy and Office of Environmental Management. DOE/EM-0290. pgs. 21-22. June 1996.

13. Reconstruction of Historical Rocky Flats Operations and Identification of Release Points, Project Tasks 3 & 4. ChemRisk. pg. 4. August 1992.
14. Part B-VII Personnel Training. Rocky Flats Plant, RCRA Permit and Compliance Documents, EG & G Rocky Flats. pg.VII-1. May 3, 1996.
15. Floyd, Dennis. Telephone Interview. Manufacturing Science Corporation. Back, Dave. November 19, 1997.
16. Easton, Robert. Telephone Interview. Kaiser-Hill (Industrial Relations). Back, Dave. November 19, 1997.
17. McCormick, Robert. Telephone Interview. Kaiser-Hill (Industrial Relations). Back, Dave. July 21, 1997.
18. Agreement Between: Kaiser-Hill Company, LLC, Rocky Flats Environment Technical Site and The United Steelworkers of America, AFL-CIO-CLC Local 8031. pgs. 11-12. October 13, 1996.
19. Agreement Between Kaiser-Hill Company, LLC, Rocky Flats Environment Technical Site and The United Steelworkers of America, AFL-CIO-CLC Local 8031. pgs. 52-53. October 13, 1996.
20. Agreement Between Kaiser-Hill Company, LLC, Rocky Flats Environment Technical Site and The United Steelworkers of America, AFL-CIO-CLC Local 8031. pgs. 188-134. October 13, 1996.
21. Keese, Chris. Telephone Interview. Kaiser-Hill (Labor Relations). Back, Dave. December 4, 1997.
22. Dondilinger, Marty. Telephone Interview. Kaiser-Hill Human Resources. Back, Dave. December 22, 1997.
23. Ten Year Plan. Rocky Flats Environmental Technology Site, Draft Version 1.0. Appendix C. July 30, 1996.
24. RFETS EXPOSURE SURVEILLANCE PROJECT, Data Dictionary for Exposure Database. Ref. [C:\rflats\expsurv\ssoc\ssocdb.doc, last revised 14, October, 1997].
25. Reconstruction of Historical Rocky Flats Operations and Identification of Release Points, Project Task 3 & 4. ChemRisk. pg. 194. August 1992.

26. Work to Begin on Mound Remediation This Spring. The ADVISOR. Spring Newsletter. pg. 1-3. 1997.
27. Operational Units at Rocky Flats. U.S. Department of Energy Fact Sheet. November 1994.
28. Rocky Flats Plant RCRA Permit and Compliance Documents, EG & G Rocky Flats. September 1995.
29. Pegram, David. Telephone Interview. DOE-HQ, RFETS (Industrial Hygiene). Back, Dave. July 15, 1997.
30. Wood Jim. Telephone Interview. Safe Sites of Colorado (SSOC). Back, Dave. December 2, 1997.
31. Decommissioning Operations Plan RF/RMRS-97085.UN. For the Cluster Interim Measure/ Rev. 0. Page 55. October 16, 1997.
32. Plutonium Group on Environmental, Safety and Health Vulnerabilities Associated with the Department's Plutonium Storage. U.S. Department of Energy, Volume II, Part 1: Working Group Assessment Team Report: DOE/EH-0415. Rocky Flats Plant. pg. 104. August 18, 1994.
33. Rotchen, Ann. Telephone Interview. DynCorp of Colorado. RFETS (Medical Records). Back, Dave. November 10, 1997.
34. Beryllium Health Surveillance Program Newsletter, FJF-066-96. February 19, 1996. DynCorp of Colorado, Inc. POC Joseph Furman, M.D. Occupational Medical Director. 11 Dec. 1997. <<http://www.dimensional.com/-mhj/rfets-newsletter.htm>>.
35. Haines, Peggy. Telephone Interview. Technical Field Science Corporation. Back, Dave. November 25, 1997.
36. Prochnow, David. Telephone Interview. Kaiser-Hill. Back, Dave. December 2, 1997.
37. Rocky Flats Environmental Technology Site. Site Treatment Plan Proposed Rebaseline, Conceptual Draft. October 1, 1996.
38. Ten Year Plan. Rocky Flats Environmental Technology Site, Section 0.10.4. July 30, 1996.
39. Robotics Crosscutting Program. Office of Science and Technology. DOE/EM-0299. pgs. 72-80. August 1996.

40. Plutonium Focus Area-Technology Summary. U.S. Department of Energy, Office of Science and Technology. DOE/EM-0297. pgs. 11-35. August 1996.
41. Lucerna, Joe. Telephone Interview. Kaiser-Hill Co. Back, Dave. April 8, 1997.
42. Plutonium Focus Area- Technology Summary. U.S. Department of Energy, Office of Science and Technology. DOE/EM-0297. pgs 36-68. August 1996.
43. Decontamination & Decommissioning Focus Area-Technology Summary. U.S. Department of Energy, Office of Science and Technology. DOE/EM-0300. pgs. 178-182. August 1996.
44. Mixed Waste Characterization, Treatment & disposal Focus Area Technology Summary. U.S. Department of Energy, Office of Science and Technology. DOE/EM-0293. pg. 19-24. August 1996.
45. Characterization, Monitoring & Sensor Technology Crosscutting Program, Technology Summary. U.S. Department of Energy, Office of Science and Technology. DOE/EM-0298. pgs. 61-63. August 1996.
46. Mixed Waste Characterization, Treatment & Disposal Focus Area-Technology Summary. U.S. Department of Energy, Office of Science and Technology. DOE/EM-0293. pgs. 53-70. August 1996.
47. Decontamination & Decommissioning Focus Area-Technology Summary. U.S. Department of Energy, Office of Science and Technology. DOE/EM-0300. pgs. 89-107. August 1996.
48. Plutonium Focus Area-Technology Summary. U.S. Department of Energy, Office of Science and Technology. DOE/EM-0297. pgs. 1-10. August 1996.
49. REMS - Radiation Exposure Monitoring System. U.S. Department of Energy. 25 Oct. 1996. <<http://rems.eh.doe.gov/rems.htm>>.
50. Department of Energy Occurrence Reporting Program. U.S. Department of Energy, Office of Information Management. 03 Aug. 1998. <<http://www.tis.eh.doe.gov/web/oeaf/orps/orps.html>>.
51. Facility Profile Information Management System. U.S. Department of Energy, Office of Environment, Safety and Health. 12 Aug 1998. <<http://search.dis.anl.gov/>>.
52. Lessons Learned Information Services. U.S. Department of Energy. 02 June 1998. <<http://tis-hq.eh.doe.gov/others/ll/ll.html>>.

53. Occupational Injury and Property Damage Summary. U.S. Department of Environment, Safety and Health. 17 Aug. 1998. <<http://tis.eh.doe.gov/docs/oipds/>>.
54. Comprehensive Epidemiologic Data Resource. U.S. Department of Energy. 28 April 1998. <<http://cedr.lbl.gov/>>.
55. Environmental Safety and Health Computerized Accident / Incident Record keeping and Reporting System (CAIRS). U.S. Department of Energy. 01 May 1998. <<http://tis-nt.eh.doe.gov/cairs/>>.
56. Environmental Safety and Health Technical Information System Internet Resource Directory. U.S. Department of Energy. 9 April 1998. <<http://tis.eh.doe.gov/others/ird/ird.html>>.
57. "High Temperature Vacuum Distillation Separation of Plutonium Waste Salts." Office of Science and Technology. U.S. Department of Energy. 09 April 1998. <<http://tis.eh.doe.gov/others/ird/ird.html>>.
58. Decontamination & Decommissioning Focus Area-Technology Summary. U.S. Department of Energy, Office of Science and Technology. DOE/EM-0300. pgs. 61-63. August 1996.
59. Bistline, Bob. Telephone Interview. Department of Energy Rocky Flats Field Office. Back, Dave. August 21, 1998.
60. "Rocky Flats Facility as it Appeared in 1990." Reconstruction of Historical Rocky Flats & Identification of Release Points, Project Task 3 & 4. ChemRisk. Figure 3-8. August 1992.
61. Diane Morrel. Telephone Interview. Kaiser-Hill Co. (Industrial Hygiene Program Manager). Back, Dave. August 21, 1998.
62. DOE Repositories, EG&G Databases, Appendix D. U.S. Department of Energy, Openess:Human Radiation Experiments. 24 August 1998. <<http://www.ohre.doe.gov/new/findin.../rockyplant/intro/append/appd..html>>.

Internet Sites Identified:

“The Rocky Flats Closure Project.” Rocky Flats Environmental Technology Site. U.S. Department of Energy. 5 Aug. 1998 <<http://www.rfets.gov/rfclosre.htm>>.

Rocky Flats Environmental Technology Site. United States Department of Energy. 5 Aug. 1998. <<http://www.rfets.gov>>.

“Rocky Flats Fact Sheet: 1995 Accomplishments.” Rocky Flats Environmental Technology Site. U.S. Department of Energy. March 1997. <<http://www.rfets.gov/95Accs.htm>>.

“Rocky Flats Fact Sheet: Environmental Restoration Program.” Rocky Flats Environmental Technology Site. U.S. Department of Energy. March 1997. <<http://www.rfets.gov/errest.htm>>.

“Rocky Flats Fact Sheet: May 11, 1969 Plutonium Fire.” Rocky Flats Environmental Technology Site. U.S. Department of Energy. March 1997. <<http://www.rfets.gov/69puFire.htm>>.

“Rocky Flats Fact Sheet: 1957 Plutonium Fire.” Rocky Flats Environmental Technology Site. U.S. Department of Energy. March 1997. <<http://www.rfets.gov/57Fire.htm>>.

Defense Nuclear Facilities Safety Board. 17 Aug. 1998. <<http://www.dnfsb.gov>>.

“Colorado Department of Health / Rocky Flats Database.” The Colorado Alliance of Research Libraries. 17 Aug. 1998. <http://set.coalliance.org/cgi-bin/cw_cgi?getTerms+15188+-903381050>.

“Office of Nuclear Safety Radiological Oversight: Rocky Flats Environmental Technology Site.” U.S. Department of Energy. 5 Aug. 1998. <http://www.eh.doe.gov/rad/docs/browz/rfp_894.htm>.

“Radiological Control Evaluation: Rocky Flats Office.” U.S. Department of Energy, Rocky Flats Office. 5 Aug. 1998. <http://www.eh.doe.gov/rad/docs/browz/rfp_893.htm>.

Comprehensive Epidemiologic Data Resource. U.S. Department of Energy. 28 April 1998. <<http://cedr.lbl.gov>>.

“Reporting Releases of Hazardous Substances Under CERCLA & EPCRA” U.S. Department of Energy, Office of Environmental Policy and Assistance. 3 Aug. 1998 <<http://www.eh.doe.gov/oepa/guidance/cercla/rqs-gen.htm>>.

Office of Environmental Policy and Assistance (EH-41). U.S. Department of Energy. 17 Aug. 1998. <<http://www.eh.doe.gov/oeпа>>.

“Table S6 - Injury and Illness Ranking of Lump Construction Contractors.” U.S. Department of Environment, Safety and Health. Occupational Injury and Property Damage Summary. 17 March 1997. <<http://www.tis.eh.doe.gov:80/docs/oipds/oipds961/t961s6.html>>.

“DOE Summary Report: 1996 - January through March.” U.S. Department of Environment, Safety and Health. Occupational Injury and Property Damage Summary. 17 March 1997. <<http://www.tis.eh.doe.gov:80/docs/oipds/oipds961/inj961.html>>.

“Injury and Illness Ranking of Service Contractors - January through December, 1995.” U.S. Department of Energy. Occupational Injury and Property Damage Summary. 17 March 1997. <<http://tis.eh.doe.gov/docs/oipds/oipds954/t954s4.html>>.

Environmental Safety and Health Computerized Accident / Incident Record keeping and Reporting System (CAIRS). U.S. Department of Energy. 01 May 1998. <<http://tis-nt.eh.doe.gov/cairs/>>.

“1994 Annual Radiation Doses - Deep Dose.” U.S. Department of Energy, Office of Information Management. Technical Information System (TIS). 3 Aug. 1998. <<http://www.tis.eh.doe.gov:80/docs/ard/100002.txt>>.

“1994 Annual Radiation Doses - Total Effective Dose.” U.S. Department of Energy, Office of Information Management. Technical Information System (TIS). 3 Aug. 1998. <<http://www.tis.eh.doe.gov:80/docs/ard/100001.txt>>.

Technical Information System. U.S. Department of Energy, Office of Information Management. 17 Aug. 1998. <<http://tis-hq.eh.doe.gov>>

Environment, Safety, and Health Info Center Navigation Map. U.S. Department of Energy, Office of Information Management. 28 Feb. 1997. <<http://tis-hq.eh.doe.gov/map.html>>.

Rocky Flats Citizens Advisory Board. 10 July 1998. <<http://www.indra.com/rfcab/>>.

Colorado Department of Public Health and Environment Home Page. State of Colorado. 18 Aug. 1998. <http://www.state.co.us/gov_dir/cdphe_dir/>.

REMS - Radiation Exposure Monitoring System. U.S. Department of Energy. 25 Oct. 1996. <<http://rems.eh.doe.gov/rems.htm>>.

Department of Energy Occurrence Reporting Program. U.S. Department of Energy, Office of Information Management. 03 Aug. 1998. <<http://www.tis.eh.doe.gov/web/oeaf/orps/orps.html>>.

Facility Profile Information Management System. U.S. Department of Energy, Office of Environment, Safety and Health. 12 Aug 1998. <<http://search.dis.anl.gov/>>.

Lessons Learned Information Services. U.S. Department of Energy. 02 June 1998. <<http://tis-hq.eh.doe.gov/others/ll/ll.html>>.

Occupational Injury and Property Damage Summary. U.S. Department of Environment, Safety and Health. 17 Aug. 1998. <<http://tis.eh.doe.gov/docs/oipds/>>.

SECTION 12.0: RFETS POINTS OF CONTACT

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Joe Lucerna	Kaiser-Hill, As Above	(303) 966-7229	Technologies
Dana Door	Kaiser-Hill, As Above	(303) 966-7978	HR Reporting
Shirley Cutler	Kaiser-Hill, As Above	(303) 966-7991	Sub-contractors
Chirstine Nelson	Kaiser-Hill, As Above	(303) 966-4851	HR Info. Systems
Bob McCormick	Kaiser-Hill, As Above	(303) 966-9832	Industrial Relations
Brett Closson	Safe Sites of Colorado (SSOC), As Above	(303) 966-7781	Industrial Hygiene
Leann Holwager	Kaiser-Hill, As Above	(303) 966-2406	Industrial Hygiene
Peggy Hains	Technical Field Eng. (TFE), As Above	(303) 966-3419	Training Records
Dennis Dole	Dyncorp of Colorado (DCI) As Above	(303) 966- 7584	Training Program
Chris Keese	Kaiser-Hill, As Above	(303) 966- 3485	HR Reporting
Jim Rutenber	University of Colorado,	(303) 315-5627	Exposure Study
Michael V. Van Dyke	Tri-County Health Department 4301 East 72nd Ave. Commerce City, CO 80022-1488	(303) 227-4035	Exposure Study
Erin Rogers	Rocky Flats Citizens Advisory Board 9035 Wadsworth Parkway, Suite 2250	(303) 420-7855	Public Info. Resource
Dennis Floyd	Manufacturing Science Corp. (MSC), 3000 Youngfield Street, Suite 364, Denver, CO 80215	(303) 966- 8130	Buildings 883 and 865 D&D Reuse Contract
Paul Bengal	Denver-West Remediation Corporation (DWRC) 1819 Denver-West Drive, Building 26, Suite 200, Golden, CO 80401	(303) 966- 2535	De & Di Contact Work
Ben Evans	Kaiser-Hill, See Above	(303) 966-7491	Dismantlement of Buildings and Equipment
Ann Rotchen	Kaiser-Hill, See Above	(303) 966-8379	Medical Program & Records
Kevin Ryan	SSOC, See Above	(303) 966-7491	Nuclear Operations (SNM)
David Prochnow	Kaiser-Hill, See Above	(303) 966-7697	Records Management
Jim Wood	SSOC, See Above	(303) 966-6230	Radiological Program
Marty Dondilinger	SSOC, See Above	(303) 966-2725	Turnover rates

SECTION 12.0 (Continued): RFETS POINTS OF CONTACT

P.O.C.	Company/Organization & Location	Phone #	Area of Expertise
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David Pegram	DOE-HQ (former RFETS/EG&G)	(301)903-9840	Industrial Hygiene
Carl Spring	Colorado Department of Public Health & the Environment (CDPH&E) 4300 Cherry Creek Drive South Denver, CO 80222	(303) 692-3358	RCRA Closures
Chris Gilbreth	CDPH&E As Above	(303) 692-3371	RCRA permitting

Note: Points of Contact developed between December 1996 and October 1997, subject to change without notice.

SECTION 13.0: ACRONYMS AND GLOSSARY OF TERMS

ACM	Asbestos Containing Material
AEA	Atomic Energy Act
AECCM	Architectural, Engineering, Construction and Construction Management
AIMS	Advanced Intermediate Management Services
ALARA	As Low As Reasonably Achievable
ASAP	Accelerated Site Action Project
BHSP	Beryllium Health Surveillance Program
CAB	Citizens Advisory Board
CAIRS	Computerized Accident/Incident Reporting System
CBCT	Colorado Building Construction Trades
CBCTC	Colorado Building Construction Trades Contract/Agreement
CC&AT	Cross Cutting and Advanced Technology development
CCO	Catalytic Chemical Oxidation
CEDE	Committed Effective Dose Equivalent
CEDR	Comprehensive Epidemiologic Data Resource
CERCLA	Comprehensive Environmental Response, Compensation & Liability Act
CFR	Code of Federal Regulations
CHWA	Colorado Hazardous Waste Act
CDPHE	Colorado Department of Public Health and Environment
CW	Clean-up Tasks
CWA	Clean Water Act
DCI	DyneCorp of Colorado, Inc.
De	Deactivation Task
Di	Dismantlement Task
D&D	Decontamination and Decommissioning
DHHS	Department of Health and Human Services of the Centers for Disease Control and Prevention
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DOP	Decommissioning Operations Plan
DOT	Department of Transportation
DWRC	Denver West Remediation Corporation
EG&G	Ederton, Germeshausen & Grier (DOE/RFO Contractor)
EKG	Electrocardiogram
EM	U.S. Department of Energy Office of Environmental Management
EPA	Environmental Protection Agency
ER&WM	Environmental Restoration and Waste Management
ES&H	Environmental Safety & Health
ESAR	End State of Ash Residues
FBU	Fluidized Bed Units
FFCA	Federal Facility Compliance Act of 1992

SECTION 13.0 (Continued): ACRONYMS AND GLOSSARY OF TERMS

FPIMS	Facility Profile Information Management System
FOSRA	Fuel Oil Storage Removal Action
FY	Fiscal Year
GOCO	Government Owned/Contractor Operated
H&S	Safety and Hygiene (Manual)
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High Efficiency Particulate Air (Filtration)
HERB	Health-related Energy Research Branch
HGMS	High-Gradient Magnetic Separation
HVAC	Heating Ventilation and Air Conditioning
HW	Hazardous Waste
HWMU	Hazardous Waste Management Unit
IH	Industrial Hygiene
IHSS	Individual Hazardous Substance Site
IMAC	Integrated Management Contract
ISB	Integrated Site Baseline
LLMW	Low-Level Mixed Waste
LLRW	Low Level Radioactive Waste
LSA	Low Specific Activity
LTTD	Low Temperature Thermal Desorption
M&O	Maintenance and Operation
MEO	Mediated Electrochemical Oxidation
MOU	Memorandum of Understanding
METC	Morgantown Energy Technology Center
MICROSPI	Multi sensor Inspection and Characterization Robot for Small Pipes
MSC	Manufacturing Science Corporation
MT	Metric Ton
NARA	National Archives Record Administration
NEPA	National Environmental Policy Act
NFA	No Further Action
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NTS	Nevada Test Site
OJT	On the Job Training
ORNL	Oak Ridge National Laboratory
ORPS	Occurrence Reporting and Processing System
OS&H	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PCB	Polychlorinated Biphenyls

SECTION 13.0 (Continued): ACRONYMS AND GLOSSARY OF TERMS

PEIC	Public Environmental Information Centers
POC	Point of Contact
PPE	Personal Protective Equipment
PSTP	Proposed Site Treatment Plan
PU&D	Property Utilization and Disposal
PuSPS	Plutonium Stabilization and Packaging System
RA	Removal Action
RD&T	Research Development and Testing
RadCon	Radiological Control
RCM	Radiological Control Manual
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RFFO	Rocky Flats Field Office
RFLII	Rocky Flats Local Impacts Initiative
RHS	Radiological Health System
RMDB	Record Management Data Base
RMRS	Rocky Mountain Remediation Services
RSM	Recyclable Scrap Metal
RTDP	Robotics Technology Development Program
S&M	Surveillance and Maintenance
SAIC	Science Applications International Corporation
SCDE	Supercritical Carbon Dioxide Extraction
SNM	Special Nuclear Materials
SOP	Standard Operating Procedures
SSOC	Safe Sites of Colorado
SWMU	Solid Waste Management Units
STP	Site Treatment Plan
TEDE	Total Effective Dose Equivalents
TIRS	Transient Infrared Spectroscopy
TIS	Technical Information Service
TRU	Transuranic Waste
TRUPACT II	Transuranic Package Transporter
TSCA	Toxic Substances Control Act
TSD	Treatment, Storage and Disposal
TSR	Training, Scheduling, and Records
USC	United States Code
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tanks
USWA	United Steel Workers of America
VOC	Volatile Organic Compounds
WAC	Waste Acceptance Criteria
WIPP	Waste Isolation Pilot Plant

SECTION 13.0 (Continued): ACRONYMS AND GLOSSARY OF TERMS

- ACM** **Asbestos Containing Material.** Asbestos fibers that are a portion of the overall site waste stream generated by construction, maintenance and building decommissioning activities.
- AEA** **Atomic Energy Act.** The Act of 1946 gave responsibility for production and control of nuclear materials with the Atomic Energy Commission. The Act of 1954 allowed the Atomic Energy Commission to license private companies to use nuclear materials, construct and operate nuclear plants.
- AEC** **Atomic Energy Commission.** The AEC was created by the U.S. Congress in 1946 as the civilian agency responsible for the production of nuclear weapons. The AEC also researched and regulated atomic energy. It's weapons production and research activities were given to the *Energy Research and Development Administration* in 1975, while its regulatory responsibility was given to the new Nuclear Regulatory Commission.
- ALARA** **As Low As Reasonably Achievable.** A phrase and acronym (As Low As Reasonably Achievable) used to describe an approach to radiation exposure and emissions control or management whereby the exposures and resulting doses to the public are maintained as far below the specified limits as economic, technical and practical considerations will permit.
- CERCLA** **Comprehensive Environmental Response, Compensation and Liability Act.** A Federal law, enacted in 1980, that governs the cleanup of hazardous, toxic and radioactive substances. The Act and its amendments created a trust fund, commonly known as Superfund, to finance the investigation and cleanup of abandoned and uncontrolled hazardous waste sites.
- CFR** **Code of Federal Regulations.** The index containing United States law.
- Ci** **Curie.** The unit of quantity of radioactivity. It requires that in the given sample of any material, 37 billion disintegrations occur each second.
- COC** **Contaminants of Concern**
- CW** **Clean Up Worker.** A worker involved with the treatment, transportation, storage and disposal of Low Level Radioactive Waste (LLRW).

SECTION 13.0 (Continued): ACRONYMS AND GLOSSARY OF TERMS

- CWA** **Clean Water Act.** This act amended the Federal Water Pollution Control Act first passed in 1956. Its objective is to restore and maintain the chemical, physical and biological integrity of the nation's waters, including surface waters and navigable streams. It regulates discharges to or dredging of wetlands. Its major enforcement tool is the National Pollutant Discharge Elimination System (NPDES) permit.
- D&D** **Decontamination and Decommissioning Program.** A program involved with the decontamination and decommissioning of structures and associated equipment.
- De** **Deactivation:** The process/task of placing a facility in a safe and stable condition to minimize the long-term cost of a surveillance and maintenance program that is protective of workers, the public and the environment until decommissioning is complete. Actions include the removal of fuel, draining and/or de-energizing of non-essential systems, removal of stored radioactive and hazardous materials and related actions. As a bridge between operations and decommissioning, based on facility-specific conditions and final disposition plans, deactivation can accomplish operations such as final process runs, and decontamination activities aimed at placing the facility in a safe and stable condition.
- Decom** **Decommissioning:** Takes place after deactivation and includes surveillance and maintenance, decontamination, and/or dismantlement. These actions are taken at the end of the life of the facility to retire it from service with adequate regard for the health and safety of the workers, the public and protection of the environment. The ultimate goal of decommissioning is the unrestricted release or restricted use of the site.
- Decon** **Decontamination:** The removal or reduction of radioactive or hazardous contamination from facilities, equipment, or environmental media by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques to achieve a stated objective or end condition.
- Di** **Dismantlement:** The task involving disassembly or demolition and removal of any structure, system, or component during decommissioning and satisfactory interim or long-term disposal of the residue from all portions of the facility.
- DHHS** **Department of Health and Human Services** The United States Government's principal agency for protecting the health of all Americans and providing essential human services, especially for those who are least able to help themselves

SECTION 13.0 (Continued): ACRONYMS AND GLOSSARY OF TERMS

DOD	Department of Defense. The federal agency in charge of defense tactics and protective strategies for the nation.
DOE	Department of Energy. Created from the Energy Research and Development Administration in 1977, the cabinet-level US Government agency is responsible for nuclear weapons production, energy research and the cleanup of hazardous and radioactive waste at its sites.
DOT	Department of Transportation. The federal agency in charge of national transportation regulations.
EDE	Effective Dose Equivalent. The sum of the weighted dose equivalents for all irradiated tissues, using the weighting factors in ICRP Publication 26.
EM	Environmental Monitoring. Periodic or continuous measuring of the quantity and type of discharges or migration of radioactive or hazardous waste from a management facility to determine the level of compliance with regulatory requirements and/or pollutant levels in various media.
Environmental Media	Consists of groundwater (perched and regional aquifer, surface water), surface soils and sediments, subsurface soils and flora and fauna.
Fixed Radiological Contamination	Any radioactive material that cannot be removed by light to moderate swiping techniques using paper or cloth smears.
FS	Feasibility Study. An analysis of the practicability of a proposal. The feasibility study emphasizes data analysis and usually recommends selection of a cost effective alternative. Usually performed with data within a remedial investigation and is collectively termed RI/FS.
HAZWOPER	Hazardous Waste Operations and Emergency Response. The activities associated with specific hazardous waste duties and the emergency response actions taken during hazardous waste accidents. HW workers are specifically trained worker groups required to be certified as such.
HEPA	High Efficiency Particulate Air (Filtration) A gas filtration system having a fibrous medium that produces a particle-removal efficiency of at least 99.97% for 0.3-micron-diameter monodisperse dioctylphthalate (DOP).

SECTION 13.0 (Continued): ACRONYMS AND GLOSSARY OF TERMS

HERB	Health-Related Energy Research Branch. The division within the National Institute for Occupational Safety and Health conducting health research for energy related studies.
HW	Hazardous Waste Worker. A worker involved in sampling, surveying, containerization, treatment, transportation, storage and disposal of hazardous wastes.
HWMU	Hazardous Waste Management Unit. An area or building within an Operable Unit (OU) that is to be decontaminated and decommissioned. There are usually many HWMUs within an OU.
LLRW	Low Level Radioactive Waste. A term for any radioactive waste that is not spent fuel, high-level, or transuranic waste.
MEK	Methyl Ethyl Ketone
uCi	microcurie. The amount of radioactivity in one microgram of the isotope radium 226.
MOU	Memorandum of Understanding. An agreement between the Department of Energy (DOE) and the Department of Health and Human Services (DHHS) which transfers responsibility for the management and conduct of energy-related analytic epidemiologic research to DHHS. DHHS has designated the Centers for Disease Control and Prevention (CDC) as the lead agency. The MOU established the need for CDC personnel, their contractors and grantees to access DOE facilities, workers and records to conduct community and worker-based health research and related activities.
mrem	millirem. 1/1000th of the unit that expresses the biologically effective dose produced by any type of radiation.
NIOSH	National Institute of Occupational Safety and Health. An federal agency associated with the Centers for Disease Control and the Public Health Service dedicated to research, evaluation and monitoring potential work related hazards.
NPDES	National Pollutant Discharge and Elimination System. Establishes standards under EPA and state regulations for point sources of discharges of pollutants.

SECTION 13.0 (Continued): ACRONYMS AND GLOSSARY OF TERMS

NTS	Nevada Test Site. A 1,350-square-mile area of the southern Nevada desert that has been the site of most of the U.S. underground and atmospheric tests since it opened in 1951.
OSHA	Occupational Safety and Health Administration. The regulatory agency that enforces the law pertaining to employee safety and health.
OU	Operable Unit. A discrete action that comprises an incremental step toward comprehensively addressing site problems. Operable Units may address geographical portions of a site, specific site problems, or initial phases of an action performed over time, or any actions that are concurrent but located in different parts of the site.
PCB	Polychlorinated Biphenyls. Commercially produced organic chemicals used in industrial applications throughout the nuclear weapons complex. PCBs are found in many of the gaskets and large electrical transformers and capacitors in the gaseous diffusion plants. PCBs have been proven to be toxic to both humans and laboratory animals.
pCi	picocurie. The picocurie is 3.7×10^{-2} disintegrations per second and is often used to express the very low natural and environmental levels of radiation.
PEIC	Public Environmental Information Center. Implemented by the DOE, the PEIC is an open reading room providing DOE documentation, US EPA regulation, site specific information and other radiation references. PEICs are usually located on or near the DOE site.
POC	Point of Contact. POCs are designated as fundamental sources of information and for this particular study include EG&G Mound Applied Technologies personnel, DOE officials and other experts in their field.
PPE	Personal Protective Equipment. PPEs include any type of equipment used to protect the worker from potentially hazardous substances in the work place. PPEs may range from respiratory devices to protective clothing.
RA	Removal Action. Removal Actions are actions necessary to monitor, assess, or evaluate the threat of concern. They are initiated when there is a need to accelerate cleanup activities involving hazardous wastes and are coordinated with US EPA and OEPA guidelines.

SECTION 13.0 (Continued): ACRONYMS AND GLOSSARY OF TERMS

- RCRA** **Resource Conservation and Recovery Act.** An act passed in 1976 as an amendment to the Solid Waste Disposal Act (1965). The primary goals of RCRA are to protect human health and the environment from the potential hazards of waste disposal; to conserve energy and natural resources, to reduce the amount of waste generated, including hazardous waste and to ensure that waste is managed in an environmentally sound manner. RCRA was amended in 1984 by the Hazardous and Solid Waste Amendments, which expanded RCRA's scope.
- SOP** **Standard Operating Procedure.** A SOP in any case refers to the guidelines for operation or standards for completing a project. A SOP will include quality assurance guidelines as well as procedures for obtaining a final goal or end point.
- STP** **Site Treatment Plan.** The STP documents the methods and actions needed to obtain proper and cost effective cleanup of a specific site.
- SWMU** **Solid Waste Management Unit.** Any facility for the collection, source separation, storage, transportation, transfer, processing, treatment or disposal of solid wastes, including hazardous wastes, whether such facility is associated with facilities generating such wastes or otherwise.
- TEDE** **Total Effective Dose Equivalent.** The total summation of all weighted dose equivalents for all irradiated tissues, using the weighting factors in ICRP Publication 26.
- USEPA** **United States Environmental Protection Agency.** A Federal agency established in 1970 responsible for enforcing environmental laws, including RCRA, CERCLA and TSCA.
- WAC** **Waste Acceptance Criteria.** EPA site specific regulatory guidelines governing land disposal restrictions at TSD sites.