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ROCKY FLATS

ENVIRONMENTAL RESTORATION TECHNICAL SUPPORT DOCUMENT (ERTSD): A NEPA SUPPORT DOCUMENT FOR THE ROCKY FLATS PLANT

Rocky Flats Environmental Restoration Project

MARCH 1994

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Approved by:

	Jean L. Reynolds QA	4/13/94 Date
3/31/94 Effective Date	S M Nesta Manager	4/13/94 Date

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AAQS	-	Ambient Air Quality Standard
ADT	-	Average Daily Vehicle Trips
AEC	-	Atomic Energy Commission
APEN	-	Air Pollution Emission Notice
AQD	-	Air Quality Division
ARARs	-	Applicable or Relevant and Appropriate Requirements
ASCS	-	Agricultural Soil Conservation Service
BGS	-	Below Ground Surface
BOD	-	Biological Oxygen Demand
BRA	-	Baseline Risk Assessment
C2	-	Category 2
CAQCC	-	Colorado Air Quality Control Commission
CCl_4	-	Carbon Tetrachloride
CDH	-	Colorado Department of Health
CDOW	-	Colorado Division of Wildlife
CEARP	-	Comprehensive Environmental Assessment and Response Program
CERCLA	-	Comprehensive Environmental Response, Compensation, and Liability Act
CERP	-	Comprehensive Environmental Restoration Program (formerly CEARP)
$CHCl_3$	-	Chloroform
CMS/FS	-	Corrective Measure Studies/Feasibility Studies
COC	-	Chemical of Concern
COL	-	Colluvium
CRDL	-	Contract-Required Detection Limit
CSU	-	Colorado State University
D&D	-	Decontamination and Decommissioning
DAR	-	Duct Assessment Report
dBA	-	Decibel Absolute
DCE	-	Dichloroethene
DCG	-	Derived Concentration Guide
DDD	-	Dichlorodiphenyldichloroethane
DDE	-	Dichlorodiphenyldichloroethylene
DDT	-	Dichlorodiphenyltrichloroethane
DNAPL	-	Dense Nonaqueous Phase Liquids
DNL	-	Typical Day-Night Sound Levels
DOE	-	Department of Energy
DQO	-	Data Quality Objectives
EA	-	Environmental Assessment
EIS	-	Environmental Impact Statement
EPOS	-	Emergency Preparedness Offsite Systems
ERDA	-	Energy Research and Development Administration
ERTSD	-	Environmental Restoration Technical Support Document
ESA	-	Endangered Species Act

FDM	-	Fugitive Dust Model
FEIS	-	Final Environmental Impact Statement
FFCA	-	Federal Facility Compliance Agreement
FID	-	Flame Ionization Detector
FONSI	-	Finding of No Significant Impact
FS	-	Feasibility Study
FSP	-	Field Sampling Plan
FTU	-	Field-scale Treatability Unit
FWCA	-	Fish and Wildlife Coordination Act
FY	-	Fiscal Year
GAC	-	Granular Activated Carbon
GWR	-	Great Western Reservoir
HAP	-	Hazardous Air Pollutants
HEPA	-	High Efficiency Particulate Air
HFD	-	Hillside French Drain
HHRA	-	Human Health Risk Assessment
HPGe	-	High Purity Germanium
HRR	-	Historical Releases Report
HSU	-	Hydrostratigraphic Units
HVAC	-	Heating, Ventilating, and Air Conditioning
I-W	-	Indiana Street-Walnut Creek Pond
IA	-	Industrial Area
IAG	-	Interagency Agreement
IHEM	-	In-House Energy Management Plan
IHSS	-	Individual Hazardous Substance Site
IM/IRA/EA	-	Interim Measure/Interim Remedial Action/Environmental Assessment
IM/IRA	-	Interim Measure/Interim Remedial Action
IM/IRAP	-	Interim Measure/Interim Remedial Action Plan
ITS	-	Interceptor Trench System
kV	-	kilo Volts
KAR	-	Undifferentiated Arapahoe/Laramie Formations
LHSU	-	Lower Hydrostratigraphic Units
LOS	-	Level of Service
MBTA	-	Migratory Bird Treaty Act
MMBtu	-	Million British Thermal Units
MSL	-	Mean Sea Level
MVA	-	Million Volt Amperes

NAAQS	-	National Ambient Air Quality Standards
NAS	-	National Academy of Sciences
NEPA	-	National Environmental Policy Act
NESHAP	-	National Emission Standards for Hazardous Air Pollutants
NPDES	-	National Pollutant Discharge Elimination System
OPWL	-	Original Process Waste Line
OU	-	Operable Unit
PA	-	Protected Area
PAH	-	Polyaromatic Hydrocarbons
PCB	-	Polychlorinated Biphenyls
PCE	-	Tetrachloroethene
pCi/g	-	Picocuries per Gram
pCi/l	-	Picocuries per Liter
PID	-	Photoionization Detector
PP/DM	-	Proposed Plan/Draft Modification
PPCD	-	Plan for Prevention of Contaminant Dispersion
QA/QC	-	Quality Assurance/Quality Control
RAAMP	-	Radioactive Ambient Air Monitoring Program
RACT	-	Reasonably Available Control Technologies
RCRA	-	Resource Conservation and Recovery Act
RFA	-	Rocky Flats Alluvium
RFEDS	-	Rocky Flats Environmental Database System
RFI/RI	-	RCRA Facilities Investigation/Remedial Investigation
RFO	-	Rocky Flats Office
RFP	-	Rocky Flats Plant
RI	-	Remedial Investigation
RWS	-	Raw Water Storage Pond
SAAM	-	Selective Alpha Air Monitor
SEP	-	Solar Evaporation Pond
SH	-	State Highway
SID	-	South Interceptor Ditch
SOC	-	Species of Concern
SPP	-	Solar Evaporation Ponds Subproject
STP	-	Sewage Treatment Plant
SWEIS	-	Site-Wide Environmental Impact Statement
SWMP	-	Surface Water Management Plan
SWMU	-	Solid Waste Management Unit

TAL	-	Target Analyte List
TCE	-	Trichloroethene
TDS	-	Total Dissolved Solids
TLLα	-	Total Long-Lived Alpha
TM	-	Technical Memorandum
TDS	-	Total Dissolved Solids
TOC	-	Total Organic Carbon
TSP	-	Treatability Studies Plan
TSS	-	Total Suspended Solids
UHSU	-	Upper Hydrostratigraphic Units
USACE	-	U.S. Army Corps of Engineers
USCS	-	Unified Soil Classification System
USFS	-	U.S. Forest Service
VAC	-	Visual Absorption Capacity
VFA	-	Valley-fill Alluvium
VOC	-	Volatile Organic Compound
VQO	-	Visual Quality Objective
WCS	-	Weathered Claystone
WQCC	-	Water Quality Control Commission

* * * * *

PURPOSE

The purpose of this Environmental Restoration Technical Support Document (ERTSD) is to summarize environmental baseline data regarding the Rocky Flats Plant (RFP) and its Operable Units (OUs). This document was commissioned by Department of Energy (DOE) and EG&G to survey the many thousands of records which exist at the Rocky Flats Plant site (and in neighboring libraries and collections), and to locate those documents most relevant for characterizing current environmental baseline conditions and nature of contamination. Those documents are addressed in this report. Ongoing studies are also described.

METHODOLOGY

The methodology involved a detailed records search. This search followed (a) interviews with key personnel at RFP, and (b) research through strings (or chains) of documents of similar titles, which have been prepared recently and historically at the Rocky Flats Plant. The records search was conducted in divisional and personal libraries at RFP, and in major RFP repositories. A great deal of assistance was obtained from EG&G to secure proper working space, communications, and logistical support during this effort.

The search yielded documents with three levels of utility for the ERTSD effort, as follows:

- **Level 1** - These documents appeared initially promising, but were later determined to have **limited or no utility** to the ERTSD process.

- **Level 2** - These documents were determined to have **possible utility** for characterizing current environmental baseline conditions, the nature of contamination, and the status of ongoing studies at the plant site.

- **Level 3** - These documents were determined to have **definite utility** for the ERTSD effort and represent the most current, comprehensive, and useful documents located during the ERTSD research process.

ERTSD ORGANIZATION

Section 1.0, Introduction, explains the background and purpose of this report, describes the organizational structure, defines the main objectives, summarizes the methodology used to collect the data and information presented, and outlines the reasons the ERTSD focuses on OUs and their remediation activities.

Section 2.0, Site History and Nature of Contamination, discusses the background and history of the Rocky Flats Plant, its activities, and previous investigations. In addition, the development of the "Operable Unit" as a investigative tool is explained. Finally, the following information is summarized for each of the 16 Operable Units: the individual hazardous substance sites (IHSSs) in each OU, the OU history and past uses, and the nature and extent of contamination in that OU.

Section 3.0, Major Disciplines/Environmental Media, presents existing baseline information on high-profile resources, with an emphasis on the relationship between the resource and past activities and contamination. Resources addressed here are soil, vegetation, aquatic life, terrestrial wildlife, surface water, groundwater, air quality, and geology.

Section 4.0, Minor Disciplines/Environmental Media, presents existing baseline information on lower-profile resources, with an emphasis on the relationship between the resource and past activities and contamination. Resources addressed here are meteorology, noise, transportation, visual resources, land use, energy, and cultural resources.

Section 5.0, Human and Ecological Risks, discusses previous, current, and/or planned assessments of human and ecological risks, at both the sitewide and OU level.

Section 6.0, Remediation, summarizes previous, current, and/or planned remediation activities at both the sitewide and OU level.

Section 7.0, References, provides a list of the works cited in the text of the ERTSD.

Section 8.0, Database and Bibliography, explains the development and structure of the database and presents a hardcopy of the complete bibliography.

* * * * *

1.0
INTRODUCTION

1.1 BACKGROUND AND PURPOSE

The Department of Energy (DOE) plans to update its 1980 Sitewide Environmental Impact Statement (SWEIS) for the Rocky Flats Plant, Golden, Colorado. The update is intended to address ongoing operations, mission changes, remediation, and the various closure activities that are and will take place at the Rocky Flats Plant (RFP).

The updated SWEIS, to be prepared under requirements of the National Environmental Policy Act (NEPA) and other DOE directives, will include an evaluation of the environmental impacts associated with existing contamination, as well as planned remediation efforts. These efforts are being planned and carried out in smaller, more manageable "operable units"; although, the overall restoration is being considered at a sitewide level.

The following document is intended to provide up-to-date information, support, and reference material for preparers of the SWEIS update, and to provide ancillary support for other NEPA studies and documents in future years. This 1994 Revision of the *Environmental Restoration Technical Support Document (ERTSD): A NEPA Support Document for the Rocky Flats Plant,* incorporates new and/or revised information into the original June 1992 issue.

The ERTSD presents a general summary of currently available information important for NEPA consideration. The organizational structure is based first, on the traditional environmental resources, such as soils, water, and air; and second, on addressing both the sitewide level and Operable Unit level.

The information presented includes: a) information on environmental setting and baseline characteristics; b) historical data on RFP and the Operable Units; c) data on contaminants present, their known or suspected levels, and their dispersion and movement; and d) remediation plans, risk assessment, and other information relevant to an environmental impact analysis of contamination and remediation at the OUs.

The ERTSD is compiled from previous, current, and ongoing studies at RFP. Referenced material includes published and unpublished reports, data summaries and analysis, plans, computer and manual databases, memoranda, letters, file information, and other sources.

1.2 ERTSD FOCUS

The focus of this document is on those NEPA resources (disciplines) that will be most affected by, or have the greatest effect on, onsite operations, remediation, and closure activities at the Rocky Flats Plant in future years. Those disciplines which are addressed in Section 3.0 of this report as, "Major Disciplines/Environmental Media," are acknowledged to be most important for study and remediation purposes at the plant site.

Those disciplines which are addressed in Section 4.0 of this report as, "Minor Disciplines/ Environmental Media" have less relevance and importance to the future activities, but will likely be affected by onsite activities.

Some disciplines traditionally addressed in NEPA documentation have not been covered within the ERTSD (e.g., recreation and socioeconomics). Since these disciplines will be affected principally in an offsite manner by future activities at Rocky Flats, they are not the subject of this document. However, literature, data, text, and computer database entries are available in project files for such topics for the interested reader.

1.3 ERTSD REPORT ORGANIZATION

An **Executive Summary** precedes Section 1.0 of this document.

Section 1.0, Introduction, explains the background and purpose of this report, describes the organizational structure, defines the main objectives, summarizes the methodology used to collect the data and information presented, and outlines the reasons the ERTSD focuses on OUs and their remediation activities.

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Section 7.0, References, provides a list of the works cited in the text of the ERTSD.

Section 8.0, Database and Bibliography, explains the development and structure of the database and presents a hardcopy of the complete bibliography.

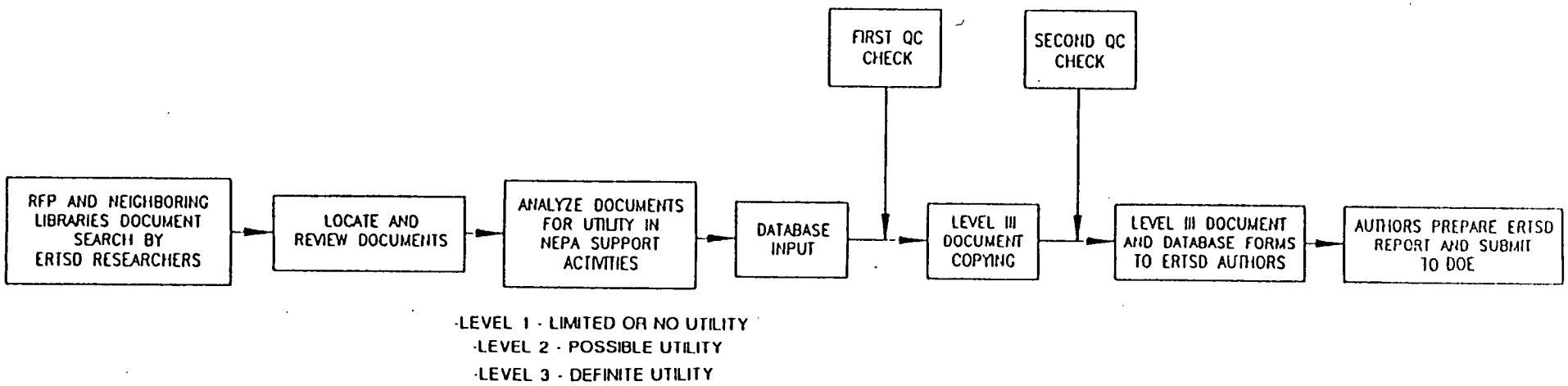
1.4 METHODOLOGY

Preparation of the ERTSD began with an initial screening of information and/or reference source quality and applicability [a topic-specific final analysis of the quality or applicability of available data will be possible for EIS preparers and other NEPA researchers]. A systematic literature review was used. Preparation of the ERTSD concluded with a more thorough review of documents and a compilation of material from selected documents. The process for preparation of the ERTSD is summarized below and in **Figure 1.5-1**.

1. Perform LEVEL 1 SCREENING:

    - Select documents from the more than 70,000 records and documents at RFP and neighboring libraries.
    - Identify and list the documents which may be relevant to the SWEIS and NEPA efforts; use interviews with key personnel, and/or a strings-of-documents research process.
    - Perform a cursory review of the records and documents identified, recording basic data (author, title, year) on the computer database coding form.
    - Identify LEVEL 1 DOCUMENTS (i.e., those with initially potential relevance, but which are later determined to have "limited or no utility" for the SWEIS and NEPA efforts).

FIGURE 1.5-1
ERTSD METHODOLOGY



Source: ERTSD

2. Perform LEVEL 2 SCREENING:

   - Continue cursory review of the target documents (non Level 1) to identify the LEVEL 2 DOCUMENTS (i.e., those that appear relevant to the SWEIS and NEPA efforts).
   - Annotate the contents of the LEVEL 2 DOCUMENTS in a brief two-to-three sentence entry on the computer database coding form.

3. Perform LEVEL 3 SCREENING:

   - Continue cursory review of the target documents (non Level 1/Level 2) to identify the LEVEL 3 DOCUMENTS (i.e., those that appear most relevant — the best, most current, most comprehensive NEPA references — to the SWEIS and NEPA efforts).
   - Develop an abstract (one to two paragraphs) of the contents on the computer database coding form.
   - Attach a copy of the cover page, table of contents, executive summary, and references of the document.

4. Notate all LEVEL 3 DOCUMENTS on the computer database coding form for later retrieval (i.e., location, control number).

5. Retrieve/photocopy the LEVEL 3 DOCUMENTS and provide relevant collections to the pre-designated authors for incorporation into the ERTSD.

6. Update the ERTSD Database in all formats. A hard copy is attached to this volume. A floppy copy has been provided to DOE, RFO under the cover letter for this milestone. Also, a copy of the database is available through RFP's Ecology and NEPA Division Server files (LAN computer network). The document database is addressed further in Section 8.0.

1.5 NOTES TO USERS

The scope of this ERTSD created the need to employ certain criteria and procedures to facilitate its initial completion in 1992 and its revision in 1994. Users of the document are reminded of the following.

Snapshot Approach. The Rocky Flats Plant is a working facility; therefore, daily operations and remediation efforts are ongoing. Data or information specific to an operable unit, a resource, or a proposed project is subject to change. For this reason, the ERTSD report is written using a point-in-time or "snapshot" approach. The most recent and approved documents were consulted when possible. The status of documents referred to is noted whenever possible, so that the user will be able to determine the validity of that document beyond the issue date of this ERTSD.

Comprehensive Summary. This document is a Technical Support Document for the SWEIS and is not intended to be a substitute for research. Rather, it is intended to act as a "roadmap" that researchers can consult for direction to the appropriate document. Preparers of the SWEIS and/or NEPA researchers are encouraged to seek out the original reference documents for additional or higher level data.

Existing Material. In most cases, existing tables, figures, and text were used in this ERTSD. These were not updated, modified, or validated as part of the ERTSD scope of work. Therefore, if there is a question as to the timeliness and/or validity of presented information, the user should, as noted previously, consult the original data or reference document cited for that information.

References Cited. Some 200 reference documents were cited within the text portion of this ERTSD. Because the most recent and approved documents were consulted (when possible), and because most of these documents have similar authors, citations are differentiated with a lowercase letter accompanying the author/date. References are listed chronologically in Section 7.0.

Database References. Database references should not be confused with references cited. Cited references apply only to ERTSD text; database references include all Level 1, 2, and 3 sources.

2.1 ROCKY FLATS PLANT

2.1.1 Physical Setting

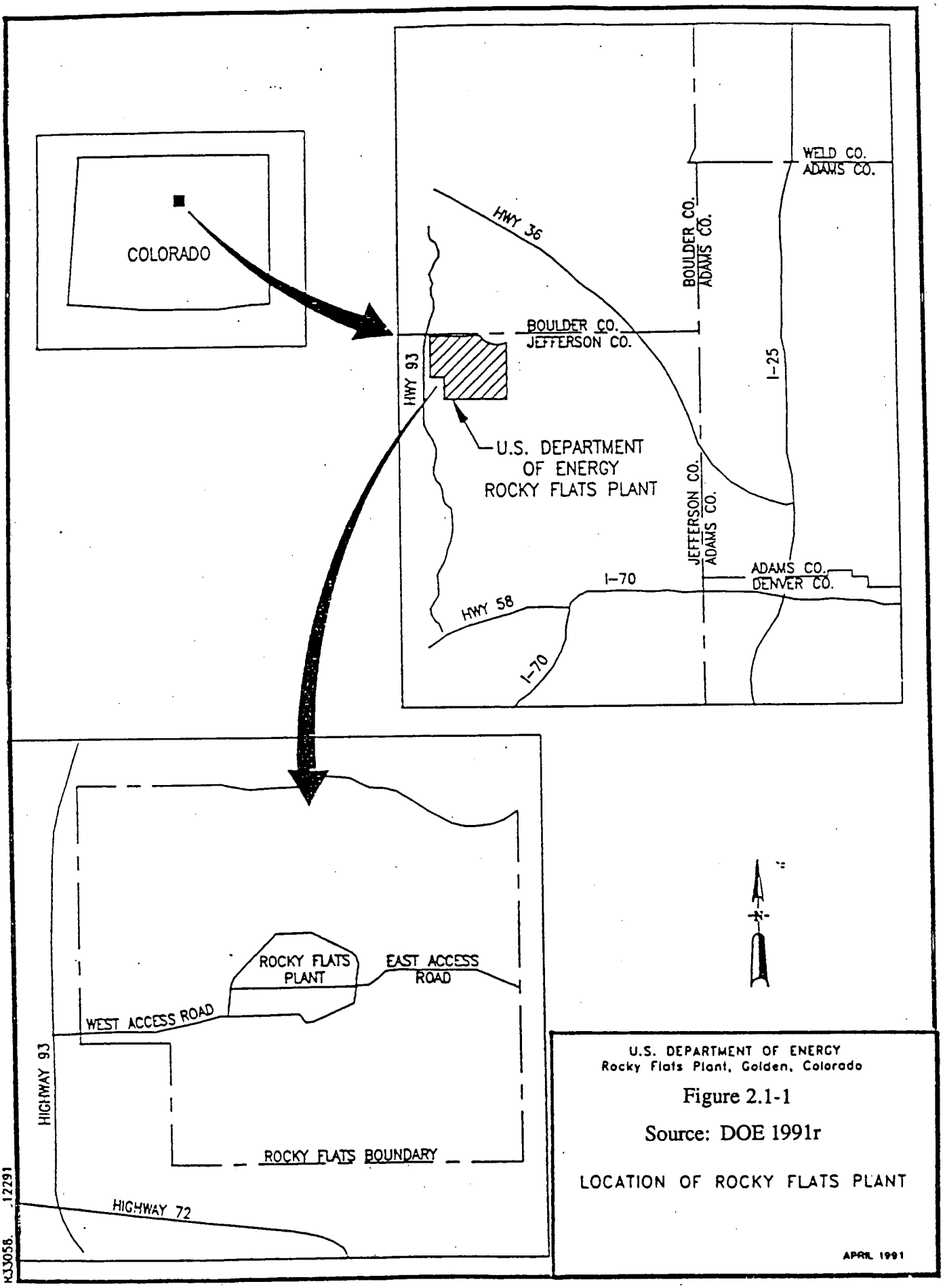
The Rocky Flats Plant (RFP) is located in northern Jefferson County, Colorado, approximately 16 miles northwest of Denver (**Figure 2.1-1**). The cities of Boulder, Broomfield, Westminster, and Arvada are located less than 10 miles to the north, northeast, east, and southeast, respectively. RFP consists of approximately 6,550 acres of Federal land and occupies Sections 1 through 4 and 9 through 15 of Township 2 South, Range 70 West, 6th Principal Meridian.

Major plant buildings are located within a RFP security area of approximately 400 acres. The security area is surrounded by a buffer zone of approximately 6,150 acres. RFP is generally bounded on the north by State Highway 128. To the east is Jefferson County Highway 17, also known as Indiana Street; to the south are agricultural and industrial properties, and State Highway 72; and to the west is State Highway 93 (**Figure 2.1-2**).

2.1.2 Site Background

RFP is a government-owned and contractor-operated facility that is part of the nationwide nuclear weapons production complex. RFP was operated for the U. S. Atomic Energy Commission (AEC) from RFP's inception in 1951 until the AEC was dissolved in January 1975. At that time, responsibility for RFP was assigned to the Energy Research and Development Administration (ERDA), which was succeeded by the Department of Energy (DOE) in 1977.

Dow Chemical USA, an operating unit of the Dow Chemical Company, was the management and operating contractor of the facility from 1951 until June 30, 1975. Rockwell International succeeded Dow Chemical USA from July 1, 1975 to January 1, 1990, when EG&G Rocky Flats, Inc. succeeded Rockwell International.



U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado

Figure 2.1-1

Source: DOE 1991r

LOCATION OF ROCKY FLATS PLANT

APRIL 1991

K33058.12291

2.1.3 Rocky Flats Plant Operations

Until 1992, RFP's primary mission was to produce metal components for nuclear weapons. These components were fabricated from plutonium, uranium, and nonradioactive metals, principally beryllium and stainless steel. Parts made at the plant were shipped elsewhere for final assembly. When a nuclear weapon is determined to be obsolete, components of these weapons which had been fabricated at RFP are returned for special processing which recovers plutonium. Other activities at RFP include research and development in metallurgy, machining, nondestructive testing, coatings, remote engineering, chemistry, and physics.

2.1.4 Previous Investigations

Various studies have been conducted at RFP to characterize environmental media and to assess the extent of radiological and chemical contaminant releases to the environment. These have included geological studies, surface water and groundwater studies, and geophysical and radiometric surveys. Several environmental, ecological, and public health studies culminated in a Final Sitewide Environmental Impact Statement (DOE 1980).

In 1986, two major environmental investigations were completed at RFP. The first was the Comprehensive Environmental Assessment and Response Program (CEARP) Installation Assessment (DOE 1986a), which included analyses and identification of current operational activities, active and inactive waste sites, current and past waste management practices, and potential environmental pathways through which contaminants could be transported.

A number of sites that could potentially have adverse impacts on the environment were identified. These sites were designated as Solid Waste Management Units (SWMUs) (DOE 1987b) and were divided into three categories:

1. Hazardous waste management units that will continue to operate and need a Resource Conservation and Recovery Act (RCRA) operating permit.

2. Hazardous waste management units that will be closed under RCRA interim status.

3. Inactive waste management units that will be investigated and cleaned up under Section 3004 (u) of RCRA or under CERCLA.

The second major environmental investigation completed at RFP in 1986 involved a hydrogeologic and hydrochemical characterization of the entire RFP site. Results of these

investigations were reported by Rockwell International in 1986. Investigation results indicated four areas to be significant contributors to environmental contamination, with each area containing several sites. The areas are the 881 Hillside Area, the 903 Pad Area, the Mound Area, and the East Trenches Area. The 881 Hillside is now known as Operable Unit (OU) 1 and the latter three are known as OU2.

2.2 CREATION OF THE OPERABLE UNITS AND INDIVIDUAL HAZARDOUS SUBSTANCE SITES (IHSSs)

The Draft Installation Assessment under the Comprehensive Environmental Restoration Program (CERP), formerly the Comprehensive Environmental Assessment and Response Program (CEARP) (DOE 1986a), appears to have been the first document to compile a list of potential hazardous waste sites at RFP. The Assessment also attempted to prioritize the sites on the basis of EPA's Hazard Ranking System (HRS) and DOE's Modified HRS scoring. High priority sites, such as the 881 Hillside, were recommended for further investigation, and remedial investigations commenced at the high priority sites.

The RCRA Part B Permit Application (DOE 1986b, DOE 1986c) for RFP was completed in November 1986 for RFP hazardous waste management units that would continue to operate. Appendix 1 of the permit application (DOE 1987b), RCRA 3004 (u) Waste Management Units, defined the inactive waste sites as SWMUs.

A plan for investigating the remaining sites, referred to as the low priority sites, was prepared in 1988. This plan identified 103 SWMUs and recommended appropriate additional investigations. The plan also presented groups of SWMUs based on their geographical locations, similar contaminants, and applicable pathways. The SWMUs were combined into ten Operable Units in the Draft Interagency Agreement (IAG) (IAG 1990).

Additional SWMUs were added to the IAG based on the RCRA Part B Application, independent reviews of aerial photographs, and facility submittals. A total of 178 SWMUs were identified. The ten OUs were reprioritized and divided into sixteen OUs (Operable Units 1 through 16) in the final IAG (1991).

The SWMUs were also renamed Individual Hazardous Substances Sites (IHSSs) in the final IAG. The term IHSS is used in the remainder of this report. The IHSSs in each OU are discussed in the following sections.

2.3 OPERABLE UNIT 1 - 881 HILLSIDE

2.3.1 Operable Unit 1 Site Description

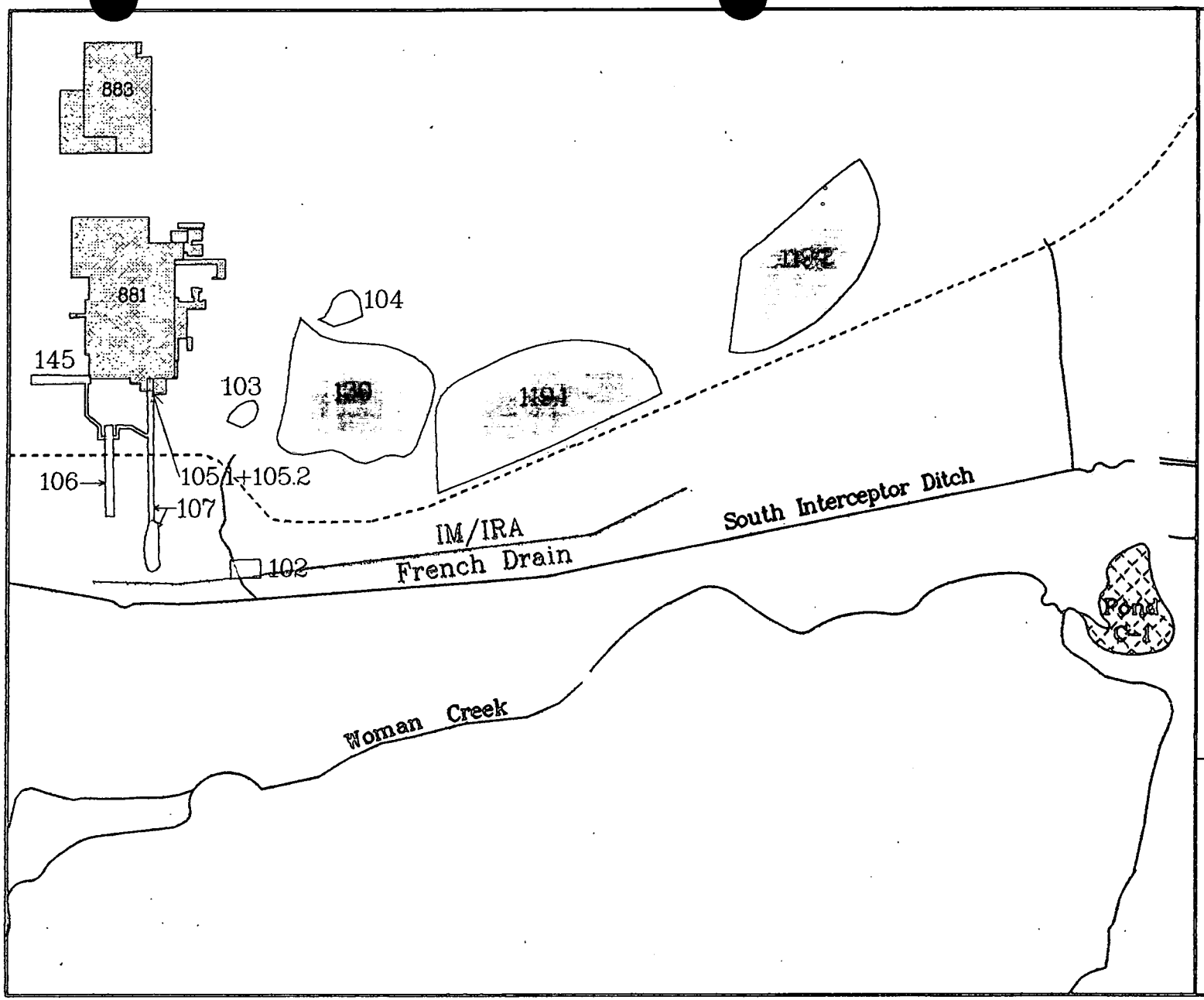
The 881 Hillside area is located south and southeast of Building 881, on the south side of the RFP security area (**Figure 2.3-1**). Eleven IHSSs within close proximity to each other are included in OU1 (DOE 1990b).

- IHSS 102 - Oil Sludge Pit
- IHSS 103 - Chemical Burial
- IHSS 104 - Liquid Dumping
- IHSS 105.1 - Building 881 Westernmost Out-of-Service Fuel Oil Tanks
- IHSS 105.2 - Building 881 Easternmost Out-of-Service Fuel Oil Tanks
- IHSS 106 - Outfall
- IHSS 107 - Building 881 Hillside Oil Leak
- IHSS 119.1 - West Scrap Metal Storage Area
- IHSS 119.2 - East Scrap Metal Storage Area
- IHSS 130 - Contaminated Soil Disposal Area East of Building 881
- IHSS 145 - Sanitary Waste Line Leak

Information on site use and history is summarized from the *Final Phase III RCRA Facility Investigation/Remedial Investigation Work Plan, Revision 1, Rocky Flats Plant, 881 Hillside Area (Operable Unit No. 1)* (DOE 1991e), and the *Historical Release Report for the Rocky Flats Plant* (DOE 1992x).

2.3.2 Operable Unit 1 Site Use and History

IHSS 102 (Oil Sludge Pit) was a pit where 30 to 50 drums of nonradioactive oil sludge were emptied in 1958. The sludge reportedly was collected during cleaning of two No. 6 fuel oil tanks (possibly tanks identified as IHSSs 105.1 and 105.2 south of Building 881). IHSS 103 (Chemical Burial) was an area south of Building 881 reportedly used to bury unknown chemicals. The exact location, dates of use, and contents of the site are unknown. No documentation confirms the existence of the site and it may have been confused with IHSS 109 (Trench T-2 in OU2). IHSS 104 (Liquid Dumping) is an area east of Building 881 reportedly used for disposal of unknown liquids and empty drums prior to 1969. No documentation confirms the existence of the site and it may also have been confused with IHSS 109 (Trench T-2 in OU2).



U.S. Department of Energy
Rocky Flats Plant

Streams, ditches, and other drainage features

Fences

Ponds/lakes

Individual Hazardous Substance Sites (IHSS)

Buildings or structures

SOURCE OF DATA:
Individual Hazardous Substance Sites - RFI/RI Phase III Report.

N

0 feet 250 500

Environmental Restoration
Technical Support Document

Operable Unit 1
881 Hillside

Figure 2.3-1

IHSSs 105.1 and 105.2 (Building 881 Westernmost Out-of-Service Fuel Oil Tanks and Building 881 Easternmost Out-of-Service Fuel Oil Tanks) are located immediately south of Building 881. These No. 6 fuel tanks were used from 1958 through 1976. They were filled with asbestos-containing material and then with concrete, presumably in 1976.

IHSS 106 (Outfall) is a six-inch-diameter, iron-pipe outfall, which existed south of Building 881 and discharged water until December 1977. Initial usage of the pipe was the discharge of sanitary waste. This practice was halted; however, the pipe was later used to discharge cooling tower blowdown.

IHSS 107 (Building 881 Hillside Oil Leak) is the location of an oil leak discovered in 1973 on the hillside south of Building 881. The oil spill was contained with straw, and the straw and soil were removed and disposed of in the present landfill north of RFP. It was discovered that the oil had emerged from the Building 881 footing drain outfall. The South Interceptor Ditch (constructed to prevent contamination entering Woman Creek) and concrete skimming pond (now replaced by the French Drain; see Section 6.2) were built below the footing drain outfall to contain the oil. No oil has been observed in the outfall since 1973.

IHSS 119.1 (West Scrap Metal Storage Area) and IHSS 119.2 (East Scrap Metal Storage Area), two areas east of Building 881 along the southern perimeter road, were used as barrel storage areas. The barrels contained unknown quantities and types of solvents and wastes. All barrels were removed from the sites in 1972. According to the Historical Release Report, a scrap metal pile (IHSS 119.2) was located in the southeast portion of the industrialized area. The site was moved to a location approximately 200 yards to the west (IHSS 119.1). The scrap metal may have had oils and/or coolants which could have dripped onto the ground.

IHSS 130 (Contaminated Soil Disposal Area East of Building 881) was an area east of Building 881 and northwest of IHSS 119.1 that was used between 1969 and 1972 to dispose of soil and asphalt contaminated with low levels of plutonium. The material was from a removal at Building 776 in 1969, from a section of Central Avenue between Eighth and Tenth Streets replaced in 1970, and from a soil removal at Building 774 in 1972.

IHSS 145 (Sanitary Waste Line Leak) occurred in 1981 when a portion of a six-inch, cast-iron sanitary sewer line located south of Building 881 leaked. The line conveyed sanitary wastes to the sanitary treatment plant. From 1969 to 1973, the line carried radioactive laundry effluent.

2.3.3 Operable Unit 1 Nature and Extent of Contamination

Information on the nature and extent of contamination is taken from the Final Phase III RFI/RI Work Plan (DOE 1991e).

Phase I and Phase II soils investigations, conducted prior to installation of the French Drain, indicated tetrachloroethene; trichloroethene; and 1,1,1-trichloroethane contamination in some samples at the 881 Hillside. Methylene chloride, acetone, and phthlates were detected but may be laboratory contamination. Investigations for the French Drain detected toluene, and possibly methylene chloride and acetone (these chemicals may also be laboratory contamination). There is no apparent metal contamination. Plutonium and americium were detected above background in soil samples that include the ground surface; however, windblown dust from the 903 Pad (OU2) is the suspected source of these radionuclides.

Tetrachloroethene and trichloroethene are the principle volatile organic compounds (VOCs) which have been detected in surface water samples in the area. Numerous metals (including potassium, magnesium, calcium, aluminum, beryllium, chromium, selenium and vanadium) and other inorganic compounds (TDS, nitrate, sulfate) have occasionally been detected above background. Gross alpha, gross beta, uranium, and plutonium exceed background in many of the surface water samples.

Groundwater is contaminated in both the eastern and western portion of the 881 Hillside. The most pronounced organic contamination is in the eastern portion of the hillside area, with tetrachloroethene; trichloroethene; 1,1-dichloroethene; 1,1-dichloroethane; 1,1,1-trichloroethane; 1,1,2-trichloroethane; and carbon tetrachloride reaching several thousand micrograms per liter in many samples.

Organic contamination in the western portion of the 881 Hillside area occurs at much lower concentrations. Concentrations of metals and inorganic constituents in the eastern portion of the study area include numerous occurrences of nickel, strontium, selenium, zinc, copper, nitrate, sulfate, and chloride above background. Gross alpha, gross beta, uranium, and tritium were detected above background.

2.4 OPERABLE UNIT 2 - 903 PAD, MOUND, AND EAST TRENCHES

2.4.1 Operable Unit 2 Site Description

Operable Unit 2 consists of IHSSs identified in the IAG as associated with the 903 Pad, the Mound, and the East Trenches which are located in close proximity to each other in the southeast portion of the RFP security area and east of the RFP security area (**Figure 2.4-1**). The 903 Pad Area consists of five IHSSs:

- IHSS 109 - Trench T-2
- IHSS 112 - 903 Pad
- IHSS 140 - Hazardous Disposal Site
- IHSS 155 - 903 Lip Area
- IHSS 183 - Gas Detoxification Area

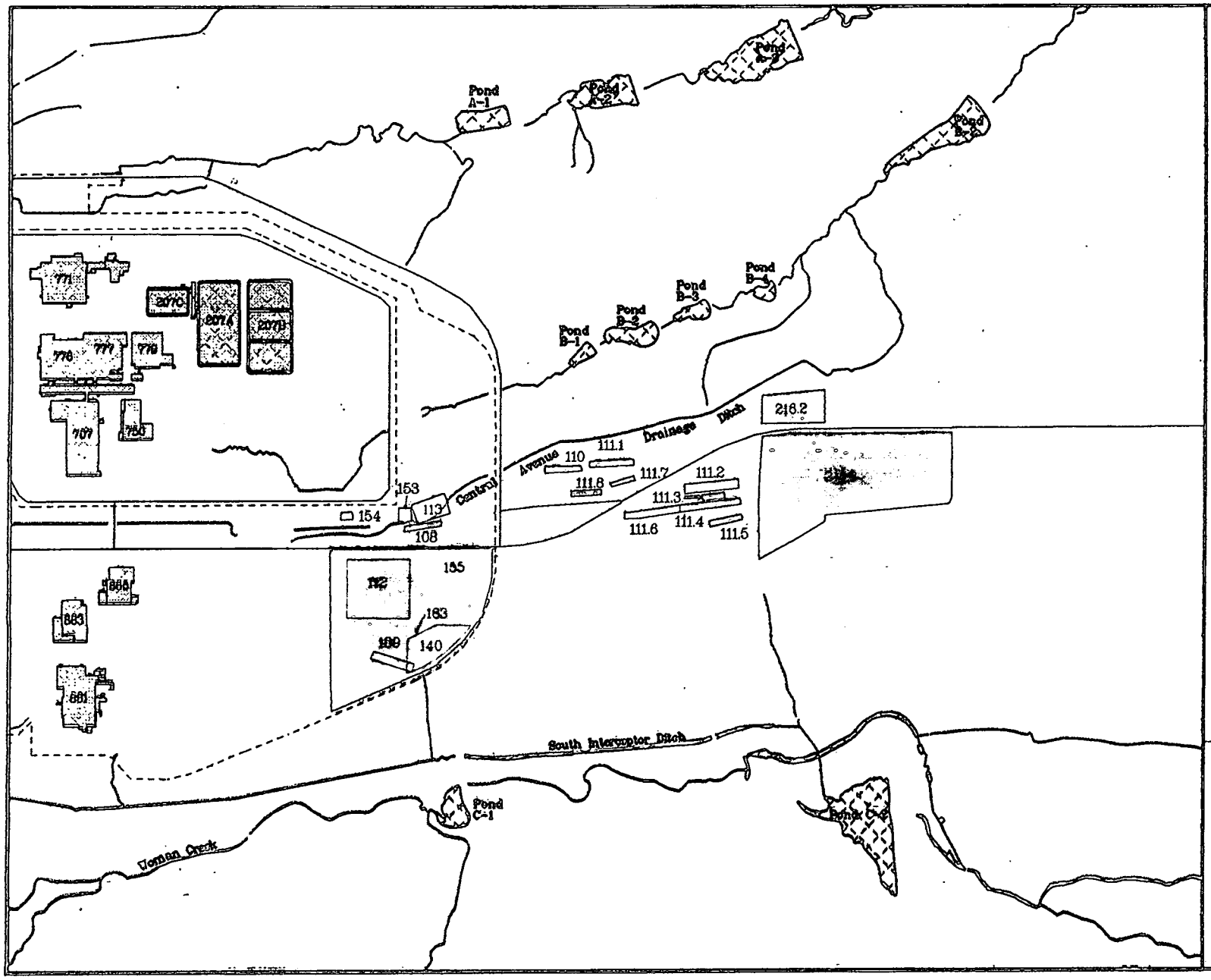
The Mound Area is composed of four IHSSs:

- IHSS 108 - Trench T-1
- IHSS 113 - Mound Area
- IHSS 153 - Oil Burn Pit No. 2
- IHSS 154 - Pallet Burn Site

The East Trenches Area consists of two IHSSs:

- IHSS 110 - Trench T-3
- IHSSs 111.1 through 111.8 - Trenches T-4 through T-11
- IHSSs 216.2 and 216.3 - East Spray Fields

Information on site use and history is taken from the *Preliminary Draft, Phase II RFI/RI Report 903 Pad, Mound and East Trenches Area Operable Unit No. 2, (Operable Unit 2)* (DOE 1993c). In June 1992, the *Final Historical Release Report for the Rocky Flats Plant* (DOE 1992x) was released. This document is a summary of known data on each IHSS, as well as other releases, and provides more complete information on site use and history.



U.S. Department of Energy
Rocky Flats Plant

- Paved roads
- Fences
- Streams, ditches, and other drainage features
- Ponds/lakes
- Individual Hazardous Substance Sites (IHSS)
- Buildings or structures

SOURCE OF DATA:
Individual Hazardous Substance Sites - Historical Release Report.

0 feet 500 1000

Environmental Restoration
Technical Support Document

Operable Unit 2
903 Pad, Mound
East Trenches

Figure 2.4-1

2.4.2 Operable Unit 2 Site Use and History

IHSS 109 (Trench T-2) is located south of the 903 Pad and west of IHSS 140 (Hazardous Disposal Site). This trench was used prior to 1968 for the disposal of sewage sludge from the onsite sanitary treatment plant and some flattened empty drums. The trench is believed to have measured approximately 10 feet wide by 20 feet long by 5 feet deep.

IHSS 112 (903 Pad) was used from 1958 to 1968 for storage of over 5,000 drums containing radioactively contaminated (uranium or plutonium) oil. Approximately three-fourths of the drums were plutonium-contaminated, while most of the balance contained uranium. Approximately 420 drums leaked to some degree.

Most of drums stored at the 903 Pad contained lathe coolant oil and carbon tetrachloride. Other liquids including hydraulic oils, vacuum pump oil, trichloroethylene, perchloroethylene, silicone oils, and acetone were also contained in the drums. Removal of all drums and wastes was completed in 1968, and the site was capped with asphalt in 1969.

IHSS 140 (Hazardous Disposal Site) is located on the hillside south of the 903 Pad and was used during the 1950s and 1960s primarily for the destruction of lithium metal. Approximately 400 to 500 pounds of metallic lithium were destroyed on the ground surface and the residues buried in this area. Smaller amounts of sodium, calcium, magnesium, solvents, nickel carbonyl, and iron carbonyl were also destroyed at this location.

IHSS 155 (903 Lip Area), adjacent to the 903 Pad (IHSS 112), is an area where plutonium (redistributed by wind and rain) from the 903 Pad is believed to have been deposited. Soil removal efforts were undertaken at the Lip Site in 1976, 1978, and 1984. After the 1984 effort, the excavated area was backfilled with clean topsoil.

IHSS 183 (Gas Detoxification Area), located south of the 903 Pad, was used between approximately 1963 and 1983 to detoxify various gases from lecture bottles. The gases consisted of various types of nitrogen oxides, chlorine, hydrogen sulfide, sulfur tetrafluoride, methane, hydrogen fluoride, and ammonia, which were used in RFP research and development work. Gas detoxification was accomplished by using various commercial neutralization processes available at the time. Other bottles were packaged and sent to offsite vendors for disposal.

IHSS 108 (Trench T-1) was used from 1954 until 1962 and contains approximately 125 drums filled with approximately 25,000 kilograms of uranium chips and possibly some plutonium.

The estimated dimensions of the trench are 15 feet by 200 feet by 5 feet deep. The trench was covered with approximately two feet of soil.

IHSS 113 (Mound Area), located north of Central Avenue in the eastern RFP security area, was used between April 1954 and September 1958 for drum disposal. Approximately 1,405 drums containing primarily depleted uranium- and beryllium-contaminated lathe coolant were placed at the Mound Site. It is likely that some drums of the coolant also contained enriched uranium and plutonium. Some drums also contained tetrachloroethene. Removal of all drums from the Mound Site was accomplished in 1970.

IHSS 153 (Oil Burn Pit No. 2) is actually two parallel trenches that were used in 1957, and from 1961 to 1965 (also possibly during the period of 1957 to 1961), to burn approximately 1,082 drums (at least 272 more drums are thought to have been burned) of coolant, still bottoms, and oil containing uranium. Approximately 300 of the emptied drums were flattened and buried in the burn pits. The residues from the burning and flattened drums were covered with backfill. In 1978, the area was excavated and contaminated soil and debris were removed and disposed offsite.

IHSS 154 (Pallet Burn Site) is southwest of the Oil Burn Pit and was reportedly used to destroy wooden pallets in 1965. The site was cleaned up and reclaimed in the 1970s. No documentation exists that verifies the existence of the site.

IHSS 110 (Trench T-3) and IHSSs 111.1 through 111.8 (Trenches T-4 through T-11)) were used from 1954 to 1968 for disposal of approximately 125,000 kilograms of sewage sludge from the sanitary treatment plant contaminated with uranium and plutonium, and approximately 300 flattened drums contaminated with uranium. Trenches T-3, T-4, T-10, and T-11 are located north of the east access road, and Trenches T-5 through T-9 are south of the east access road. Trench T-12 and T-13 have been recently identified. T-12 is thought to be an extension of T-9. Both are thought to contain sewage sludge.

IHSSs 216.2 and 216.3 (East Spray Fields) were used for spray irrigation of sewage treatment plant effluent. Effluent containing low concentrations of chromium were sprayed in the area in February and March 1989. The spray irrigation areas are located east of Trenches T-5 through T-9.

2.4.3 Operable Unit 2 Nature and Extent of Contamination

Information on the nature and extent of contamination is taken from the *Preliminary Draft, Phase II RFI/RI Report 903 Pad, Mound and East Trenches Area Operable Unit No. 2, (Operable Unit 2)* (DOE 1993c).

903 Pad Area

Two IHSSs, 112 and 109, have been identified as the main sources of contamination. In soils, polyaromatic hydrocarbons (PAHs) (not thought to be waste related — more likely from hydrocarbon fuel combustion), lithium metal, americium, and plutonium are the contaminants. Subsurface soils contain VOCs, total petroleum hydrocarbons, americium and plutonium. Wind dispersion is probably the cause of these contaminants being in the surrounding areas. Leaking drums are the source of subsurface contamination. The groundwater was found to contain VOCs (CCl_4, $CHCl_3$, 1,1-DCE, PCE, and TCE), americium, and plutonium.

Mound Area

IHSS 113 has been identified as the main source of contamination in the Mound Area. Surface soils contain PAHs, and PCBs (Aroclor-1254 and Aroclor-1260). The origin of the PCBs is unknown and the PAHs appear to occur from normal plant operations. The subsurface soil contains VOCs (PCE and TCE), PAHs, Aroclor-1254, americium, and plutonium. The groundwater contains VOCs (CCl_4, $CHCl_3$, 1,1-DCE, PCE, and TCE), americium, and plutonium.

Northeast Trenches Area

IHSSs 110, 111.1, and 111.8 are believed to be the main sources of contamination. Surface soils contain plutonium, americium, and PAHs (probably the product of normal combustion activities on plantsite). Subsurface soils contain VOCs (CCl_4, $CHCl_3$, 1,1-DCE, PCE, and TCE), PAHs, Aroclor-1254, metals (beryllium, cadmium, chromium, copper, lead, silver, and zinc), plutonium, americium, and uranium. The groundwater contains VOCs, semivolatile organic compounds, barium, and manganese.

Southeast Trenches

IHSSs 111.2, 111.4, 111.6, and Trench T-12 are believed to be the main sources of contamination. Surface soils contain PAHs (from normal onsite combustion), plutonium, and americium. Subsurface soils contain VOCs (1,1,1-TCA, 1,2-DCA, and total xylenes), metals (strontium, lithium, and cadmium), americium, plutonium, uranium, and tritium. The groundwater contains plutonium and americium.

2.5 OPERABLE UNIT 3 - OFF-SITE RELEASES

2.5.1 Operable Unit 3 Site Description

Operable Unit 3 is unique among RFP OUs in that it is located outside RFP boundaries. All of these IHSSs are located east of RFP boundaries (**Figure 2.5-1**). Four IHSS are defined by the 1991 IAG as associated with OU3:

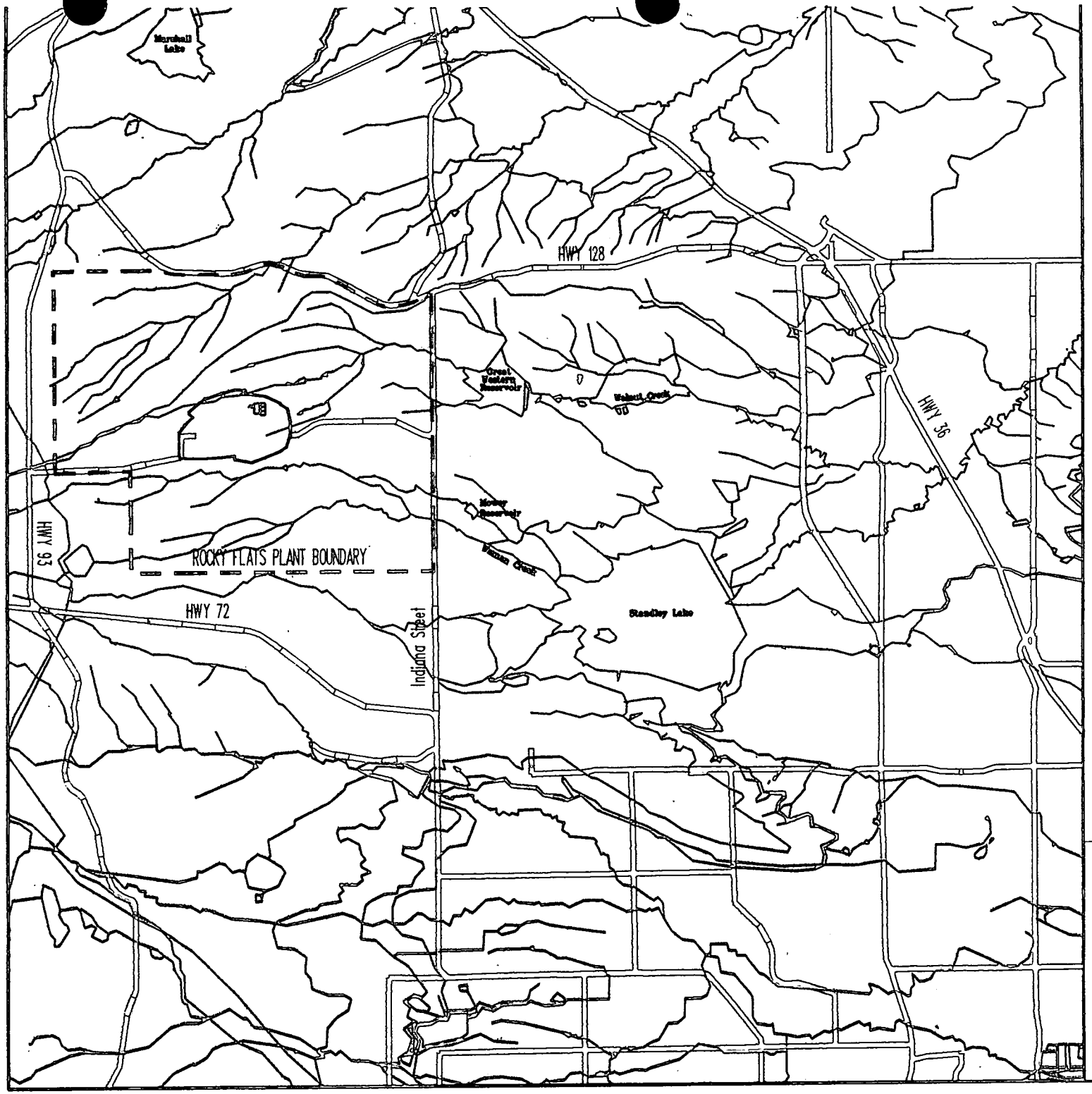
- IHSS 199 - Contamination of the Land's Surface
- IHSS 200 - Great Western Reservoir
- IHSS 201 - Standley Lake
- IHSS 202 - Mower Reservoir

The actual boundaries of IHSS 199 have not been officially defined. Sampling related to the IHSS 199 effort has occurred north, south, and west of the Rocky Flats Plant, in addition to east. (EG&G 1994k) Information on site use and history is taken from the Final RFI/RI Work Plan for Operable Unit 3, Rocky Flats Plant (DOE 1992l). The Historic Release Report does not address OU3.

2.5.2 Operable Unit 3 Site Use and History

IHSS 199 (Contamination of the Land's Surface) specifically targets offsite soil contamination as a result of RFP past releases. Included within IHSS 199 are approximately 350 acres of land which were part of a lawsuit filed in U.S. District Court by the outside property owners against the United States and other defendants, alleging contamination of the land surface by releases from RFP during its operating history.

A settlement agreement finalized in 1985 required that RFP undertake remedial action on those portions of the land containing plutonium at concentrations exceeding an action level adopted by the court from a Colorado Department of Health special construction standard for plutonium in soil of 0.9 picocuries per gram. To date, remedial activities have been undertaken on 120 acres (owned by Jefferson County) of the
350 acres.



U.S. Department of Energy
Rocky Flats Plant

Heavy duty roads

Medium duty roads

Rocky Flats Plant boundary

Streams, ditches, and other drainage features

* OU-3 is predominately east of Rocky Flats Plant boundary with additional areas north and south of the Plant boundary

N

0 feet 5000 10000

Environmental Restoration
Technical Support Document

Operable Unit 3 *
Off Site Releases

Figure 2.5-1

Date: 10-28-93

IHSS 200 encompasses Great Western Reservoir, offsite reaches of Walnut Creek (which formerly flowed into the reservoir from RFP), and downstream surface water features possibly impacted by outflow from the reservoir. Portions of Walnut Creek within RFP are not included in IHSS 200. Great Western Reservoir is located approximately one mile east of RFP's eastern boundary. The reservoir is owned by the City of Broomfield and is utilized solely for the city's municipal water supply. The reservoir and surrounding area is fenced and posted to exclude public access. The present reservoir volume is 3,250 acre-feet and the maximum height of the dam is 69 feet. The reservoir is unlined.

From 1952 through 1979, water containing decontaminated process and laundry effluent, cooling tower blowdown, and treatment system condensate were discharged to Walnut Creek via the B-Series Ponds. The effluents contained metals, radionuclides and inorganic ions (especially nitrate) within concentration limits considered acceptable at the time. Radionuclides and metals from these discharges and from inadvertent releases during re-engineering of holding pond dams accumulated in varying amounts in the sediments of the holding ponds (A- and B-Series Ponds), Walnut Creek, and Great Western Reservoir. Other sources, such as solar pond leakage and herbicide usage, could have also contributed contaminants to Great Western Reservoir.

IHSS 201 encompasses Standley Lake, offsite reaches of Woman Creek (which flows into the reservoir from RFP), and downstream surface water features possibly impacted by outflow from the reservoir. Standley Lake is a large reservoir located approximately 2 miles southeast of RFP's eastern boundary. Uses of the reservoir include municipal water supply for the cities of Westminster, Northglenn and Thornton; irrigation; and recreation. The reservoir has been owned by the Farmers Reservoir and Irrigation Company of Brighton, Colorado since its construction between 1909 and 1919. Standley Lake's present volume is 43,000 acre-feet, and 96 percent of its water comes from Clear Creek via irrigation ditches.

IHSS 202 encompasses Mower Reservoir, offsite reaches of the irrigation ditch which feeds the reservoir from Woman Creek, and downstream surface water features possibly impacted by outflow from the reservoir. Mower Reservoir is a small, privately-owned impoundment located just southeast of RFP. The reservoir is fed by Woman Creek via Mower Ditch, an irrigation ditch that originates within RFP boundary. Mower Reservoir is used for agricultural purposes and fluctuates in capacity depending upon the water supply and demand. It covers an area of approximately 9 acres and is roughly 5 feet deep at its deepest point. Outflow from Mower Reservoir flows southeast eventually into Standley Lake.

2.5.3 Operable Unit 3 Nature and Extent of Contamination

Information on the nature and extent of contamination is taken from the Final RFI/RI Work Plan for Operable Unit 3, Rocky Flats Plant (DOE 1992l).

IHSS 199 (Contamination of the Land's Surface) is comprised of 350 acres of land with concentrations of plutonium greater than 0.9 picocuries per gram. Hot spots may occur outside the designated acreage; however, it is reasonable to assume that areas outside the designated acreage contain lower concentrations of plutonium than the designated areas. Remediation has been implemented on 120 of the 250 acres of contaminated land owned by Jefferson County. Tilling of the 120 acres resulted in soil concentrations generally below the mandated cleanup level. Revegetation of this land is in progress. Very few data exist for contaminants other than plutonium.

Sampling at Great Western Reservoir (IHSS 200) indicates that layers of sediment containing elevated levels of plutonium are present within the reservoir. Plutonium exists in discrete sediment horizons (at depths of 7.5 inches and 17 inches) corresponding to historical releases from RFP. The highest concentrations are found in the deepest areas of the reservoir. There is no evidence of plutonium migration through the sediment column. Concentrations of plutonium and other radionuclides in water at the reservoir are below background levels and/or EPA drinking water standards.

Radioactive materials released from RFP may have been transported to Standley Lake (IHSS 201) through surface water and/or airborne particulates. Plutonium has been measured in sediment in the lake. The concentrations in the sediment layers exceeded baseline levels beginning in the 1966 layer, peaked in 1969, and declined after 1969. The time period correlates with the known period of windblown plutonium release from the 903 Pad at RFP. Studies of the sediments concluded that plutonium rapidly and almost irreversibly attaches itself to clay sediments.

In 1974, Battelle conducted an investigation of radionuclide concentrations in reservoirs and streams near RFP. Concentrations of plutonium-239, plutonium-240, and americium-241 in the water at the lake were above the expected atmospheric fallout background, which was not specifically quantified in the study, but were more than four orders of magnitude below EPA National Primary Drinking Water Regulation of 15 pCi/l for total long-lived alpha activity.

Very limited data have been collected to characterize Mower Reservoir (IHSS 202). RFP-derived contaminants in the reservoir are believed to have been transported primarily as airborne particulates, and, to a lesser degree, by surface water through the Woman Creek drainage. It can be inferred that contaminant concentrations resulting from releases into Woman Creek would be similar for Mower Reservoir and Standley Lake, while concentrations resulting from airborne releases, and from erosion and transport of contaminated soils by surface runoff, would be similar for Mower Reservoir and Great West Reservoir. It is expected that Mower Reservoir received similar amounts of plutonium through airborne transport as the nearby land surface.

2.6 OPERABLE UNIT 4 - SOLAR EVAPORATION PONDS

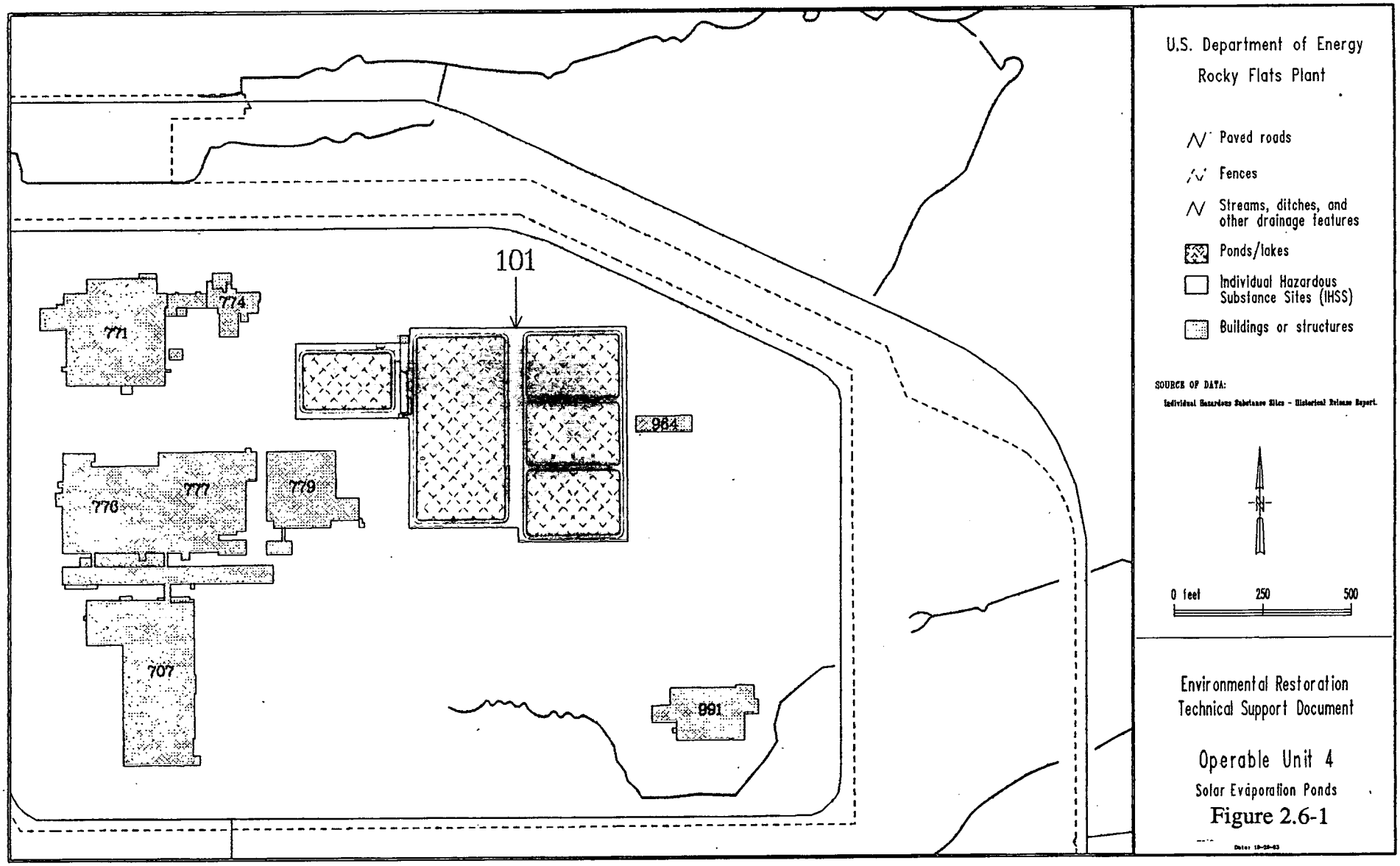
2.6.1 Operable Unit 4 Site Description

Operable Unit 4 is made up of only one IHSS. IHSS 101 (Solar Evaporation Ponds) is located in the central portion of RFP in the northeast part of the Protected Area (**Figure 2.6-1**). IHSS 101 is also known as the Solar Ponds Waste Management Unit. Other areas and features which are considered pertinent to the characterization of OU4 are the Original Pond, the Interceptor Trench System (also known as the french drain system), and areas in the immediate vicinity of the Solar Ponds. The IHSS contains five surface impoundments:

- IHSS 101 - Solar Evaporation Ponds
  - Pond 207-A
  - Pond 207-B North
  - Pond 207-B Center
  - Pond 207-B South
  - Pond 207-C

Specific details concerning the construction of each pond, the trenches, and the Interceptor Trench System (ITS) are contained in the Draft Final Phase I RFI/RI Work Plan (DOE 1991p).

Information on the site use and history is taken from the *OU4 Solar Evaporation Pond Interim Measures/Interim Remedial Action, Environmental Assessment* [IM/IRA/EA] *Decision Document* (DOE 1994a). In June 1992, a final Historical Release Report for the Rocky Flats Plant was released (DOE 1992x). This document is a summary of known data on each IHSS, as well as other releases, and provides more complete information on site use and history.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U.S. Department of Energy
Rocky Flats Plant
Paved roads
Fences
Streams, ditches, and other drainage features
Ponds/lakes
Individual Hazardous Substance Sites (IHSS)
Buildings or structures
SOURCE OF DATA:
Individual Hazardous Substance Sites - Historical Release Report.
0 feet
250
500
Environmental Restoration
Technical Support Document
Operable Unit 4
Solar Evaporation Ponds

Figure 2.6-1

2.6.2 Operable Unit 4 Site Use and History

The Solar Ponds were constructed primarily to store and treat by evaporation low-level radioactive process wastes and neutralized acidic wastes containing high nitrates and aluminum hydroxide. During their use, these ponds are known to have received additional wastes such as the following:

- sanitary sewer sludge,
- lithium metal,
- radioactively contaminated aluminum scrap,
- acid waste,
- sodium nitrate,
- ferric chloride,
- lithium chloride,
- sulfuric acid,
- ammonium persulfates,
- hydrochloric acid,
- nitric acid,
- hexavalent chromium, and
- cyanide solutions.

Solvents and other organics have not been routinely discharged into the ponds. However, low concentrations of solvents may have been present as a minor constituent in other wastes.

The Original Pond was constructed in 1953 and removed by 1970. Pond 207-A was placed into service in August 1956. Ponds 207-B, North, Center, and South were placed into service in June 1960. Pond 207-C was constructed in 1970 to provide additional storage capacity and to allow the transfer and storage of liquids from the other ponds in order to perform repair work. The design of Pond 207-C included a leak detection pipe and sump.

These ponds were formerly used to store and treat liquid process wastes having less than 100,000 picocuries per liter (pCi/l) of total long-lived alpha activity (DOE 1980). Subsequent construction activities included the installation of interceptor trenches Nos. 1 through 6 and two sumps during the period from April 1970 through July 1974 to prevent natural seepage and pond leakage from entering North Walnut Creek. This system has been replaced by the current ITS, which was installed in April 1981.

Sludges from the solar evaporation ponds have been removed from time to time to implement repair work on the pond liners. From 1976 to 1977, the 207-B ponds were cleaned and decommissioned. Soils were removed from between ponds and Pond 207-B, South was relined using Hypalon. As the sludges were removed from Pond 207-A in 1986, they were mixed with Portland cement in Building 788 and solidified as a mixture of sludge and concrete (pondcrete) for shipment to an offsite low-level radioactive waste disposal site. The final sludge was removed from Pond 207-A in 1988.

2.6.3 Operable Unit 4 Nature and Extent of Contamination

The OU4 Solar Evaporation Pond IM/IRA/EA (DOE 1994a) discusses the results of the contaminant investigation of the solar ponds. The ponds are probably the source of beryllium, cadmium, chromium, nickel, and mercury found in surficial and subsurface soils. Surficial metals probably derive from aerosol dispersion of liquids in the ponds. A drainage tile between Ponds 207-A and 207-B appears to have discharged contaminants to the hillside north of the ponds.

The concentration of metals beneath the ponds implies that groundwater transport is limited. Nitrates have concentrated in the soils and vadose zone (that portion of the soil that lies above the historical low water level; may include bedrock) beneath the ponds.

As with the metals, radionuclides (americium, uranium, and plutonium) have been detected in the soil and subsurface and are attributed to the ponds. The processes for distributing radionuclides in soils are similar to those responsible for the metals. Tritium has been detected and is distributed by groundwater.

Semivolatiles are generally confined to surficial soil samples. These chemicals include benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)anthracene, chrysene, and pyrene. They are attributed to nonwaste activities such as oil leakage from vehicles and, possibly, relining of the ponds. Toluene, acetone, and methylene chloride were frequently detected; however, the results suggest that laboratory contamination may account for a substantial part of the findings.

2.7 OPERABLE UNIT 5 - WOMAN CREEK PRIORITY DRAINAGE

2.7.1 Operable Unit 5 Site Description

Ten IHSSs, geographically located along or within the drainage areas of Woman Creek, were originally designated as Operable Unit 5, Woman Creek Priority Drainage (**Figure 2.7-1**). The IHSSs are identified in the 1991 IAG as:

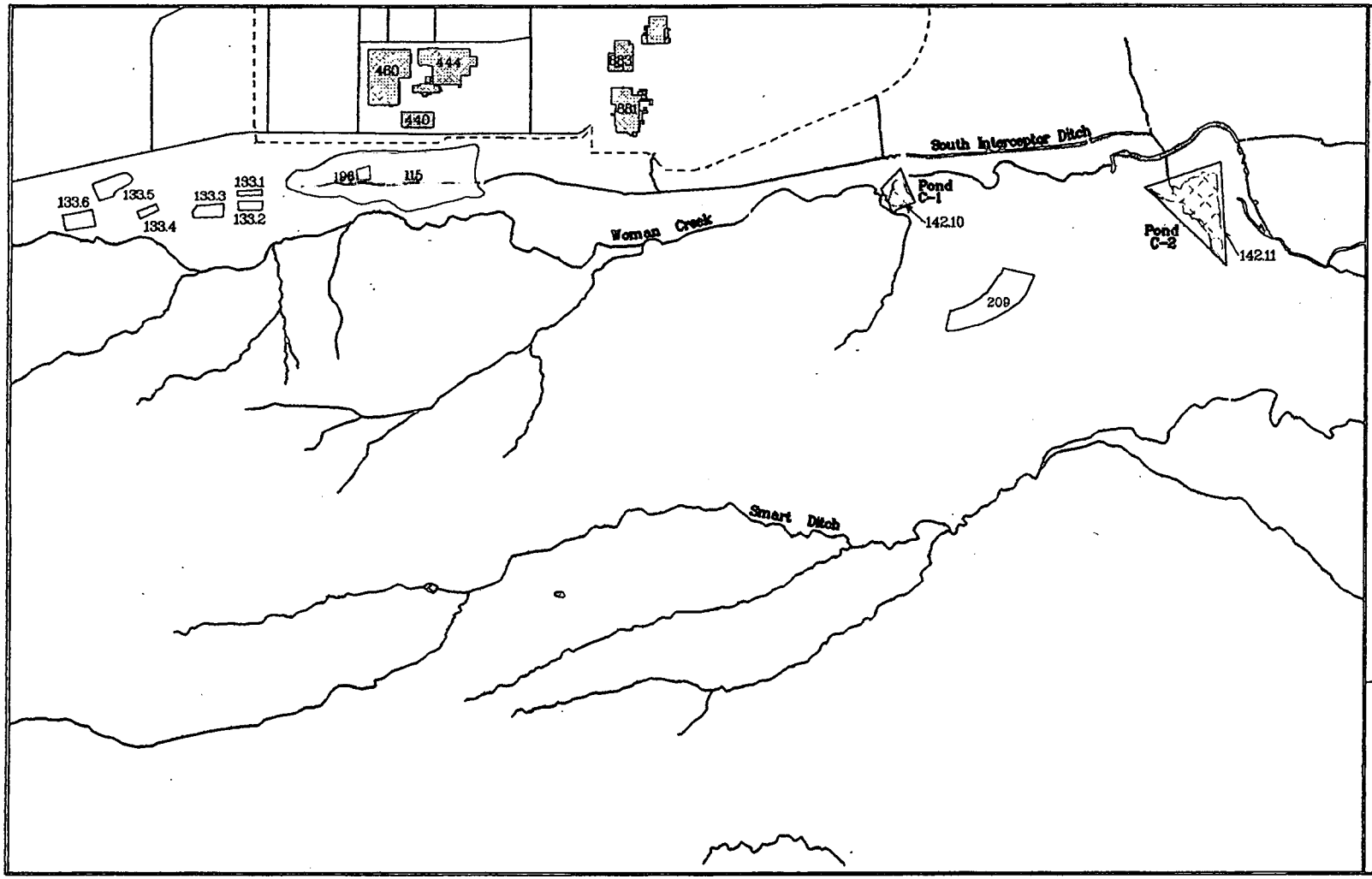
- IHSS 115 - Original Landfill
- IHSS 133.1 - Ash Pit I-1
- IHSS 133.2 - Ash Pit I-2
- IHSS 133.3 - Ash Pit I-3
- IHSS 133.4 - Ash Pit I-4
- IHSS 133.5 - Incinerator
- IHSS 133.6 - Concrete Wash Pad
- IHSS 142.10 - C-1 Pond
- IHSS 142.11 - C-2 Pond
- IHSS 196 - Water Treatment Plant Backwash Pond
- IHSS 209 - Surface Disturbance Southeast of Building 881

IHSS 196 was not identified with OU5 in the IAG. The investigatory and remediation work associated with this IHSS was transferred to OU5 from OU16 for logistical reasons in correspondence dated May 27, 1993, from the Colorado Department of Health (CDH 1993).

Two additional surface disturbances have been identified and are included in the OU5 Work Plan (DOE 1992n). One disturbance is located south of the Ash Pits and the other is west of IHSS 209.

The boundaries for each IHSS are the same as those established in the IAG, except IHSS 115 (Original Landfill) and IHSS 209 (Surface Disturbances Southeast of Building 881). The southern boundary of the landfill has been extended approximately 300 feet toward the south across the South Interceptor Ditch (SID). The boundary of IHSS 209 has been extended to the north and southwest.

Information on the site use and history is taken from Final Phase I RFI/RI Work Plan, Woman Creek Priority Drainage (Operable Unit No. 5) (DOE 1992n) and the Historical Release Report for the Rocky Flats Plant (DOE 1992x).



U.S. Department of Energy
Rocky Flats Plant

Paved roads

Fences

Streams, ditches, and other drainage features

Ponds/lakes

Individual Hazardous Substance Sites (IHSS)

Buildings or structures

SOURCE OF DATA:
Individual Hazardous Substance Sites - 60% Work Plan.

0 feet 750 1500

Environmental Restoration
Technical Support Document

Operable Unit 5
Woman Creek

Figure 2.7-1

2.7.2 Operable Unit 5 Site Use and History

The natural drainage of Woman Creek has been somewhat modified in the OU5 area by the construction of the C-Series Ponds and the South Interceptor Ditch (SID). The purpose of the SID is to collect runoff from the security zone before it reaches Woman Creek. Water from the SID is diverted to detention Pond C-2.

IHSS 115 (Original Landfill) is located within the buffer zone just south of the 400 Area security fence and south of the west access road. The Original Landfill covers approximately 7.5 acres. It was operated from 1952 to 1968 and was used to dispose of general wastes and unknown nonradioactive hazardous chemical wastes. It is estimated that 2 million cubic feet of miscellaneous RFP wastes are buried in the Original Landfill, including solvents, paint thinners, paints, pesticides, and cleaners. The Original Landfill also received beryllium and/or uranium wastes (wastes containing PCBs) and may have been used as a graphite dump. In the late-1970s, hotspots containing depleted uranium were uncovered in the landfill. These hotspots were removed in one box of soil in July of 1979.

The Original Landfill was closed with a soil cover (date unknown); however, a bottom liner was not installed. The slope on the south side of the Original Landfill has been regraded in the past to correct sloughing and erosion-related problems. The surface of the Original Landfill is hummocky and irregular.

IHSSs 133.1, 133.2, 133.3, and 133.4 (Ash Pits 1-4), IHSS 133.5 (Incinerator), and IHSS 133.6 (Concrete Wash Pad) are located south-southwest of the 400 Area security area along the north slope of Woman Creek. The four ash pits were used to dispose of the ash from the Incinerator. Ash from the Incinerator may also have been pushed over the side of the hill into the Woman Creek drainage and/or onto the Concrete Wash Pad. Following the shutdown of the Incinerator, the Ash Pits were covered with unknown fill. The Incinerator was used between 1952 and 1968 to burn general RFP wastes and small quantities of depleted uranium-contaminated combustibles (<100 grams). Depleted uranium is also believed to have been burned in the Incinerator. The Incinerator was removed by 1971. The Concrete Wash Pad appears to be an area that was used primarily to wash out waste concrete from concrete trucks used during construction of the plant facilities.

IHSS 142.10 (C-1 Pond) and IHSS 142.11 (C-2 Pond) are located along Woman Creek, southeast of the 400 Area security area and within the buffer zone. The C-Series Ponds were constructed to control surface water runoff from the Industrial Area and from Woman Creek, and to provide monitoring of waters discharged from RFP Ponds 6, 7, and 8 — which were located near Woman Creek and abandoned in the early 1960s.

Pond C-1 was constructed in 1955. Filter backwash water from the water treatment facility was discharged to Pond C-1 between plant startup in 1952 and December 1973. Cooling tower blowdown water was discharged to Pond C-1 until late 1974. In the early 1970s, plant operations changed and this pond was used principally to manage surface water runoff in the Woman Creek drainage (i.e., Pond C-1 now serves as a flow-through retention pond and its discharges bypass Pond C-2 and are returned to the natural channel below Pond C-2).

Pond C-2 was constructed in 1979 to control surface water runoff and to serve as a spill control pond. Water from the SID feeds into Pond C-2, which now discharges into the Broomfield Diversion Ditch (see Section 3.5.6).

Other problems and/or releases known to have occurred in the C-Series drainage include untreated sanitary sewage, steam condensate from Building 881, resuspended soils and runoff from the 903 Pad, and runoff from the East Spray Field.

IHSS 196 (Water Treatment Plant Backwash Pond) was located approximately 800 feet south of Building 124. Through the early 1970s, backwash from the raw water treatment plant was collected in the unlined pond. Reportedly, the pond dried up and was destroyed in the late 1970s. The area is now a grassy meadow.

IHSS 209 (Surface Disturbance Southeast of Building 881) is located southeast of Pond C-1. The 5.2 acre area is thought to have been a borrow pit. No known disposal activities took place at this site; however, RFP has agreed, as part of the IAG, to investigate the pit as a potential disposal site.

In addition to IHSS 209, there are two other surface disturbances in the proximity of this IHSS that are being investigated as part of the Phase I RFI/RI process for OU5. These two areas are being investigated as potential disposal sites. The first disturbance is located approximately 1,500 feet west of IHSS 209 and consists of four small disturbed areas symmetrically placed around a fifth disturbed area (total area is approximately 52,500 square feet).

The second disturbance is located approximately 1,200 feet south of IHSS 133 (Ash Pits, etc.) and south of Woman Creek. The area consists of five former excavation areas visible at ground level, but primarily visible from aerial photographs.

2.7.3 Operable Unit 5 Nature and Extent of Contamination

Descriptions of the nature and extent of contamination are historical documentations based on research conducted for the Historical Release Report (DOE 1992x) and the OU5 Work Plan (DOE 1992n).

IHSS 115 (Original Landfill) received numerous materials during its operation. Chemicals that may have been placed in the Original Landfill include commonly used solvents, such as trichloroethylene; carbon tetrachloride; tetrachloroethylene; petroleum distillates; 1,1,1-trichloroethane; dichloromethane; benzene; paint; and paint thinners. Metals such as beryllium, uranium, lead, and chromium may also be present. Radiological surveys of the area have indicated the presence of radionuclides, and some soil containing uranium was previously removed from the Original Landfill. Metals and radionuclides have been detected in groundwater near the Original Landfill.

IHSSs 133.1 through 133.6 (Ash Pits, Incinerator and Concrete Wash Pad) are thought to contain incinerator ash generated from 1952 to 1968, when the Incinerator was in operation. In addition, an estimated 100 grams of depleted uranium are thought to have been burned in the Incinerator. Metals were detected in Ash Pit 3 during a rayscope survey conducted prior to 1973. Metals and radionuclides have been detected in groundwater monitoring wells near the Ash Pits in 1986.

IHSSs 142.10 and 142.11 (Ponds C-1 and C-2) are regularly sampled as part of the surface-water monitoring program. Water in the ponds has been known to contain detectable concentrations of metals and radionuclides; however, some of the radionuclides may represent background concentrations. In addition, radionuclides are highly insoluble, tend to bond to soil particles, and migrate at an extremely slow rate. Therefore, managed detection periods allow sedimentation to occur, which effectively settles potentially contaminated suspended soils, removing them from the water column. Radionuclides have been detected in the pond sediments. Since 1989, sediments have been sampled for other parameters as well. Detectable concentrations of pesticides and PCBs have not been reported. Few organic parameters have been detected above the Contract-Required Quantitation Limit (per EPA's Contract Laboratory Guidance). Metals have been detected in the sediments, although background metal concentrations for OU5 have not been established.

Based on past uses, the water in the Water Treatment Plant Backwash Pond (IHSS 196) would have contained flocculates (aluminum sulfates and lime), residual chlorine, and suspended solids.

IHSS 209 (Surface Disturbances) and the previously noted ancillary disturbances are being investigated to determine whether these areas were used as disposal sites. Presently, however, no known contamination exists.

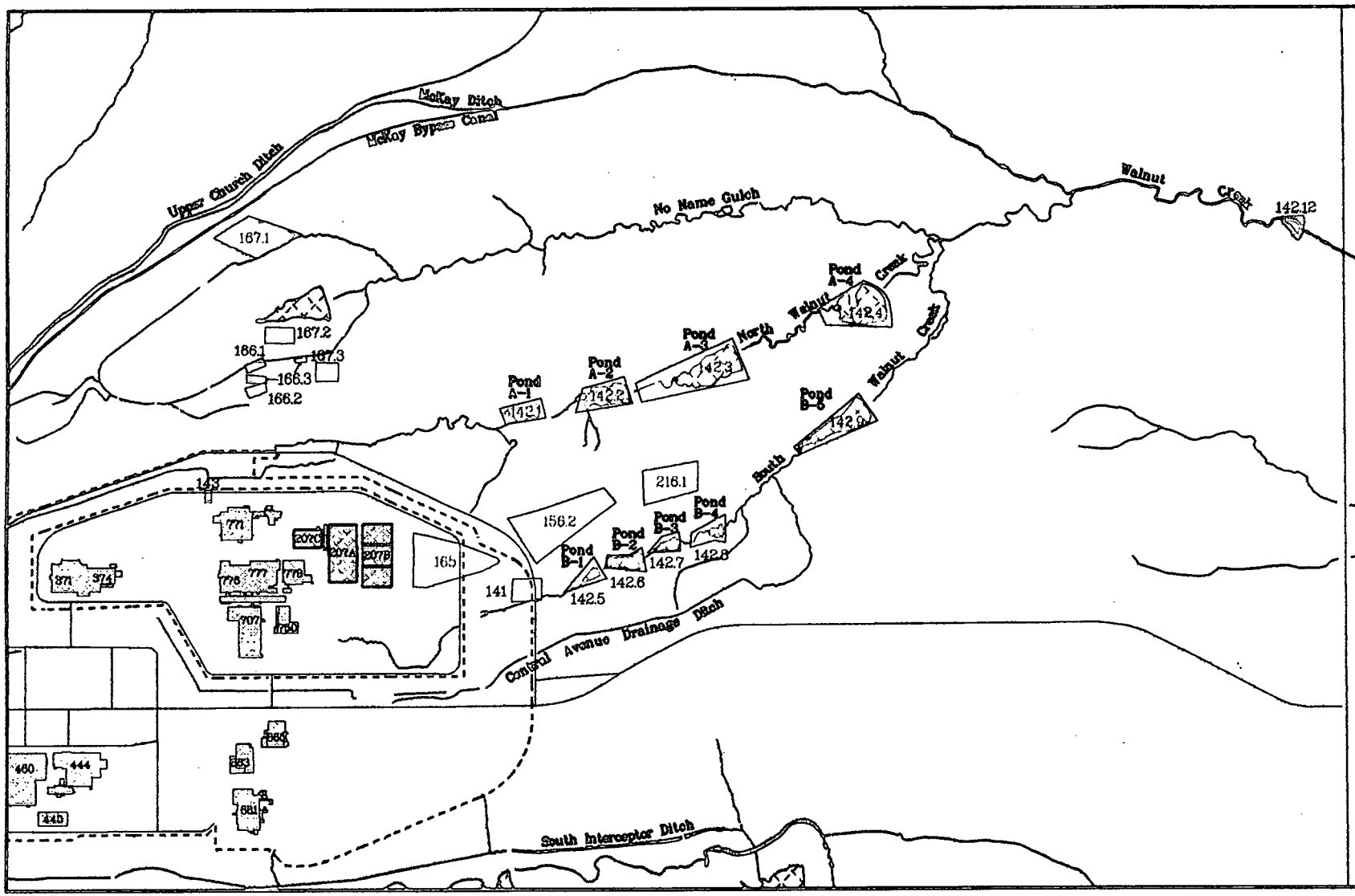
2.8 OPERABLE UNIT 6 - WALNUT CREEK PRIORITY DRAINAGE

2.8.1 Operable Unit 6 Site Description

Until recently, 21 IHSSs recently made up Operable Unit 6, which encompasses the drainages of North and South Walnut Creeks (**Figure 2.8-1**). The 1991 IAG identified twenty IHSSs within OU6 and another IHSS (156.2) was added to this OU due to its proximity to the OU. Also, the investigatory and remediation work associated with IHSSs 167.2 and 167.3 were transferred from OU6 to OU7 for logistical reasons in correspondence dated May 27, 1993 from the Colorado Department of Health (CDH 1993). The remaining 19 IHSSs are:

- IHSS 141 - Sludge Dispersal Area
- IHSS 142.1 - Pond A-1
- IHSS 142.2 - Pond A-2
- IHSS 142.3 - Pond A-3
- IHSS 142.4 - Pond A-4
- IHSS 142.12 - Flume Pond (IAG name: A-5 Pond)
- IHSS 142.5 - Pond B-1
- IHSS 142.6 - Pond B-2
- IHSS 142.7 - Pond B-3
- IHSS 142.8 - Pond B-4
- IHSS 142.9 - Pond B-5
- IHSS 143 - Old Outfall-Building 771 (IAG name: Old Outfall)
- IHSS 156.2 - Soil Dump Area
- IHSS 165 - Triangle Area
- IHSS 166.1 - Trench A
- IHSS 166.2 - Trench B
- IHSS 166.3 - Trench C
- IHSS 167.1 - Spray Field: North Area [IHSSs 167.2 and 167.3 to OU7]
- IHSS 216.1 - East Spray Fields — North Area (WP name: East Area Spray Field)

Information on site use, history, and nature and extent of contamination was derived from the OU 6 RFI/RI Work Plan (DOE 1992o) and the Historical Release Report (DOE 1992x).



U.S. Department of Energy
Rocky Flats Plant

Paved roads

Fences

Streams, ditches, and other drainage features

Ponds/lakes

Individual Hazardous Substance Sites (IHSS)

Buildings or structures

SOURCE OF DATA:
Individual Hazardous Substance Sites - DOE Work Plan.

0 feet 750 1500

Environmental Restoration
Technical Support Document

Operable Unit 6
Walnut Creek
Figure 2.8-1.

2.8.2 Operable Unit 6 Site Use and History

IHSS 141 (Sludge Dispersal Area) straddles the eastern perimeter of the Protected Area (PA) and the Buffer Zone, just west of Pond B-1. Two corrugated metal buildings that cover the present-day drying beds of the Sewage Treatment Plant (STP) in Building 995 are located within this IHSS. Two paved roads cross the IHSS in a north-south direction; one is within the PA, the other is within the Buffer Zone. A drainage ditch separates the roads and is outside of the PA and empties into the B-Series Ponds. Prior to 1983, IHSS 141 received airborne radioactive particles from dried-sludge packaging operations. The sludge was generated by the STP. Radioactive laundry effluent was the only known radioactive effluent entering the drying beds between 1969 and 1972. By the latter half of 1972, plumbing changes were made and all RFP wastes were channeled through the STP and then into the drying beds which resulted in increased radioactivity levels in the sludges. Also, an overflow incident at Building 701 in June of 1972 contributed elevated levels of plutonium to the effluent entering the STP.

IHSSs 142.1, 142.2, 142.3, and 142.4 (Ponds A-1, A-2, A-3, A-4) are located along North Walnut Creek. According to the OU6 RFI/RI Work Plan, the A-Series Ponds received discharges from several sources (DOE 1992o). Between 1952 and 1979, Pond A-1 was used to hold laundry wastewater that contained nitrates and radioactive substances, including plutonium and uranium, that was discharged into North Walnut Creek from the production facilities on the north side of the Industrial Area (IA). Pond A-1 also received process liquid waste, cooling tower blowdown, and steam condensate discharges, which contained chromates and algicides. After construction of Pond A-2 (and prior to 1978), the water in Pond A-1 was allowed to flow into Pond A-2 where it evaporated or was spray evaporated. Pond A-3 was constructed in 1971 and Pond A-4 was constructed in 1980. Both ponds have been used to impound water from upstream. Use and management of the ponds is discussed in detail in Section 3.5 of this ERTSD.

IHSS 142.12 (Flume Pond) is located downstream of Pond A-4 and just west of Indiana Street. This pond receives treated water discharged downstream of Pond A-4 and runoff from the immediate area. Water from upper Walnut Creek is temporarily detained in the Flume Pond (named the A-5 Pond in the IAG) until it reaches a level high enough to flow out and downstream into lower Walnut Creek. The effluent from the Flume Pond is sampled daily when discharging downstream. Flow measurements are also taken at this pond using two Parshall Flumes (6-inch throat and 36-inch throat).

IHSSs 142.5, 142.6, 142.7, 142.8, and 142.9 (Ponds B-1, B-2, B-3, B-4, and B-5) are located along South Walnut Creek. Historically, several waste disposal activities have been associated with the B-Series ponds since the beginning of RFP operations in 1952 (DOE

1992o). Between 1952 and 1973, decontaminated process water and laundry wastewater were released into South Walnut Creek and subsequently into the ponds. Nitrate, plutonium, and uranium were contained in these wastes; however, the volume of wastes is unknown. Ponds B-1 and B-4 also received sanitary effluent from the sewage treatment plant. Pond reconstruction activities conducted between 1971 and 1973 resulted in disturbances to the pond sediments, which caused much of the upstream sediment to migrate to Pond B-1. Subsequently, this increased the total plutonium inventory in the B-Series ponds.

IHSS 143 (Old Outfall — Building 771) is located northwest of Building 771 and the Guard Station (Building 773) within the Protected Area and discharges into North Walnut Creek. The IHSS is approximately 30,000 square feet in area and has been covered with fill. Temporary trailers are currently sited on or near this IHSS. Because of the construction activities in this area, the existing drainage systems are different from the drainage system that existed during the operation of the Old Outfall. The Old Outfall acted as a catchment basin for liquids from various sources, the main one being the laundry holding tanks in Building 771. Liquid wastes from the holding tanks in Building 771, which contained plutonium, were discharged into the Old Outfall area if plutonium concentrations were found to be below 3,300 disintegration per minute per liter (d/m/l). It is estimated that between 1953 and 1957, 4.5 million gallons of liquid were released into the Old Outfall. In 1957, a waste line was installed to transfer these liquids from the holding tanks to Building 774. However, periodic releases occurred between 1957 and 1965 due to occasional equipment problems. During this period, 434,000 gallons of liquid containing 0.25 mCi of plutonium were released to the Old Outfall.

IHSS 156.2 (Soil Dump Area) is located within the Buffer Zone, just north of Pond B-1, and covers an area of approximately 5.9 acres. Geographically, the IHSS is located on a east-west trending interfluve separating North and South Walnut Creeks. A dirt road follows the ridge line of this interfluve. Between 50 and 75 dump-truck loads of soil containing low levels of plutonium were placed here. Sources of the soil are thought to be soil excavated for a multiple building construction project ["Part V" project, which included Building 707 and 774] and sediments from Pond B-5 discharge outlet modification activities.

IHSS 165 (Triangle Area) is located, primarily, within the Protected Area between the NE Perimeter Road on the north and Spruce Avenue on the south. The IHSS covers approximately 5.7 acres (it overlaps slightly with IHSS 176). Fencing for the Protected Area crosses through the eastern one-third of this IHSS in a north-south direction. IHSS 165 is not paved, is sparely vegetated, and has been partially covered with gravel fill of unknown thickness. The Triangle Area is presently used as a storage yard for various types of equipment and pipes.

Previously, the IHSS 165 (Triangle Area) was used as storage for miscellaneous wastes between 1966 and 1975. Beginning in 1966, it was used as storage for drums from Building 883. Drums were originally placed directly on the ground, but were placed on pallets from 1967, on. The drums contained scrap materials (graphite molds, crucibles, incinerator ash heels, crucible heels, Raschig Rings, and combustible wastes). These wastes were stored in the area until they could be processed for plutonium in Building 771. Waste from a 1969 fire in Building 776 were drummed and held at the Triangle Area until they could be processed at Building 771. By 1968, about 5,000 drums were being stored. High winds in 1968 were responsible for damaging many drums located at the Triangle Area; leaking drums were found periodically from 1969-1973. Some contaminated soil was removed and shipped offsite in 1969. To help prevent future leakage, drums were also placed in cargo containers from 1969 to 1970. These cargo containers were shipped for disposal to Idaho in 1975. In addition, some contaminated areas were treated with a strippable coating to prevent resuspension of waste into the air.

IHSSs 166.1. 166.2, and 166.3 (Trenches A, B, and C) are located north of the Protected Area on a plateau separating North Walnut Creek and the unnamed tributary to the north. IHSS 166.1 (Trench A) is estimated to be 40 feet by 190 feet; it is located about 100 feet southeast of the Present Landfill. IHSS 166.2 (Trench B) is approximately 40 feet by 190 feet; it is located about 125 feet south of Trench A. IHSS 166.3 (Trench C) actually consists of two separate trenches. The first one is estimated to be 30 feet by 200 feet; it is located between Trenches A and B. The second one is about 20 feet by 100 feet; it is located about 300 feet east of Trench A. Little documentation is available on the operation of these trenches (dates for when trenches were active are assumed from aerial photographs): Trench A (1964-1974); Trench B (1959-unknown); and Trench C (1964-1974). The trenches are thought to have been used to dispose of uranium- and/or plutonium-contaminated sludge from the Sewage Treatment Plant (Building 995).

IHSS 167.1 (Spray Field: North Area) is located north of North Walnut Creek and the Protected Area. The North Area is estimated to be 3.96 acres in area and is partially located on the plateau areas that bound the unnamed tributary on North Walnut Creek. The spray field is presently covered by grasses common to RFP. The periods during which the spray field was used are not precisely known, although the field is known to have been used shortly after the present landfill became operational in 1968. The field was used solely for spray evaporation of two ponds located east of the present landfill (IHSS 114). The East Landfill Pond (the existing landfill pond) was used to intercept groundwater that may have been contaminated by leachate generated at the landfill and was used for spill control. The West Landfill Pond (no longer present) was used to impound leachate generated by the landfill. It was covered over in May of 1981 with expansion of the landfill.

IHSS 216.1 (East Spray Fields — North Area) is located in the Buffer Zone, northeast of the northeastern boundary of the Protected Area. It is geographically on an east-west trending interfluve that separates North and South Walnut Creeks (in the vicinity of the A-Series and B-Series Ponds). The field covers approximately 3.4 acres. It became operational in 1989 to provide an additional area to accommodate the spray evaporation of Pond B-3. Pond B-3 collects local surface runoff and the treated effluent from the Sewage Treatment Plant. Due to excessive runoff problems, use of this field ceased shortly after it came online in 1989.

2.8.3 Operable Unit 6 Nature and Extent of Contamination

Prior to 1983, all RFP wastes were processed at the STP. Therefore, a potential for contamination within the drying beds — i.e., IHSS 141 (Sludge Dispersal Area) — is possible from a variety of chemicals, including plutonium. Data from an adjacent groundwater monitoring well and a downstream surface water sampling location indicate metals and radionuclides above Contract-Required Detection Limits (CRDL).

Numerous investigations have been conducted on the water and sediment quality of IHSSs 142.1, 142.2, 142.3, and 142.4 (Ponds A-1, A-2, A-3, A-4), according to the OU6 Work Plan (DOE 1992o). These studies have been conducted as required by the EPA, as required for a RCRA Part B permit application, and as private investigations. Contaminant concentrations derived from the analytical studies are noted in the OU6 Work Plan; analytical data results from current sampling are presented in the Monthly Environmental Monitoring Report (EG&G 1990a).

A 1979 study concerning radioactivity associated with the pond sediments concluded that most of the plutonium was attached to pond sediments, and that plutonium in the water column was present depending on the amount of suspended material in the sample. The study also noted that fixation of plutonium by sediments was rapid and essentially irreversible; the highest plutonium concentrations found within the pond sediments were found at subsurface depths rather than on sediment surface (DOE 1992o).

IHSS 142.12 (Flume Pond) effluent is sampled daily during any discharge into Walnut Creek. The OU 6 Work Plan review analytical results from effluent sampling, which showed concentrations of some radionuclides. Sampling results are provided monthly to the regulatory agencies in the Monthly Environmental Monitoring Report (EG&G 1990a)

As with the A-Series Ponds, several investigations of the water and sediment quality have been undertaken over the years for IHSSs 142.5, 142.6, 142.7, 142.8, and 142.9 (Ponds B-1,

B-2, B-3, B-4, and B-5). These investigations included studies by EPA in 1970, a 1980 study on plutonium in freshwater systems, and a 1986 study associated with the RCRA Part B Permit Application. Contaminant concentrations derived from the analytical studies are noted in the OU6 Work Plan; analytical data results from current sampling in the South Walnut Creek drainage are presented in the Monthly Environmental Monitoring Report (EG&G 1990a)

A 1980 study was conducted to determine the behavior of plutonium in freshwater systems. The study indicates evidence of resuspension of sediments of plutonium during pond reconstruction activities between 1971 and 1973, as well as evidence of an accidental release of water containing low concentrations of plutonium into the sanitary waste system. The study also indicated that the highest plutonium concentrations occurred in Pond B-1.

The 1986 study, "Trends in the Rocky Flats Surface Water Monitoring," summarized analytical data collected between 1980 and 1985. Samples from the various B-Series ponds showed concentrations of major ions, uranium, plutonium, zinc, nitrate, and some organics. Samples from groundwater monitoring wells near the B-Series ponds showed concentrations of metals, radionuclides, and organics.

Several soil investigations have been conducted at IHSS 143 (Old Outfall — Building 771). The earliest of these are thought to have been in 1956 and 1958. Maximum concentrations of 130 d/m/g gross alpha and 2,000 d/m/g gross alpha were recorded. Hot spots were detected in 1970 at concentrations greater than 190,000 d/m/g. Contamination of North Walnut Creek may have been partially due to discharges flowing from the Old Outfall into the creek. In addition, contaminants may have leached through the soil from the discharge flow and seeped into the creek downstream. No organics were detected above CRDL levels at an exiting surface water sampling location downstream of the Old Outfall; however, several metals and radionuclides were detected. Existing groundwater data was not considered in the OU6 Work Plan because the wells are considered too far away to provide useful data.

Soils placed in IHSS 156.2 (Soil Dump Area) contained low levels of plutonium, although the volume of plutonium and concentrations is not known. A piezometer was installed in the northwest corner of this IHSS (exact location unknown); however, no records or completion details of the well are available. No data from previous investigations on nearby monitoring stations were identified for by the OU6 Work Plan.

In late 1974, an initial radiometric survey of IHSS 165 (Triangle Area) identified 26 spots that were above background. Additional surveys were conducted from 1975 to 1980. As a result of these surveys, soil has been removed several times from this IHSS and has been shipped offsite for disposal. The OU6 Work Plan stated that soil was removed when surface counts of

radionuclides were detected at 1,000 cpm or greater. Data from a groundwater monitoring well upgradient of the Triangle Area indicated that several metals and radionuclides were detected above the CRDL. Data from a well located in the western third of the IHSS indicated that several metals and VOCs were detected above the CRDL, and only one radionuclide was detected above the CRDL.

Only one previous investigation has been performed for IHSSs 166.1, 166.2, and 166.3 (Trenches A, B, and C). As part of this investigation, soil samples were collected from IHSS 166.1 (Trench A). Laboratory results from these samples reported relatively low concentrations of uranium. Volatile organics were also detected.

The OU6 Work Plan reviewed data from a nearby surface water sampling location and a nearby existing groundwater monitoring well. Several metals and radionuclides were detected above the CRDL; one VOC (trichloroethene) was detected above CRDL.

No previous studies have been conducted at IHSS 167.1 (Spray Field: North Area); although some chemical analytical results from surface water sampling conducted at the East and West ponds have been interpreted by the OU 6 Work Plan. Tritium and strontium were detected in the drainage of the landfill in September of 1973. Since the ponds collected leachate from the landfill, concentrations of these radionuclides are of concern for this IHSS. Groundwater is also sampled from monitoring wells nearby. Depth to groundwater beneath the fields has not been established, however.

No previous studies have been conducted at IHSS 216.1 (East Spray Fields — North Area). The Historical Release Report (HRR) indicates that analytical data for treated effluent from the Sewage Treatment Plant is presented in the Monthly Environmental Monitoring Report (EG&G 1990a). Analytes are: pH, five day biochemical oxygen demand, total suspended solids, nitrate as nitrogen, total chromium, total phosphorus, total residual chlorine, total phosphorus, total residual chlorine, fecal coliform, and oil and grease.

The HRR also indicates that a spill of chromic acid in Building 444 on February 22, 1989 was inadvertently pumped into the sanitary sewer system, which would go through the Sewage Treatment Plant and Pond B-3 for spray evaporation to the East Area Spray Area.

2.9 OPERABLE UNIT 7 - PRESENT LANDFILL AND INACTIVE HAZARDOUS WASTE STORAGE AREA

2.9.1 Operable Unit 7 Site Description

Operable Unit No. 7 consists of four IHSSs (**Figure 2.9-1**). IHSSs 167.2 and 167.3 were not identified with OU7 in the 1991 IAG. The investigatory and remediation work associated with these IHSSs was transferred from OU6 to OU7 for logistical reasons in correspondence dated May 27, 1993, from the Colorado Department of Health (CDH 1993). The four IHSSs are:

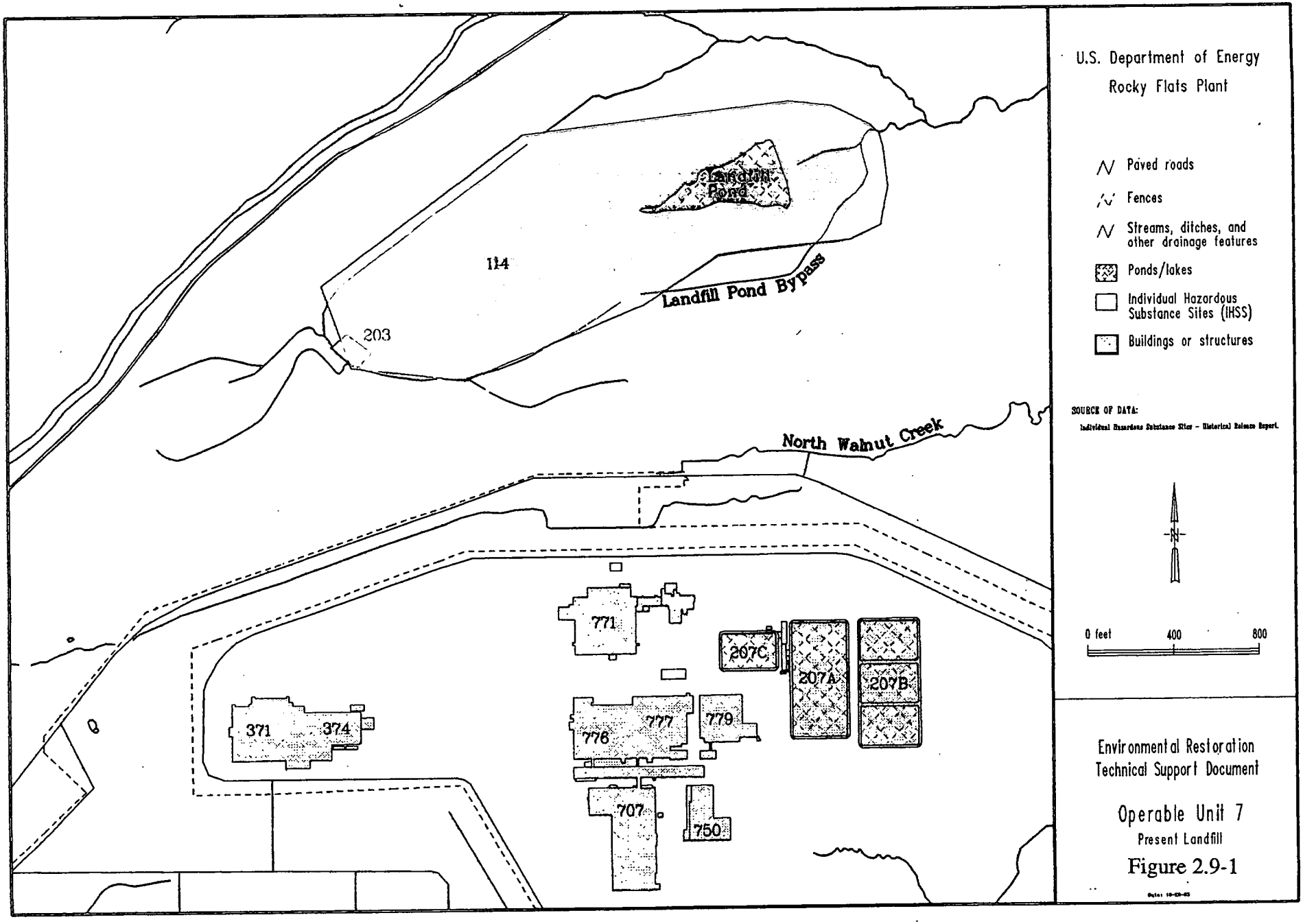
- IHSS 114 - Present Landfill
- IHSS 167.2 - Spray Field; Pond Area (Center Area)
- IHSS 167.3 - Spray Field; South Area
- IHSS 203 - Inactive Hazardous Waste Storage Areas

Information on site use and history is taken from the Phase I RFI/RI Work Plan, Present Landfill, IHSS 114, and Inactive Waste Storage Area, IHSS 203, Operable Unit No. 7 (DOE 1991y). Information on site use, history, and nature and extent of contamination for IHSSs 167.2 and 167.3 was derived from the OU6 Work Plan (DOE 1992o) and the Historical Release Report (DOE 1992x).

2.9.2 Operable Unit 7 Site Use and History

IHSS 114 (Present Landfill) is located to the north of the plant security area on the western end of an unnamed tributary of North Walnut Creek. The landfill is still in use (DOE 1991y). At one time, there were two ponds downstream of the landfill. The western pond was covered by landfill expansion in 1981. The east pond (Pond 2) was constructed in 1974 to protect surface water and groundwater from contamination by leachate generated in the landfill.

The Present Landfill was designed for disposal of RFP's nonradioactive solid waste, including paper, rags, floor sweepings, cartons, mixed garbage and rubbish, demolition materials, and miscellaneous items. Hazardous waste that was sent to the landfill includes paints, solvents, degreasers, oil filters, and metal cuttings and shavings (including mineral and asbestos dust), and miscellaneous metal chips coated with oils and carbon tetrachloride. Landfill operations were initiated in August 1968. From 1968 to 1978, the landfill received approximately 20 cubic yards of compacted waste per day. After dumping, each waste layer is monitored for radiation (this practice began in 1973) and then covered with six inches of soil. When the waste-soil layers are within 3 feet of final elevation, the lift is completed with a 3-foot-thick layer of compacted soil.



Environmental Restoration
Technical Support Document

Operable Unit 7
Present Landfill

Figure 2.9-1

In 1973, tritium was detected at the drainage of the landfill. In response, the two ponds were constructed and sampling initiated. During 1974 and 1975, surface water controls and a groundwater diversion and leachate collection system were constructed to address the presence of an apparent tritium source. The volume of material in the present landfill is currently estimated to be approximately 405,000 cubic yards.

IHSSs 167.2, and 167.3 (Spray Fields: Pond Area, and South Area) are located north of North Walnut Creek and the Protected Area. The Pond Area is estimated to be 0.72 acres in area; and the South Area — 0.92 acres. The South Area is partially located on the plateau areas that bound the unnamed tributary on North Walnut Creek. The Pond Area is located on a north-facing slope of the present Landfill Pond. These spray fields are presently covered by grasses common to RFP.

The periods during which these spray fields were used are not precisely known, although the fields are known to have been used shortly after the present landfill became operational in 1968. The fields were used solely for spray evaporation of two ponds located east of the present landfill (IHSS 114). The East Landfill Pond (the existing landfill pond) was used to intercept groundwater that may have been contaminated by leachate generated at the landfill, and was used for spill control. The West Landfill Pond (no longer present) was used to impound leachate generated by the landfill. It was covered over in May of 1981 with expansion of the landfill.

IHSS 203 (Inactive Hazardous Waste Storage Area) is located on the southwest corner of the Present Landfill. The storage area was actively used between 1986 and 1987. The Inactive Hazardous Waste Storage Area was operated as a hazardous waste storage area for both drummed liquids and solids. Fifty-five-gallon containers with free liquids were stored within 14 cargo containers. One additional container was used to store spill control items such as oil sorbent and sorbent pillows.

During maximum inventory, the hazardous waste area consisted of eight 20-foot-long cargo containers, each capable of holding eighteen 55-gallon drums, and six 40-foot-long cargo containers, each capable of holding forty 55-gallon drums. RCRA-listed wastes were stored in 12 of the 14 cargo containers and included solvents, coolants, machining wastes, cuttings, lubricating oils, organics, and acids. Two of the cargo containers were used to store polychlorinated biphenyl (PCB)-contaminated soil and debris, as well as PCB-contaminated oil from transformers taken out of service. In May 1987, all of the containers were removed from the site. The area has been vacant since then.

2.9.3 Operable Unit 7 Nature and Extent of Contamination

Both IHSS 114 (Present Landfill) and IHSS 203 (Inactive Waste Storage Area) have had little direct characterization of the types of contaminants conducted; therefore, most of what is known is based on waste stream identification studies and groundwater and surface water quality monitoring (DOE 1991y). Previous evaluations of groundwater quality from wells at the periphery of the landfill indicate the landfill contributes calcium, bicarbonate, and, to a lesser extent, sulfate, iron, manganese, zinc, and strontium to the groundwater.

Volatile contamination, primarily trichloroethylene and 1,1,1-trichloroethane, has been found sporadically and at low concentrations in groundwater in some areas at the landfill periphery. Elevated uranium and tritium levels also exist in some areas. Soil contamination has not been characterized, but it may be reasonable to assume that the nature of contamination is similar to the groundwater contamination.

The primary mechanism for release of contaminants from the Present Landfill into the affected media appears to be by percolation of groundwater (leachate) through the wastes and then out of the landfill. Groundwater flow exiting the wastes can potentially distribute contamination vertically downward and laterally downgradient. In the case of the Inactive Hazardous Waste Storage Area, any spilled material could be released by percolation into the landfill wastes.

No previous studies have been conducted at IHSSs 167.2 and 167.3 (Spray Fields: Pond Area and South Area); although some chemical analytical results from surface water sampling conducted at the East and West ponds have been interpreted by the OU 6 Work Plan. Tritium and strontium were detected in the drainage of the landfill in September of 1973. Since the ponds collected leachate from the landfill, concentrations of these radionuclides are of concern for these two IHSSs. Groundwater is also sampled from monitoring wells nearby. Depth to groundwater beneath the fields has not been established, however.

2.10 OPERABLE UNIT 8 - 700 AREA

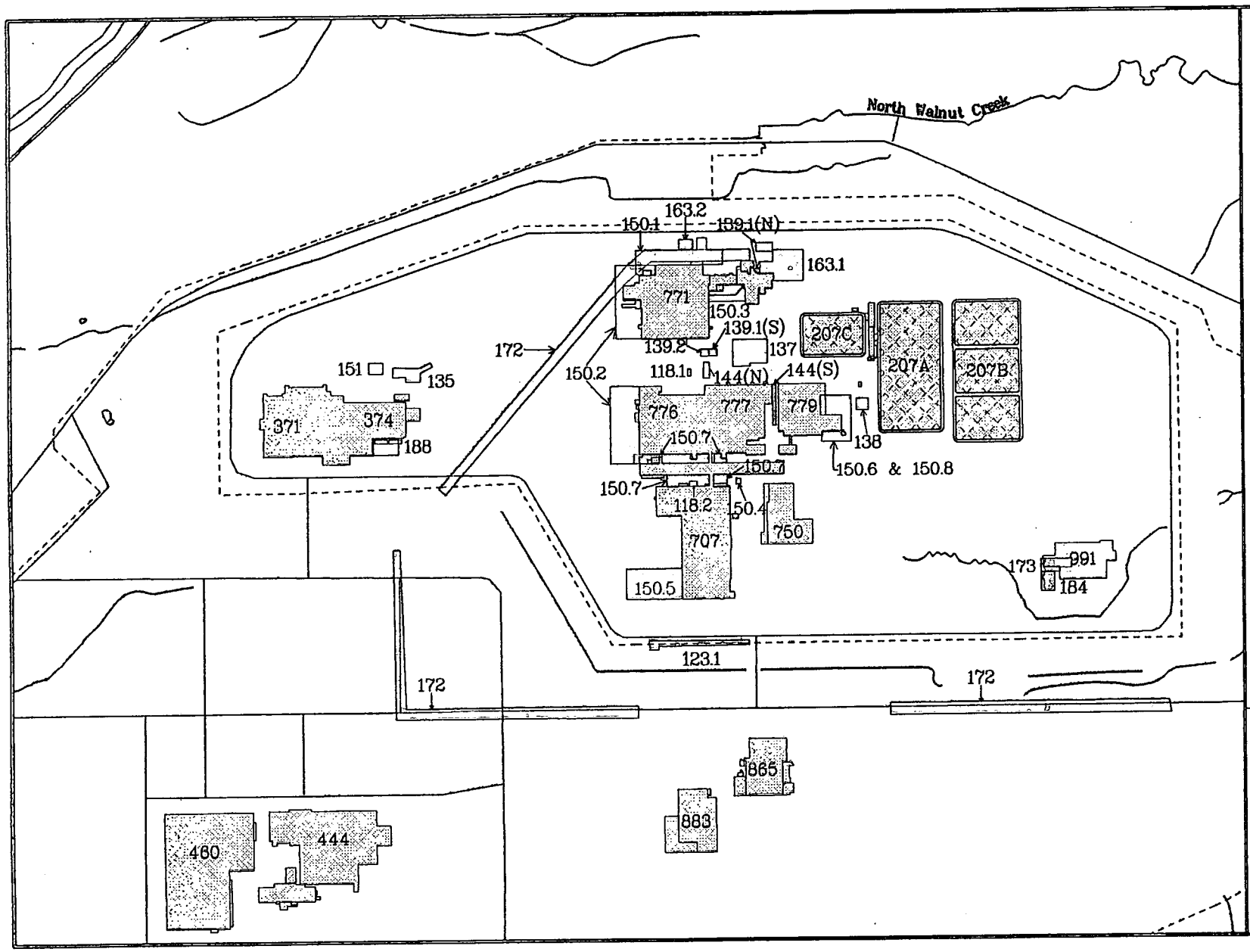
2.10.1 Operable Unit 8 Site Description

Thirty-two IHSSs formerly made up Operable Unit 8. DOE, CDH and EPA have modified the IAG, such that the investigatory and remediation work associated with 123.2, 125, 126.1, 126.2, 127, 132, 146.1, 146.2, 146.3, 146.4, 146.5, 146.6, 149, and 159 has been transferred from OU8 to OU9 for logistical reasons in correspondence dated April 21, 1992

from the Colorado Department of Health (CDH 1992). OU8 now consists of 24 IHSSs located in the 700 Area (**Figure 2.10-1**). The remaining 24 IHSSs are:

- IHSS 118.1 - Multiple Solvent Spills West of Building 730
- IHSS 118.2 - Solvent Spill South End of Building 776
- IHSS 123.1 - Valve Vault 7
- IHSS 135 - Cooling Tower Blowdown
- IHSS 137 - Cooling Tower Blowdown Building 774
- IHSS 138 - Cooling Tower Blowdown Building 779
- IHSS 139.1 - Caustic/Acid Spills: Hydroxide Tank Area
- IHSS 139.2 - Caustic/Acid Spills: Hydrofluoric Acid Tanks Spill
- IHSS 144 - Sewer Line Breaks
- IHSS 150.1 - Radioactive Site North of Building 771
- IHSS 150.2 - Radioactive Site West of Building 771
- IHSS 150.3 - Radioactive Site Between Buildings 771 and 774
- IHSS 150.4 - Radioactive Site Northwest of Building 750
- IHSS 150.5 - Radioactive Site West of Building 707
- IHSS 150.6 - Radioactive Site South of Building 779
- IHSS 150.7 - Radioactive Site South of Building 776
- IHSS 150.8 - Radioactive Site Northeast of Building 779
- IHSS 151 - Fuel Oil Leak
- IHSS 163.1 - Radioactive Site 700 Area Site#3 Wash Area
- IHSS 163.2 - Radioactive Site 700 Area Site#3 Buried Slab
- IHSS 172 - Central Avenue Waste Spill
- IHSS 173 - South Dock Building 991
- IHSS 184 - Building 991 Steam Cleaning Area
- IHSS 188 - Acid Leak

The descriptions of the site use, history, and nature and extent of contamination are derived from the following sources: Draft Phase I RFI/RI Work Plan, 700 Area, Operable Unit 8 (DOE 1992p), Remedial Investigation and Feasibility Study Plans for Low Priority Sites (Rockwell 1988), the Historical Release Report (DOE 1992x), and RCRA 3004 (u) Waste Management Units for Rocky Flats Plant (DOE 1987b).



U.S. Department of Energy
Rocky Flats Plant

Paved roads

Fences

Streams, ditches, and other drainage features

Ponds/lakes

Individual Hazardous Substance Sites (IHSS)

Buildings or structures

SOURCE OF DATA:
Individual Hazardous Substance Sites - 699 Work Plan.

0 feet 400 800

Environmental Restoration
Technical Support Document

Operable Unit 8
700 Area
Figure 2.10-1

2.10.2 Operable Unit 8 Site Use and History

IHSSs 118.1 and 118.2 (Multiple Solvent Spills) are two units resulting from leaks and spills from storage tanks. IHSS 118.1(West of Building 730) is the result of leaks and spills of carbon tetrachloride during normal filling operations of a 5,000 gallon tank west of Building 730. The tank was removed in 1981. IHSS 118.2 (South End of Building 776) covers an area of 30 feet by 70 feet and is the result of overflows of organic solvents from several storage tanks located in Building 776 or the rupture of a 5,000 gallon tank, north of Building 707, in 1981.

IHSS 123.1 (Valve Vault 7) is located southwest of Building 707. The valve controls the 800 Area main process waste line. In 1983, a malfunction caused the vault to fill with process wastewater and overflow.

IHSS 135 (Cooling Tower Blowdown), near Building 374, is believed to have been first used in 1981 when the cooling tower in Building 373 was cleaned and the slurry portion pumped into a small retention pond. IHSS 137 (Cooling Tower Blowdown Building 774) may be the cooling tower facilities related to Building 776. Several leaks have been reported at the cooling tower in the past. In 1976, approximately 400 gallons of cooling tower water from IHSS 138 (Cooling Tower Blowdown Building 779) leaked into a storm drain east of Building 779. A second spill at this site occurred in 1990.

IHSSs 139.1 and 139.2 (Caustic/Acid Spills) occurred during material transfers and tank fillings. Leaks and spills of caustics have also been reported to have occurred at the caustics receiving areas north and south of Building 774. IHSS 139.1 (Hydroxide Tank Area) is located south of Building 771 and north of Building 774. IHSS 139.2 (Hydrofluoric Acid Tanks Spill) is located at Building 714.

IHSS 144 (Sewer Line Breaks) occurred when an increased rate in the sanitary waste transfer line from the laundry waste holding tanks to the sanitary waste treatment plant pressurized the line and caused overflows in several locations. Contaminated soil was removed from the spill site after the incident.

IHSSs 150.1-150.8 (Radioactive Sites) are eight areas outside of Buildings in the 700 Area that received radioactive contamination from spills and leaks. The spills and leaks were mostly of liquid process waste containing radioactive compounds and caustic and acid solutions.

IHSS 151 (Fuel Oil Leak) was formed in August 1981, when 196 gallons of #2 fuel oil from an underground tank was spilled north of Building 374. It was reported that the spill covered an area 30 feet by 35 feet. It appears the spill was cleaned up. Additional spills occurred in 1982 and 1988.

IHSSs 163.1 (Radioactive Site 700 Area Site #3 Wash Area) was reportedly used to wash equipment contaminated with radioactivity. The effluent from the wash process flowed onto the ground. IHSS 163.2 (Radioactive Site 700 Area Site #3 Buried Slab) is a concrete slab contaminated with "direct count americium" which was buried north of Buildings 771 and 774. The slab was later excavated and the contaminated portion of the slab was cut away and disposed of offsite.

IHSS 172 (Central Avenue Waste Spill) occurred in 1968, when plutonium-contaminated oils and oils with lathe coolant from the cleanup of the 903 Drum Storage Site, were spilled along Central Avenue and Sixth Street. The wastes were spilled along a one-mile route from the 903 Drum Storage Site to Building 771. The road has been seal-coated and resurfaced since the spill.

IHSS 173 (South Dock Building 991) consists of Building 991 and associated vaults 996, 997, 998, and 991, which have been in operation since 1952. Incidents involving small quantities of plutonium, uranium, and beryllium have been noted in Building 991. Routine radiological surveys indicate that, with the exception of Vault 996, which may be slightly contaminated with uranium, the vaults remain free of radionuclide contamination. An aerial survey of RFP indicates gross radioactivity and americium centered on Building 991.

IHSS 184 (Building 991 Steam Cleaning Area) may have been used to steam clean radionuclide-contaminated equipment and drums between 1953 and 1978. The rinse was collected in a sump for treatment in the original process waste system. The IHSS is a 50-square-foot area in the southeast part of the protected area (PA) near Building 992 and within the area of IHSS 173.

IHSS 188 (Acid Leak) occurred in 1983 when a drum containing a mixture of nitric and hydrochloric acid leaked near the east gate of Building 374.

2.10.3 Operable Unit 8 Nature and Extent of Contamination

Previous investigations have not been conducted at these IHSSs; therefore, the nature and extent of contamination is assumed, based on materials previously stored at the sites and on previous site uses. Materials stored in the tanks involved in IHSSs 118.1 and 118.2 (Multiple Solvent Spills) included carbon tetrachloride, petroleum distillates, paint thinners, 1,1,1-trichloroethane and methyl ethyl ketone.

Process wastes, typically containing uranium, solvents, oils, beryllium, nitric acid, hydrochloric acid, and fluoride, were released from IHSS 123.1 (Valve Vault 7).

Cooling tower blowdown from IHSSs 135, 137, and 138 typically contained algicides and chromates. The 1976 spill from IHSS 138 also included radionuclides. The 1990 spill from IHSS 138 contained phosphates.

Materials stored in the tanks involved in IHSSs 139.1 and 139.2 (Caustic/Acid Spills) included hydrochloric, hydrofluoric, nitric and sulfuric acids, and sodium hydroxide and potassium hydroxide.

IHSS 144 (Sewer Line Breaks) involved the release of radioactive laundry wastewater.

IHSSs 150.1-150.8 (Radioactive Sites) were primarily releases of liquid process wastes containing radioactive compounds and solutions containing caustics and acids.

Spills of #2 fuel oil were the cause of IHSS 151 (Fuel Oil Leak).

IHSSs 163.1 and 163.2 (Radioactive Site 700 Area Site #3 Wash Area, and Buried Slab) and IHSS 173 (South Dock Building 991) may have been contaminated with radioactive compounds including americium. No radioactivity above background levels has been detected by radiometric surveys of the IHSS 163.1 and 163.2 locations; however, radioactivity has been measured at IHSS 173.

At IHSS 184 (Building 991 Steam Cleaning Area), radiometric surveys have not detected radioactivity above background levels.

IHSS 172 (Central Avenue Waste spill) consisted of less than 100 gallons of plutonium contaminated oils and oils with lathe coolant (hydraulic oil and carbon tetrachloride). A spill of a mixture of nitric and hydrochloric acid was the cause of IHSS 188 (Acid Leak).

2.11 OPERABLE UNIT 9 - ORIGINAL PROCESS WASTE LINES

2.11.1 Operable Unit 9 Site Description

In the 1991 IAG, OU9 consisted of only one IHSS — IHSS 121 (Original Process Waste Lines). The investigatory and remediation work associated with 20 additional IHSSs was transferred to OU9 from several other OUs for logistical reasons in correspondence dated April 21, 1992 from the Colorado Department of Health (CDH 1992). IHSSs 123.2, 125, 126.1, 126.2, 127, 132, 146.1, 146.2, 146.3, 146.4, 146.5, 146.6, 149, and 159 were transferred from OU8; IHSS 147.1 was transferred from OU12; IHSS 122 was transferred form OU13; and IHSS 215 was transferred from OU15. Operable Unit 9 now consists of the following 21 IHSSs (**Figure 2.11-1**):

- IHSS 121 - Original Process Waste Lines
- IHSS 122 - Underground Concrete Tank [OU13]
- IHSS 123.2 - Valve Vault West of Building 707 [OU8]
- IHSS 124.1 - 30,000 Gallon Tank (Tank #68) [OU10]
- IHSS 124.2 - 14,000 Gallon Tank (Tank #66) [OU10]
- IHSS 124.3 - 14,000 Gallon Tank (Tank #67) [OU10]
- IHSS 125 - Holding Tank (Tank #66) [OU8]
- IHSS 126.1 - Westernmost Out-of-Service Waste Tank [OU8]
- IHSS 126.2 - Easternmost Out-of-Service Waste Tank [OU8]
- IHSS 127 - Low-Level Radioactive Waste Leak [OU8]
- IHSS 132 - Radioactive Site 700 Area Site #4 [OU8]
- IHSS 146.1 - 7,500 Gallon Tank (31) [OU8]
- IHSS 146.2 - 7,500 Gallon Tank (32) [OU8]
- IHSS 146.3 - 7,500 Gallon Tank (34W) [OU8]
- IHSS 146.4 - 7,500 Gallon Tank (34E) [OU8]
- IHSS 146.5 - 7,500 Gallon Tank (30) [OU8]
- IHSS 146.6 - 7,500 Gallon Tank (33) [OU8]
- IHSS 147.1 - Process Waste Leaks (Maas) Area [OU12]
- IHSS 149 - Effluent Pipe [OU8]
- IHSS 159 - Radioactive Site - Building 559 (OU8)
- IHSS 215 - Tank T-40, Unit 55.13 [OU15]

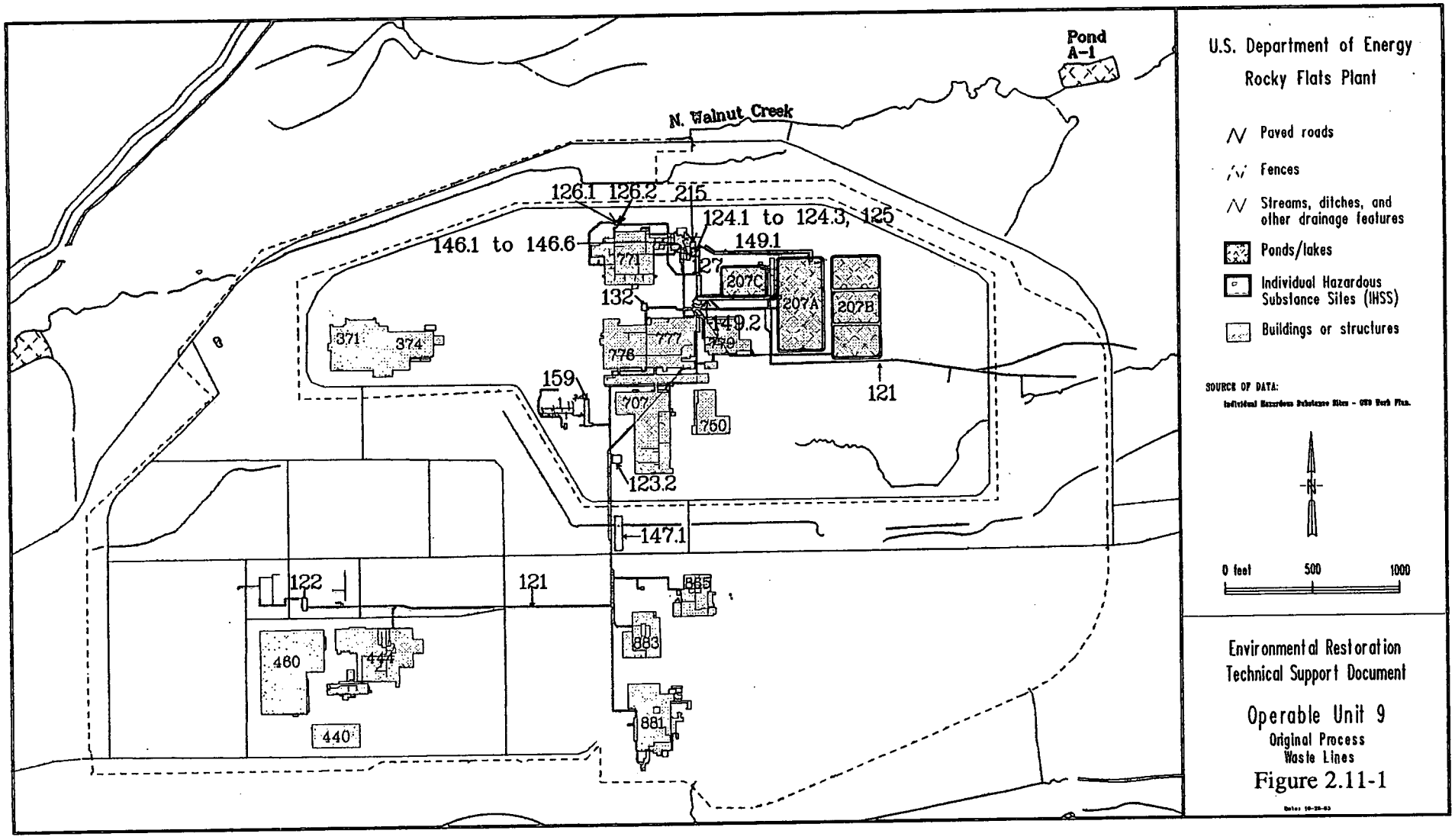

Pond A-1
N. Walnut Creek
126.1 126.2 215
124.1 to 124.3, 125
146.1 to 146.6
149.1
771
27
207C
207A
207B
132
149.2
371
374
777
778
759
159
707
760
121
123.2
147.1
122
121
885
883
460
444
440
881
U.S. Department of Energy
Rocky Flats Plant
Paved roads
Fences
Streams, ditches, and other drainage features
Ponds/lakes
Individual Hazardous Substance Sites (IHSS)
Buildings or structures
SOURCE OF DATA:
Individual Hazardous Substance Sites - OU9 Work Plan.
N
0 feet
500
1000
Environmental Restoration
Technical Support Document
Operable Unit 9
Original Process
Waste Lines

Figure 2.11-1

Detailed site investigations have not been conducted at the 20 IHSSs added to OU9. Information on site use, history, and nature and extent of contamination for OU9's IHSS 121 is taken from Draft Final Phase I RFI/RI Work Plan, Original Process Waste Lines (Operable Unit No. 9) (DOE 1992q) and the Historical Release Report (DOE 1992x). Similar information regarding IHSSs added from other OUs was derived from their respective OU Work Plans (i.e., DOE 1992p; DOE 1991a; DOE 1992b; DOE 1992c; and DOE 1993b). In addition, some material was obtained from RCRA 3004(u) Waste Management Units for Rocky Flats Plant (DOE 1987b) and November 1986 Part B Permit Application (DOE 1986c).

2.11.2 Operable Unit 9 Site Use and History

IHSS 121 (Original Process Waste Lines) is an abandoned network of tanks and underground pipelines used for transport and temporary storage of aqueous process waste from RFP production activities (**Figure 2.11-1**). As currently defined, the Original Process Waste Lines (OPWL) consist of 35,000 feet of underground pipelines and 39 tank locations containing a total of 65 tanks (DOE 1992q). Components of the OPWL exist in RFP Building areas 100, 400, 500, 600, 700, 800, 900; at the Solar Evaporation Ponds; and between the Solar Ponds area and Pond B-2 in the Walnut Creek Drainage.

IHSS 121 (OPWL) was placed into operation in 1952 and additions were made to the system through 1975. The OPWL was replaced during the 1975-1983 period by an inspectable process waste system. Some tanks and pipelines from the original system were incorporated into the new process system or into the plant exhaust plenum fire deluge system. The OPWL is known to have transported or stored various aqueous process wastes containing low-level radioactive materials, nitrates, caustics, and acid. Certain process waste streams also contained metals, volatile organic compounds, oils and greases, and cleaning compounds. The general purpose of the OPWL was to transfer process waste from facilities which generated the wastes to the RFP process waste treatment facility housed in Building 774. Other components of the OPWL were used to transfer treated process wastes from Building 774 to disposal locations, including the Solar Evaporation Ponds and Pond B-2.

IHSS 121 (OPWL) pipelines vary from 1 inch to 10 inches in diameter and are constructed of a variety of materials, including black iron, cast iron, plastic, polyethylene, vitrified clay, cement/asbestos, saran-lined steel, stainless steel, PVC, pyrex glass, and teflon. Tanks varied in volume from 250 to 200,000 gallons, and included sumps, underground tanks, above-grade tanks, and on-grade tanks. When enclosed in buildings, pipelines were flushed with water and then sealed at wall and floor penetrations. Underground pipelines outside of buildings were abandoned in place without sealing or decontamination.

IHSS 122 (Underground Concrete Tank) is a 3,000 gallon underground tank located south of Building 441. The tank held process waste from Buildings 123 and 441 and may have leaked. Occasionally the tank fills with groundwater which is transferred to the new process waste system for treatment.

IHSS 123.2 (Valve Vault West of Building 707) is at a process waste line elbow west of Building 707. This vault overflowed a number of times due to leaks at the elbow. In 1973, the valve vault was replaced.

IHSSs 124.1, 124.2, and 124.3 consist of three underground concrete tanks located adjacent to Building 774. IHSS 124.1 (30,000 Gallon Tank - Tank #68) is 16 feet wide, 28.7 feet long, and 10.3 feet deep. IHSS 124.2 (14,000 Gallon Tank - Tank #66) and IHSS 124.3 (14,000 Gallon Tank - Tank #67) are each 20 feet long, 10 feet wide, and 10.2 feet deep, and they share an inner wall. The primary function of IHSSs 124.2 and 124.3 was to receive treated liquid decant from the second-stage batch precipitation process in Building 774. IHSS 124.1 was used as a backup if the other tanks were not available. IHSS 124.1 also received aqueous waste from miscellaneous sources such as spills in Buildings 460, 483, and 484. IHSS 124.1 was installed in 1959, and the two other tanks in 1953. The tanks received potentially ignitable, corrosive, reactive, and metal-containing wastes. Solvents may have also been stored in the tanks.

IHSS 125 (Holding Tank - Tank #66) is also identified as Tank T-66 and is discussed in the preceding paragraph as IHSS 124.2.

IHSS 126.1 (Westernmost Out-of-Service Waste Tank) and IHSS 126.2 (Easternmost Out-of-Service Waste Tank) are located below Building 728. Each reinforced concrete tank has a design capacity of 25,000 gallons. Since 1984, the tanks have served as overflow for fire deluge water. The tanks reportedly fill with groundwater, and the liquid is pumped periodically into the process waste system for treatment.

IHSS 127 (Low-Level Radioactive Waste Leak) occurred on a waste discharge line between Buildings 995 and 774. The line was severed several times during construction activities near Building 774.

In IHSS 132 (Radioactive Site - 700 Area Site #4), four out-of-service radioactive waste tanks in Building 730 are suspected of having had overflows. The tanks have been cleaned and are now used as plenum deluge tanks. The tanks periodically fill with groundwater and are pumped out to the process waste system for treatment.

IHSSs 146.1 through 146.6 (7,500 Gallon Tanks 31, 32, 34W, 34E, 30, and 33) represent a six-chambered reinforced concrete holding tank structure south of Building 774. These tanks overflowed frequently. Contaminated soil was removed from the site when the tanks were decommissioned in 1972.

IHSS 147.1 (Process Waste Leaks [Maas] Area) occurred along the process waste lines north of Building 881, also known as the Maas Area. Leaks were reported numerous times between 1955 and 1984.

IHSS 149 (Effluent Pipe) was two 1.5-inch PVC pipes installed in 1972 to transfer wastes between Building 774 and the Solar Evaporation Ponds. The lines broke several times and were known to leak. They were abandoned in place in 1980.

IHSS 159 (Radioactive Site - Building 559) was the result of leaks from glass lines. When Building 559 began operations in 1968, the process waste system consisted of Pyrex glass lines beneath the building. Contaminated soil was removed from the site on several occasions.

IHSS 215 (Tank T-40, Unit 55.13) is a concrete tank used to store sludge generated from precipitation of liquid process waste. This tank, which had interim status, was included in the November 1986 Part B Permit Application (DOE 1986c). Use of the tank ceased in 1989. An interim status closure plan was prepared for the tank and submitted to CDH and EPA in 1989 (Rockwell 1989).

2.11.3 Operable Unit 9 Nature and Extent of Contamination

At IHSS 121, low-level radioactive aqueous wastes with high nitrate concentrations were a primary OPWL waste stream. Volatile and semivolatile organics were transferred through the OPWL in small quantities. Numerous acids were discharged to the OPWL, as well as bases, metals, and small quantities of other liquids, including pickling liquor from foundry operations, medical decontamination fluids, miscellaneous laboratory wastes, and laundry effluent.

Releases from the OPWL and associated IHSSs may have occurred as a result of leakage, deterioration of pipes, breakage, and overflows. The lateral and vertical extent of releases are not precisely known but are expected to be largely confined to the pipeline trench backfill materials and adjacent soils.

2.12 OPERABLE UNIT 10 - OTHER OUTSIDE CLOSURES

2.12.1 Operable Unit 10 Site Description

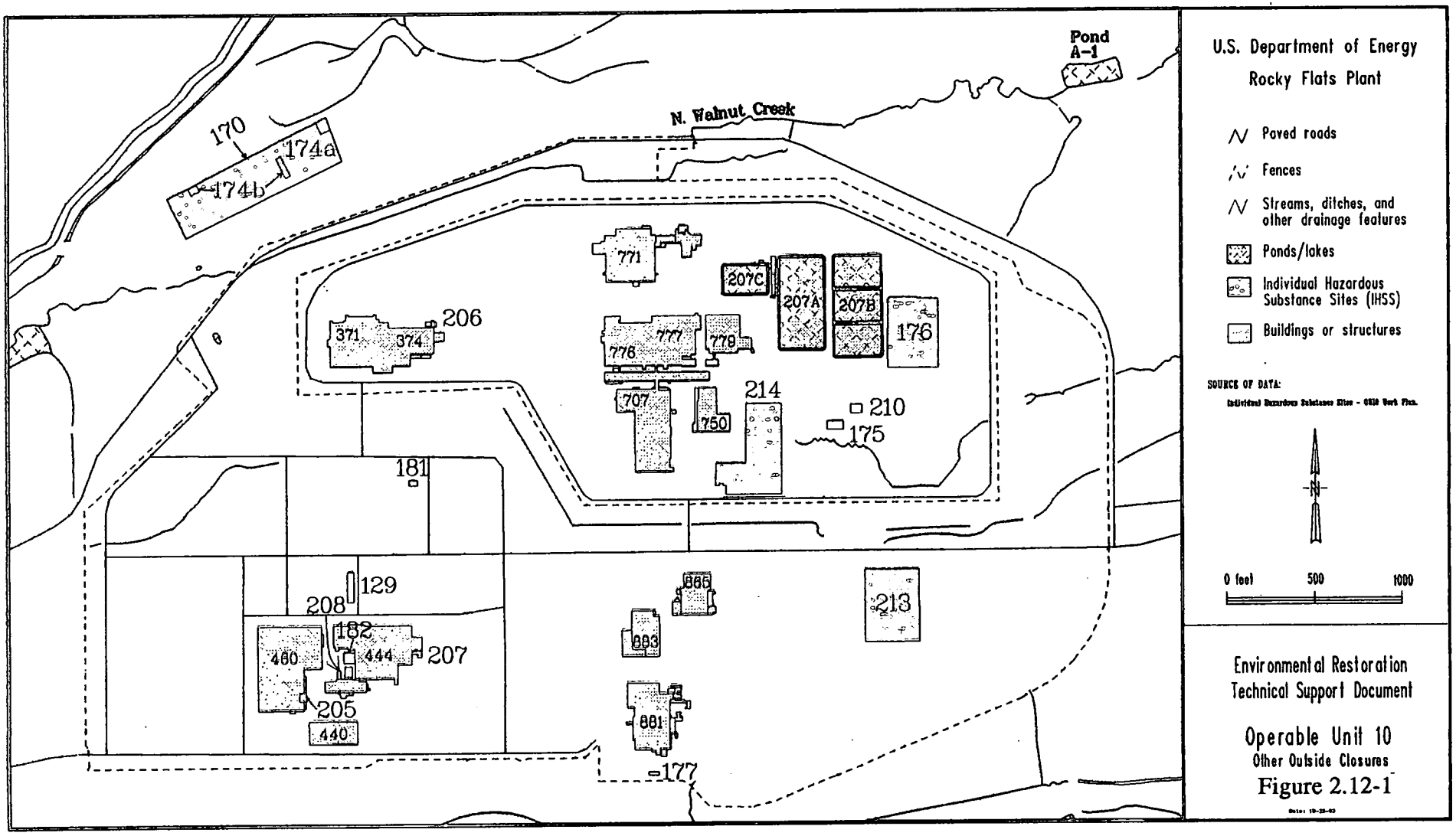
The 1991 IAG identified 18 IHSSs in OU10. However, the investigatory and remediation work associated with IHSSs 124.1, 124.2, and 124.3 was transferred to OU9 for logistical reasons in correspondence dated April 21, 1992, from the Colorado Department of Health (CDH 1992). A total of 15 IHSSs are currently grouped into OU10 (**Figure 2.12-1**). They are:

- IHSS 129 - Oil Leak
- IHSS 170 - PU&D Storage Yard - Waste Spills
- IHSS 174 - PU&D Container Storage Facilities
- IHSS 175 - S&W Building 980 Container Storage Facility
- IHSS 176 - S&W Contractor Storage Yard
- IHSS 177 - Building 885 Drum Storage Area
- IHSS 181 - Building 334 Cargo Container Area
- IHSS 182 - Building 444/453 Drum Storage Area
- IHSS 205 - Building 460 Sump #3 Acid Site
- IHSS 206 - Inactive D-836 Hazardous Waste Tank
- IHSS 207 - Inactive Building 444 Acid Dumpster
- IHSS 208 - Inactive 444/447 Waste Storage Area
- IHSS 210 - Unit 16, Building 980 Cargo Container
- IHSS 213 - Unit 15, 904 Pad Pondcrete Storage
- IHSS 214 - Unit 25, 750 Pad Pondcrete and Saltcrete Storage

Information on site use, history, and nature and extent of contamination was derived from the *Draft Final Phase I RFI/RI Work Plan, Rocky Flats Plant, Other Outside Closures (Operable Unit No. 10)* (DOE 1991a) and the Historical Release Report for the Rocky Flats Plant (DOE 1992x).

2.12.2 Operable Unit 10 Site Use and History

IHSS 129 (Oil Leak) is one of four underground fuel oil tanks near Building 443 and is used to store #6 fuel oil for the Building 443 steam plant. Tank #4 was installed in 1967 and was used to store fuel oil until 1984 when it was used to store a waste mixture of water and compressor oil. Spent solvents may have also been added to the tank. A leak was discovered in the vicinity of Tank 4 in 1986, and the tank was emptied.


Pond A-1
N. Walnut Creek
170
174a
174b
771
207C
207A
207B
176
371
374
206
776
777
779
707
750
214
210
175
181
129
208
182
460
444
207
205
440
865
883
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N
0 feet
500
1000
Environmental Restoration
Technical Support Document
Operable Unit 10
Other Outside Closures

Figure 2.12-1

IHSS 170 (PU&D Storage Yard - Waste Spills) is approximately 260 feet by 1,000 feet in size and is located southwest of the Present Landfill. Use of the Yard began in 1974 but it is presently inactive — so no materials are stored in the IHSS (EG&G 1994a). It has been used to store containers such as barrels, drums, and cargo boxes, spent batteries, empty dumpsters, dumpsters filled with metal shavings coated with lathe coolant, drums of spent solvents and waste oils, and miscellaneous equipment and vehicles. Approximately 1,800 gallons of liquid waste, in six tanks, have been generated from the cleanup of the Yard.

IHSS 174 (PU&D Container Storage Facilities) is made up of two separate areas within the aforementioned PU&D Storage Yard — PU&D Drum Storage Facility (IHSS 174a) and PU&D Dumpster Storage Facilities (IHSS 174b). Releases have occurred in the past from leaking dumpsters and drums of solvents and waste oils, and during battery removal.

IHSS 175 (S&W Building 980 Container Storage Facility) is reportedly located in the eastern third of a storage yard located south of Building 980. The IHSS was used from approximately 1980 to 1986 for storage of 55-gallon drums containing wastes generated by the S&W contractor's maintenance and fabrication shops. The general area was regraded in 1988.

IHSS 176 (S&W Contractor Storage Yard) is located approximately 50 feet east of the Solar Evaporation Ponds in the vicinity of Building 964. The yard has been used for storage since 1970. Drum storage began in 1970 and continued until 1985. Most of the yard area has been used for storage of surplus or raw materials for use by contractors in construction or maintenance projects rather than for drum storage or accumulation.

IHSS 177 (Building 885 Drum Storage Area) consists of the eastern and western sections of Building 885. The areas are both 10 feet by 20 feet in size and are covered by a roof and enclosed on two or three sides. The drum storage area was first used in the mid-1950s and is still used as a 90-day accumulation area and a satellite collection station. The west area stored unused and waste oil drums, while the east area stored unused and waste paint, and paint solvents.

IHSS 181 (Building 334 Cargo Container Area) was 8 feet by 20 feet in size and was located outside Building 334 between 1984 and 1986. Drums stored in the container held machine oils, solvents and machine coolants, and possibly low-level radioactive wastes. The container was capable of holding a maximum of eighteen 55-gallon drums, but the maximum number placed in the container was seven.

IHSS 182 (Building 444/453 Drum Storage Area) was a 45-foot by 45-foot area located between Building 444 and 453. The site was used from the late 1960s until 1986 to store 55-

gallon drums containing waste hydraulic oils and chlorinated solvents. Beryllium and low-level uranium contamination was sometimes present in the waste. Up to 200 drums could be stored in the area.

IHSS 205 (Building 460 Sump #3 Acid Site) is located in the wall of Room 156B in Building 460 and was used as a staging area between acid wastes generated inside the building and two acid dumpsters located along the southeast corner of Building 460. The sump provided additional storage for the dumpsters, which had a capacity of 250 gallons (although both dumpsters were not used simultaneously). Generated wastes were transferred to the sump and on to one of the dumpsters. When full, the dumpster was moved to a nearby area where waste was removed and drummed, or waste could be transported by truck directly to Buildings 374 or 774 for treatment. In 1989, one of the dumpsters overfilled, releasing 5-7 gallons of dilute nitric acid and nitrad waste into a storm drain.

IHSS 206 (Inactive D-836 Hazardous Waste Tank) was a 19,000 gallon, carbon steel tank used for hazardous waste storage. The tank has no secondary containment and was located on compacted soil. The tank can be seen in a 1980 RFP photograph, situated at the northwest corner of Building 371 near Door 5. The tank was used to hold off-specification product water from Building 374 (i.e., water too high in conductivity). A spill of condensate water occurred on February 18, 1980, when a line from the evaporator to the tank was disconnected. The spill was found to contain low concentrations of tritium. The tank has been identified as Unit #42.14 in the RCRA Part B Permit Application (tank specifications are noted within the permit).

IHSS 207 (Inactive Building 444 Acid Dumpster) was located outside and to the east of Building 444. The acid dumpsters were used to store acidic wastes from Building 444 and operated from 1980 through 1987. The waste consisted of phosphoric and sulfuric acid waste from the chemical milling of beryllium, and electropolishing solution from chemical milling.

IHSS 208 (Inactive 444/447 Waste Storage Area) was previously identified in the RCRA Part B Permit Application as Unit #3, and was located in the same area as IHSS 182. This storage area consisted of a 20- by 8-foot cargo container which was used from 1986 to 1987 at the same location as IHSS 182. Typically, stored wastes included plating acids, metal plating solutions, developer, and fixer.

IHSS 210 (Unit 16, Building 980 Cargo Container) is located south of Spruce Avenue and east of 10th Street. Unit 16 provided solid and liquid waste drum storage for automotive oils, stoddard solvents, paints and paint thinner, paper and rags contaminated with oils, grease, gasoline, diesel fuel, solvents, metals scraps, and fiberglass resins and catalysts. The area has

been used for several years to store waste from paint work, automotive work, and machine work performed in Building 980. Drum storage was terminated in 1988.

IHSS 213 (Unit 15, 904 Pad Pondcrete Storage) area is located in the southeastern portion of the plant production area and occupies a 129,505-square-foot area. The 904 Pad is used for the storage of pondcrete (cemented Solar Evaporation Pond sludge) and saltcrete (cemented residual salts [produced by the evaporation of liquid process water]). The pad was constructed in 1987 over previously contaminated soil in the pad area.

IHSS 214 (Unit 25, 750 Pad Pondcrete and Saltcrete Storage) was initially constructed as a parking lot for Building 750. The 750 Pad is used for the storage of pondcrete and saltcrete in an area covering 142,000 square feet. The parking lot was constructed in 1969. The pad was modified for waste storage in 1986 and has been used for storage from 1986 to the present.

2.12.3 Operable Unit 10 Nature and Extent of Contamination

Analytical results for soil samples taken in the vicinity of IHSS 129 (Oil Leak) indicate the presence of organics including 1,1,1-trichloroethane, methylene chloride, benzene, toluene, ethylbenzene, 2-butanone, and total xylenes, and metals including mercury, cadmium, copper, and lead. Radionuclides were not tested. Groundwater data are not available for this site.

No previous investigations have been performed at IHSS 170 (PU&D Storage Yard - Waste Spills) so the nature and extent of contamination is unknown.

Soil sampling has been conducted at IHSS 174 (PU&D Container Storage Facilities). Soils here contain concentrations of volatile organics, metals, nitrates, and radionuclides above background levels. Acetone, methylene chloride and nitrate/nitrite were detected in a groundwater sample from a well northeast of IHSSs 170 and 174.

Soil samples were collected in IHSS 175 (S&W Building 980 Container Storage Facility) in 1988. Volatile organics, metals, nitrate, and radionuclides were detected above background levels in the samples. No groundwater data are known to have been collected.

Analysis of soil samples taken from borings in IHSS 176 (S&W Contractor Storage Yard) indicates levels of volatile organics, metals, nitrate, and radionuclides above background concentrations. Groundwater data from an upgradient well indicate the presence of metals, inorganics, and radionuclides above background levels.

No documentation of spills or leaks were found in relationship to IHSS 181 (Building 334 Cargo Container Area). While in use, the storage container was monitored weekly on its inside and outside. No other documentation was found which detailed the response to this operation. According to the closure plan, there is no visual evidence of a release to the environment; however, the 1988 closure plan will be superseded by the OU10 RFI/RI process.

A sitewide radiometric survey of IHSS 182 (Building 444/453 Drum Storage Area) was performed from 1977 through 1984. The purpose of the survey was to identify surface areas extremely contaminated with plutonium. The area around Building 453 was surveyed in May of 1984. The area north of Building 453 was identified as being unable to be surveyed due to high-level background radioactivity.

As of August 2, 1984, a contaminated area discovered by the survey team near Door 2 of Building 453 had not been reduced to background. Further documentation of the fate of constituents released to the environment was found. However, information in the HRR indicates that IHSS location noted in the 1991 IAG is inaccurate and should be enlarged. It is proposed that the north and east boundaries of the IHSS be extended to the edges of Building 444 and the south and west boundaries should extend outward approximately another 50 feet.

IHSS 205 (Building 460 Sump #3 Acid Site) contained a combination of nitric acid and nitrad (hydrofluoric acid and ammonium salts). The 1989 spill released 5-7 gallons of dilute nitric acid and nitrad waste into a storm drain. The acid was allowed to flow through the storm drain and on to Pond C-2. The acid was diluted by the natural mixing with snow on the ground. After the 1989 spill, pH values at the Pond C-2 inlet and at the interceptor ditch were 6.9. Puddles outside of Building 460 had a pH of 2.0. A chemical buffer was used to neutralize the spill. No documentation was found which describes the buffering agents used.

No documentation was found which detailed a response to the 1980 spill in IHSS 206 (Inactive D-836 Hazardous Waste Tank). A 1988 closure plan will be superseded by the OU10 RFI/RI process. In addition, it is proposed that the location of IHSS 206 be moved to a area believed to be occupied by the tank. This area is different than the location indicated in the 1991 IAG map, which had the site located north of Building 374.

Potential contaminants at IHSS 207 (Inactive Building 444 Acid Dumpster) are cadmium, chromium, lead, silver, and radionuclides. No previous soil or water sampling investigations have been performed at the IHSS.

No previous investigations have been conducted at IHSS 208 (Inactive 444/447 Waste Storage Area) or IHSS 210 (Unit 16, Building 980 Cargo Container), therefore, no specific information is available concerning the nature and extent of contamination.

Analysis of soil samples taken in the area of IHSS 213 (Unit 15, 904 Pad Pondcrete Storage Area) indicated levels above background for gross alpha, gross beta, total plutonium, total uranium, uranium-234, uranium-238, americium-241, and plutonium-239. In addition, analysis of surface water samples taken in the area of IHSS 213 indicates levels above background for nitrate, cyanide, and cadmium. However, surface water is not a good indication of IHSS-specific contamination; cyanides could be coming from some other source (EG&G 1994a). To assess groundwater contamination, further data are needed.

Soil samples taken from IHSS 214 (Unit 25, 750 Pad Pondcrete and Saltcrete Storage Area) indicate levels above background for gross alpha and gross beta. Surface water samples have levels above background for nitrate, cyanide, and cadmium. Further data are needed to assess groundwater contamination.

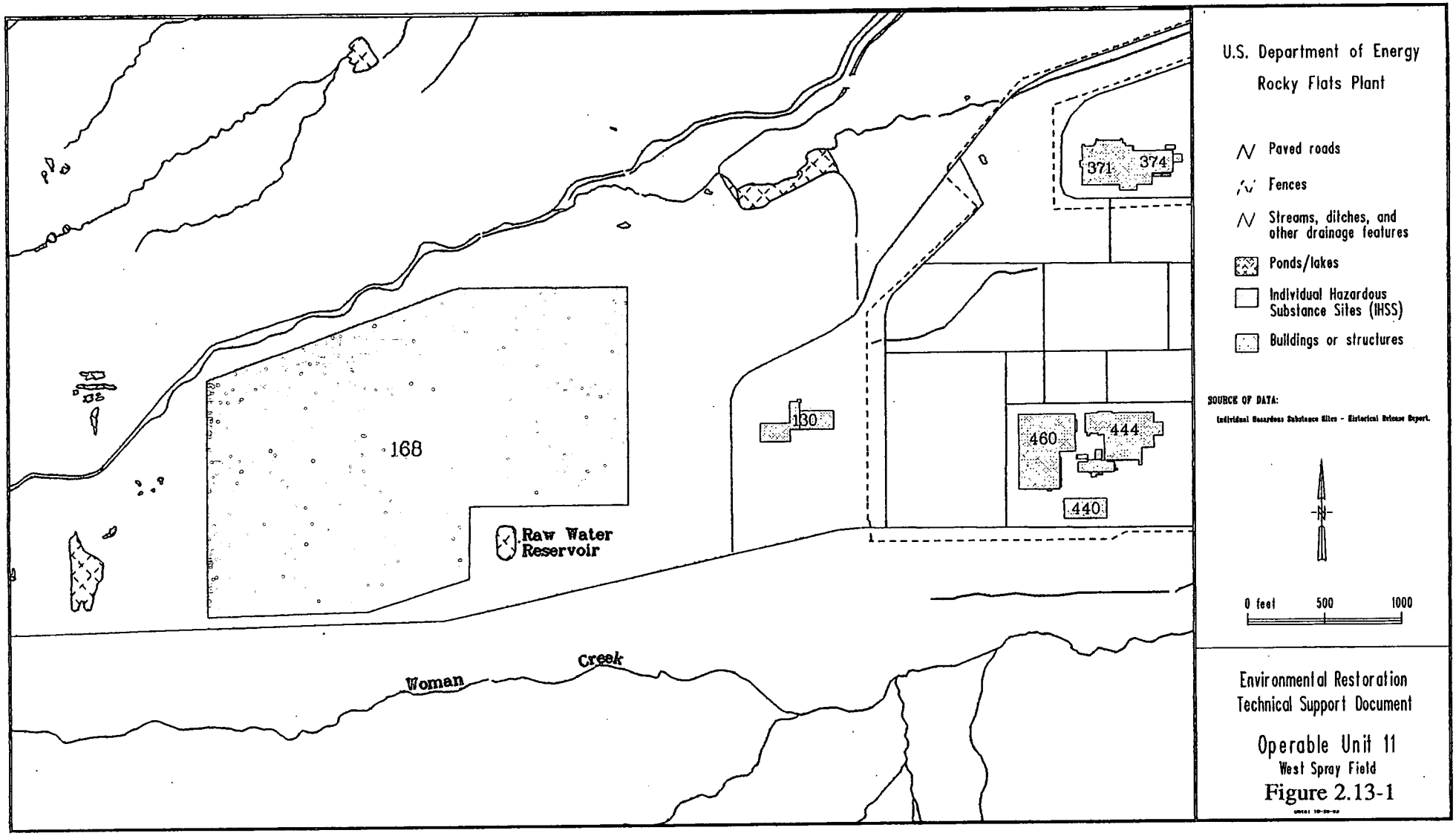
2.13 OPERABLE UNIT 11 - WEST SPRAY FIELD

2.13.1 Operable Unit 11 Site Description

Operable Unit 11 is made up of only one IHSS; however, it covers an area of approximately 4,577,000 square feet or about 105 acres:

- IHSS 168 - West Spray Field

It consists of undeveloped acreage located west of the T-130 trailers on the west side of the Industrial Area (**Figure 2.13-1**). Three areas within the IHSS were used for spray application during the operation of this unit. The total combined area of direct spray application is about 14 acres or one-seventh of the total West Spray Field Area Information on site use, history, and nature and extent of contamination is taken from Final Phase I RFI/RI Work Plan for OU11 (West Spray Field), Rocky Flats Plant (DOE 1992a) and the Historical Release Report (DOE 1992x).



Environmental Restoration
Technical Support Document

Operable Unit 11
West Spray Field

Figure 2.13-1

2.13.2 Operable Unit 11 Site Use and History

IHSS 168 (West Spray Field) was operated from April 1982 to October 1985. During operation, excess liquids from Solar Evaporation Ponds 207-B North and 207-B Center were pumped periodically to the West Spray Field for spray application. The purpose of the spraying was to dispose of the liquids through evaporation and irrigation.

The ponds received water from the interceptor system installed to collect groundwater seepage at the Solar Ponds and treated sanitary effluent from the sanitary wastewater treatment plant. Spray application was conducted using moving and fixed irrigation lines with impulse heads and using a spray impulse cannon. Runoff of liquids and windblown spray beyond the boundaries of the spray field are documented on aerial photographs.

Total application rates for the spray field were between 250 and 450 gallons per minute. Spraying generally occurred in intervals of six to ten hours daily for periods of two to four days. The estimated maximum total application could have been as much as 190 inches per acre for 14.1 acres for all four years of operation.

2.13.3 Operable Unit 11 Nature and Extent of Contamination

The source of contamination to IHSS 168 (West Spray Field) is the liquids from the Solar Evaporation Ponds that were sprayed at the spray field. The liquids are known to contain major ions, radionuclides, metals, and some organics. Previous sampling has been done at the West Spray Field, and the results have been compared to background levels in the area.

Soil samples from the spray field show slightly elevated levels of arsenic, lead, manganese, mercury, zinc, and several volatile organic compounds (VOCs). Presence of VOCs is most likely due to laboratory contamination (EG&G 1994g). Gross alpha, plutonium, uranium-233, -234, and -238 are also above background levels in soils. Groundwater monitoring wells have been installed in the West Spray Field. Site characterization of OU11 will likely be initiated in the first quarter of Calendar Year 1994.

2.14 OPERABLE UNIT 12 - 400/800 AREA

2.14.1 Operable Unit 12 Site Description

The boundaries of OU12 fall within the Building 400, 600, and 800 areas, located in the south western portion of RFP (**Figure 2.14-1**). Operable Unit 12 originally consisted of twelve IHSSs identified in the 1986 Comprehensive Environmental Assessment and Response Program (CEARP) - now Environmental Restoration Management - and in the 1991 Interagency Agreement. According to the OU12 Work Plan (DOE 1992b), on April 21, 1992, IHSS 147.1 was transferred for investigation and remediation to OU9 (Original Process Waste Lines). Further, the Work Plan indicated that the existence of IHSS 136.3 could not be documented in RFP's Historical Release Report (HRR), could not be investigated, and was, therefore, dropped from OU12.

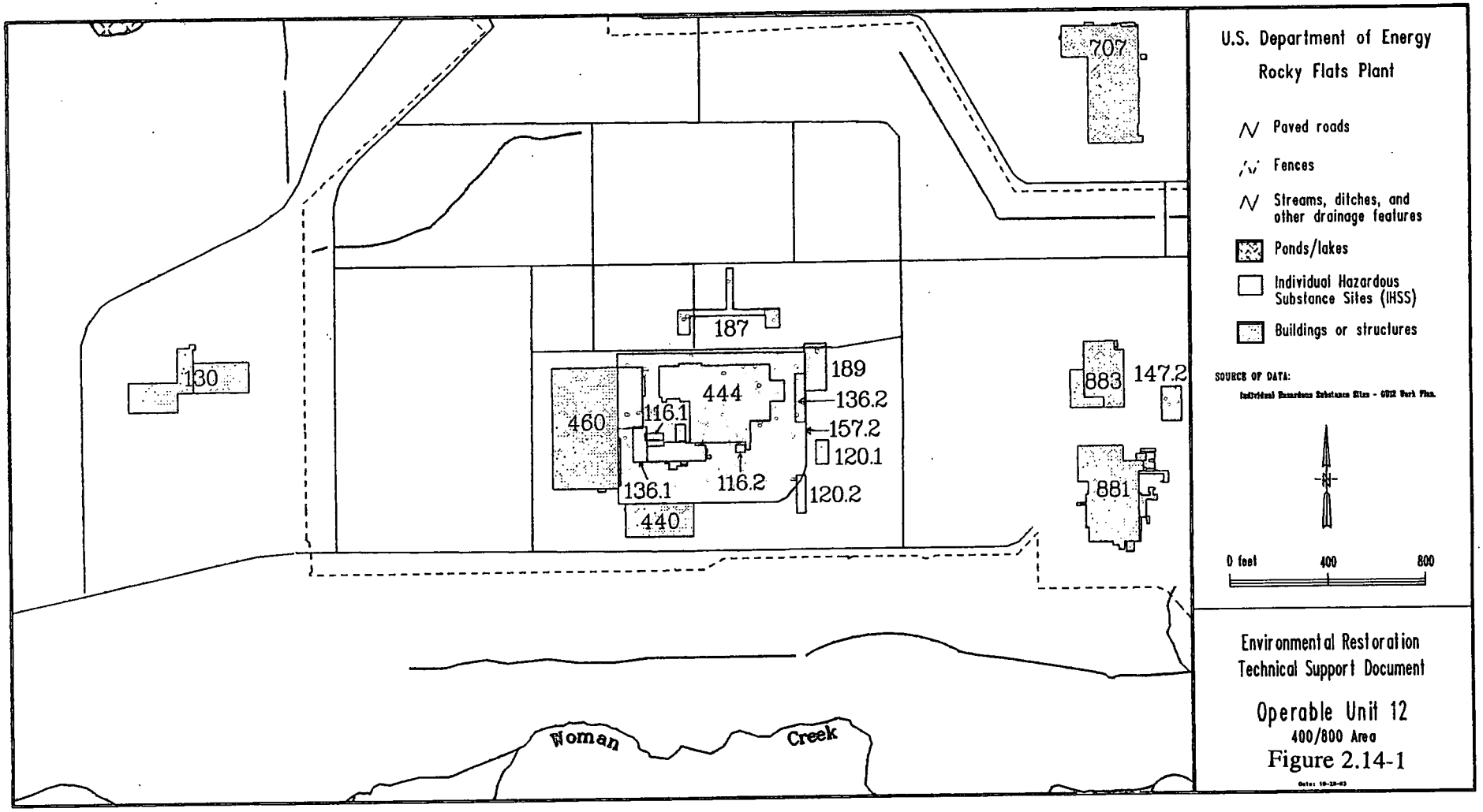
Ten IHSSs designated within OU12. They are:

- IHSS 116.1 - West Loading Dock Building 444
- IHSS 116.2 - South Loading Dock Building 444
- IHSS 120.1 - Fiberglassing Area North of Building 664
- IHSS 120.2 - Fiberglassing Area West of Building 664
- IHSS 136.1 - Cooling Tower Pond West of Building 444
- IHSS 136.2 - Cooling Tower Pond East of Building 444
- IHSS 147.2 - Building 881 Conversion Activity
- IHSS 157.2 - Radioactive Site South Area
- IHSS 187 - Sulfuric Acid Spill
- IHSS 189 - Nitric Acid Tanks

The Final Phase I OU 12 RFI/RI Work Plan was prepared in October 1992, and was approved November 2, 1992 (EG&G 1994a). The descriptions of the sites and contamination are based on the OU12 Work Plan and the Historical Release Report (DOE 1992x).

2.14.2 Operable Unit 12 Site Use and History

IHSSs 116.1, and 116.2 consist of two loading dock areas, the west and the south loading dock areas in the vicinity of Buildings 444 and 447. No details concerning specific releases from the docks have been documented; however drums containing nonradioactive solvents may have been stored on the west dock and oil was stored nearby at Building 453. The location of IHSS 116.2 has been revised from the original IAG location based on recent investigations.



Environmental Restoration
Technical Support Document

Operable Unit 12
400/800 Area

Figure 2.14-1

According to the HRR, an accident released uranium to the dock, surrounding walk, and driveways; and while extinguishing a fire, the south dock was covered with airborne oxide. Also, prior to 1970, chlorinated hydrocarbons were disposed of near the dock.

IHSSs 136.1 and 136.2 were used as retention ponds from 1956 to 1969 to contain and evaporate cooling towers blowdown and cleaning solution from Building 447 and possibly Building 444 (DOE 1992b). After the liquid evaporated, the area was backfilled. The former location of the west pond is now occupied by Building 460, above ground tanks and paving.

IHSS 157.2, the Radioactive Site South Area, is located within a secured area and includes soil and paved areas surrounding Buildings 439, 440, 444, and 447. The OU12 Work Plan cites concerns involving low levels of uranium and chemical contamination associated with storage practices, disposal of solvents, spills and releases, fires, and process line incidents.

The sulfuric acid spill occurred in 1970 east of Building 443. An aboveground tank containing the acid began leaking through a flange. The Fire Department initially began neutralizing the tank and area with lime. The lockout chain was cut and the acid was allowed to drain to the 448 mixing tank and then to the 443 neutralizing tank. The tank was allowed to empty. Due to lack of secondary containment facilities, a certain amount of the acid drained into the stormwater system in a ditch running south of Building 442 and to a ditch running northeast of Building 442. Ponds were constructed to collect the contents of the latter flow. Acid was also removed from the neutralization tank (due to leakage into the sanitary sewer), packed in drums, and placed in earthen pits southeast of Building 442. No documentation exists concerning removal of contaminated soil, however photos suggest soil was excavated.

IHSS 189 (Nitric Acid Tanks) involves numerous spills occurring primarily during the transfer of nitric acid at two 10,000-gallon storage tanks located at receiving area 218 (east of Building 444). Incidents have been reported from 1952-1986. Spilled material was reportedly neutralized with sodium bicarbonate or washed down with water to dilute the acid and disperse it on the ground.

Two areas north and west of Building 664 (IHSSs 120.1 and 120.2) were used for fiberglassing waste packaging boxes from 1972-1979 although the HRR found no documentation detailing releases, possible spills of polyester resin, peroxide catalysts, and cleaning solvents may have occurred in these areas.

According to the OU12 Work Plan, IAG data indicated that low-level radioactive waste contamination was thought to exist north of Building 881 due to leaks in the process waste lines; however, there are no process waste lines in the area of IAG IHSS 147.2. HRR

research suspects this contamination may have been associated with conversion of the building from uranium-manufacturing activity to metal fabrication (1964-1966), in which case, conversion items were stored farther northeast of the building. No documentation could be found in HRR research that indicated a release due to conversion activities in the IAG location; the HRR recommends moving the IHSS to the conversion activity storage area.

2.14.3 Operable Unit 12 Nature and Extent of Contamination

Descriptions of the nature and extent of contamination are historical documentations based on research conducted for the Historical Release Report (HRR).

There is record of significant oil staining around Building 453, located just north of the West Loading Dock (IHSS 116.1). There is the possibility that solvents and hydrocarbons leaked or spilled from drums stored on the dock. A radiometric survey performed in the Spring of 1984 identified the area around the dock as one which could not be surveyed for plutonium due to high-level background radioactivity.

At IHSS 116.2 perclene (tetrachloroethene) still bottoms and nitric acid were stored on the dock. Documentation indicates that spills and leaks occurred. Also, until 1970, chlorinated hydrocarbon solvents used to rinse beryllium parts were disposed of on the ground outside Room 106, which opens to the dock.

The primary suspected contaminant at IHSSs 136.1 and 136.2 (Cooling Tower Ponds) is chromium. Blowdown discharged to the ponds contained chromium and algicides. These pond sites may also have been used to dispose of lithium and small amounts of depleted uranium.

The principal materials contributing to contamination at IHSS 157.2 are depleted and enriched uranium, beryllium, chlorinated hydrocarbon solvents, including carbon tetrachloride and hydraulic oil. There may also be lithium and chromium in the sediments due to the IHSS's proximity to IHSSs 136.1 and 136.2.

The sulfuric acid spill at IHSS 187 released approximately 1,500 gallons of 94 percent sulfuric acid to the drainage areas. The spill area was treated with lime to help neutralize the acid.

Small volumes of nitric acid were released in three documented occurrences. The routine response was to rinse the acid spill on the ground.

At the Building 664 Fiberglassing Areas (IHSSs 120.1 and 120.2), the chemicals of interest are believed to be polyester resins (styrene monomer) and cleaning solvents. Also, an area of higher than background levels of gamma radiation and americium, detected west and overlapping the site. IHSS 147.2 may have been contaminated with beryllium and enriched or depleted uranium associated with equipment stored at the site.

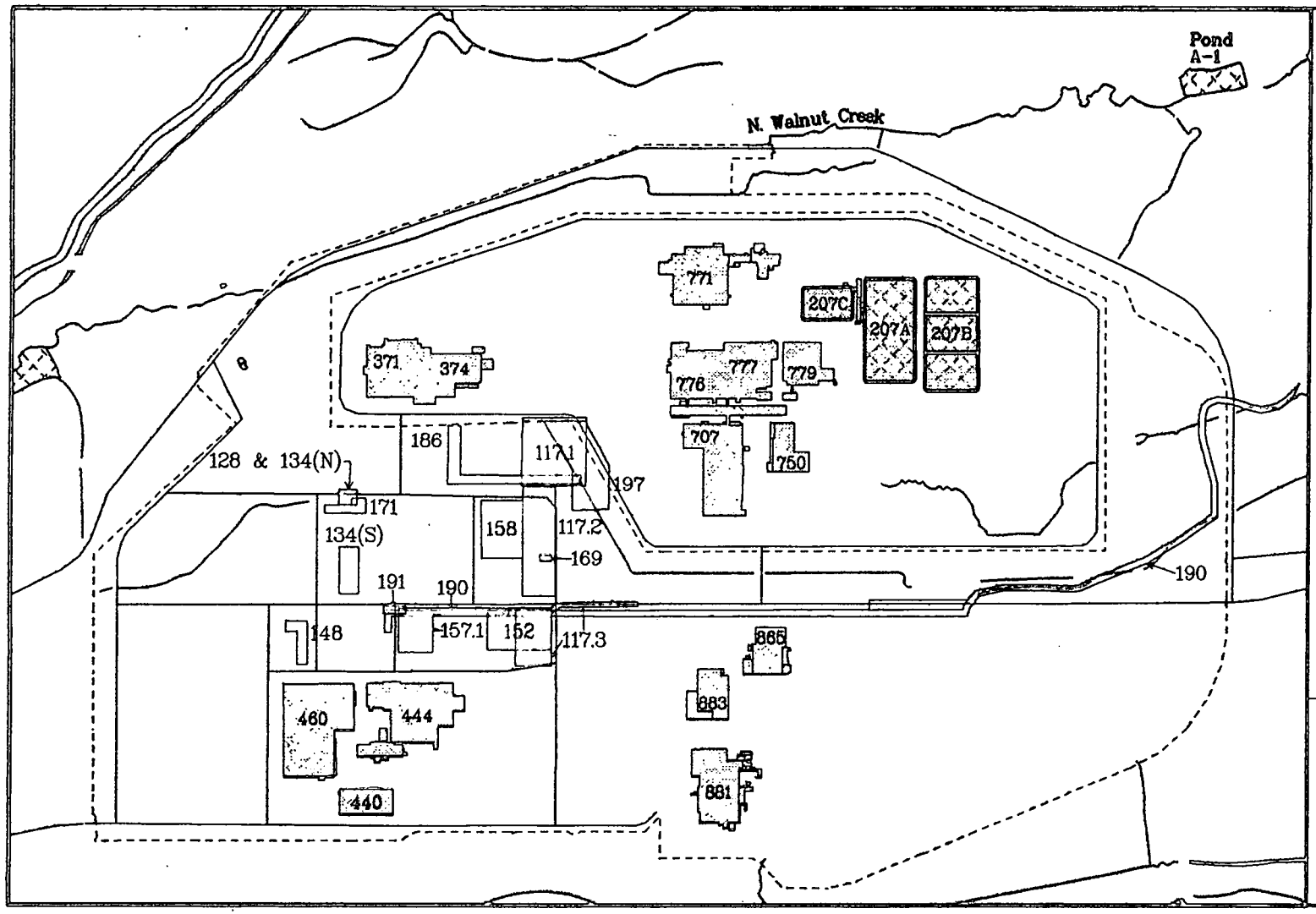
2.15 OPERABLE UNIT 13 - 100 AREA

2.15.1 Operable Unit 13 Site Description

Fifteen IHSSs currently comprise Operable Unit 13. A modification to the 1991 IAG transferred the investigatory and remediation work associated with IHSS 122 from OU13 to OU9 for logistical reasons in correspondence dated April 21, 1992 (CDH 1992). In addition, the work associated with IHSS 197 has been transferred from OU16 to OU13 in correspondence dated May 27, 1993 (CDH 1993). The IHSSs in OU13 are (**Figure 2.15-1**):

- IHSS 117.1 - North Site Chemical Storage
- IHSS 117.2 - Middle Site Chemical Storage
- IHSS 117.3 - Chemical Storage - South Site
- IHSS 128 - Oil Burn Pit No. 1
- IHSS 134 - Lithium Metal Destruction Site
- IHSS 148 - Waste Leaks
- IHSS 152 - Fuel Oil Tank 221 Spills
- IHSS 157.1 - Radioactive Site North Area
- IHSS 158 - Radioactive Site-Building 551
- IHSS 169 - Waste Drum Peroxide Burial
- IHSS 171 - Fire Department Training Ground
- IHSS 186 - Valve Vaults 11, 12, and 13
- IHSS 190 - Caustic Leak
- IHSS 191 - Hydrogen Peroxide Spill
- IHSS 197 - Scrap Metal Sites - 500 Area

Detailed site investigations have not been conducted at OU13, but a work plan has been prepared. The following descriptions of the sites and contamination are based on the *Final Phase I RFI/RI Work Plan, Rocky Flats Plant, 100 Area (Operable Unit No. 13)* (DOE 1992c), and the *Final No Further Action Justification Document, Rocky Flats Plant Low-Priority Sites (Operable Unit 16)* (DOE 1992e), and the Historical Release Report (DOE 1992x).



U.S. Department of Energy
Rocky Flats Plant

Paved roads

Fences

Streams, ditches, and other drainage features

Ponds/lakes

Individual Hazardous Substance Sites (IHSS)

Buildings or structures

SOURCE OF DATA:
Individual Hazardous Substance Sites - 0032 Work Plan.

0 feet 500 1000

Environmental Restoration
Technical Support Document

Operable Unit 13
100 Area

Figure 2.15-1

2.15.2 Operable Unit 13 Site Use and History

IHSSs 117.1, 117.2, and 117.3 (Chemical Storage Sites) consist of three sites used for general and chemical storage prior to the mid-1970s. The North Site Chemical Storage (IHSS 117.1) was used as a general warehouse storage yard including possibly scrap metal storage; the Middle Site Chemical Storage (IHSS 117.2) was used as a nonradioactive chemical storage facility, and storage for pallets, wooden boxes, cargo containers, and new drums; and the Chemical Storage - South Site (IHSS 117.3) was used as storage including possibly wooden boxes and drums. Drums containing acids, oils, soaps, solvents, and beryllium scrap metal were stored at the Middle Site Chemical Storage (IHSS 117.2).

IHSS 128 (Oil Burn Pit No. 1) was a pit in which six or ten (conflicting reports) drums of waste oil containing depleted uranium were burned in August 1956. After burning, the pit was covered with soil. The waste oils were generated in Building 444 and 881. Building 335 is identified as being located over the pit, although the location may actually be under Sage Avenue and the Sage Avenue Ditch based on reviews of aerial photographs.

IHSS 134 (Lithium Metal Destruction Site) consisted of shallow trenches or pits. The trenches were filled with water, and lithium metal (powder) was disposed of by reaction with the water. The residues left from the reaction were then covered with soil. The site operated between 1956 and 1970. It is believed that approximately 400 to 500 pounds of lithium were disposed of in this way as well as small amounts of metallic sodium, calcium, magnesium, and possibly graphite. Parts of Building 335 and Sage Avenue are presently located over the site. Additional burning occurred near Building 331. This site may be added as an IHSS (proposed 134.2), while the former location would be identified as IHSS 134.1.

IHSS 148 (Waste Leaks) consists of several small spills of nitrate wastes occurred around the outside of Building 123. Dates and volumes of the spills are unknown. Spilled wastes may have contained radionuclides.

IHSS 152 (Fuel Oil Tank 221 Spills) consists of one 50-foot diameter surface fuel tank which contains No. 6 fuel oil. In January 1971, the fuel tank overflowed while being filled and approximately 700 gallons of fuel oil was confined to ditches and the open field east of the tank. The area was cleaned up, and the oil recycled. In February 1979 and 1984, similar spills of 400 gallons and 50 gallons, respectively, occurred.

IHSS 157.1 (Radioactive Site North Area) was produced by laundry operations from 1953 until approximately 1972 in Building 442 caused radioactive contamination of soil around the building. Barrels stored near the building may have contributed some of the contamination.

IHSS 158 (Radioactive Site - Building 551) is an area used to load boxed radioactive wastes into railroad container cars. Residual radioactive contamination may have remained at the site from leaks and damaged boxes. In July 1963, and again in 1970, an area to the north of Building 551 received drums and equipment from offsite which were contaminated with uranium above acceptable levels. The areas around Building 551 are suspect for contamination because of these and other minor incidences.

IHSS 169 (Waste Drum Peroxide Burial) consisted of a leaking 55-gallon drum of hydrogen peroxide that was reportedly buried in IHSS 117.2 (Middle Site Chemical Storage) east of Building 551. The area is now paved and used for storage.

IHSS 171 (Fire Department Training Ground) is an area east of Building 335 used by RFP fire fighters for training purposes from 1969 to the present. The fire fighters have burned waste solvents, diesel fuel, and plenum filters.

IHSS 186 (Valve Vaults 11,12, and 13) was caused by various leaks and damages to pipes . Leaks have caused solution to enter Valve Vault 13 (June 1985), Valve Vault 12 (September 1988), and Valve Vaults 11, 12, and 13 (October 1989). Damaged or leaking pipes have led to solution being released near Valve Vault 13 (June 1985), between Valve Vaults 12 and 13 (October 1986), and between Building 374 and Valve Vault 13 (June 1987). Soil around the leakage sites in the October 1986 incident was removed and shipped offsite. No release of contamination occurred with the June 1985 and June 1986 incidents.

IHSS 190 (Caustic Leak) occurred in 1978 when approximately 1,000 gallons of concentrated sodium hydroxide were accidently released from the Steam Plant catch basin to the Central Avenue Ditch. The liquid was diverted to Pond B-1 and neutralized with alum. The liquid was then transferred to the Solar Evaporation Pond 207-B North.

IHSS 191 (Hydrogen Peroxide Spill) occurred in April 1981 when a 55-gallon drum of hydrogen peroxide was dropped at the corner of 5th Street and Central Avenue. The drum ruptured, and the liquid was contained in a hole dug at this location. The hole was subsequently covered. The area has been paved since the time of the spill.

IHSS 197 (Scrap Metal Sites - 500 Area) southwest of Building 559 was used for disposal of scrap nonradioactive, nonhazardous, and nonprecious metals accumulated primarily during construction activities and from process areas. The sites were removed in the early 1980s when the Protected Area (PA) was constructed. Material extracted from the sites was monitored to determine the presence of radioactivity and was found to be clean. The residue was placed in the Present Landfill. One of the sites may have received used transformers that contained PCBs; however, no transformers were found during the excavation.

2.15.3 Operable Unit 13 Nature and Extent of Contamination

Since previous investigations have not been conducted at these units, the nature and extent of contamination is based on materials stored at the sites and previous site uses (DOE 1992c, DOE 1992e, and DOE 1992x).

IHSS 117.1 (North Site Chemical Storage), IHSS 117.2 (Middle Site Chemical Storage), and IHSS 117.3 (Chemical Storage - South Site) were used for storage of acids, organic solvents, soaps, and oils. These materials plus beryllium, aluminum nitrate, and uranium are assumed to be the potential contaminants at these IHSSs.

IHSS 128 (Oil Burn Pit No. 1) is a pit area that contains approximately 70 cubic feet of depleted uranium. The Lithium Metal Destruction Site (IHSS 134) may contain residues of lithium and small amounts of sodium, calcium, and magnesium. The lithium has likely reacted with the soil to form lithium carbonate. Nitrate wastes containing radionuclides may have been spilled at IHSS 148 (Waste Leaks) site, although radioactive surveys of the area have found radioactivity levels consistent with background levels.

No. 6 fuel oil is the potential contaminant at IHSS 152 (Fuel Oil Tank 221 Spills). The IHSS 157.1 (Radioactive Site North Area) may be contaminated by uranium, beryllium and solvents. Plutonium may also be present. IHSS 158 (Radioactive Site - Building 551) is suspected of being contaminated with uranium. IHSS 169 (Waste Drum Peroxide Burial) may still contain peroxide; however, the peroxide should have decomposed over a short period of time. The site is not considered to be a chemical hazard. Residues of the burning of diesel fuel is the concern at IHSS 171 (Fire Department Training Ground).

Radioactive process wastes (sometimes acidic) were released in Valve Vaults 11, 12, and 13 (IHSS 186) area. Sodium hydroxide is the potential contaminant at the Caustic Leak (IHSS 190). However, it is likely that any sodium hydroxide remaining in the environment would have been neutralized by the buffering action of the soil. The soil also would have converted

any remaining hydrogen peroxide at the Hydrogen Peroxide Spill (IHSS 191) into nonhazardous compounds.

There is a slight possibility that transformers containing PCBs may have been disposed at IHSS 197 (Scrap Metal Sites).

2.16 OPERABLE UNIT 14 - RADIOACTIVE SITES

2.16.1 Operable Unit 14 Site Description

Operable Unit 14 currently consists of eight IHSSs that are considered radioactive sites and have not been previously grouped into other operable units (**Figure 2.16-1**). The IHSSs in this OU (IAG 1991) are:

- IHSS 131 - Radioactive Site - 700 Area Site No. 1
- IHSS 156.1 - Building 371 Parking Lot
- IHSS 160 - Radioactive Site - 444 Parking Lot
- IHSS 161 - Storage Site West of Building 664
- IHSS 162 - Radioactive Site - 700 Area Site No. 2
- IHSS 164.1 - Radioactive Sites from Building 776
- IHSS 164.2 - Radioactive Site 800 Area Site No. 2, Building 886 Spills
- IHSS 164.3 - Radioactive Site 800 Area Site No. 2, Building 889 Storage Pad

CDH and EPA have moved IHSS 156.2 (Soil Dump Area), from OU14 to OU6 (CDH 1992). Detailed site investigations have not been conducted at OU14. The descriptions of the sites and contamination are based on the *Final Phase IN RFI/RI Work Plan, Rocky Flats Plant, Radioactive Sites (Operable Unit No. 14)* (DOE 1992d) and the Historical Release Report (DOE 1992x).

2.16.2 Operable Unit 14 Site Use and History

IHSS 131 (Radioactive Site - 700 Area Site #1), consists of two areas, of up to 1,500 square feet (one report stated 40 square feet) north of Building 776 and 2,000 square feet west of Building 776 that was contaminated, possibly by plutonium, following an explosion in 1964 and fire fighting efforts following the 1969 fire. This area has subsequently been covered with seal coat and gravel. Precise boundaries of IHSS 131 are not defined.

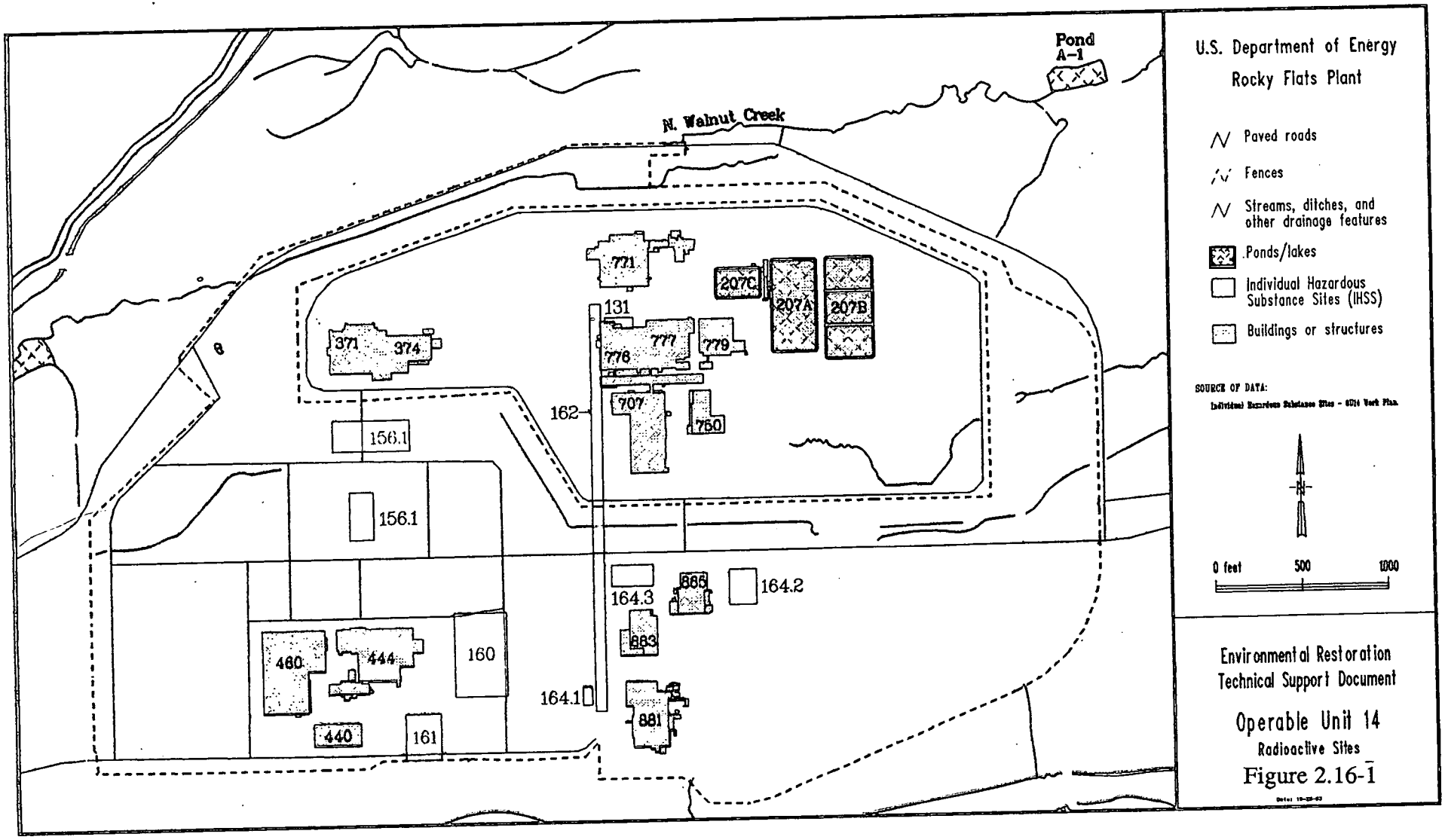

Pond
A-1
N. Walnut Creek
771
207C
207A
207B
131
371
374
776
777
779
707
760
162
156.1
156.1
164.3
886
164.2
883
480
444
160
164.1
881
440
161
U.S. Department of Energy
Rocky Flats Plant
Paved roads
Fences
Streams, ditches, and other drainage features
Ponds/lakes
Individual Hazardous Substance Sites (IHSS)
Buildings or structures
SOURCE OF DATA:
Individual Hazardous Substance Sites - 6024 Work Plan
0 feet
500
1000
Environmental Restoration
Technical Support Document
Operable Unit 14
Radioactive Sites

Figure 2.16-1

IHSS 156.1 (Building 371 Parking Lot) is an area where low-level plutonium-contaminated soil collected around Building 774 was placed in the area now covered by the Building 334 parking lot. The soil was removed from that location prior to construction of the parking lot and moved to the IHSS 165 (Triangle Area in OU6) and then to the landfill. However, the location is now shown to be under Building 371 parking lot and is identified as IHSS 156.1based on review of aerial photographs. [The 1991 IAG identified this IHSS as Building 334 Parking Lot.]

IHSS 160 (Radioactive Site - Building 444 Parking Lot) and IHSS 161 (Storage Site West of Building 664) are sites within the 600 area may have received low-level radioactive contamination from plutonium and uranium. Punctured and leaking waste drums and boxes containing both solid and liquid wastes contaminated with uranium and plutonium were stored in the area of the Building 444 parking lot and staged in Building 664. Surface soil was removed from Building 444 parking lot and the areas east and west of the Building 444 parking lot and west of Building 664 in the early 1970s. Small amounts of plutonium and uranium may have remained.

IHSS 162 (Radioactive Site - 700 Area Site No. 2) was produces during 1974, when several radioactive spots on 8th Street were located during pavement monitoring. The street was paved over to immobilize the contaminated spots.

IHSS 164.1 (Radioactive Site 800 Area Site No. 2 Concrete Slab), IHSS 164.2 (Radioactive Site 800 Area Site No. 2, Building 886 Spills), and IHSS 164.3 (Radioactive Site 800 Area Site No. 2, Building 889 Storage Pad) consist of three contaminated areas within the 800 area. The areas are presently covered by relatively new cement sidewalks, parking lots, and driveways. In 1958, an area several hundred square feet in size (IHSS 164.1), located northwest of Building 881 and southwest of Building 883, was radioactively contaminated from a concrete slab that had been removed from the east wall of Building 776. The slab was broken up, removed and the area was cleaned up.

Two other areas within the 800 area have also been contaminated with uranium. Spills involving uranium have resulted in possible infiltration under and around Building 886 (IHSS 164.2). A storage pad north of Building 889 (IHSS 164.3) was used temporarily to store contaminated drums and uranium-contaminated equipment prior to decontamination procedures. The volume and type of radioactive compounds is unknown.

2.16.3 Operable Unit 14 Nature and Extent of Contamination

Since previous investigations have not been conducted at these units, the nature and extent of contamination is based on materials stored at the sites and previous site uses (DOE 1992d and DOE 1992x).

IHSS 131 (Radioactive Site - 700 Area Site No. 1) and IHSS 156.1 (Building 371 Parking Lot) may have been contaminated by plutonium. Small amounts of plutonium and uranium may have remained at IHSS 160 (Radioactive Site - 444 Parking Lot) and IHSS 161 (Storage Site West of Building 664); however, no radioactivity above background levels was detected during the radiometric survey of the IHSS 160 area. The radioactive hot spots in the pavement on 8th Street may still exist as IHSS 162 (Radioactive Site - 700 Area Site No. 2). Radioactivity may also exist at IHSS 164.1 (Radioactive Sites from Building 776), IHSS 164.2 (Radioactive Site 800 Area Site No. 2, Building 886 Spills), and IHSS 164.3 (Radioactive Site 800 Area Site No. 2 and Building 889 Storage Pad).

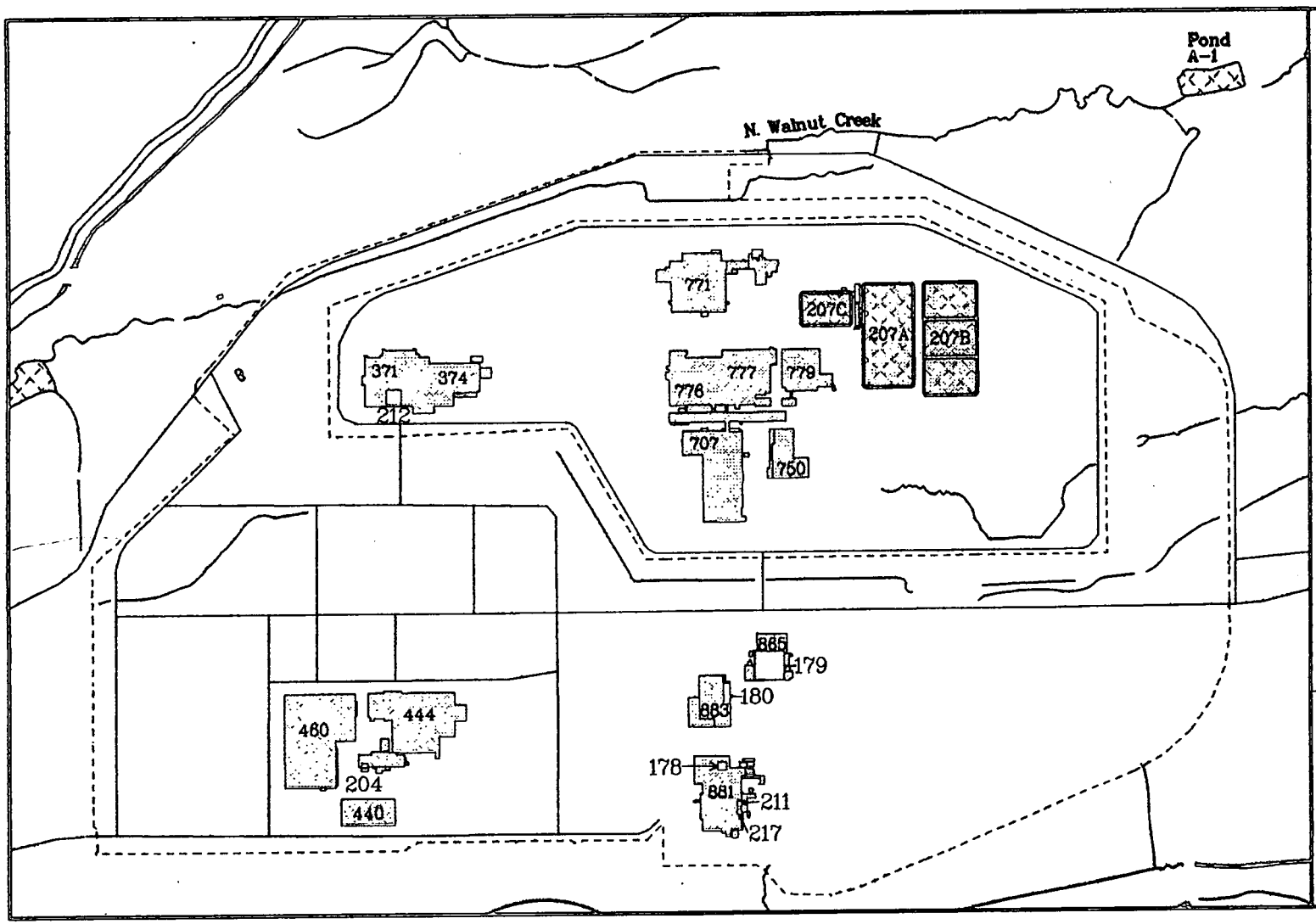
Additional groundwater or soil contaminants may be found within the IHSSs. However, the origin of the contaminants may be nearby IHSSs not assigned to OU14. These contaminants include VOCs (IHSS 131); VOCs, antimony, arsenic, beryllium, and lead (IHSS 156.1); VOCs (IHSSs 160 and 161).

2.17 OPERABLE UNIT 15 - INSIDE BUILDING CLOSURES

2.17.1 Operable Unit 15 Site Description

Operable Unit 15 currently consists of six IHSSs that are located within RFP buildings (**Figure 2.17-1**). CDH and EPA modified the original IAG list for OU15, and IHSS 215 is now included in OU9 (CDH 1992). IHSS 212 (Building 371 Drum Storage, Unit 63) has been removed from the IAG schedule for OU15 because it is an active RCRA storage site. (EG&G 1994d). The IHSSs in this OU (IAG 1991) are:

- IHSS 178 - Building 881 Drum Storage Area
- IHSS 179 - Building 865 Drum Storage Area
- IHSS 180 - Building 883 Drum Storage Area
- IHSS 204 - Original Uranium Chip Roaster
- IHSS 211 - Building 881 Drum Storage, Unit 26
- IHSS 217 - Building 881 Cyanide Bench Scale Treatment, Unit 32



U.S. Department of Energy
Rocky Flats Plant

Paved roads
Fences
Streams, ditches, and other drainage features
Ponds/lakes
Individual Hazardous Substance Sites (IHSS)
Buildings or structures

SOURCE OF DATA:
Individual Hazardous Substance Sites - Historical Release Report.

0 feet 500 1000

Environmental Restoration
Technical Support Document

Operable Unit 15
Inside Building Closures
Figure 2.17-1

Detailed site investigations have not been conducted at OU15, but a Work Plan has been prepared. The descriptions of several of the sites and contamination are based on the *Final Phase I RFI/RI Work Plan, OU15, Inside Building Closures* (DOE 1993b) and the Historical Release Report (DOE 1992x).

2.17.2 Operable Unit 15 Site Use and History

IHSS 178 (Building 881 Drum Storage Area) is a 5-foot by 5-foot area located in Room 165 of Building 881. The area was first used in 1953 and is still in use for less than 90-day storage. Up to five 55-gallon drums containing waste that have hazardous and possibly low-level radioactive constituents are stored in the area.

IHSS 179 (Building 865 Drum Storage Area) is an 8-foot by 12-foot area located in Room 145 of Building 865. The area was first used in 1970 and is currently designated as a 90-day accumulation area. Up to 10 55-gallon drums can be stored in the area. Until 1986, wastes containing oils, chlorinated solvents and possibly beryllium could be stored. After 1986, only waste containing oils, possibly contaminated with beryllium and radioactive constituents, are stored there.

IHSS 180 (Building 883 Drum Storage Area) is a 10-foot by 16-foot area located in Room 104 of Building 883. The area has been used since 1981, and during part of that time was used as a RCRA 90-day accumulation area. It currently is used to store low-level (not mixed) radioactive waste. A maximum of 30 55-gallon drums containing waste oils that are contaminated with solvents and uranium have been stored in the area.

IHSS 204 (Original Uranium Chip Roaster) is located in Rooms 32 and 502 of Building 447. The unit is constructed of mild steel casing, lined with alumina refractory brick. It was used to convert pyrophoric elemental uranium to an oxide for safe storage and transport.

IHSS 211 (Building 881 Drum Storage, Unit 26), is in Room 266B of Building 881 and measures 20 feet by 10 feet. The area was first used in 1981 and is currently used as a 90-day accumulation area. Up to twenty-nine 55-gallon drums of low-level mixed (primarily laboratory process) wastes have been stored in the area.

IHSS 217 (Building 881 Cyanide Bench Scale Treatment, Unit 32) was produced when bench scale treatment of hazardous waste occurred. The treatment involved the analysis of laboratory wastes for cyanide content. After treatment, the wastes were collected in a 4-liter polyethylene bottle and oxidized to form cyanate. Once the process was complete, the bottle was poured into the process waste system. This unit is no longer in use and an interim status closure plan for the unit was submitted to CDH/EPA in 1988.

2.17.3 Operable Unit 15 Nature and Extent of Contamination

Since previous investigations have not been conducted at these units, the nature and extent of contamination is based on materials stored at the sites and previous site uses (DOE 1993b and DOE 1992x).

Hazardous wastes (such as waste-containing volatile organic compounds) and low-level radioactive wastes have been stored in the Building 881 Drum Storage Area (IHSS 178). Currently, drums stored in the Building 865 Drum Storage Area (IHSS 179) contain volatile organic compounds, beryllium, and radioactive waste; previously stored drums contained chlorinated solvents. Waste oil contaminated with volatile organic compounds, beryllium and radioactivity have been stored at the Building 883 Drum Storage Area (IHSS 180). No documented releases have occurred in IHSSs 178, 179, and 180.

Uranium chips, coated with freon TF and 1,1,1-trichloroethane, were handled in the Original Uranium Chip Roaster (IHSS 204). The freon and 1,1,1-trichloroethane burned away during the roasting process, while the uranium was oxidized.

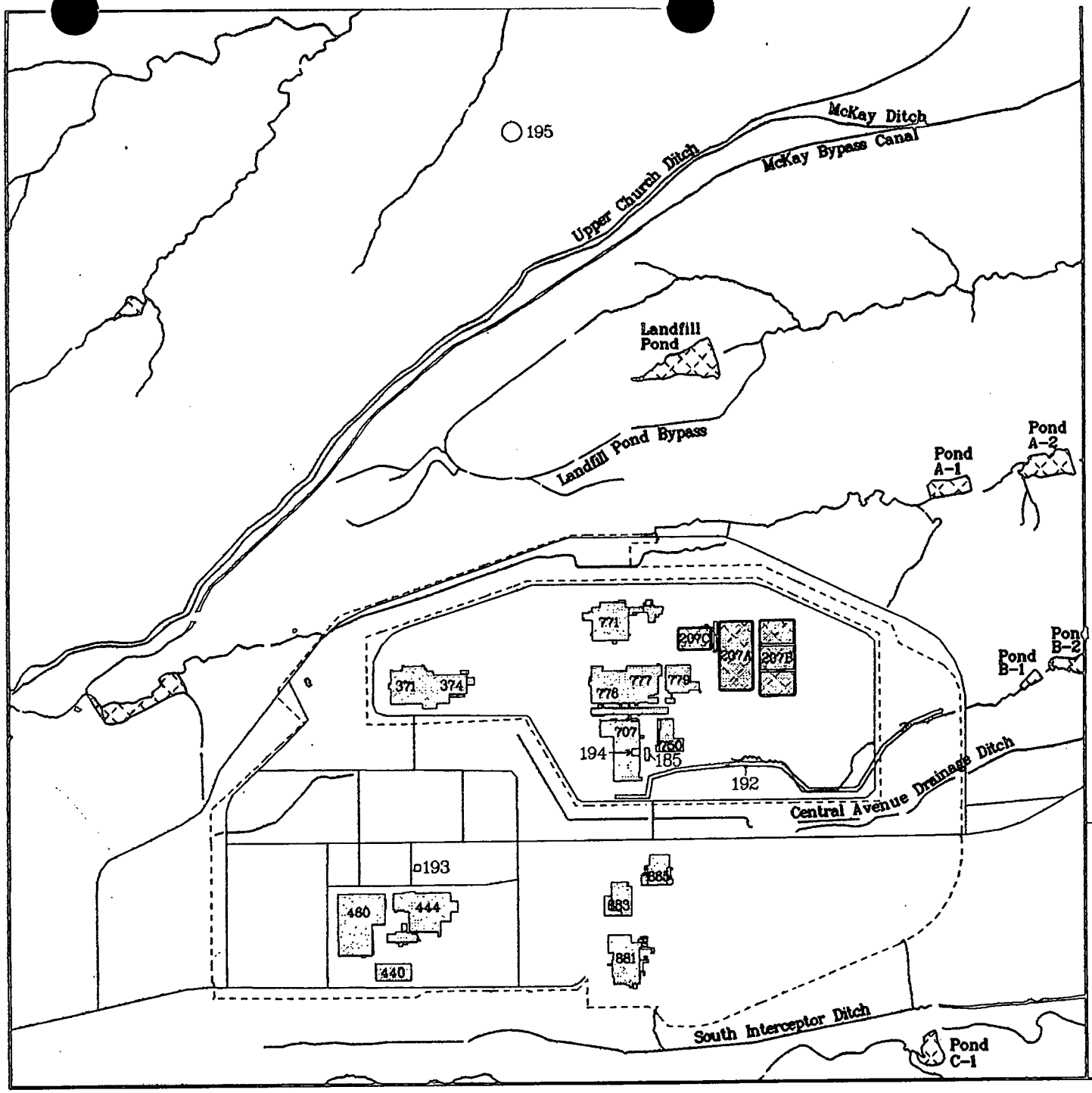
Laboratory process wastes including low-level combustibles, low-level metal and glass, low-level combustible hazardous waste and low-level glass and metal hazardous waste, were stored at Building 881 Drum Storage, Unit 26 (IHSS 211). Up to 4 liters of cyanide-contaminated laboratory wastes were stored in Building 881 Cyanide Bench Scale Treatment, Unit 32 (IHSS 217). No releases to the environment have been documented.

2.18 OPERABLE UNIT 16 - LOW-PRIORITY SITES

2.18.1 Operable Unit 16 Site Description

Operable Unit 16 currently consists of five IHSSs that are categorized as low-priority sites (**Figure 2.18-1**). The IHSSs in this OU (IAG 1991) are:

- IHSS 185 - Solvent Spill
- IHSS 192 - Antifreeze Discharge
- IHSS 193 - Steam Condensate Leak - 400 Area
- IHSS 194 - Steam Condensate Leak - 700 Area
- IHSS 195 - Nickel Carbonyl Disposal



U.S. Department of Energy
Rocky Flats Plant

Paved roads

Fences

Streams, ditches, and other drainage features

Ponds/lakes

Individual Hazardous Substance Sites (IHSS)

Buildings or structures

SOURCE OF DATA:

Individual Hazardous Substance Sites - Historical Release Report.

N

0 feet 750 1500

Environmental Restoration
Technical Support Document

Operable Unit 16
Low Priority Sites

Figure 2.18-1

CDH and EPA modified the original IAG list for OU16. IHSSs 196 and 197 are now assigned to OU5 and OU13, respectively (CDH 1993). Discussions regarding these IHSSs will be found in the appropriate OU sections.

Detailed site investigations have not been conducted at OU16. The descriptions of the sites and contamination are based on the *Final No Further Action Justification Document, Rocky Flats Plant Low-Priority Sites (Operable Unit 16)* (DOE 1992e) and the Historical Release Report (DOE 1992x). In 1994, the OU16 should be closed under a "No Action" Record of Decision (EG&G 1994d).

2.18.2 Operable Unit 16 Site Use and History

IHSS 185 (Solvent Spill) resulted when a fork-lift punctured a 55-gallon drum of 1,1,1-trichloroethane at the southeast loading dock of Building 707 in 1986. The drum was sealed, placed in an overpack drum and sent to Rocky Flats' Hazardous Waste Group for disposal. A commercial absorbent was used to clean up the spill and then placed in a drum. Conflicting reports have the absorbent being taken offsite or to Hazardous Storage.

IHSS 192 (Antifreeze Discharge) occurred in December 1980, when approximately 155 gallons of 25 percent ethylene glycol was released from a chiller unit into a floor drain in Building 708 which drained into the storm water system. The flow was contained by diverting the storm water discharge into South Walnut Creek which flows into Pond B-1.

IHSS 193 (Steam Condensate Leak - 400 Area) was produced in November 1979, when a steam condensate line between Building 443 and a valve pit north of the gasoline storage tank leaked. Water analyses indicated a low concentration of amines. This line was taken out of service and the condensate was rerouted through a different system.

IHSS 194 was produced in September 1979, when a steam condensate line broke near Building 707 and water from this line flowed through Pond B-4 into Walnut Creek.

IHSS 195 (Nickel Carbonyl Disposal) occurred in 1972, when several cylinders of nickel carbonyl were destroyed in a hole drilled in the buffer zone northwest of RFP production area. The valves were opened and the cylinders were lowered into the hole by rope. After 24 hours, the cylinders were removed, punctured and buried in the Present Landfill. Two cylinders became wedged in the hole and were buried in place. The exact location of the borehole is unknown.

2.18.3 Operable Unit 16 Nature and Extent of Contamination

Since previous investigations have not been conducted at these units, the nature and extent of contamination is based on materials stored at the sites and previous site uses (DOE 1992e).

The Solvent Spill (IHSS 185) was a spill of approximately four gallons of 1,1,1-trichloroethane. The Antifreeze Discharge (IHSS 192) was a spill of ethylene glycol; the spill was contained in Pond B-1. The Steam Condensate Leak - 400 Area (IHSS 193) contained amines. The Steam Condensate Leaks - 400 Area (IHSS 194) contained tritium. Nickel carbonyl is highly volatile and long-term environmental hazard would not result from the Nickel Carbonyl Disposal (IHSS 195).

* * * * *

This section summarizes baseline study conditions for the major disciplines/environmental media at RFP. These disciplines receive the most attention based upon expressions of both public and agency concerns regarding Rocky Flats Plant operations, remediation, and closure activities. Disciplines addressed in this section are: soils, vegetation, aquatic life, terrestrial wildlife, surface water, groundwater, air quality, and geology.

The following text sections will provide brief descriptions of baseline information, which may include potential contaminants of concern, ranges of data values, and background values or potential Applicable or Relevant and Appropriate Requirements (ARARs) for each particular discipline or medium.

3.1 SOILS

3.1.1 Sitewide Conditions

Discussion of sitewide conditions and OU-specific soil conditions are focused, first, on native soils, and second, on affected soils.

3.1.1.1 Sitewide Native Soils

The RFP site area is situated on a broad, dissected, eastward-sloping pediment or erosional plain at an elevation of approximately 6,000 feet Mean Sea Level (MSL). The pediment is capped by alluvial fans comprised of rocky soil materials eroded from the Front Range to the west of the RFP site area. The fans, which comprise the Rocky Flats Alluvium, extend to the east about 5 miles from their origin at the mouth of Coal Creek Canyon.

The pediment capped by the alluvium terminates with an abrupt drop in elevation to a lower area of low rolling hills. The alluvial cap and underlying bedrock of the pediment are dissected by the incised drainages of the intermittent Rock, Walnut, and Woman creeks. The industrial area of the RFP is located near the eastern edge of the pediment between stream-cut valleys of North Walnut Creek and Woman Creek.

Soils of the RFP site area are continually forming in all of the surficial geologic materials: a) the rocky alluvial fan deposits of the pediment surface, b) the clayey residuum and colluvial deposits, c) landslide deposits derived from the rocky alluvial fan deposits of the pediment surface, d) from the mudstones and shales of the valley side slopes, e) the loamy and clayey alluvial deposits of the valley bottoms, and f) the deposits of mixed soil materials of the eastern hills (EG&G 1994f).

Soil mapping and descriptions for the site area are presented in the published *Soil Survey of Golden Area, Colorado* (SCS 1980). This soil survey is the source of information for the following descriptions of the RFP site area soils. Soil taxonomic classification terms presented below are defined in *Soil Taxonomy - A Basic Classification for Making and Interpreting Soil Surveys* (SCS 1975).

RFP Site Area - Western Half

The pediment surface in the western half of the RFP site is dominated by deep, well-drained Flatirons soils (Flatirons very cobbly sandy loam, 0 to 3 percent slopes, and Flatirons very stony sandy loam, 0 to 5 percent slopes). The soils of these two mapping units are strongly developed (Aridic Paleustolls) and differ primarily in the size of the rocks found in the matrix. Characteristics of a strongly developed soil in this region include a clay-enriched and strongly structured B horizon beneath the surface A horizon (SCS 1975; Birkeland 1984).

The surface A horizon for Flatirons soil is typically a very cobbly or stony sandy loam approximately 13 inches thick. The underlying horizon(s) are very gravelly sandy clays or very gravelly sandy clay loams to a depth of 60 inches or greater (EG&G 1994f). Inclusions (i.e., other soils, urban land) make up approximately 15 percent of the two mapping units.

RFP Site Area - Eastern Half

The eastern half of the RFP site has a number of different soils which are developing in various situations created by stream-cut erosion of the dominant mesa-like pediment found in the western half of the site. Soils are developing on valley slopes, hills, and drainage bottoms.

Valley-Slope Soils. Principal valley-slope soils are the deep, well-drained, strongly developed (Aridic Argiustolls) Nederland very cobbly sandy loam, 15 to 60 percent slopes (pediment/terrace escarpment) and the Denver-Kutch-Midway clay loams complex, 9 to 25 percent slopes. Both soil mapping units occur in the stream-cut valleys in the western half of the site area. The Nederland soils typically have a very cobbly sandy loam A horizon approximately 10 inches thick which is underlain by a very cobbly sandy clay loam subsoil to

a depth of 60 inches. Inclusions of other soils and urban land make up approximately 15 percent of the map unit.

The soils of the Denver-Kutch-Midway complex are deep, moderately deep, and shallow, respectively; well drained; and comprise 35, 30, and 20 percent of the map unit, respectively. Inclusions and urban land comprise approximately 15 percent of the map unit. The Denver and Kutch soils are strongly developed (Torrertic Argiustolls); the Midway soils are weakly developed (Ustic Torriorthents). A horizons for the three soils of the complex range from 3 to 6 inches in depth, are clay loams in texture, and overlie clay loam to clay subsoils.

Hill Soils. The rolling, hilly topography of the eastern half of the RFP site area is dominated by strongly developed (Aridic Argiustolls) soils which are well drained and range from shallow to deep. These soils occupy high, hill-like terraces and fans, and the ridges and side-slopes of hills. The principal soil mapping units, listed in order of increasing steepness of slope, are as follows:

- Nunn clay loam, 0 to 2 percent slopes.
- Standley-Nunn gravelly clay loams complex, 0 to 5 percent slopes.
- Denver clay loam, 5 to 9 percent slopes.
- Denver-Kutch clay loams complex, 5 to 9 percent slopes.
- Denver-Kutch clay loams complex, 9 to 15 percent slopes.
- Willowman-Leyden cobbly loams complex, 9 to 30 percent slopes.
- Leyden-Primen-Standley cobbly clay loams complex, 15 to 50 percent slopes.

The Nunn and Standley soils occupy nearly-level high terraces, fans, and ridges in the site area. Both are deep and well-drained. The A horizon of the Nunn soil is typically a clay loam about 6 inches thick; the subsoil consists of an upper clay-textured layer underlain by clay loam material to a depth of 60 inches. The A horizon of the Standley soil is typically a gravelly clay loam about 9 inches thick; the subsoil grades in texture to a depth of 60 inches from gravelly clay, to gravelly clay loam, to gravelly loam. Both mapping units contain inclusions and urban land totalling approximately 15 percent.

The Denver and Kutch soils occupy sloping to moderately steep hill slopes. Characteristics for both soils were described above. The three Denver/Denver-Kutch mapping units contain inclusions and urban land totalling approximately 15 percent.

The Willowman, Leyden, Primen, and Standley soils of the two remaining mapping units occupy moderately steep to very steep hill sides, ridges, and escarpments. Soils of the Willowman-Leyden complex are deep and moderately deep, respectively; well drained; and

comprise 60 and 25 percent of the mapping unit, respectively. The Willowman soil typically has a cobbly loam A horizon approximately 6 inches thick; the subsoil grades in texture to a depth of 60 inches from a very gravelly clay loam, to very gravelly loam, to very gravelly sandy loam. The Leyden soil typically has a cobbly loam A horizon approximately 3 inches thick; the subsoil is gravelly clay loam to gravelly clay. This complex contains approximately 15 percent inclusions of other soils and urban lands.

The Leyden, Primen, and Standley soils are moderately deep, shallow, and deep, respectively. All are well drained. The soils comprise 35, 30, and 20 percent, respectively, of the soil mapping unit. Characteristics of the Leyden and Standley soils are described above. The Primen soil typically has a cobbly clay loam A horizon about 9 inches thick; the subsoil is cobbly and gravelly clay loam to a depth of about 18 inches (bedrock contact). This complex contains approximately 15 percent inclusions of other soils and urban lands.

Drainage Bottoms Soils. Principal soil mapping units occupying the drainage bottoms throughout the RFP site area are the deep, well-drained Haverson loam, 0 to 3 percent slopes; clay loam, 0 to 2 percent slopes; Englewood clay loam, 2 to 5 percent slopes; and McClave clay loam, 0-3 percent slopes (EG&G 1994f). The Englewood soils are strongly developed (Torrertic Argiustolls) and occur on alluvial fans and in drainage ways. The Englewood soils typically have a clay loam A horizon approximately 9 inches thick which is underlain to a depth of 60 inches by clay and clay loam soil materials. Both soil mapping units include about 15 percent inclusions of other soils and urban land.

The Haverson soil is weakly developed (Ustic Torrifluvents) and occurs on floodplains and low terraces of the drainage bottoms. Typically, the A horizon is a loam about 6 inches thick. The subsoil is stratified clay loam, gravelly loam, and very gravelly loam sand to a depth of 60 inches. Inclusions of other soils and urban land make up about 15 percent of the mapping unit.

McClave soils are strongly developed (cumulic haplaquolls) and occur in floodplains of the drainage bottoms. McClave soils are deep, somewhat poorly drained, "wet" soils. Typically, the surface A horizon extends to 26 inches. The next horizon is a brown clay loam to a depth of 42 inches which exhibits color mottling due to alternating oxidizing and reducing conditions. The substratum is a brown, sandy clay loam to a depth of 60 inches or greater which also exhibits mottling. (EG&G 1994f)

3.1.1.2 Sitewide Affected Soils

The RFP site has served as a nuclear weapons components manufacturing facility since 1952. Native soils have been affected by the siting of facilities and their operations (storage, disposal, and accidental releases/spills). Impacts to soils have resulted from the construction of facilities and the operations of the plant. Construction of facilities has involved the excavation, compaction, and burial of native soils.

Operations have involved similar impacts, plus the introduction of soil contaminants introduced by (a) the purposeful disposal of waste materials/streams and (b) the accidental releases/spills of contaminants. The distribution of contaminants in soils has been extended from source locations by entrainment and transport in migrating surface waters, groundwater, and windblown dust. The contaminants of primary concern with regard to soils have been air-borne deposited radionuclides from resuspended contaminated soil particles (DOE 1987a).

Plutonium is considered to be the principal radionuclide contaminant in the RFP site area (DOE 1987a). Plutonium contamination in the soils is a consequence of past releases of material from the plant facilities and fallout from past world-wide detonations of nuclear weapons (DOE 1987a). Leaking barrels of plutonium-contaminated waste industrial oil in OU2 (specifically, the 903 Pad) are considered the main specific source of contaminated soils around the RFP site area (Krey and Hardy 1970).

Wind dispersal of contaminated soil particles during 903 Pad area cleanup operations is the presumed mechanism by which soils in the area east of the 903 Pad were contaminated (Krey and Hardy 1970; Seed, et al. 1971; Poet and Martell 1972; Johnson, et al. 1976; Little 1980; Little, et al. 1980). Studies addressing this mechanism and its effects were being developed at the time of this writing.

Cleanup operations involved the removal of the drums and the construction of an asphalt pad over the storage area. Krey and Krajeuskl (1972) and Krey (1976) estimated approximately 11.4 Ci of plutonium was released from the leaking drums; 1.7 Ci was estimated to be covered by the asphalt pad, 1.4 Ci was released off the RFP site area, and approximately 8.3 Ci remain onsite.

The plutonium release from the leaking drums represents more than 99 percent of the total plutonium activity released from the RFP since its inception (DOE 1987a). DOE (1987a) summarized that plutonium had clearly migrated offsite since its initial release (Illsley and Hume 1979); however, there was no evidence that significant migration had continued since its initial release in the late 1960s.

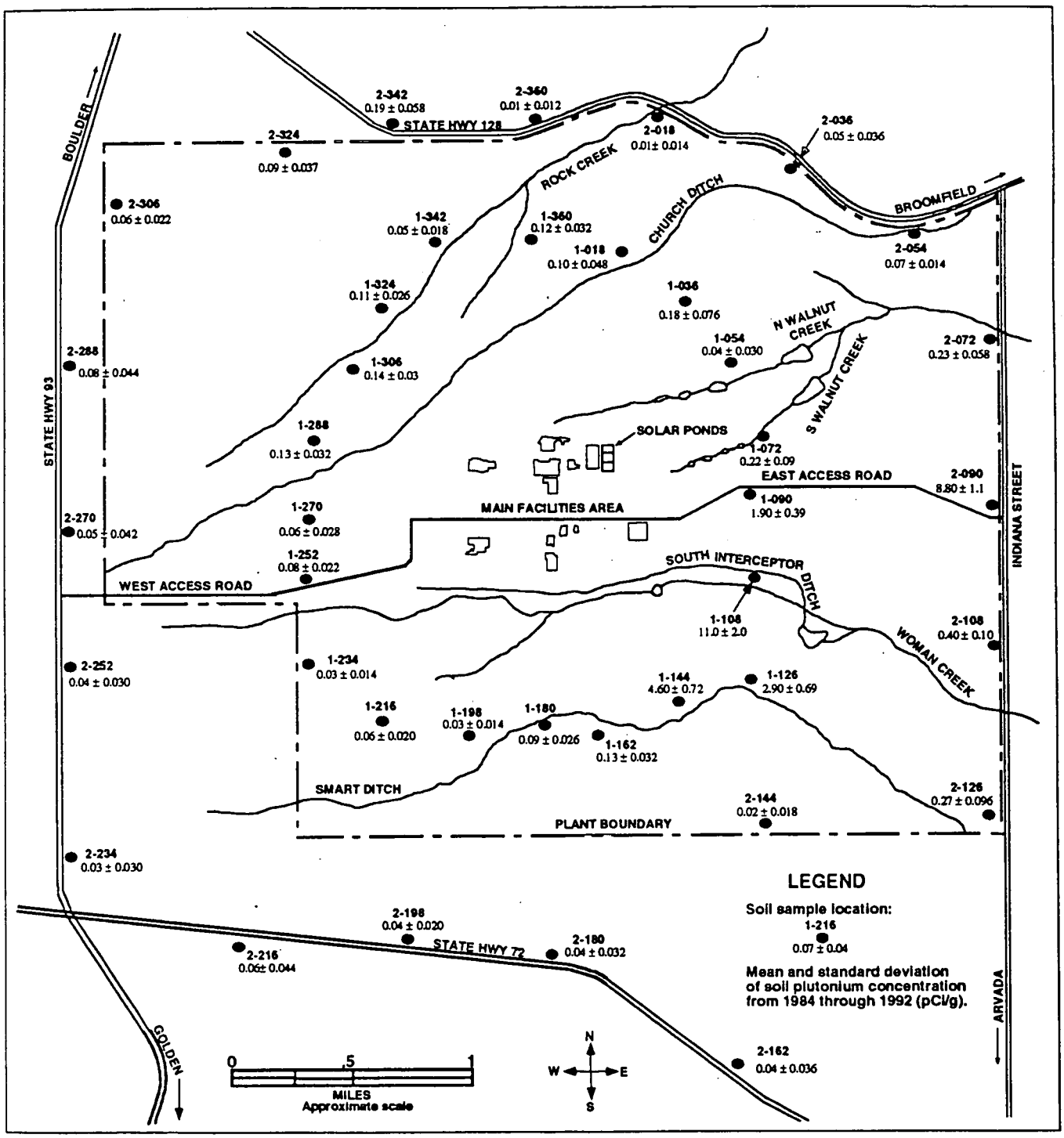
Annual soil sampling for plutonium was initiated in 1972 (EG&G 1990b). The sampling program was designed to detect any significant changes in soil plutonium levels around the RFP (DOE 1987a). This annual monitoring program involves the collection of forty 10 x 10 centimeter surface soil samples at radial intervals of approximately 18 degrees and at approximate distances of 1.6 and 3.2 kilometers from the RFP center. The soil sampling program has consistently shown elevated plutonium concentrations in soils east and south east of the RFP (**Figure 3.1-1**).

The Colorado Department of Health (CDH) conducted 11 surficial soil surveys for plutonium distribution and concentrations around the RFP between 1970 and 1989 (CDH 1990b; CDH 1990c; Terry 1991). The surveys involved the sampling of surface soil in 13 sectors defined with respect to distance and direction from the center of the RFP (**Figure 3.1-2**). Results of the surveys show that a plutonium concentration gradient occurs in the RFP site area; highest plutonium concentrations occur closest to the RFP.

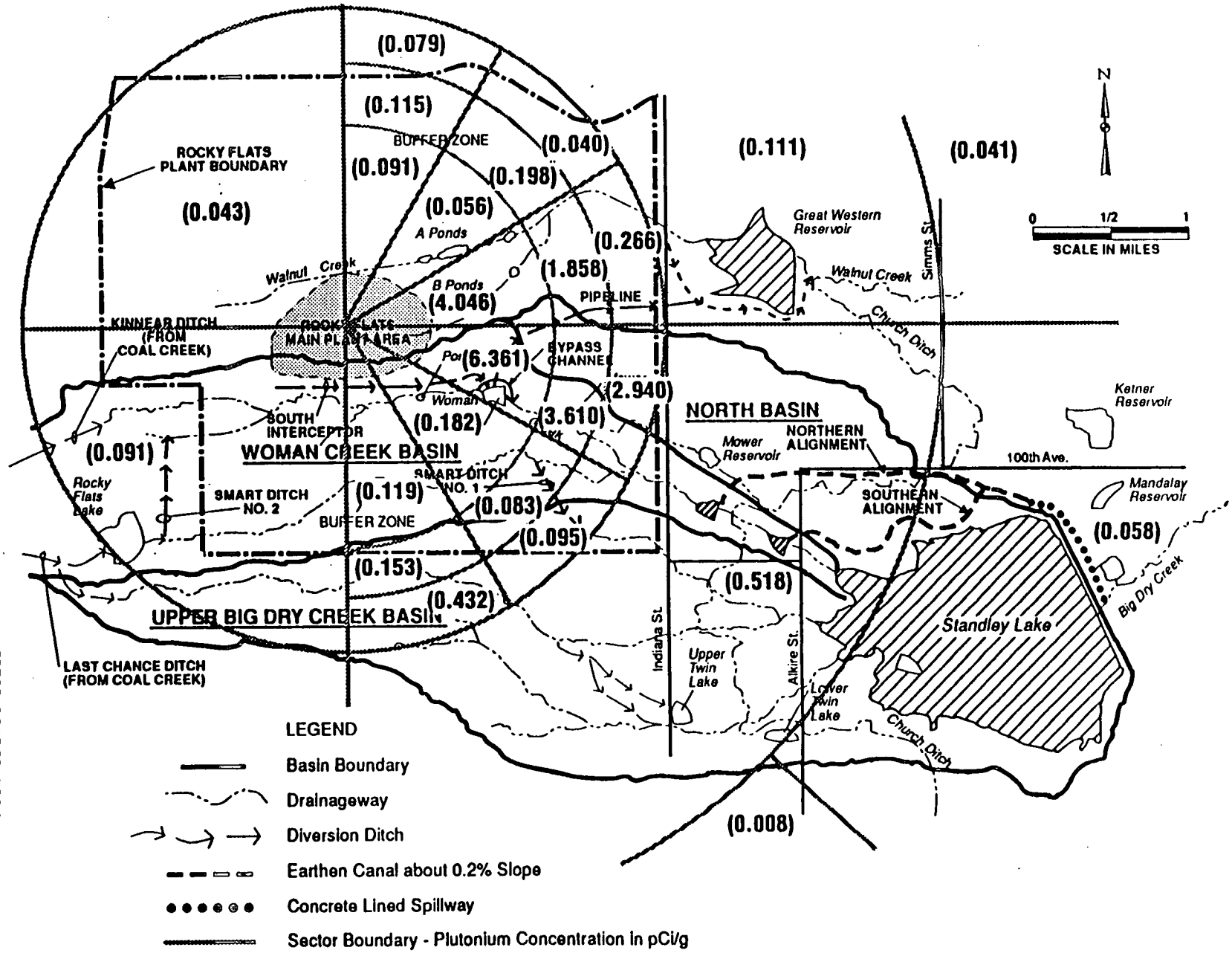
Considering direction from the RFP, higher concentrations of plutonium were found east and east-southeast of the RFP center. These results are consistent with the results of annual soil plutonium monitoring reported by EG&G and with the prevailing wind directions in the area (EG&G 1990b). Results of the CDH studies indicate plutonium levels have generally declined steadily since the first of the 11 yearly surveys; however, this trend has been questioned by EG&G (1991d) based on sampling protocol and regression modeling fit.

Studies cited in the OU2 Phase I RI (Rockwell 1988) found elevated concentrations of plutonium and americium in composite borehole samples collected adjacent to IHSS 108 (Trench T-1), IHSS 109 (Trench T-2), IHSS 140 (Hazardous Disposal Site), and in filtered surface water samples from seeps and stream sediment samples along Woman Creek. The elevated concentrations of plutonium in seep waters above Woman Creek suggest some of the plutonium may travel in surface waters and groundwater. Additional studies for surficial soils located in OU2 are discussed in Section 3.1.3 of this report.

Figure 3.1-1
Soil Sampling Locations and Soil Plutonium Concentrations
(1984-1992)



Source: EG&G 1992e



ERTSD SOURCE: EG&G 1992

1989 COLORADO DEPARTMENT OF HEALTH SURFACE SOIL SURVEY RESULTS

ERTSD FIGURE 3.1-2

150271

Contaminants, other than radionuclides, were also addressed by the DOE (1987a). Soil samples were requested and collected for the following situations:

- Improper asbestos disposal practices at the IHSS 114 (Present Landfill).
- Waste materials exposed due to slumping and erosion of IHSS 115 (Original Landfill.
- Spray irrigation of water from runoff retention Pond B-3 to soils in IHSSs 216.1 - 216.3 (East Spray Fields).
- Spray irrigation of water from Solar Pond 207 B-North to soils in IHSS 168 (West Spray Field).
- Nitrate contamination of soils from leakage of IHSS 101 (Solar Evaporation Ponds).

The Final Treatability Studies Plan (DOE 1991cc) presents available data on concentrations of contaminants at sites within OUs 1, 2, 4, 5, 6, 7, 11, and the South Interceptor Ditch. Additional radionuclide and nonradionuclide contamination situations will be addressed as appropriate in the following discussions of soils and soil contamination for the individual OUs.

3.1.2 Operable Unit 1 - 881 Hillside

3.1.2.1 OU1 Native Soils

Final Phase III RCRA Facility Investigation/Remedial Investigation Work Plan, Revision 1, Rocky Flats Plant, 881 Hillside Area (Operable Unit No. 1) (DOE 1991e), describes the soils in OU1:

> Surficial soils of OU No. 1 are predominantly moderately deep to deep well-drained clay loams of moderate to low permeability. The area is drained by Woman Creek and soils along the flood plain and low terraces have formed in stratified loamy alluvium. The higher gently sloping soils are formed from Rocky Flats Alluvium and colluvium where gravels and cobbles are common. The hillsides in the area are formed from cobbly, gravelly, and loamy alluvium (mixed sources) or claystone. Runoff is generally rapid and erosion hazard can be severe on the steeper slopes. Numerous soil series occur in the area; however, all belong in the Arguistoll great group with the exception of some entisolls in the drainages. Arguistolls are generally characterized as well-drained soils with mollic (dark) epipedons, argillic "B" horizons, and calcic "C" horizons. They exist in ustic moisture regimes (limited moisture, but adequate for plant growth during growing season). The two predominant subgroups are Torretic and Aridic, with the Torrertic Arguistolls having more pronounced shrinking and swelling capability.

3.1.2.2 OU1 Affected Soils

The Phase I and Phase II soils investigations detected elevated levels of plutonium and americium. The source is believed to be contaminated dust blown in from the 903 Pad Area of OU2. Metals were detected generally at background levels. Investigation along the French Drain route found toluene present. Additional soil sampling has been proposed to acquire data for use in performing human health risk assessment and environmental evaluation, to determining the volume of soil needing remediation, and for evaluation of remediation actions. Sediments will also be collected to evaluate soil migration to Woman Creek. (DOE 1992f)

3.1.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

3.1.3.1 OU2 Native Soils

The *Preliminary Draft Phase II RFI/RI Report 903 Pad, Mound and East Trenches Area (Operable Unit 2)* (DOE 1993c) describes the soils:

> Surficial soils of OU No. 2 are predominantly moderately deep to deep, well-drained clay loams of moderate to low permeability. The area is drained by Woman Creek, and soils along the flood plain and low terraces have formed in stratified loamy alluvium. The higher, gently sloping soils are formed from Rocky Flats Alluvium, where gravels and cobbles are common. The hillsides in the area are formed from cobbly, gravelly, and loamy alluvium (mixed sources) or claystone. Runoff is generally rapid and erosion hazard can be severe on the steeper slopes. Numerous soil series occur in the area; however, all belong in the Argiustolls great group with the exception of some entisolls in the drainages. Argiustolls are generally characterized as well-drained soils with mollic (dark) epipedons, argillic "B" horizons, and calcic "C" horizons. They exist in ustic moisture regimes (limited moisture, but adequate for plant growth during growing season). The two predominant subgroups are Torrertic and Aridic, with the Torrertic Argiustolls having more pronounced shrinking and swelling capability.

3.1.3.2 OU2 Affected Soils

Toluene, PCE, TCE, 2-butanone, CCl_4, and methylene chloride were reported in samples from the 903 Pad and East Trenches Area. Additionally, total xylenes and ethylbenzene were reported for the 903 Pad, while 1,2-dichloroethane, 1,1,1-TCA, 1,1,2-TCA were reported for the East Trenches. Acetone and methylene chloride were recorded for the Mound Area; however, concentrations were too low to state that the contaminants definitively were from the Mound Area.

Plutonium and americium are the primary radionuclide contaminants, with concentrations approaching 100 pCi/g. The "Americium Zone" contains an americium concentration, that by

inference, indicates plutonium concentrations as high as 457 pCi/g. Aluminum, arsenic, barium, cadmium, calcium, iron, mercury, manganese, lead, antimony, vanadium, and zinc were recorded above background concentrations; although generally by a factor of less than two (DOE 1992i).

3.1.4 Operable Unit 3 - Off-Site Releases

3.1.4.1 OU3 Native Soils

Three of the four IHSSs in OU3 are reservoirs; the fourth, IHSS 199 (Contamination of the Land's Surface) consists of plutonium-contaminated lands located offsite of the RFP area. Soils in the IHSS 199 area, located east and south of the RFP area, are similar to those occurring in the eastern half of the RFP area. These are well drained, clayey, and loamy soils on high terraces, hill slopes, and fans.

The primary soil type is the Nunn-Denver complex, comprised of approximately 45 percent Nunn, 25 percent Denver, and 30 percent inclusions and urban land. In the IHSS 199 remedy acreage, the soils are Denver-Kutch-Midway clay loams, estimated at 50 percent Denver, 30 percent Kutch, and 20 percent Midway. Denver and Kutch soils are found on hill slopes and Midway soils are found on ridge crests. This soil complex is generally unsuitable for cultivation for the purpose of remediation. (DOE 1992l)

3.1.4.2 OU3 Affected Soils

The nature and extent of soils contamination are described in Section 2.5.3 of this report. Plutonium and americium are the only contaminants detected above background levels (DOE 1991l). Soil sampling has been completed for an area approximately 3 miles wide (beginning at and proceeding east of Indiana Street) and 4 miles long (EG&G 1994k). Currently, approximately 350 acres of land within IHSS 199 contain plutonium concentrations in the surface soils in excess of the 0.9 pCi/g CDH special construction standard.

Approximately 120 acres of the 350 acres are undergoing active remediation. Additional conclusions to date regarding plutonium contamination in OU3 (specifically addressing the proposed route of the Standley Lake Diversion Project) are found in the Draft Environmental Assessment Standley Lake Diversion Project (DOE 1992bb): Ninety-nine percent of the total plutonium is found in the top 8.3 inches of soil while 50 percent is found in the top 1.2 inches,

and land east of Rocky Flats apparently has not been measurably affected by plutonium emissions since 1975.

3.1.5 Operable Unit 4 - Solar Evaporation Ponds

3.1.5.1 OU4 Native Soils

The *OU4 Solar Evaporation Pond Interim Measures/Interim Remedial Action, Environmental Assessment, Decision Document* (DOE 1994a), describes soils in OU4.

> Three types of soil have been described by the Soil Conservation Service at the RFP. These soil types are designated as the following: the Flatiron Series, located on Rocky Flats Alluvium; the Nederland Series, commonly located on the upper slopes flanking the Rocky Flats Alluvium; and the Denver-Kutch-Midway Series, located on slopes flanking the Nederland soils. The Flatiron Series is a very cobbly sandy loam that exhibits a slow infiltration rate and is located on slopes of 0 to 3 percent. The Denver-Kutch-Midway Series is a clay loam, also exhibiting a slow infiltration rate, and is developed on the Arapahoe Formation claystones where slopes range from 9 to 25 percent. The Nederland Series develops adjacent to the Flatiron Series along the periphery of the Rocky Flats Alluvium where slopes are 15 to 50 percent. The Nederland soil exhibits a moderate infiltration rate. All three soil types at the RFP are partially obscured by fill materials, gravel, or buildings and other structures. Soil types have not been distinguished in core logs drilled at OU4 because the soils are described using the Unified Soil Classification System (USCS) designations.

3.1.5.2 OU4 Affected Soils

The nature and extent of soils contamination are described in Section 2.6.3 of this report and in the OU4 Solar Evaporation Pond IM/IR/EA (DOE 1994a). Soil samples collected in the vicinity of the solar ponds detected beryllium, cadmium, chromium, mercury, nickel, strontium, nitrates, Aroclor-1254, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, fluoranthone, pyrene, plutonium, uranium, americium, and tritium.

3.1.6 Operable Unit 5 - Woman Creek Priority Drainage

3.1.6.1 OU5 Native Soils

Eleven IHSSs, located on the valley sideslopes or in the valley bottom of Woman Creek, comprise OU5. Soil mapping units occurring within the OU5 area include the Denver-Kutch-Midway clay loams complex, 9 to 25 percent slopes (valley sideslopes) and the Haverson loam, 0 to 3 percent slopes (low terraces and floodplains of the valley bottom) (Section

3.1.1.1). Additional key soil attributes important to planning IHSS/other-affected-areas remediation are addressed in the published soil survey (SCS 1980).

3.1.6.2 OU5 Affected Soils

The nature and extent of soil contamination within OU5 is not well documented. Organic solvent-, metal-, and radionuclide-containing wastes have been placed in the Original Landfill (IHSS 115) or burned (IHSSs 133.1 to 133.6); therefore, some soil contamination is anticipated. Surficial soil sampling is proposed as part of Phase I RFI/RI studies to characterize the nature and extent of contamination within OU5.

3.1.7 Operable Unit 6 - Walnut Creek Priority Drainage

3.1.7.1 OU6 Native Soils

OU6 is comprised of 19 IHSSs which are located on the valley sideslopes or in the valley bottoms of the three contributory drainages of Walnut Creek of the RFP site. The locations of the 19 IHSSs are described in Sections 2.8.1 and 2.8.2 of this report and in the Final Phase I RFI/RI Work Plan for OU6 (DOE 1992o).

Soil mapping units occurring within the OU6 area include the Denver-Kutch-Midway clay loams complex, 9 to 25 percent slopes (valley sideslopes) and the Haverson loam, 0 to 3 percent slopes (low terraces and floodplains of the valley bottom). See Section 3.1.2.1 of this report for information on additional key soil attributes important for remediation.

3.1.7.2 OU6 Affected Soils

The nature and extent of known soil contamination within OU6 is described in Section 2.8.3 of this report and in the Final Phase I RFI/RI Work Plan for OU6 (DOE 1992o). Only four of the 19 IHSSs have had soil samples collected in the past: Trench A (IHSS 166.1), the Triangle Area (IHSS 165), the Old Outfall (IHSS 143), and the Soil Dump Area (IHSS 156.2). Uranium-233, 234, and 238, and several volatile organic compounds were detected in soils collected near Trench A.

The presence of radionuclides were identified during previous radiometric surveys of the Triangle Area. Elevated levels of plutonium and organics were found in samples taken at the

Old Outfall. Soils at the Soil Dump Area may contain plutonium. Additional soil sampling is proposed for OU6 in the Phase I Work Plan (DOE 1992o).

3.1.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

3.1.8.1 OU7 Native Soils

The nature and location of OU7 and its IHSSs are described in Sections 2.9.1 and 2.9.2 of this report and the Phase I RFI/RI Work Plan for OU7 (DOE 1991y). Mapped soil units occurring within OU7 are the same as those mapped for OU4, notably the pediment alluvial cap; Flatirons very cobbly, sandy loam; and Denver-Kutch-Midway clay loams complex (SCS 1980). Discussions of general soil characteristics and key soil attributes are presented in Section 3.1.2.1.

3.1.8.2 OU7 Affected Soils

The nature and extent of soils contamination has not been addressed by any previous study; however, those contaminants found in groundwater within OU7 would be expected to also be present in overlying soils. Surficial soil sampling is proposed in the Phase I Work Plan (DOE 1991y).

3.1.9 Operable Unit 8 - 700 Area

3.1.9.1 OU8 Native Soils

The nature and locations of the 24 IHSSs comprising OU8 are described in Sections 2.10.1 and 2.10.2 of this report and the Draft Remedial Investigation and Feasibility Study Plans for Low Priority Sites report (Rockwell 1988). The IHSSs are located in soils mapped as Flatirons very cobbly sandy loam, zero to three percent slopes. Discussions of general soil characteristics and key soil attributes are presented in Section 3.1.2.1.

3.1.9.2 OU8 Affected Soils

The nature and extent of soils contamination is being investigated as part of the implementation of the Phase I RFI/RI Work Plan for OU8 (EG&G 1994b). A variety of soil contamination

situations is expected due to the variety of stored hazardous waste materials and/or leakage to soils (Sections 2.10.1 and 2.10.2).

3.1.10 Operable Unit 9 - Original Process Waste Lines

3.1.10.1 OU9 Native Soils

The nature and general location of the 21 IHSSs comprising OU9 are described in Section 2.11.1 and 2.11.2 of this report and the Final Phase I RFI/RI Work Plan for OU9 (DOE 1992q). The native soils are the same as those mapped for OU8 in the Industrial Area (notably Flatirons very cobbly, sandy loam, 0 to 3 percent slopes).

3.1.10.2 OU9 Affected Soils

The nature and extent of soils contamination has not been addressed by any previous studies; however, releases of low-level radioactive and nitrate-rich aqueous wastes, and streams containing organics, acids, bases, and metals are likely to have occurred at points of system failure (Section 2.11). The Phase I Work Plan (DOE 1992q) proposes a two-phased approach to sampling soils for contaminants. The first phase will focus on residual contamination in system components and immediately adjacent soils; the second phase will define the extent of contamination for locations identified in the first phase.

3.1.11 Operable Unit 10 - Other Outside Closures

3.1.11.1 OU10 Native Soils

The nature and general locations of the 15 IHSSs comprising OU10 are described in Sections 2.12.1 and 2.12.2 of this report and in the Draft Final Phase I RFI/RI Work Plan for OU10 (DOE 1991a). Only two IHSSs within OU10 could be considered as having native soils; the rest of the IHSSs are in the Industrial Area of the plant and are composed of fill material, not soil (EG&G 1994a).

3.1.11.2 OU10 Affected Soils

A preliminary assessment of the nature and extent of soils contamination has been conducted for several of the IHSSs (Section 2.12.3). Soils of several IHSSs contain concentrations of organics, metals, nitrates, and radionuclides above background levels. Additional surficial soil sampling is proposed in the Phase I Work Plan (DOE 1991a) to characterize the nature and

extent of soils contamination within OU10 because a preliminary sampling/assessment does not constitute an evaluation of the nature and extent of contamination (EG&G 1994a).

3.1.12 Operable Unit 11 - West Spray Field

3.1.12.1 OU11 Native Soils

The nature and location of contaminants in OU11 (West Spray Field) are described in Sections 2.13.1 and 2.13.2 of this report and in the Final Phase I RFI/RI Work Plan for OU11 (DOE 1992a). The native soils are Flatirons very cobbly, sandy loam.

3.1.12.2 OU11 Affected Soils

The nature and known extent of soils contamination within OU11 are described in Section 2.13.3 of this report and in the Phase I Work Plan (DOE 1992a). Soil samples collected during two previous investigations show slightly elevated levels of arsenic, lead, manganese, mercury, zinc, and several volatile organic compounds. Gross alpha, plutonium, uranium-233, 234, and 238 also exceeded soil background levels. Additional surficial soil sampling for radionuclide, nitrates, metals, and inorganics is proposed in the Phase I Work Plan (DOE 1992a).

3.1.13 Operable Unit 12 - 400/800 Area

3.1.13.1 OU12 Native Soils

The native soils for OU12 are the same as those mapped for OU8 (i.e., Flatirons, very cobbly sandy loam, 0 to 3% slopes, as are most soils in the Industrial Area). Discussions of general soil characteristics and key soil attributes are presented in Section 3.1.2.1.

3.1.13.2 OU12 Affected Soils

The nature and extent of actual soil contamination within this OU will be determined through site characterization activities.

3.1.14 Operable Unit 13 - 100 Area

3.1.14.1 OU13 Native Soils

Soils are of the Flatiron Series (very cobbly, sandy loams with a slow infiltration rate) located on the Rocky Flat Alluvium, Nederland Series (very cobbly, sandy loams with a moderate infiltration rate) located on the upper flanking Rocky Flat Alluvium, and Denver-Kutch-Midway Series (clay loams), located on slopes flanking the Nederland Series. Prior to construction at Rocky Flats, the whole OU was covered by the Flatiron Series.

3.1.14.2 OU13 Affected Soils

IHSS 117.1 alluvium samples include copper, barium, iron, manganese, cadmium, potassium, vanadium, zinc, and sodium above background concentrations. Organic compounds detected include toluene, benzene, carbon disulfide in alluvium and bedrock; and ethyl benzene, and xylenes in alluvium. Radionuclides exceeding background in alluvium were plutonium, radium, strontium, tritium and uranium. Contaminants can not be directly linked to IHSS 117.1; actual sources may be upgradient.

IHSS 117.2 has not had direct sampling performed. However, wells downgradient of the IHSS have found arsenic, copper, chromium, lead, barium, magnesium, iron, nickel, potassium, vanadium, and zinc exceeding background levels in the alluvium. Cesium, plutonium, radium, tritium, and uranium also exceed background in the alluvium. Acetone and 2-butanone were detected in alluvium samples. These results can not, with certainty, be attributed to this IHSS because of the potential contribution from other sources. IHSS 117.3 has not had soil sampling performed upgradient; downgradient wells do not display any contamination that can be linked to activities at this IHSS.

IHSS 128 has not been directly sampled. However, in a nearby well acetone and carbon disulfide were detected in the alluvium; vanadium was detected above maximum background concentrations in bedrock; and plutonium, radium, and uranium were detected above background concentrations in alluvium. However, it is difficult to associate the results with the IHSS. For example, radionuclide contamination may be from emissions and surface water transport.

IHSS 134 has not been directly sampled. However, two wells (one is discussed under IHSS 128) are near the site. The second well found copper and zinc at concentrations greater than maximum surficial background; lead and arsenic exceed background for bedrock; and

plutonium, radium, strontium, and uranium exceed maximum background for alluvium. The results, however, do not correlate with expected results for burning lithium and magnesium.

IHSS 148 has not had soil sampling performed. IHSS 152 has not had soil sampling performed. A well approximately 900 feet downgradient found no contaminants indicative of fuel oil.

IHSS 157.1 has had no apparent recent soil analyses. In 1954, the soil had radioactive contaminant levels that exceeded 10 times background. However, the soil has changed substantially since the days of the original contamination.

IHSS 158 has not been directly sampled. Based on the results of upgradient and downgradient wells, the contamination in surficial and bedrock strata can not be attributed to the IHSS.

IHSS 169 may not have occurred, and if it did, no chemical contamination would currently persist. IHSS 171 has had no soil sampling. A borehole approximately 100 feet north-northeast found no contamination that can be directly linked to the IHSS.

IHSS 186 has had no soil sampling. One well located upgradient of the IHSS found plutonium, radium, strontium and uranium exceeding background concentrations. Metals were also found exceeding background; however, the location of the well may prevent the IHSS from actually contributing any contaminants.

IHSS 190 has had no soil sampling. As a result of the 1978 incident, sodium, aluminum, and sulfate are expected to be constituents. IHSS 191 would not have chemical contaminants that would currently persist in the soil. (DOE 1992c)

3.1.15 Operable Unit 14 - Radioactive Sites

3.1.15.1 OU14 Native Soils

Soils are of the Flatiron Series (very cobbly, sandy loams with a slow infiltration rate) located on the Rocky Flat Alluvium, Nederland Series (very cobbly, sandy loams with a moderate infiltration rate) located on the upper flanking Rocky Flat Alluvium, and Denver-Kutch-Midway Series (clay loams), located on slopes flanking the Nederland Series. Prior to construction at Rocky Flats, the whole OU was covered by the Flatiron Series. (EG&G 1994j)

3.1.15.2 OU14 Affected Soils

IHSS 131 is suspected of having plutonium resulting from the 1964 and 1969 fires. Borehole analyses in IHSS 156.1 have found antimony, arsenic, beryllium, and lead; plutonium, radium, strontium, and americium were found; however, concentrations do not represent significantly high levels of contamination. Acetone and methylene chloride were the only organic constituents detected.

PCBs have been detected within IHSS 160. Plutonium at a concentration of 15.9 pCi/g was detected in the top three feet of soil in the northeast corner. Inorganic compounds were not detected. Tetrachloroethylene; carbon disulfide; 1,1,1-trichloroethane have also been detected.

IHSS 161 has potential plutonium and uranium contamination. However, borehole analyses do not indicate high concentrations of radionuclides or inorganics in the area of the boreholes. Methylene chloride, acetone, and tetrachloroethylene were detected in a borehole in the northwest portion of the IHSS.

IHSS 162 is affected by other overlapping IHSSs. The potential contaminants are VOCs, radionuclides, beryllium, iron, chromium, nitric acid, hydrochloric acid, and fluoride. The presence of PCBs is suspected. Plutonium and americium may also be present above background levels.

IHSS 164.1 is suspected of being contaminated with plutonium. However, a preliminary assessment from one borehole in the IHSS does not indicate that high levels of contamination are present. IHSS 164.2 is suspected of being contaminated with uranium. (DOE 1992d)

Surveys in IHSS 164.3 have found indications of possible uranium contamination. Further investigations are needed to determine if the sources are environmental releases or properly stored materials. (EG&G 1994j)

3.1.16 Operable Unit 15 - Inside Building Closures

3.1.16.1 OU15 Native Soils

The thickness of surficial deposits, which includes the Rocky Flats Alluvium, colluvium, valley fill alluvium, disturbed gravel, and artificial fills varies between 30 feet southwest of Building 447 to approximately 10 feet under Building 865 and 883. The Rocky Flats Alluvium is unconsolidated and consists of cobbles, gravel, sands, and gravelly clays.

Colluvium is composed of unconsolidated clays, valley fill alluvium consists of unconsolidated poorly sorted sand, gravel, and pebbles in a silty clay, disturbed gravel has clay, silt, sand, gravel and pebble, and artificial fill composed of material from the Rocky Flats Alluvium, colluvium, claystone, and concrete rubble (DOE 1993b).

3.1.16.2 OU15 Affected Soils

No site-specific information regarding affected soil was located for inclusion in the report.

3.1.17 Operable Unit 16 - Low-Priority Sites

3.1.17.1 OU16 Native Soils

Surficial deposits are comprised of Rocky Flats alluvium, colluvium, valley fill alluvium, disturbed ground, and artificial fill.

3.1.17.2 OU16 Affected Soils

There is no residual chemical contamination associated with the soils in any of the IHSSs in OU16 (EG&G 1994d).

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3.2 VEGETATION

3.2.1 Sitewide Conditions

RFP is located in a transition zone between the Great Plains and the Rocky Mountain foothills. This transition area is predominantly a mid-grass prairie. The area may have originally been forested with ponderosa pine, with the trees having been removed by burning and cutting by both Indians and white settlers (Weber, et al. 1974).

Although ponderosa pine savanna occurs on a portion of the facility, the forest has generally not recovered, apparently due to strong winter winds, soil erosion, dryness, and grazing (Weber, et al. 1974). Other human influences on the vegetation have included farming in portions of the area, grazing at various levels of intensity, and disturbance produced by industrial activities.

A botanical inventory of the RFP facilities was conducted in the mid-1970s (Weber et al. 1974; also presented in DOE 1980). This inventory reported 327 species of vascular plants, 25 lichens, 15 bryophytes, and one macroscopic green algae. The RFP flora included species representative of tall-grass prairie, short-grass prairie, and lower montane and foothill ravine communities.

The vegetation of RFP and adjoining areas was mapped in the 1970s. At that time, RFP included lands which had been acquired in 1951 and had been generally undisturbed since then, and lands acquired in 1974 which had been overgrazed or cultivated prior to that time. As a result, this map shows large portions of the study area dominated by vegetation characteristic of pastures, or more severely disturbed. More recent observations indicate that plant succession has progressed substantially in these areas since the studies in the mid-1970s, and most areas mapped as annual weed communities are now perennial grassland.

The *Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant, Final Report* (DOE 1992r), lists terrestrial 532 plants, comprised of 25 lichens, 16 bryophytes, four vascular cryptogams, and 487 vascular plants. Of these, trees and shrubs account for seven percent of the total species, cacti one percent, graminoids (grasses and grass-like plants) 25 percent, and forbs (broad-leaf herbs) 67 percent.

Rocky Flats has 3 hydrologic zones: xeric, mesic, and hydric. These zones were further divided into 17 communities and subcommunities. Xeric conditions occur on ridge tops and terraces. Xeric soils have the lowest moisture content. There were 91 species of plants found in these areas. Mesic conditions are found on hillsides in ravines and valleys. Mesic soils

have a greater moisture content than xeric soils. There are 149 species of plants that reside in the mesic zone. Hydric conditions are generally found near creek channels, hillside seeps, and springs. Hydric soils have a high water content. Riparian woodlands (which includes bottomland shrubs) contained 280 species of plants and 162 species were found in marshlands (DOE 1992r).

Rocky Flats has a current inventory of vegetative species that is updated regularly based on field investigations (EG&G 1994i). A recent evaluation of threatened, endangered and sensitive plant species at RFP is presented in EG&G (1991e). The status and occurrence of special status plants are summarized below:

- **Forktip threeawn** (Aristida basiramea). No federal status, but included by Colorado Natural Heritage Program on its List 3, species for which more information is needed (Colorado Natural Areas Program 1991). Observed at RFP in 1973, and confirmed during recent studies (DOE 1992r).

- **Colorado butterfly plant** (Gaura neomexicana var. coloradensis). Federal Category 2 (C2). Category 2 candidate species are those, "for which information in the possession of the Service (U.S. Fish and Wildlife Service) indicates that proposing to list the taxon as endangered or threatened species is possibly appropriate, but for which substantial data on biological vulnerability and threat(s) are not currently known or on file to support proposed rules."

  Included on List 1 of the Colorado Natural Areas Program (i.e., species federally threatened or endangered) are plants rare throughout their range, or characterized by extremely narrow geographic distribution. Colorado butterfly plants were not located during an inventory of the Rocky Flats Plant conducted during the summer of 1993. Potentially suitable habitat is found along drainages on plantsite (ESCO 1993b).

- **Toothcup** (Rotala ramosior). No federal status, included on List 3 of Colorado Natural Areas Program. Not known to occur at RFP, but potentially suitable habitat is available.

- **Ute Ladies'-tresses** (Spiranthes diluvialis). Listed as threatened by the U.S. Fish and Wildlife Service (Federal Register 57:2048, January 17, 1992), and on List 1 of the Colorado Natural Areas Program. No plants were located during an inventory of the Rocky Flats Plant conducted during the summers of

1992 and 1993. Potentially suitable habitat is found along drainages on plantsite (ESCO 1993b).

- **Bell's Twinpod** (Physaria bellii). Federal Category 2 (C2) species (Federal Register 55:35, February 21, 1990). This species has been located near Rocky Flats and potentially suitable habitat is available at Rocky Flats; however, no plants have been found on plantsite (EG&G 1994i).

Rocky Flats currently has a procedure for identifying and protecting threatened and endangered species and their habitat. The procedure is 1-DO6-EPR-END.03, "Identification and Protection of Threatened, Endangered, and Special Concern Species."

A wetlands assessment of RFP has also recently been prepared (EG&G 1991f). This document provides a list of wetland indicator species present at RFP and short descriptions of the various wetland types. There are approximately 107 acres of areal wetlands and 84,970 feet of linear wetlands within RFP. In addition, there are about 156 acres of areal wetlands and 14,190 feet of linear wetlands located east of RFP, of which 140 acres occur at Great Western Reservoir. Wetlands at RFP include an open lake, ponds, intermittent streams, and hillside seeps. The Baseline Biological Characterization report (DOE 1992r) delineated 173 acres of wetland communities including short marsh, tall marsh, and wet meadows. Open water is excluded (37 acres). U.S. Army Corps of Engineers (USACE 1989) briefly discusses historic changes in wetlands and riparian areas at RFP:

> Originally, drainageways were intermittent and dominated by overflow range site vegetation, with limited amounts of wetland vegetation in the lower bank or channel areas. Woody vegetation was likely excluded due to prairie fires, intermittent nature of the drainageways, and other variables. During the past several decades flower periods in some of the drainages have been extended by alteration of site hydrology, and this has been accompanied by expansion of several species of woody vegetation, although this cover is still quite limited in extent. Woody plants known to occur in or near the drainageways are hawthorn, wild plum, chokecherry, snowberry, plains cottonwood, and willow. At some locations Canada thistle, quackgrass, and smooth brome have invaded the drainageways.

The Corps of Engineers is currently preparing a wetland inventory report for the Rocky Flats Plant. The report should be available May 1994.

Sitewide studies of contamination in vegetation at RFP have focused on plutonium. A number of studies have been completed; many of these are summarized in Rockwell (1986). The studies summarized show that vegetation is contaminated with plutonium in some areas, that vegetation concentrations are related to soil concentrations, that there is very little movement of

plutonium from soils into plants through the roots, that most plutonium on plants is surficial dust, and that grasses rather than soils are the primary means of resuspension of plutonium.

Other reports not cited in Rockwell (1986), but which report essentially the same conclusions, include Arthur and Alldredge (1982), Whicker, et al. (1990), Whicker and Ibrahim (1991), Jarvis (1991), and Langer (1991). Paine (1977) reported that concentration ratios of plutonium from pond sediments to plants were higher than expected, and much higher than for upland plants. A study of the effects of irradiation on plant community structure and chromosome aberrations, and a comparison to changes in communities from other disturbances, is reported by Fraley (1978). Whicker (1993) concluded that a plant's root system provides a minor pathway for the transport of plutonium.

Ongoing studies at Rocky Flats provide additional data regarding the composition of plant species on plantsite.

3.2.2 Operable Unit 1 - 881 Hillside

Little site-specific vegetation information is available for the 881 Hillside. DOE (1991e) includes a brief summarization of sitewide vegetation characteristics, taken from DOE (1980). DOE (1990a) only discusses wetlands, and provides the following information:

> Wetlands areas have been identified along both the Woman Creek and South Interceptor Ditch drainage areas. As described in the preceding section, hydrologic factors with respect to Woman Creek (and therefore, the vegetation features associated with them) are not anticipated to be significantly affected as a result of the proposed action. Evenly-spaced drop structures along the South Interceptor Ditch have lowered flow velocities, increased sediment accumulation, and created fairly dense linear stands of wetlands. From a point due south of the 881 Building and extending to the C-2 Pond, approximately 0.15 acre of wetland are contained within this portion of the South Interceptor Ditch. The species are observed to be primarily Typha latifolia or cattails (greater than 95% predominance), Eleocharis macrostachya (spike rush), and Scirpus americanus (bull rush) (sic). The wetlands function primarily as flow attenuation with additional minor contributions in wildlife habitat and water quality enhancement.

Small areas of wetlands exist on the 881 Hillside. Species found in the South Interceptor Ditch (SID) include two species of willows, cottonwoods, baltic rush, and cattails (Typha angustifolia). The vegetation in the SID and Pond C-2 provide good wildlife habitat especially for some species of bird (EG&G 1994i).

Additional information about vegetation at this OU can be obtained from sitewide vegetation studies, including Weber, et al. (1974); DOE (1992r); EG&G (1991f); and EG&G (1991e).

No specific information regarding contaminants on vegetation in this OU was located for purposes of this report. Plans for evaluating the vegetation and other biota of OU1 for contaminants are presented in DOE (1991e).

3.2.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

Little site-specific description of vegetation is available for the 903 Pad, Mound, and East Trenches. DOE (1991h) includes a brief summarization of sitewide vegetation characteristics, taken from the sitewide EIS (DOE 1980). DOE (1989) provides the same information about Woman Creek and South Interceptor Ditch (quoted in Section 3.2.2), and predicts that impacts to vegetation from proposed interim measures will be minimal. Additional information about vegetation at this OU can be obtained from sitewide vegetation studies, including Weber, et al. (1974); DOE (1992r); EG&G (1991f); and EG&G (1991e).

A number of studies have investigated the extent of contamination and associated ecological effects of plutonium released from the 903 Pad. These have been summarized in Section 3.2.1 and include Rockwell (1986); Arthur and Alldredge (1982); Whicker, et al. (1990); Whicker and Ibrahim (1991); Jarvis (1991); and Paine (1977).

DOE (1991h) presents an environmental evaluation work plan. The purpose is to document a qualitative and (where possible) a quantitative assessment of actual or potential threats of damage to the environment, including wildlife and vegetation species, habitats, and sensitive ecosystems. The field sampling plan will be integrated with the OU2 Phase II RFI/RI field sampling program provided in DOE (1991h).

Two isolated stands of wetlands containing primarily cattails (Typha latifolia) were located within IHSS 140. These sites are seeps where the contact between alluvium and bedrock occurs at the surface. (DOE 1991g)

3.2.4 Operable Unit 3 - Off-Site Releases

The vegetation of OU3, Offsite Releases, is described in DOE (1992l):

> Much of the land surface in OU3 has been converted to land uses that no longer have native species or natural ecosystems. Disturbed land surfaces include cultivation for agricultural crops, roads and right-of-way, development for housing and commerce, and canals and reservoirs for water control and storage. Much of this land surface [exists] as secondary growth of vegetation, including managed lawns and grasses. The vegetation tends to be weedy and the species present are those that invade after disturbance. Grazing is common in grasslands except the open space property of Jefferson County and the City of Broomfield.

The vegetation in the IHSS 199 area consists of native grasses and weeds, with various shrubs and small trees along drainages. Native grasses common to the area include western wheatgrass, green needlegrass, blue grama, and sideoats grama. Lands that have been tilled and seeded as part of remediation have been dominated in the early stages of regrowth by weeds, including Canadian, Russian and musk thistles, mustards, bindweed, and cheatgrass. Although these weeds compete with the grasses planted at the remedy acreage, they provide fair but unreliable stabilization of soils. As of late 1990, planted grasses have become established on approximately 50 percent of the northern remedy acreage and provide excellent soil stabilization. Planted grasses were characterized as being marginally established on 15 to 20 percent of the northern acreage and unestablished on 30 to 35 percent of the acreage, owing primarily to surface cobbles and competition from weeds. The seed mix mandated by the Settlement Agreement includes western wheatgrass, sideoats grama, pubescent wheatgrass, and smooth brome. Winter wheat and sorghum also have been planted on these lands as winter cover to help prevent soil erosion during remediation.

IHSS 199 (Contamination of the Land's Surface) includes approximately 350 acres of land which are included in a lawsuit by outside property owners against the United States and other defendants. The 1985 settlement agreement required that RFP undertake remedial action on lands containing more than 0.9 picocuries per gram of soil. A list of remedial actions implemented to date on 120 acres is provided in DOE (1992l).

These include various tillings, plants, grass seed drilling, mulching, irrigation, and weed control. More detailed information about these remedial actions, which included removal and planting of vegetation, is provided in Documents 11, 14, 15, and 16 attached to DOE (1991l). A draft environmental assessment on the herbicide weed control has been prepared (DOE 1991j).

A draft Environmental Assessment (EA) has been prepared for the proposed Standley Lake Diversion Project (DOE 1992bb). This EA includes a description of vegetation types present in the project area. Short grassland contains native short grasses such as buffalo grass and blue grama; cheatgrass and prairie junegrass may be common. Mixed grassland contains some moist areas having tallgrass prairie species such as bluestem, prairie dropseed, slender wheatgrass. The drier areas have little bluestem, blue grama, hairy grama, side-oats grama, and needle-and-thread; grazed areas may have yucca, cacti and cheatgrass.

Creek bottoms contain slender wheatgrass, western wheatgrass, blue grass, and smooth brome. Disturbed areas contain knapweed, cudweed, cheatgrass and milkweed. Wetlands contain cattails, sedges, and rushes. Riparian zones contain cottonwood trees, willow, lead plant, and possibly chokecherry and wild plum.

Appropriate habitat may be present for two sensitive plant species: Ute ladies' tresses (Spiranthes diluvialis) and Tulip or Prairie gentian (Eustoma grandiflorum) [Rocky Flats does not include the Prairie gentian on the "potential" list because this species is not known to be in general vicinity of the plant. (EG&G 1994i)].

Field investigations have included looking for the Colorado Butterfly Plant in OU3; however, none have been located (EG&G 1994i).

3.2.5 Operable Unit 4 - Solar Evaporation Ponds

The vegetation in OU4 is discussed in the *OU4 Solar Evaporation Pond Interim Measures/Interim Remedial Action Environmental Assessment Decision Document* (DOE 1994a) and "consists of three basic habitat types in the industrial area and on the hillside north of the solar ponds:

- Reclaimed Grassland - smooth brome, crested wheatgrass, and western wheatgrass. Small inclusions of shortgrass steppe/xeric mixed grassland exist on the eastern edge of the slope;

- Disturbance/Barren Lands - mostly bare with some annual grasses and forbs on the perimeter which grades into the reclaimed grassland. A seepage area is also present in this habitat which supports some sedges and grasses; and

- Tall Marsh and Short Marsh - The tall marsh is characterized by cattail and baltic rush. Other dominant species include Canada thistle (Cirsium arvense) and spikerush (Eleocharis sp.). The short marsh is associated with the seeps from the alluvium-bedrock interface and along the lower edge of the tall marsh habitat. These two habitat types are not extensive and occur as inclusions in the reclaimed grassland habitat.

The OU4 area has been disturbed and contains limited natural habitat. Vegetation consists almost entirely of disturbed reclaimed grasslands with few shrubs. There is a large weedy component in disturbed areas. Revegetation is composed of a combination of introduced species and native species that either persisted or seeded naturally.

The most common introduced species are smooth brome (Bromus inermis), crested wheatgrass (Agropyron cristatium), and western wheatgrass (A. smithii). Western wheatgrass is the native species that is predominant in the moist areas, and mountain muhly (Muhlenbergia montana) is dominant on the drier eastern portion of the area.

The seeps are dominated by cattails (Typha latifolia) and baltic rush (Juncus balticus) with smaller areas of spike rush on the edges of the seeps. Weeds are common along roads and around wells and drilling sites that are subject to continual disturbance. Forbs and weedy species encountered include Canada thistle (Cirsium arvense), yellow sweet clover (Melilotus officinalis), Kochia (Kochia scoparia), goatsbeard (Tragopogon dubius), mustards, and annual grasses.

Additional information about vegetation at this OU can be obtained from sitewide vegetation studies, including Weber, et al. (1974); DOE (1992r); EG&G (1991f); DOE (1994a); and EG&G (1991e). An environmental evaluation work plan and field sampling plan is provided in DOE (1991p), and includes additional vegetation sampling and analysis.

3.2.6 Operable Unit 5 - Woman Creek Priority Drainage

No site-specific information on vegetation in Woman Creek was available at the time the ERTSD was revised. Information about upland and wetland vegetation in OU5 can be obtained from sitewide vegetation studies, including Weber, et al. (1974); DOE (1992r); EG&G (1991f); and EG&G (1991e). An environmental evaluation work plan and field sampling plan is provided in DOE (1992n), and includes additional vegetation sampling and analysis. Paine (1977) provided some composited concentrations of plutonium in RFP ponds, and indicated that the transfer of plutonium from sediments to aerial portions of wetland plants was higher than reported from previous laboratory experiments.

3.2.7 Operable Unit 6 - Walnut Creek Priority Drainage

No site-specific information on vegetation in Walnut Creek was available at the time the ERTSD was prepared. Information about upland and wetland vegetation in OU6 can be obtained from sitewide vegetation studies, including Weber, et al. (1974); DOE (1992r); EG&G (1991f); and EG&G (1991e). An environmental evaluation work plan and field sampling plan is provided in DOE (1992o), and includes additional vegetation sampling and analysis. Paine (1977) provided some composited concentrations of plutonium in RFP ponds, and indicated that the transfer of plutonium from sediments to areal portions of wetland plants was higher than reported from previous laboratory experiments.

3.2.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

Regarding the Present Landfill, Rockwell (1988a) indicates that there is currently little vegetation on the Present Landfill cover. Information about vegetation in the vicinity of OU7 can be

obtained from sitewide vegetation studies, including Weber, et al. (1974); DOE (1992r); EG&G (1991f); and EG&G (1991e). A short description of an environmental evaluation to be conducted for OU7, including terrestrial ecology field studies, is provided in DOE (1991y). A substantial portion of the landfill has been seeded with a "reclamation seed mix", but currently the landfill still qualifies as a "disturbed" (EG&G 1994i).

3.2.9 Operable Unit 8 - 700 Area

General information about vegetation at, and adjacent to, OU8 can be obtained from sitewide vegetation studies, including:

- A Botanical Inventory of the Rocky Flats AEC Site (Weber, et al. 1974);
- Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant (DOE 1992r);
- Wetlands Assessment, Rocky Flats Plant Site (DOE 1991f);
- Threatened and Endangered Species Evaluation, Rocky Flats Plant Site (EG&G 1991e).

These sources should be consulted in conjunction with the current RFP botanical database, which is managed by the Ecology and NEPA Division. Vegetation within the Industrial Area of RFP exists in communities highly modified from comparable communities in the buffer zone.

Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

3.2.10 Operable Unit 9 - Original Process Waste Lines

General information about vegetation at, and adjacent to, OU9 can be obtained from sitewide vegetation studies, including:

- A Botanical Inventory of the Rocky Flats AEC Site (Weber, et al. 1974);
- Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant (DOE 1992r);
- Wetlands Assessment, Rocky Flats Plant Site (DOE 1991f);
- Threatened and Endangered Species Evaluation, Rocky Flats Plant Site (EG&G 1991e).

These sources should be consulted in conjunction with the current RFP botanical database, which is managed by the Ecology and NEPA Division. Vegetation within the Industrial Area of RFP exists in communities highly modified from comparable communities in the buffer zone.

Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

3.2.11 Operable Unit 10 - Other Outside Closures

General information about vegetation at, and adjacent to, OU10 can be obtained from sitewide vegetation studies, including:

- A Botanical Inventory of the Rocky Flats AEC Site (Weber, et al. 1974);
- Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant (DOE 1992r);
- Wetlands Assessment, Rocky Flats Plant Site (DOE 1991f);
- Threatened and Endangered Species Evaluation, Rocky Flats Plant Site (EG&G 1991e).

These sources should be consulted in conjunction with the current RFP botanical database, which is managed by the Ecology and NEPA Division. Vegetation within the Industrial Area of RFP exists in communities highly modified from comparable communities in the buffer zone.

Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

3.2.12 Operable Unit 11 - West Spray Field

A description of the biota of the West Spray Field is provided in DOE (1992r). The area is primarily mesic mixed grassland dominated by Canada bluegrass (Poa compressa), big bluestem (Andropogon gerardii), and mountain muhly (Muhlenbergia montana). Riparian shrubland along intermittent stream channels is dominated by Kentucky bluegrass (Poa pratensis). A map of habitats present in this area is present as Figure 9-1 in that document. Other species present

in these habitats are listed in the text, as determined from five transects in each habitat. No sensitive plant species are known to occur at or near OU11, but potential habitat is present and the work plan includes surveys for these species.

Additional information about vegetation in the vicinity of OU11 can be obtained from sitewide vegetation studies, including Weber, et al. (1974); DOE (1992r); EG&G (1991f); and EG&G (1991e). A detailed environmental evaluation work plan, which includes additional vegetation sampling, is provided in DOE (1992a).

3.2.13 Operable Unit 12 - 400/800 Area

General information about vegetation at, and adjacent to, OU12 can be obtained from sitewide vegetation studies, including:

- A Botanical Inventory of the Rocky Flats AEC Site (Weber, et al. 1974);
- Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant (DOE 1992r);
- Wetlands Assessment, Rocky Flats Plant Site (DOE 1991f);
- Threatened and Endangered Species Evaluation, Rocky Flats Plant Site (EG&G 1991e).

These sources should be consulted in conjunction with the current RFP botanical database, which is managed by the Ecology and NEPA Division. Vegetation within the Industrial Area of RFP exists in communities highly modified from comparable communities in the buffer zone.

Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

3.2.14 Operable Unit 13 - 100 Area

General information about vegetation at, and adjacent to, OU13 can be obtained from sitewide vegetation studies, including:

- A Botanical Inventory of the Rocky Flats AEC Site (Weber, et al. 1974);
- Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant (DOE 1992r);

- Wetlands Assessment, Rocky Flats Plant Site (DOE 1991f);
- Threatened and Endangered Species Evaluation, Rocky Flats Plant Site (EG&G 1991e).

These sources should be consulted in conjunction with the current RFP botanical database, which is managed by the Ecology and NEPA Division. Vegetation within the Industrial Area of RFP exists in communities highly modified from comparable communities in the buffer zone.

Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

OU13 is located in a highly industrialized and disturbed area. Vegetation is limited to landscape species and invading eurasian species. Where landscaping has been installed, vegetation consists of grasses and ornamental shrubs. Otherwise, in disturbed areas species are commonly Russian thistle, sow thistle, cheatgrass, St. Johnswort, and knapweed. Some wetland vegetation grows along portions of drainage ditches. (EG&G 1994i)

3.2.15 Operable Unit 14 - Radioactive Sites

General information about vegetation at, and adjacent to, OU14 can be obtained from sitewide vegetation studies, including:

- A Botanical Inventory of the Rocky Flats AEC Site (Weber, et al. 1974);
- Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant (DOE 1992r);
- Wetlands Assessment, Rocky Flats Plant Site (DOE 1991f);
- Threatened and Endangered Species Evaluation, Rocky Flats Plant Site (EG&G 1991e).

These sources should be consulted in conjunction with the current RFP botanical database, which is managed by the Ecology and NEPA Division. Vegetation within the Industrial Area of RFP exists in communities highly modified from comparable communities in the buffer zone.

Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI:*

Industrial Area Environmental Evaluation (DOE 1993k), which was in draft form at the time of this writing.

The area around the IHSSs is highly developed, consequently vegetation is limited to scattered conifer trees and strips of grass near IHSSs 160 and 162.

3.2.16 Operable Unit 15 - Inside Building Closures

The industrialized portion of the Rocky Flats Plant is highly developed with vegetation generally limited to small landscaped areas (primarily grass and some trees). Further, all of the OU15 IHSSs are interior to buildings.

3.2.17 Operable Unit 16 - Low-Priority Sites

Vegetation within the industrialized area is limited to landscaped areas or highly disturbed habitat. These areas are too small to support viable ecosystems. Wildlife obtains most food and cover outside these areas of limited vegetation, or from human refuse (EG&G 1994i).

General information about vegetation at and adjacent to OU16 can be obtained from sitewide vegetation studies, including Weber, et al. (1974); DOE (1992r); EG&G (1991f); and EG&G (1991e). These sources should be used in conjunction with the current RFP botanical database managed by the Ecology and NEPA Division.

Vegetation within the industrial area of RFP exists in communities highly modified from comparable communities in the buffer zone. Site-specific information is part of the Phase I RFI/RI Investigation process for each OU.

* * *

3.3 AQUATIC LIFE

3.3.1 Sitewide Conditions

Aquatic resources at RFP consist of fish, phytoplankton, zooplankton, periphyton, and benthos which exist in streams, ponds and reservoirs on and around the RFP. Aquatic resources information exists for the general area of the Front Range. The most detailed RFP data come from the *Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant, Final Report* (DOE 1992r).

Phytoplankton, periphyton, benthic macroinvertebrates, and fish populations were evaluated. Other descriptive ecological data useful in NEPA compliance are also being gathered in compliance studies for the various OUs (Endangered Species Act Compliance, Fish & Wildlife Coordination Act Compliance, and Migratory Bird Treaty Act Compliance).

3.3.1.1 Drainages, Streams, Ponds, and Reservoirs

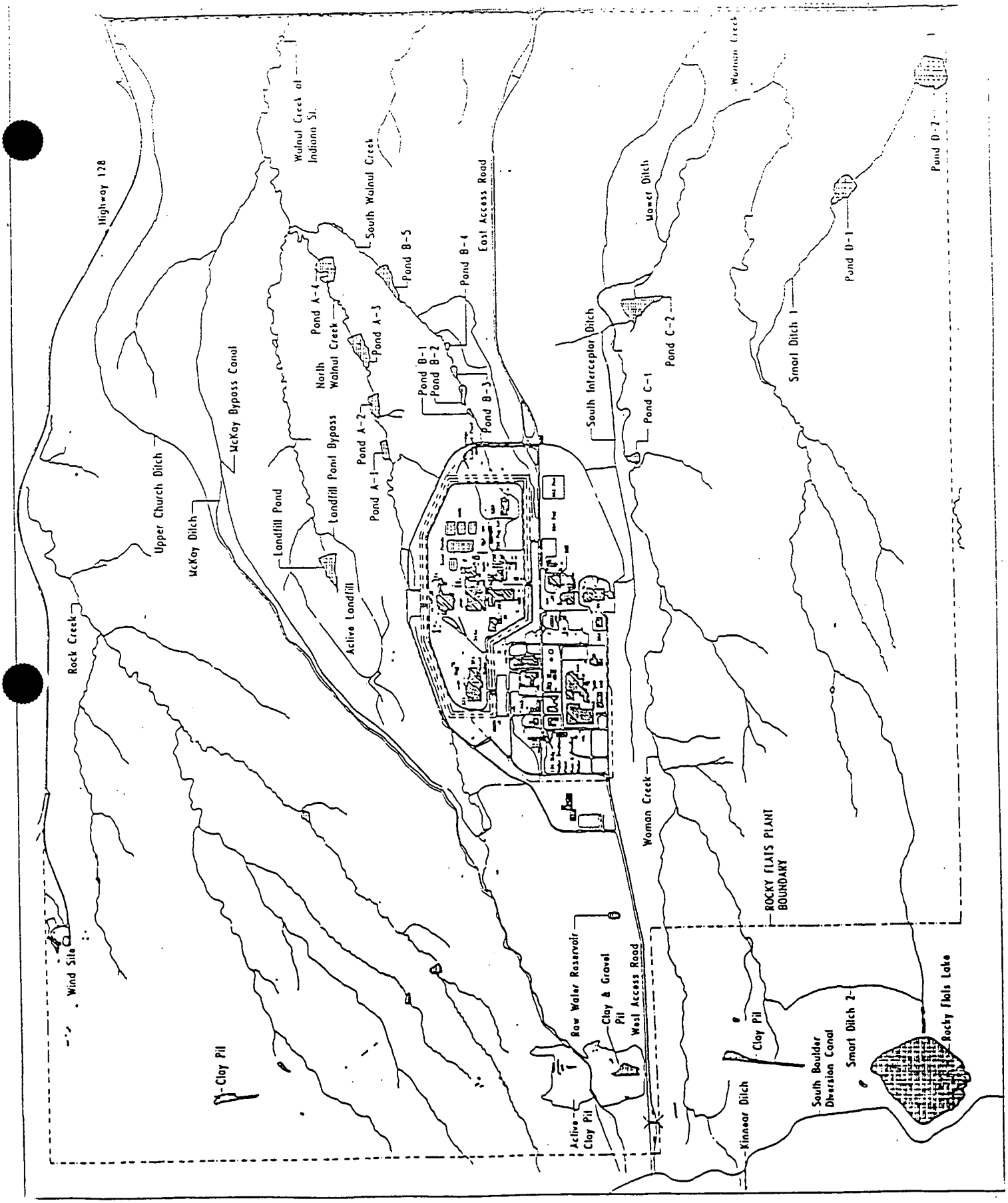
Figure 3.3-1 shows the location of drainages, streams, ponds, and reservoirs on and around the RFP. **Table 3.3-1** identifies systems within each operable unit that may support aquatic life on the RFP.

Drainages generally flow from west to east. Two notable drainages collect surface water from both the Buffer Zone and the Rocky Flats Plant manufacturing areas (EG&G 1990b):

- Walnut Creek includes two named branches (DOE 1992o):

  North Walnut Creek.This system drains the northern portion of the RFP manufacturing area and, along with unnamed tributaries, drains the northeastern RFP Buffer Zone including the Present Landfill area. The A-series ponds 1-4 (IHSS's 142.1 through 142.4) are located in the North Walnut Creek drainage. The Indiana Street-Walnut Creek Pond (IHSS 142.12) is located east of the confluence of North and South Walnut Creeks and west of Indiana Street.

  South Walnut Creek. This system drains eastern and central portions of the RFP manufacturing area and also receives effluent from the Sewage Treatment Plant. The B-series ponds (IHSS's 142.5—142.9) are located in this drainage (DOE 1991f). Terminal pond B-5 discharges to Terminal Pond A-4 which, after treatment, is discharged to the Indiana Street-Walnut Creek Pond and diverted around Great Western Reservoir.



EG&G ROCKY FLATS PLANT, INC.
ROCKY FLATS PLANT
GOLDEN, COLORADO

Figure 3.3-1

Surface Water Features

Source: EG&G 1991bb

TABLE 3.3-1
AQUATIC SYSTEMS RELATED TO OPERABLE UNITS

Operable Unit Number	Operable Unit Description	Aquatic IHSSs In This OU By Definition	Aquatic Systems (Non-IHSS) Pertaining To This OU	Aquatic Systems Affected By This OU
1	881 Hillside		South Interceptor Ditch (SID)	Pond C-2
2	903 Pad, Mound, East Trenches		South Walnut Creek	B-Series Ponds, SID, Pond C-2, Pond I-W
3	Off Site Releases	Great Western Reservoir (IHSS 200); Mower Reservoir (IHSS 202); Standley Lake (IHSS 201)		Downstream
4	Solar Evaporation Ponds	Ponds 207-A, 207-B North, 207-B Center, 207-B South, 207-C (All IHSS 101)		Walnut Creek; Great Western Reservoir. (No Direct Discharge to These)
5	Woman Creek	Pond C-1 (IHSS 142.10); Pond C-2 (IHSS 142.11)	Woman Creek SID	Standley Lake
6	Walnut Creek	Ponds A-1 Through A-4 (IHSSs 142.1--142.4), Pond I-W (142.12); Ponds B-1 Through B-5 (IHSSs 142.5--142.9)	Walnut Creek, North Walnut Creek, South Walnut Creek	(Historically) Great Western Reservoir (Currently Diverted)
7	Present Landfill		Landfill Pond (Pond 2)	Tributary to Walnut Creek

- Woman Creek system drains the southern, nonindustrialized portion of the RFP (DOE 1992n). Ponds C-1 and C-2 are located in this drainage. Woman Creek discharges into Standley Lake to the east. Discharges from Pond C-2 are pumped through an 8,000-ft pipeline into the Broomfield Diversion Ditch (EG&G 1990b).

The Buffer Zone areas contribute to two additional drainages. Rock Creek drains the northwestern corner of this site and flows northeast through the north Buffer Zone to its off-site confluence with Coal Creek. A small portion of the south Buffer Zone is in the Big Dry Creek drainage (Figure 3.5-3).

The D-series ponds (Figure 3.3-1) are in the southeastern Buffer Zone on Smart Ditch (Hurley and Hunt 1979). The lower pond, D-2, may be either dry or filled depending on how the irrigation water is diverted by the water rights owner (EG&G 1994i). The uppermost pond, D-1, was characterized for aquatic life and has a well-developed emergent plant community and aquatic regime.

Three offsite reservoirs which are east of and downstream from the RFP are included in OU3:

- Standley Lake. This is the largest reservoir and receives water from several sources but mainly from Clear Creek, through Farmers Highline Canal and Croke Ditch. Woman Creek is a minor water source for Standley Lake.

- Great Western Reservoir. Walnut Creek at one time drained into this reservoir but has now been diverted around it, via the Broomfield Diversion Ditch.

- Mower Reservoir. This small impoundment is located to one side of Woman Creek and upstream of Standley Lake, and receives water diverted from Woman Creek (EG&G 1994i).

In addition to the aquatic life in these water features, a planktonic community has developed in IHSS 101 (Ford 1992; DOE 1991p). IHSS 101 (Solar Evaporation Ponds) does not have a

surface discharge into South Walnut Creek and the ponds are currently being decommissioned. The Solar Evaporation Ponds are the subject of Sections 2.6, 3.2.5, and 3.5.5.

Other minor surface water features on the RFP (Figure 3.3-1) include:

- Raw Water Storage Reservoir
- Present Landfill Pond located in OU7
- Abandoned stock ponds, vernal ponds and seeps.

3.3.1.2 Water Quality

The presence, distribution and density of aquatic organisms is affected by water quality parameters (temperature, nutrient level, hardness, dissolved oxygen, etc.); habitat characteristics (substrate, flow, stream/pond depth, etc.); and biological factors (predator-prey interactions, competition, etc.) During his study of RFP phytoplankton populations, Kugrens (1989) specifically evaluated the water quality of sampled ponds regarding aquatic life. The evaluation was based on Biological Oxygen Demand (BOD) values, species numbers by month and species population numbers by month. His water quality categories are listed below:

- Good: Raw Water Storage Pond, Pond C-1 and Great Western Reservoir. Water quality characteristics are low nutrient levels, broad algal diversity, and low plankton densities.

- Eutrophic/Clean: Ponds B-5, C-2 and Indiana Street-Walnut Creek Pond. Water quality characteristics are high algal diversity, high algal growth, and species which are found in higher elevation lakes or cold, pristine waters.

- Enigmatic: A-series ponds. Water quality characteristics are high nitrate and other nutrient levels, clear water, and fluctuating productivity.

- Poor: Ponds B-1, B-2, B-3. Although B-1 did support algal growth, study results indicated the suppression or elimination of algal growth at periodic intervals, perhaps from RFP discharges. Water quality characteristic is widely fluctuating algal productivity.

- Toxic: Pond B-3. Water quality characteristic is suppressed algal growth possibly from toxic substances released through the Sewage Treatment Plant (STP).

It should be clear that these categories of water quality are not based on water quality parameters such as dissolved oxygen, pH, nutrient levels, hardness, etc., but on subjective evaluations based on the range of BOD values and the types and densities of species present.

The Baseline Biological Characterization report (DOE 1992r) discussed water quality in Rocky Flats watersheds. In 1991 the Woman Creek watershed had a pH range of 7.2 to 8.6, dissolved oxygen concentrations ranged from 5.0 mg/l to 13.2 mg/l, nitrate concentrations ranged from 0.5 mg/l to 4.2 mg/l, and orthophosphate concentrations ranged from 0.36 mg/l to 5.0 mg/l.

In 1991 the Walnut Creek watershed had a pH of 7.5 to 9.0 (in fall), dissolved oxygen concentration of 7.0 mg/l, nitrate concentration ranged from 0.6 mg/l to 5.2 mg/l and orthophosphate concentrations ranged from 0.12 mg/l to 0.85 mg/l. Lastly, in 1991, the Rock Creek watershed had a pH of 7.0 to 9.0, dissolved oxygen concentrations of 8.2 mg/l to 13.2 mg/l, nitrate concentrations of 0.5 mg/l to 1.5 mg/l and orthophosphate concentrations of 0.42 mg/l to 4.1 mg/l.

3.3.1.3 Sediments

The sediments of Great Western Reservoir and Standley Lake were studied to investigate the deposition of radionuclides. Estimates of sediment depth and areal extent were made but aquatic life was not reported (Rockwell 1984). Pond B-5 was selected to study pond sediments and their role in the dispersion of plutonium (Reese, et al. 1978). A brief description, dating from 1970, of the sediment in Great Western Reservoir and Standley Lake notes that a decomposing organic layer exists in both (DOE 1991w).

3.3.1.4 Phytoplankton Studies

From June 1988 to June 1989, monthly phytoplankton samples were collected and analyzed for Biological Oxygen Demand (BOD) (Kugrens 1988, 1989). Samples were collected from the following locations:

- A-Series Ponds.
- B-Series Ponds.
- Indiana Street-Walnut Creek Pond (I-W).
- Great Western Reservoir (GWR).
- Sewage Treatment Plant (STP).
- Raw Water Storage Pond (RWS).

Naturally occurring phytoplankton were collected and identified; abundant species were tested for their contribution to BOD. The total number of species identified for each sampling location ranged from nine species at the Sewage Treatment Plant (with and without chlorine treatment) to 57 species at Pond B-5. Fifty species or more were identified at the Raw Water Storage Pond, Indiana Street-Walnut Creek Pond and Pond B-5. All other locations supported 30 or more species except Pond B-3, in which 16 species were identified. The Great Western Reservoir supported 44 species.

These studies indicated that high BOD values in Pond B-3 did not result from algal blooms but from other organic accumulations (possibly high BOD effluent from the STP). It also appeared that Rocky Flats effluent discharged to the Great Western Reservoir (GWR) was not an inoculum for algal blooms observed in the reservoir; the GWR supports a dominant phytoplankton community that differs from those at RFP. Another finding was that phytoplankton populations in the ponds and GWR experienced fluctuations not attributed to temperature effects. Each pond developed a distinctive phytoplankton population indicating that physical conditions in the ponds are also distinctive.

A study was conducted of Ponds A-3 and A-4 to investigate potential toxicity as a factor influencing population numbers and diversity (EG&G 1991a). This study was prompted by Kugrens' (1989) tentative conclusions that suppression or cessation of algal productivity in Pond A-3 was caused by toxic releases from the RFP. Five areas were investigated in the study:

- Acute toxicity as evaluated with the Microtox System.
- Laboratory algal population growth in pond water supplemented with nutrients.
- Nutrient loading.
- Algal productivity measured as photosynthetic pigment levels.
- Water quality parameters.

The conclusion drawn from this study was that the two pond waters were nontoxic during the duration of the study. Independent biomonitoring investigations by another laboratory were also carried out during this study. This laboratory, using the Microtox System, Ceriodaphnia spp. and the fathead minnow (Pimephales promelas), showed that these pond waters were not acutely toxic to these species. Results of this study indicated that Ponds A-3 and A-4 are phosphorus-limited at intervals and thus support low populations of phytoplankton.

Paine (1980) (cited in Rockwell 1986) conducted a study of plutonium in the RFP freshwater systems. Zooplankton and phytoplankton were analyzed for plutonium concentrations; however, species involved in the analyses were not identified other than as planktonic species.

The Baseline Biological Characterization report (DOE 1992r) identified 115 species of phytoplankton; 80 were members of the chrysophyta group (mostly diatoms) and 10 were zooplankton, including Ceriodaphnia.

3.3.1.5 Biomonitoring Studies

Rocky Flats Plant has conducted whole effluent toxicity testing on surface waters from various locations within the RFP. T.H.E. Consultants (1989) conducted bioassay tests using Ceriodaphnia spp. and the fathead minnow (Pimephales promelas). Surface waters were collected from Ponds A-4, B-5 and C-2 (sampling locations SWA4COMP, SWB5COMP and SWC2COMP) in June, 1989. Five dilutions were used: 100 percent, 50 percent, 25 percent, 12.5 percent, and 6 percent. Ceriodaphnia were exposed to the five dilutions for 48 hours and the fathead minnows were exposed to the same dilutions for 96 hours. Four replicates were run for each control and test dilution. Survival ranged from 85 percent to 90 percent in all dilution tests. The 85 percent survival occurred in the 25 percent dilution tests. Results did not indicate acute toxicity to the two organisms from the surface waters tested during this period.

In the EG&G (1991a) study, toxicity of ponds A-3 and A-4 were tested by an independent laboratory using Ceriodaphnia and the fathead minnow. These results showed that the 100 percent dilution test passed the LC50 test for toxicity for these two organisms each month during the period they were tested. These results paralleled those of the 1989 study indicating no acute toxicity at ponds A-3 and A-4.

3.3.1.6 Macroinvertebrates

Paine's 1980 study indicated that crayfish (no species name given) concentrated plutonium in the exoskeleton. W-W Services (1976) reported that crayfish, amphipods, mayflies and caddisflies were found primarily in Pond B-4 and in Woman Creek.

The Baseline Biological Characterization report (DOE 1992r), identified 155 taxa of benthic macroinvertebrates, including 76 taxa of Diptera (flies), 16 taxa of Tricoptera (caddisflies), 16 taxa of Coleoptera (beetles), and 11 taxa of Ephemeroptera (mayflies).

3.3.1.7 Fish

The Baseline Biological Characterization report (DOE 1992r) identifies nine species of fish that were recorded at Rocky Flat:

- Stoneroller (Campostoma anomalum)
- Carp (Cyprinus carpio)
- Gold Fish (Carassius auratus)
- Fathead Minnow (Pimephales promelas)
- Golden Shiner (Notemigonus crysoleucas)
- Creek Chub (Semotilus atromaculatus)
- White Sucker (Catostomus commersoni)
- Green Sunfish (Lepomis cyanellus)
- Largemouth Bass (Micropterus salmoides)

The following fish are Species of Special Concern (SOC) and may occur in aquatic systems around the Rocky Flats Plant:

- Common Shiner (Notropis comutus) - a Colorado State SOC
- Plains Top Minnow (Fundulus sciadicus) - a Federal Category 2 species

These species have yet to be observed at RFP (DOE 1991t).

3.3.1.8 Periphyton

All of the ponds and streams support aquatic vegetation. Periphyton is aquatic vegetation attached to channel substrates or rooted vegetation and is an amorphous mass of algae, diatoms, some sediment, and detritus. The Baseline Biological Characterization report (DOE 1992r) identified 121 species of periphyton. The groups with the most species were Chrysophyta with 69 and Chlorophyta with 30.

Aquatic life data for specific OUs is sparse, based on the results of this literature review. For background, Table 3.3-1 shows aquatic systems most closely associated with various OUs. For additional information about vegetation refer to the sitewide vegetation studies cited in the Vegetation Section 3.2.

Aquatic resources do not occur, for the most part, within the industrial areas of RFP. Aquatic species are largely limited to runoff ditches. Site-specific information will be part of the Phase I RFI/RI Investigation process for each OU.

An ecological sampling plan is typically developed at the "Work Plan" stage. OUs 8, 9, 10, 12, 13, and 14 are being addressed within the Phase I RFI/RI Industrial Area Environmental Evaluation, which was in draft form at the time of this writing.

3.3.2 Operable Unit 1 - 881 Hillside

Nine species of fish were recorded at Rocky Flats during the Baseline Characterization Study (DOE 1992r). The following fish species were identified in Woman Creek near OU1: stoneroller, fathead minnow, golden shiner, creek chub, white sucker, green sunfish, and largemouth bass.

In addition, six amphibians were recorded at Rocky Flats, including the tiger salamander (Ambystoma tigrinum), boreal chorus frog (Pseudacris triseriatus) and the northern leopard frog (Rana pipiens). These species would be found in marshlands.

3.3.3 Operable Unit 2 - 903 Pad, Mound, East Trenches

There are no aquatic habitats within OU2 that are capable of developing a viable aquatic ecosystem. Although the OU2 area is bounded by South Walnut Creek on the north and the South Interceptor Ditch and Woman Creek on the south, no IHSSs intercept these waterways.

Refer to Section 3.3.2 for a description of fish species associated with Woman Creek. Fathead minnows were also found in South Walnut Creek and marshlands in Walnut Creek would also contain amphibians.

3.3.4 Operable Unit 3 - Off-Site Releases

Fish collected from Standley Lake (IHSS 201) by the Colorado Department of Health (CDH 1990a) in June 1989 include the following:

- Carp (Cyprinus carpio)
- Channel Catfish (Ictalurus punctatus)
- Green Sunfish (Lepomis cyanellus)
- Largemouth Bass (Micropterus salmoides)
- Smallmouth Bass (Micropterus dolomieui)

- Rainbow Trout (Salmo gairdneri)
- Walleye (Stizostedion vitreum)
- Western White Sucker (Catostomus commersoni)
- Yellow Perch (Perca flavescens)

These species were collected by gill net and electro-shocking.

In this study, four fish species (walleyes, channel catfish, smallmouth bass, and rainbow trout) were analyzed for selected metals, radioactive substances and priority organic pollutants. Radioactive materials were not detected. Low concentrations of cadmium, mercury, selenium, DDT, DDE, DDD, and malathion were detected in some or all species. The source of contamination was not determined. The contaminants may come from Clear Creek which contributes ninety-six percent of the flow to the lake. The results of a health risk assessment indicate that consumption of a reasonable quantity of fish from Standley Lake does not present an appreciable health risk to the public (CDH 1990a). The pesticides likely come from the agricultural areas surrounding Standley Lake (EG&G 1994i).

Habitat descriptions were not identified or described for either the fish species or the amphibians noted above.

3.3.5 Operable Unit 4 - Solar Evaporation Ponds

There is no habitat capable of sustaining an aquatic ecosystem in OU4. No permanent or intermittent streams are present and the solar ponds are being dewatered (DOE 1994a).

3.3.6 Operable Unit 5 - Woman Creek Priority Drainage

According to a recent pond management study, the water columns within the ponds meet or exceed current water quality standards (DOE 1993l). The existence of certain biotic receptors in these ponds is evidence of *de minimis* risk associated with potential contaminants in the ponds.

3.3.7 Operable Unit 6 - Walnut Creek Priority Drainage

According to a recent pond management study, the water columns within the ponds meet or exceed current water quality standards (DOE 1993l). The existence of certain biotic receptors in these ponds is evidence of *de minimis* risk associated with potential contaminants in the ponds. For example, a beaver and a small community of bass occupy Pond A-2 (EG&G 1994i).

Biota in the B Series ponds are affected by conditions that allow algal blooms to occur. These blooms occur in Ponds B-3, B-4, B-5, and A-4, especially during the summer months. Several factors contribute to the occurrence of this condition. Discharge from the Sewage Treatment Plant (STP) introduces a nutrient-rich mixture into the pond water. Nitrates and phosphates, common to most wastewater treatment plant discharge, enter the ponds. This mixture, with other existing conditions (stagnant water from required holding periods, volume manipulations, a relatively small receiving area, and warm temperatures) combine to create the algal blooms (DOE 1993l).

The STP discharges approximately 150,000 gallons per day, which is typical for a facility serving 7000 people. The STP discharge meets the required water quality standards. The impacts from the condition described would occur in most situations where a wastewater treatment plant discharged a large amount of effluent into a small, nonflowing receiving area. Nitrates and phosphates are common to most wastewater treatment plant discharge (DOE 1993l).

Relative to the condition described above, phosphorous is the limiting nutrient. State water quality standards have established a maximum (12.0 mg/l) and average (8.0 mg/l) phosphorous level for wastewater discharge. Recent sampling in RFP ponds showed a maximum phosphorous level of 3.3 mg/l and an average of 1.4 mg/l, both substantially below standards. Water quality standards for acid-base balance (pH) require that wastewater discharges have a pH between 6.0 and 9.0 (standard units). Recent sampling in RFP ponds indicates that the pH in the summer months has reached a maximum of 9.9 (DOE 1993l).

The impact to biota from this condition is that decaying algal blooms sap the dissolved oxygen from the water, making it unavailable to fish and other species. The biological succession process is inhibited and a natural sequence species diversity does not develop. A minimum of 5 percent dissolved oxygen is required to support most fish. During the decay of algal blooms, dissolved oxygen drops below the level necessary to support bass and green sunfish (DOE 1993l).

Therefore, the larger predator fish (e.g. bass and green sunfish) and the associated specie-mix are absent from affected ponds. The ponds do support a number of smaller fish species, such as minnows, that are capable of surviving occasional anoxic conditions. An indirect result of this condition is that species that feed on minnows (e.g. great blue herons, cormorants, raccoons) are more abundant, and the various birds and mammals that would normally feed on the larger fish species are absent or occur in limited numbers (DOE 1993l).

The pond system was not designed or intended to be operated as a natural system and its main function is not to support substantial biota. However, the incidence of algal blooms could

possibly be reduced in various ways without interfering with the function of the pond system. It would be most effective to address the lack of aeration in the ponds. If the water was flowing, natural aeration would occur. Although natural flow is not possible, installation of aeration fountains in affected ponds may be an option (DOE 1993l).

Further, any reduction in holding periods, so that water does not sit stagnant for an extended time during warm temperatures, would significantly contribute to lessening the impact of algal blooms. Also, the impact of these blooms would be lessened if the level of phosphorous in the STP discharge were reduced to 0.1 mg/l or eliminated by bypassing the pond system (DOE 1993l).

3.3.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

Investigation of aquatic resources in the Landfill Pond was not completed; therefore, that data could be included in the Baseline Biological Characterization (DOE 1992r). Current data will be interpreted and presented in the OU7 RFI/RI Report.

3.3.9 Operable Unit 8 - 700 Area

Aquatic resources do not occur, for the most part, within the Industrial Area of RFP. Aquatic species are largely limited to runoff ditches. Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

3.3.10 Operable Unit 9 - Original Process Waste Lines

Aquatic resources do not occur, for the most part, within the Industrial Area of RFP. Aquatic species are largely limited to runoff ditches. Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

3.3.11 Operable Unit 10 - Other Outside Closures

Aquatic resources do not occur, for the most part, within the Industrial Area of RFP. Aquatic species are largely limited to runoff ditches. Some aquatic species known to occur are crayfish, tiger salamanders, northern leopard frogs, some mollusks, and numerous aquatic insects. Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

3.3.12 Operable Unit 11 - West Spray Field

Low spots in OU11 often provide ponds of melt water in the Spring when boreal chorus frogs congregate to breed. Other aquatic species occur in diversion ditches on the northern boundary of OU11. These species include crayfish, tiger salamanders, northern leopard frogs, some mollusks, and numerous aquatic insects.

3.3.13 Operable Unit 12 - 400/800 Area

Aquatic resources do not occur, for the most part, within the Industrial Area of RFP. Aquatic species would be limited to runoff ditches. Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

3.3.14 Operable Unit 13 - 100 Area

Aquatic resources do not occur, for the most part, within the Industrial Area of RFP. Aquatic species are largely limited to runoff ditches. Some aquatic species known to occur are crayfish, tiger salamanders, northern leopard frogs, some mollusks, and numerous aquatic insects. Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

3.3.15 Operable Unit 14 - Radioactive Sites

Aquatic resources do not occur, for the most part, within the Industrial Area of RFP. Aquatic species are largely limited to runoff ditches. Some aquatic species known to occur are crayfish, tiger salamanders, northern leopard frogs, some mollusks, and numerous aquatic insects. Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

3.3.16 Operable Unit 15 - Inside Building Closures

The industrialized area is highly disturbed and provides little habitat for the establishment of a well-developed aquatic ecosystem. Further, all of the OU15 IHSSs are interior to buildings.

3.3.17 Operable Unit 16 - Low-Priority Sites

No site-specific information is available regarding aquatic ecosystems in OU16.

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3.4 TERRESTRIAL WILDLIFE

3.4.1 Sitewide Conditions

The wildlife at RFP is generally characteristic of prairie habitats. The *Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant, Final Report* (DOE 1992r) lists terrestrial animal species in five taxonomic groups: arthropods, amphibians, birds, mammals, and reptiles. Thirty-three bird species have been confirmed to nest on RFP, while another twenty-two species have been characterized as possible breeding species. Thirty-one mammal species were documented.

The most common large mammal is the mule deer (Odocoileus hemionus). Other mammals on RFP include the coyote (Canis latrans), red fox (Vulpes vulpes), striped skunk (Mephitis mephitis), long-tailed weasel (Mustela frenata), northern pocket gopher (Thomomys talpoides), white-tailed jackrabbit (Lepus townsendii), and the meadow vole (Microtus pennsylvanicus). Also recorded were six amphibians, eight reptiles, and 124 families of arthropods.

Rocky Flats has a current inventory of wildlife species that is regularly updated based on field investigations (EG&G 1994i).

3.4.1.1 Wildlife Habitat

The area in the immediate vicinity of RFP is primarily agricultural or undeveloped (DOE 1980). The natural environment and ecology of RFP in largely influenced by its proximity to the Front Range of the Rocky Mountains, and the elevation of approximately 6,000 feet (DOE 1980). The Rocky Flats Plant is situated in a region where plains grassland vegetation meets lower montane forest (DOE 1980). Prior to acquisition of the land by the government, much of the Rocky Flats area was used for cattle grazing (Hurley and Hunt 1977).

The present vegetation of the upper plains grassland has been characterized (Marr 1964) as consisting primarily of heavily grazed pastures (grazing ended over 20 years ago [EG&G 1994i]), composed of herbs and relatively unpalatable grasses (DOE 1980). The Baseline Biological Characterization report (DOE 1992r) identified three vegetation zones (mesic, xeric, and hydric) divided into 17 plant communities. These same 17 communities were grouped into five wildlife habitats (shrubland, grassland, disturbed areas, woodland, and marshland).

Since acquisition of the RFP property, vegetation recovery in disturbed plant communities has begun and continues as a slow process. Recovery and redevelopment of native plant communities has been significant (DOE 1992r, EG&G 1994i).

3.4.1.2 Contaminant Studies on Wildlife

Plutonium studies on wildlife have been conducted on arthropods (Bly and Whicker 1979), small mammals (Little 1980, Whicker 1977, Hunt 1977), nesting mourning doves (Whicker 1976, 1977), mule deer (Arthur 1977, Hiatt 1977, Hunt 1977), pocket gopher (Whicker 1977, Winsor and Whicker 1980), and snakes (Geigor and Winsor 1977). Studies concerning potential contamination of wildlife at RFP are being conducted as part of the various OU-specific Remedial Investigations (RIs); past studies were conducted by Colorado State University (CSU) Department of Radiology and Radiation Biology (Whicker, et al. 1990, 1991, Whicker and Ibrahim 1991, 1992).

Whicker (1993) concluded that small mammals residing in the most highly plutonium contaminated areas have low tissue concentrations of plutonium, and that concentrations in animal populations have decreased over time.

Biocides have been used in cooling-tower water treatment systems to prevent biological fouling. Biocides and herbicides have been used in weed and pest control on RFP. Plans for application of pesticides and herbicides are prepared in accordance with the Federal Working Group on Pest Management. Regulations concerning pesticide and herbicide application are published in 40 CFR Parts 150-189.

3.4.1.3 Threatened and Endangered Species

Several listed endangered or threatened terrestrial wildlife species potentially occur in or near RFP. These include bald eagle (Haliaeetus leucocephalus), peregrine falcon (Falco peregrinus), whooping crane (Grus americana), and black-footed ferret (Mustela nigripes) (DOE 1991x, USFWS 1990). Studies conducted in 1991 indicated that habitat potentially suitable for the endangered black-footed ferret and the peregrine falcon is present on the RFP (EG&G 1991e). The bald eagle was identified as occasionally using habitats associated with Standley Lake and Great Western Reservoir during winter (EG&G 1991e).

Bald Eagle

A pair of nesting bald eagles were observed in November 1991, November 1992 to March 1993, and October 1993 to March 1994 at Standley Lake (CBO 1994, EG&G 1994i). The eagles established a nest in a stand of trees, along the northwest portion of the lake, in the 1992-1993 time period. A new nest was begun in December 1993 approximately 300 meters east of the main nest. During behavioral studies in the 1993-1994 time period, the eagles were observed to prey primarily on prairie dogs and unknown mammals (93%) and fish (7%).

Approximately two-thirds of the observed prey was stolen from ferruginous hawks, golden eagles, and bald eagles. The Standley Lake home range (daytime) for the birds is approximately 4.7 km^2. This does not include the range defined by roosting behavior in Eldorado Canyon. (CBO 1994)

Current Rocky Flats monitoring programs have recorded casual use of the Plant by bald eagles, generally during the winter months. Hunting success has not been directly observed, but general hunting behavior has been observed. (EG&G 1994i)

Peregrine Falcon

Two subspecies of peregrine falcon could potentially occur at RFP. The arctic peregrine falcon (F. p. tundris) is listed as threatened and is a migrant through the area in spring and fall. The American peregrine falcon (F. p. anatum) nests in Colorado and is listed federally and by the State as endangered (DOE 1991x). The RFP may be used for hunting by the peregrine falcon. However, no habitat features important to these species are present (DOE 1991x). Two historic aeries, or nesting sites (one occupied in 1991) occur within a 10-mile radius of RFP (EG&G 1991e). Two individual peregrine falcons were observed at RFP in early fall 1991 (DOE 1991v).

Black-footed Ferret

The black-footed ferret is listed federally and by the State of Colorado as endangered (DOE 1991x). Black-footed ferrets require large prairie dog colonies or complexes of small prairie dog colonies as habitat. Based on recent surveys of the RFP area, 15 acres of prairie dog towns occur within the facility boundary (EG&G 1991e, DOE 1991t). The colonies are part of a complex totalling 753 acres, which would be of sufficient size to support black-footed ferret (DOE 1991x). No confirmed sightings of black-footed ferret have been reported for this area (EG&G 1991e).

Whooping Crane

The whooping crane is listed federally and by the State of Colorado as endangered. The whooping crane occurs in Colorado only during spring and fall migration. In 1985 and 1986, some whooping cranes were seen flying along the Front Range. Whooping cranes could

conceivably show up at RFP for a night roost if they were lost or blown off course, but there are no habitat features especially attractive to them (DOE 1991x).

3.4.1.4 Candidate Species

Several candidate species for federal listing may potentially occur at RFP. Most are Category 1 or 2 Candidate species, meaning that listing may be appropriate, but that further information is required to support listing as threatened or endangered. These species include the white-faced ibis (Pelgadis chichi), ferruginous hawk (Buteo regalis), mountain plover (Charadrius montanus), long-billed curlew (Numenius americanus), Preble's meadow jumping mouse (Zapus hudsonius preblei), swift fox (Vulpes velox), and Texas horned lizard (Phrynosoma cornutum) (DOE 1991x, EG&G 1991e, USFWS 1989).

Potential habitat for the western snowy plover (Charadrius alexandrinus nivosus) is not present on the RFP (EG&G 1991e). The USFWS has recently been petitioned to add the ferruginous hawk to the endangered species list, and a status review of the species is ongoing (USFWS 1991). Additionally, Swainson's hawk (Buteo Swansoni), a Federal Category 3C species, has attempted to nest on RFP. Category 3 comprises taxa that were once being considered for listing as endangered or threatened but are not currently receiving such consideration. Subcategory "3C" comprises taxa considered more abundant than previously thought (USFWS 1989).

Ferruginous Hawk

Ferruginous hawks, a Federal Category 2 species, have been observed adjacent to the industrial area in winter, spring, and early summer 1990-1991 (DOE 1992r). Ferruginous hawks have been observed at RFP (DOE 1980, DOE 1991v, DOE 1992r) and probably occur throughout the year, but no nests are known within RFP (DOE 1991x), although a juvenile was observed near the 881 HIllside in late spring-early summer 1991 (DOE 1992r). Most observations of this species have been in association with black-tailed prairie dog colonies southeast and northeast of RFP.

Prebles Jumping Mouse

The Preble's Jumping Mouse was captured (19 total) during trapping sessions conducted in 1992 and 1993. The apparent preferred habitat for this species are riparian areas that contain willows. Captures were made in both Woman Creek and Rock Creek drainages (ESCO 1993a, EG&G 1994i).

3.4.1.5 Regulatory Compliance

Any federal action, including remedial actions, may require consultation with the USFWS and the Colorado Division of Wildlife (CDOW) concerning potential impacts to biological resources protected under the Endangered Species Act (ESA) [50 CFR 17.11], the Eagle Protection Act (50 CFR 22, 16 U.S.C. 688-688c), the Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. 661-66c), and the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712).

Rocky Flats has implemented one procedure to identify and protect threatened and endangered species and their habitats and has developed a draft procedure to protect migratory birds. The two procedures are 1-DO6-EPR-END.03, "Identification and Protection of Threatened, Endangered, and Special-Concern Species" and 1-G98-EPR-END.04, "Migratory Bird Evaluation and Protection" (Draft). A Rocky Flats Bald Eagle Protection Plan has also been prepared.

3.4.2 Operable Unit 1 - 881 Hillside

Threatened and Endangered Species

Information on threatened and endangered species was taken from the *Final Habitat Survey Report* (DOE 1991v). This source should also be consulted in conjunction with the current RFP botanical database, which is managed by the Ecology and NEPA Division.

Bald eagles, a Federal and State endangered species, have been observed soaring over most of the Rocky Flats Plant (EG&G 1994i). No bald eagles have been observed near the 881 Hillside French Drain (881-HFD).

Peregrine falcons, a federal and state endangered species, were observed at RFP in early fall 1991. However no peregrine falcons have been observed near the 881-HFD.

Ferruginous hawks, a Federal Category 2 species, have been observed adjacent to the 881-HFD in winter, spring, and early summer. A juvenile male was resident in the vicinity of 881 Hillside for a six-week period in late spring and early summer 1991; nesting was not documented. This individual was observed hunting primarily in the riparian zone of Woman Creek and Hillside, directly below the 881-HFD.

In early June 1991, a Swainson's hawk, a Federal Category 3C species, attempted to nest in a cottonwood tree 1,500 m southeast of 881-HFD. This nest was abandoned in early July for unknown reasons. The nesting pair was not observed hunting in the vicinity of 881-HFD.

The 2.8 hectares included in OU1 should not be considered critical threatened and/or endangered species habitat.

Migratory Birds

A number of species of passerine birds were observed nesting on the 881-Hillside, located directly below the 881-HFD. These include the western kingbird (Tyrannus tyrannus), vesper sparrow (Pooecetes gramineus), western meadowlark (Sturnella neglecta), mallard (Anas platyrhynchos), American kestrel (Falco sparverius), and American robin (Turdus migratorius). A more complete list of nesting and foraging passerine is presented in the DOE report (1991v), and population density values will be calculated as part of the OU1 RI. A common nighthawk (Chordeiles minor) nest was recorded on the 881 Hillside during the 1993 field season (EG&G 1994i).

Potential Impacts

The Fish and Wildlife Coordination Act, Migratory Bird Treaty Act Compliance report for 881 Hillside area stated that, "based on data currently available, the Department of Energy, Rocky Flats Office (DOE, RFO) has determined that any excavation for the 881-HFD could have adverse impacts on migratory bird species." At the time of the report in 1991, the DOE, RFO proposed to:

- Develop a plan that will minimize the possibility of increasing sediment loads in Woman Creek.
- Develop a plan that will minimize impacts to the vegetation on either side of the 881-HFD.
- Negotiate a mitigation strategy with the USFWS to offset the loss of this habitat.

These actions have since been initiated or completed.

3.4.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

Investigations into plutonium deposition and distribution patterns in a terrestrial ecosystem immediately downwind of the 903 Pad area began in 1972 (Little 1977). In 1989, CSU Department of Radiological Health Sciences began a reinvestigation of the area including studies of small mammals (Whicker, et al. 1990, 1991, Whicker and Ibrahim 1991, 1992) and mule deer (Whicker, et al. 1990).

Studies of small mammals have been comprised of analyses of plutonium isotope concentrations in various small mammal tissues, including the pelt, liver, bone, and lungs (Whicker, et al. 1992).

Mule deer studies have included radio-telemetry to assess habitat use patterns and aerial surveys to estimate deer numbers (Whicker, et al. 1990). Future deer studies may include radionuclide uptake and population dynamics (Whicker, et al. 1990). Section 3.4.1 further discusses general site conditions applicable to OU2.

3.4.4 Operable Unit 3 - Off-Site Releases

Terrestrial Wildlife

Wildlife offsite in Operable Unit 3 are primarily species typical of the open grasslands along the Colorado Front Range. Agriculture and the steadily encroaching residential development around Standley Lake, however, has influenced the presence of some species.

Mule deer reside in the area, primarily in the RFP buffer zone and open grassland north and west of Standley Lake. An estimated 160-180 deer may be permanent residents in the RFP area (DOE 1992r). Several species of smaller game and nongame animals are abundant in the area including white-tailed jackrabbit, coyote, and red fox.

The Jefferson County and City of Broomfield open space areas have been removed from agricultural use, and prairie dog towns are very common in these and other open areas around Standley Lake. Many species of rodents, such as deer mice (Peromyscus maniculatus), northern pocket gopher, and 13-lined ground squirrels (Spermophilus tridecemlineatus) are common. Muskrat (Ondatra zibethicus) and raccoons (Procyon lotor) may occur in the creek bottoms and around the impoundments (DOE 1992bb).

Numerous bird species are in the area, including the small songbirds of open grasslands, larger predators, and species common to the wetland and lakeshore habitats. In the grassland areas, western meadowlarks, horned larks (Eremophila alpestris), black-billed magpies (Pica pica), mourning doves (Zenaida macroura), and white-crowned sparrows (Zonotrichia leucophrys) are abundant.

Common predators include great-horned owls (Bubo virginianus) (in the riparian zones), red-tailed hawk (Buteo jamaicensis), and American kestrels. Woodpeckers, flickers, nuthatches, and chickadees are also common in riparian habitats. In the wetland and meadow habitats, red-winged blackbirds (Agelaius phoeniceus) and killdeer (Charadrius vociferus) are common.

Several species of waterfowl and shorebirds use Standley Lake on a seasonal basis, while common snipe, mallards, and coots are resident species (DOE 1992bb).

The common snakes in the project area include bull snakes (Pituophis melanoleucus sayi) and prairie rattlesnakes (Crotalus viridis viridis) in the grassland areas, and the western plains garter snake (Thamnophis radix haydeni) in the creek and lake shoreline areas. The eastern short-horned lizard (Phrynsoma douglassi) has been reported in the area. Various species of frogs and toads are found in wetland and meadow habitats around Standley Lake (DOE 1992bb).

Threatened and Endangered Species

Two species of birds that are listed as threatened or endangered by the USFWS and the CDOW could be found seasonally in the project area. These include the bald eagle (Haliaeetus leucocephalus) and two subspecies of peregrine falcon (Falco peregrinus anatum and F.p. tundris).

Three species of birds that are seasonal migrants to the Colorado Front Range are listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) and CDOW (the whooping crane, least tern [Sterna antillarum], and piping plover [Charadrius melodus]). These birds prefer open water, large marshes, and river habitats in the Platte River Valley. These species would only be rare visitors to OU3 (DOE 1992bb).

The bald eagle is a winter visitor in the area, frequenting open water in large reservoirs, areas around prairie dog colonies, and certain sections of the South Platte River. A pair of bald eagles have established a nest near Standley Lake, east of OU3. Additional information regarding these eagles can be found in Section 3.4.1.

The peregrine falcon may occasionally occur in the unit as it hunts for prey in the open grasslands. There are no known suitable nesting habitats in OU3 for these falcons (DOE 1992bb).

The numerous prairie dog towns in the general area north and east of Standley Lake potentially provide habitat and prey for the endangered black-footed ferret. However, wild ferret populations in Colorado are believed to be extinct. None have been reported in Colorado in recent history, and the USFWS is considering discontinuing required ferret surveys in the Denver metropolitan area (DOE 1992bb).

No suitable habitat for the Ute Ladies'-tresses (Spiranthes diluvialis) is found in OU3.

3.4.5 Operable Unit 4 - Solar Evaporation Ponds

The OU4 Solar Evaporation Pond IM/IRA/EA (DOE 1994a) discusses the wildlife found in OU4.

> Live trapping conducted in the solar pond area suggests that animal species in OU4 include the white-footed deer mouse (Peromyscus maniculatus) and western harvest mouse (Reithrodontomys megalotis), although populations were lower than expected. Field observations suggest that the feral cat is the predominant predator in OU4, which may account for the relatively unsuccessful live mammal trapping. Other potential predators include the great horned owl (Bubo viginianus), American kestrel (Falco sparverius), and red fox (Vulpes vulpes). Common birds that were found to be nesting within the solar pond area were the English sparrow (Passer domesticus), house finch (Carpodacus mexicanus), American robin (Turdus migratorius), Say's phoebe (Sayornis saya), barn swallow (Hirundo rustica), European starling (Sturnus vulgaris), ducks (Anus sp), and killdeer (Charadrius vociferus). Other wildlife species were also identified as feeding within the OU4 area, but are not nesting.

3.4.6 Operable Unit 5 - Woman Creek Priority Drainage

Threatened and Endangered Species

Information pertaining to threatened and endangered species is taken from the *Endangered Species Act Compliance for the South Interceptor Ditch* (DOE 1991t). Bald eagles, a federal and state endangered species, have been observed soaring over the developed area and flying over the many portions of the buffer zone. No bald eagles have been observed near the South Interceptor Ditch (SID) at OU5.

Peregrine falcons, a federal and state endangered species, were observed at RFP in early fall 1991. However, no peregrine falcons have been observed in the proximity of the SID.

Ferruginous hawks, a Federal Category 2 species, have been observed adjacent to the SID in winter, spring and early summer. A juvenile male was resident in the vicinity of the ditch for a six-week period in late spring and early summer 1991; nesting was not documented. This individual was observed hunting primarily in the riparian zone of Woman Creek and Hillside, directly above the SID.

Swainson's hawk, a Federal Category 3C species, had attempted to nest in early June 1991 in a cottonwood tree 1000 m southeast of SID. This nest was abandoned in early July for unknown reasons. The nesting pair was not observed hunting in the vicinity of SID.

Regarding Preble's meadow jumping mouse, one individual of this species (a Federal Category 2 species), was confirmed as having been captured and released in a rehabilitation habitat type transect (MR02A) about 20 m south of the SID during the spring sampling season. Attempts to trap jumping mice (Zapus spp.) in the vicinity of the SID during the fall were unsuccessful.

Migratory Birds

A number of species of passerine birds were observed nesting on the 881-HFD, located directly above the central reach of the SID. These include Western Kingbird, Mourning Dove, Vesper Sparrow, Western Meadowlark, Mallard, Killdeer, Yellow Warbler, Red-winged Blackbird, American Kestrel, and American Robin (DOE 1991u). A more complete list of nesting and foraging passerine is presented in the DOE report (1991v), and population density values will be calculated as part of the OU1 Environmental Evaluation in the RI report (DOE 1991v).

Potential Impacts

The Final Biological Survey Report for the SID states that "based on the information currently available, DOE, RFO has determined that any excavation or rebuilding of the SID could have adverse direct, indirect or cumulative impacts on SOC [species of special concern] in or near the project. Before proceeding with any excavation activities, DOE, RFO proposes to more fully characterize the role (if any) that this habitat plays in the maintenance of Zapus [Preble's jumping mouse] populations" (DOE 1991t).

3.4.7 Operable Unit 6 - Walnut Creek Priority Drainage

A study by Paine (1980) was initiated to determine the behavior of plutonium in freshwater aquatic environs at RFP. Samples of biotic and abiotic components were collected, including small mammals in close proximity to detention ponds.

The Baseline Biological Characterization report (DOE 1992r) identifies wildlife associated with the A- and B-Series ponds. According to a recent pond management study, a few federally-designated and state-designated species are of interest regarding current pond management operations (DOE 1992 pond).

Endangered Species

The bald eagle and the peregrine falcon are both federally-designated as "endangered." The bald eagle, according to the *Baseline Biological Characterization of the Terrestrial and Aquatic*

Habitats at the Rocky Flats Plant (DOE 1992r), may occur as an irregular visitor during the winter, or as a migrant during spring and fall migration. This species has not been observed to roost or actively pursue prey on RFP, although individuals have been observed perching on utility poles in the northern portion of the Buffer Zone.

Three individual adult bald eagles, and as many as six immature bald eagles, were observed in 1993; two were building a nest near Standley Lake, located offsite and southeast of RFP. None were, however, observed to nest or roost at this nest. The area will continue to be monitored to determine if the eagles return to and use this nest in the future. (EG&G 1994i)

Smaller mammals are the key item in the eagle diet. Often these eagles opt to steal the kill of the ferruginous hawk, rather than kill their own. They will also eat larger fish species, such as the bass; although it has not been demonstrated that bald eagles feed from the RFP pond system. Given the limited fish population of the pond system, pond management operations are expected to have minimal effect on bald eagles. Further, there is currently no bald eagle "critical habitat" associated with the ponds.

The baseline study (DOE 1992r) indicates that the peregrine falcon occurs as a migrant at RFP, although none have been observed during the breeding season. The U.S. Fish & Wildlife Service developed a Peregrine Falcon Recovery Plan that discourages land-use practices and/or development that may adversely affect the character of habitat or prey base within approximately a 10-mile radius of a falcon's nesting cliff. The existence of two potential nesting cliffs within this radius has been documented (DOE 1992r); therefore, all of RFP may be considered potential foraging habitat.

Primarily these falcons will prey on waterfowl, which in turn, would potentially feed on fish species that might be found in the ponds. Falcons, as a rule, do not eat fish. Mammals are not typical prey. Impacts to falcons from pond management would, as with the eagle, be expected to be minimal due to the limited prey base and the diminutive area of the pond system.

Threatened Species

In compliance with the Endangered Species Act, RFP is in the second year of a three-year protocol to determine the presence of Ute ladies'-tresses, a rare plant species, within the plantsite. Individuals of this species were not observed throughout the first year of this survey. Riparian areas were identified in a 1992 Report of Findings (DOE 1992y) as being potential suitable habitat for this plant. Pond operations do not pose a barrier to distribution of this plant on RFP.

Candidate Species

The ferruginous hawk is listed as a Category 2 species on the federally-designated "Candidate" list. This species of hawk is a common winter resident and/or seasonal migrant; although it has been documented by the baseline study (DOE 1992r) as being observed adjacent to the industrial area of RFP during the winter, spring, and early summer of 1990 and 1991.

Most observations of the ferruginous hawk have been near prairie dog colonies southeast and northeast of RFP. Nesting activities were not observed; however, a juvenile male resided in this vicinity for a 6-week period in late spring and early summer of 1991. It was noted to be hunting primarily in the riparian zone of Woman Creek and along the 881 Hillside area, which is directly south of the Industrial Area.

This hawk nests in large trees or on cliffs. As noted previously, the bald eagle is known to seek out the habitat of the ferruginous hawk and steal its kill. Consequently, bald eagles may be indirectly affected by impacts on this hawk. However, the primary prey of the ferruginous hawk is terrestrial and not common near the ponds.

The loggerhead shrike is also a Category 2 predatory bird species that is commonly observed on RFP during seasonal migration periods. This shrike principally eats insects, reptiles, and small mammals, none of which are affected by pond management operations.

Preble's meadow jumping mouse, a Category 2 mammal, has been observed in the bottomland of Woman and Walnut Creeks, but would not be affected by the water level fluctuations or other operations associated with pond management.

Colorado Species of Special Concern

Three bird species that might be observed at RFP during migration periods have been classified by the Colorado Department of Wildlife as "Species of Special Concern" within the state. They are Barrow's goldeneye, the greater sandhill crane, and the American white pelican. The Barrow's goldeneye is a possible winter visitor on the ponds, although it does not nest there. It feeds on aquatic plants. The greater sandhill crane may occur during seasonal migration and would expected to be associated with terrestrial areas. They feed on larger fish species. Neither of these species have been observed at RFP. White pelicans have been recorded on some Rocky Flats on pond areas (Ponds C-2 and D-1 in 1993) during seasonal migration (EG&G 1994i).

The Forktip Threeawn, a member of the Grass Family, is limited to a single site on RFP, according to the baseline study (DOE 1992r). It prefers sandstone outcrops and bare, disturbed areas and has been observed in a disturbed site along the railroad tracks southwest of the industrial area. The baseline study indicates that this plant is rare in Colorado (although common in surrounding states) and, thus, it carries the C0-3 designation. The greatest risk to this plant on RFP is from competing plant species of advanced successional stages. This plant does not occur near the ponds and is not affected by the pond management operations.

3.4.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

The wildlife present at OU7, Present Landfill, is generally characteristic of prairie habitats. The Environmental Assessment (EA) for the New Sanitary Landfill (DOE 1991x) lists the major wildlife species found at OU7. The EA evaluated two alternative new landfill sites. Any of the species listed may occur at both alternative new landfill sites, each of which consists of mid-grass upland prairie. The raptor species may use the area for foraging, but it is very unlikely that raptors would use the sites for nesting because they are treeless, have no cliffs or bluffs, and have no prairie dog towns (habitat for burrowing owls).

A partial inventory of wildlife species, including aquatic biota, is presented in the previous EIS (DOE 1980). Eighteen species of mammals, 38 species of birds, and 7 species of reptiles and amphibians were recorded. Additional wildlife species potentially occurring at RFP are presented in various reports (Meaney 1990, Kingery and Dillon 1987, Hammerson and Langlois 1981, EG&G 1991e, and DOE 1990a).

Threatened, Endangered, and Candidate Species

Peregrine Falcon. Two subspecies of peregrine falcon could potentially occur at OU-7. The arctic peregrine falcon is listed as threatened and is a migrant through the area in spring and fall. The American peregrine falcon nests in Colorado and is listed federally and by the State of Colorado as endangered. The Rocky Flats area and the alternative new landfill sites may be used for hunting by peregrine falcon. However, no habitat features important to these species are present (DOE 1991x).

Black-Footed Ferret. The black-footed ferret is listed federally and by the State of Colorado as endangered. The black-footed ferret depends primarily on prairie dog towns for its source of food and shelter. Confirmed sightings of the ferret are difficult, because it is a nocturnal predator and spends 90 percent of its life underground. Based on a recent survey of the RFP area (EG&G 1991e), only 15 acres of prairie dog towns occur within the facility boundary.

The colony is part of a complex totalling 753 acres, which would be of sufficient size to support a black-footed ferret. No prairie dog towns or potential black-footed ferret habitat are present at or near the Present Landfill site, based on the EG&G (1991e) study and on a field reconnaissance made during the preparation of the EA for the new sanitary landfill (DOE 1991x).

Bald Eagle. The bald eagle is listed federally and by the State of Colorado as endangered. Most bald eagles in Colorado are winter residents at rivers and large lakes from early November to mid-April. Bald eagles are visitors to the RFP area, generally during the winter months. Little suitable habitat occurs at RFP other than perching locations (DOE 1990a). Although ponds, isolated groves, and individual cottonwood trees occur at the plant site, no open water or trees are present at or adjacent to the Present Landfill location, and occurrence of bald eagles at these sites is highly unlikely.

Whooping Crane. The whooping crane is listed federally and by the State of Colorado as endangered. The whooping crane occurs in Colorado only during spring and fall migration. In 1985 and 1986, some whooping cranes were seen flying along the Front Range. Whooping cranes could conceivably night roost at RFP if they were lost or blown off course during a storm, but no habitat features of OU7 are especially attractive to them. Whooping cranes typically congregate in large marshes and wetlands, in broad open river bottoms, and in prairies.

Candidate Species

Several candidate species for federal listing may potentially occur at OU7. All are Category 2 Candidate species, meaning that listing may be appropriate, but that further information is required to support listing as threatened or endangered. These species are listed in Section 3.4.1. Ferruginous hawks have been observed at RFP (DOE 1980) and probably occur in the area throughout the year, but no nests are known within RFP. The other species have not been recorded at RFP, and the alternative new landfill sites do not appear to provide suitable habitat for them. Further information regarding candidate species at RFP may be found in other reports (Meaney 1990; Kingery and Dillon 1987; Hammerson 1986).

3.4.9 Operable Unit 8 - 700 Area

General information about terrestrial wildlife at, and adjacent to, OU8 can be obtained from sitewide biota studies, such as:

- Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant (DOE 1992r);

- Wetlands Assessment, Rocky Flats Plant Site (EG&G 1991f);
- Threatened and Endangered Species Evaluation, Rocky Flats Plant Site (EG&G 1991e).

These sources should be consulted in conjunction with the current RFP biota database, which is managed by the Ecology and NEPA Division. Biota within the Industrial Area of RFP exists in communities highly modified from comparable communities in the buffer zone.

Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

The objective of the IA Environmental Evaluation is to characterize and address effects of contaminants on ecological resources present in the IA, and then to determine if there is a risk of contamination of offsite biota by target taxa migrating from RFP. The evaluation will consist of habitat and biota surveys and ecotoxicological investigations.

3.4.10 Operable Unit 9 - Original Process Waste Lines

General information about terrestrial wildlife at, and adjacent to, OU9 can be obtained from sitewide biota studies, such as:

- Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant (DOE 1992r);
- Wetlands Assessment, Rocky Flats Plant Site (EG&G 1991f);
- Threatened and Endangered Species Evaluation, Rocky Flats Plant Site (EG&G 1991e).

These sources should be consulted in conjunction with the current RFP biota database, which is managed by the Ecology and NEPA Division. Biota within the Industrial Area of RFP exists in communities highly modified from comparable communities in the buffer zone.

Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

The objective of the IA Environmental Evaluation is to characterize and address effects of contaminants on ecological resources present in the IA, and then to determine if there is a risk of contamination of offsite biota by target taxa migrating from RFP. The evaluation will consist of habitat and biota surveys and ecotoxicological investigations.

3.4.11 Operable Unit 10 - Other Outside Closures

General information about terrestrial wildlife at, and adjacent to, OU10 can be obtained from sitewide biota studies, such as:

- Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant (DOE 1992r);
- Wetlands Assessment, Rocky Flats Plant Site (EG&G 1991f);
- Threatened and Endangered Species Evaluation, Rocky Flats Plant Site (EG&G 1991e).

These sources should be consulted in conjunction with the current RFP biota database, which is managed by the Ecology and NEPA Division. Biota within the Industrial Area of RFP exists in communities highly modified from comparable communities in the buffer zone.

Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

The objective of the IA Environmental Evaluation is to characterize and address effects of contaminants on ecological resources present in the IA, and then to determine if there is a risk of contamination of offsite biota by target taxa migrating from RFP. The evaluation will consist of habitat and biota surveys and ecotoxicological investigations.

3.4.12 Operable Unit 11 - West Spray Field

A phase I RI will be conducted at OU11. Wildlife, vegetation, habitat types, and wetland/riparian areas will be identified as part of this investigation. Wetland and terrestrial vegetation and small mammals will be sampled as part of quantitative surveys and analyzed for radionuclides (DOE 1992a). However, general information on wildlife and threatened and endangered species occurring at RFP briefly described in 3.4.1 may be applicable. The biota

has been identified and is recorded in the Rocky Flats inventory of wildlife species that is regularly updated based on field investigations (EG&G 1994i).

3.4.13 Operable Unit 12 - 400/800 Area

Biota within the industrial area of RFP exists in communities highly modified from comparable communities in the buffer zone. While the general information on terrestrial wildlife presented in Section 3.4.1 is applicable at the OU level, site-specific information is part of the Phase I RFI/RI Investigation process for each OU.

An ecological sampling plan is developed at the Phase I RFI/RI Work Plan Stage. OUs 8, 9, 10, 12, 13, and 14 are being address within the *Phase I RFI/RI: Industrial Area Environmental Evaluation,* which was in draft form at the time of this writing.

The objective of the Environmental Evaluation is to characterize and address effects of contaminants on ecological resources present, and then to determine if there is a risk of contamination of offsite biota by target taxa migrating from RFP. The evaluation will consist of habitat and biota surveys and ecotoxicological investigation.

General information about terrestrial wildlife at, and adjacent to, OU12 can be obtained from sitewide biota studies, such as:

- Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant (DOE 1992r);
- Wetlands Assessment, Rocky Flats Plant Site (EG&G 1991f);
- Threatened and Endangered Species Evaluation, Rocky Flats Plant Site (EG&G 1991e).

These sources should be consulted in conjunction with the current RFP biota database, which is managed by the Ecology and NEPA Division. Biota within the Industrial Area of RFP exists in communities highly modified from comparable communities in the buffer zone.

Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

The objective of the IA Environmental Evaluation is to characterize and address effects of contaminants on ecological resources present in the IA, and then to determine if there is a risk of contamination of offsite biota by target taxa migrating from RFP. The evaluation will consist of habitat and biota surveys and ecotoxicological investigations.

3.4.14 Operable Unit 13 - 100 Area

General information about terrestrial wildlife at, and adjacent to, OU13 can be obtained from sitewide biota studies, such as:

- Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant (DOE 1992r);
- Wetlands Assessment, Rocky Flats Plant Site (EG&G 1991f);
- Threatened and Endangered Species Evaluation, Rocky Flats Plant Site (EG&G 1991e).

These sources should be consulted in conjunction with the current RFP biota database, which is managed by the Ecology and NEPA Division. Biota within the Industrial Area of RFP exists in communities highly modified from comparable communities in the buffer zone.

Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

The objective of the IA Environmental Evaluation is to characterize and address effects of contaminants on ecological resources present in the IA, and then to determine if there is a risk of contamination of offsite biota by target taxa migrating from RFP. The evaluation will consist of habitat and biota surveys and ecotoxicological investigations.

OU13 is located in a highly industrialized area offering little habitat for wildlife population. Further, lack of habitat discourages larger species such as mule deer and coyotes from entering the area. Occasionally smaller mammals such as mice, raccoons, cottontail rabbits, and birds such as house finches, house sparrows, rock doves, and barn swallows, will be found among the buildings. (EG&G 1994i)

3.4.15 Operable Unit 14 - Radioactive Sites

General information about terrestrial wildlife at, and adjacent to, OU14 can be obtained from sitewide biota studies, such as:

- Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant (DOE 1992r);
- Wetlands Assessment, Rocky Flats Plant Site (EG&G 1991f);
- Threatened and Endangered Species Evaluation, Rocky Flats Plant Site (EG&G 1991e).

These sources should be consulted in conjunction with the current RFP biota database, which is managed by the Ecology and NEPA Division. Biota within the Industrial Area of RFP exists in communities highly modified from comparable communities in the buffer zone.

Operable Unit-specific information is typically part of the Phase I RFI/RI investigation process for each OU and an ecological sampling plan is developed at the Phase I RFI/RI Work Plan stage. Operable Units 8, 9, 10, 12, 13, and 14 are being addressed within the *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993k), which was in draft form at the time of this writing.

The objective of the IA Environmental Evaluation is to characterize and address effects of contaminants on ecological resources present in the IA, and then to determine if there is a risk of contamination of offsite biota by target taxa migrating from RFP. The evaluation will consist of habitat and biota surveys and ecotoxicological investigations.

The fence enclosing the industrialized area limits the access of larger mammals such as mule deer and coyotes. These species do enter the IA, but avoid areas that are not vegetated. Small animals such as rodents, raccoons, and cottontails can be found along with birds such as house finches, house sparrows, cliff swallows, barn swallows, rock doves, and European Starlings. (EG&G 1994i)

3.4.16 Operable Unit 15 - Inside Building Closures

The fence enclosing the industrialized area limits the access of larger mammals such as mule deer and coyotes to the area. These species do enter the IA, but avoid unvegetated areas. Small animals such as rodents, raccoons, and cottontails can be found along with birds such as house finches, house sparrows, European Starlings, rock doves, and swallows (EG&G 1994i)

The OU15 IHSSs are located within the buildings, so no wildlife, except perhaps for an occasional rodent should be found in these IHSSs.

3.4.17 Operable Unit 16 - Low-Priority Sites

Larger wildlife species (e.g., mule deer and coyotes) generally reside outside the industrialized area because of barriers such as fences, human activities, and lack of suitable habitat. Because IHSS 195 lies outside the industrialized area, larger species may be sighted near or within the IHSS. Smaller wildlife species such as cottontails, raccoons, rodents, and birds such as house finches, house sparrows, European starlings, rock doves, and swallows may be sighted within the IHSS's interior to the industrialized area (EG&G 1994i)

Biotic communities within the IA are typical of those found within industrial complexes. The disturbance and destruction of native vegetation allows eurasian species to invade. These more vigorous, opportunistic, coarse species provide a different type of habitat, extremely depauperate as compared to natural conditions. Bird and animal species that can survive in such a setting are often nonnative species, or the most opportunistic and adaptable of the native species.

Biota within the industrial area of RFP exist in communities highly modified from comparable communities in the buffer zone. While the general information on terrestrial wildlife presented in Section 3.4.1 is applicable at the OU level, site-specific information is part of the Phase I RFI/RI Investigation process for each OU.

* * *

3.5 SURFACE WATER

3.5.1 Sitewide Conditions

The drainage system for the undeveloped portion of the plant consists of both natural and man-made channels. Runoff from upstream of the Industrial Area (IA) of the plant is routed around the IA via the McKay Bypass. The drainage system for the IA consists of swales, ditches, culverts, and four long storm sewers.

Plant site runoff is routed through swales and ditches in the undeveloped portion of RFP or to storm sewers that discharge to the creeks in the IA. All runoff is stored in the RFP detention ponds for sampling and treatment, as needed, prior to discharge. Surface water runoff from the IA is thereby effectively isolated from runoff from the undeveloped portion of RFP (DOE 1993l).

This section presents a sitewide description of the various surface water features found on and around RFP. The information on surface water management was obtained from the Draft Final Surface Water Management Plan (SWMP) (DOE 1991bb). The descriptions of surface water features were obtained from the RFI/RI Work Plan for OU3 (DOE 1992l), the Rocky Flats Land Management Plan (Hurley and Hunt 1979), the Phase I RFI/RI Work Plan for the Woman Creek Priority Drainage (DOE 1992n) and the Phase I RFI/RI Work Plan for the Walnut Creek Priority Drainage (DOE 1992o).

Details concerning the distribution of contaminants were obtained from the sitewide Treatability Studies Plan (TSP) (DOE 1991cc). This section summarizes OU history, and environmental and contaminant considerations. It also contains an overview of surface water management.

3.5.1.1 Surface Water Management

The Draft Final Surface Water Management Plan (SWMP) (DOE 1991bb) provides an overview of the data and activities related to surface water at RFP. The SWMP describes how surface water is presently controlled, treated and managed on the site, and discusses proposed future improvements.

As explained in the SWMP, surface water is presently managed in different ways, depending on its source. Wastewater from plutonium processing operations and other industrial processes is treated at its own treatment plant, which is isolated from other sources and does not discharge. Nonindustrial wastewater is treated at the sanitary wastewater treatment plant, which discharges to Walnut Creek. All treated wastewater, along with stormwater runoff and

limited groundwater, discharges to receiving streams and is stored in a series of ponds (described below) prior to discharge to Segment 4 of Big Dry Creek. Pond releases are made only upon the assurance that all numeric standards for Segment 4 of Big Cry Creek will be met and after consultation with the Colorado Department of Health (CDH).

These ponds have sufficient capacity to store the 100-year flood volume from contributing drainage areas without discharge and are used for spill control, water treatment, flow measurement, water quality sampling and detention of site waters prior to downstream release. Since 1989, all Rocky Flats pond discharges have been diverted around Great Western Reservoir and Standley Lake through pipelines and diversion ditches (DOE 1991bb). Implementation of future planned improvements, described in the SWMP, will further increase the level of flood protection and reduce spill-related risks.

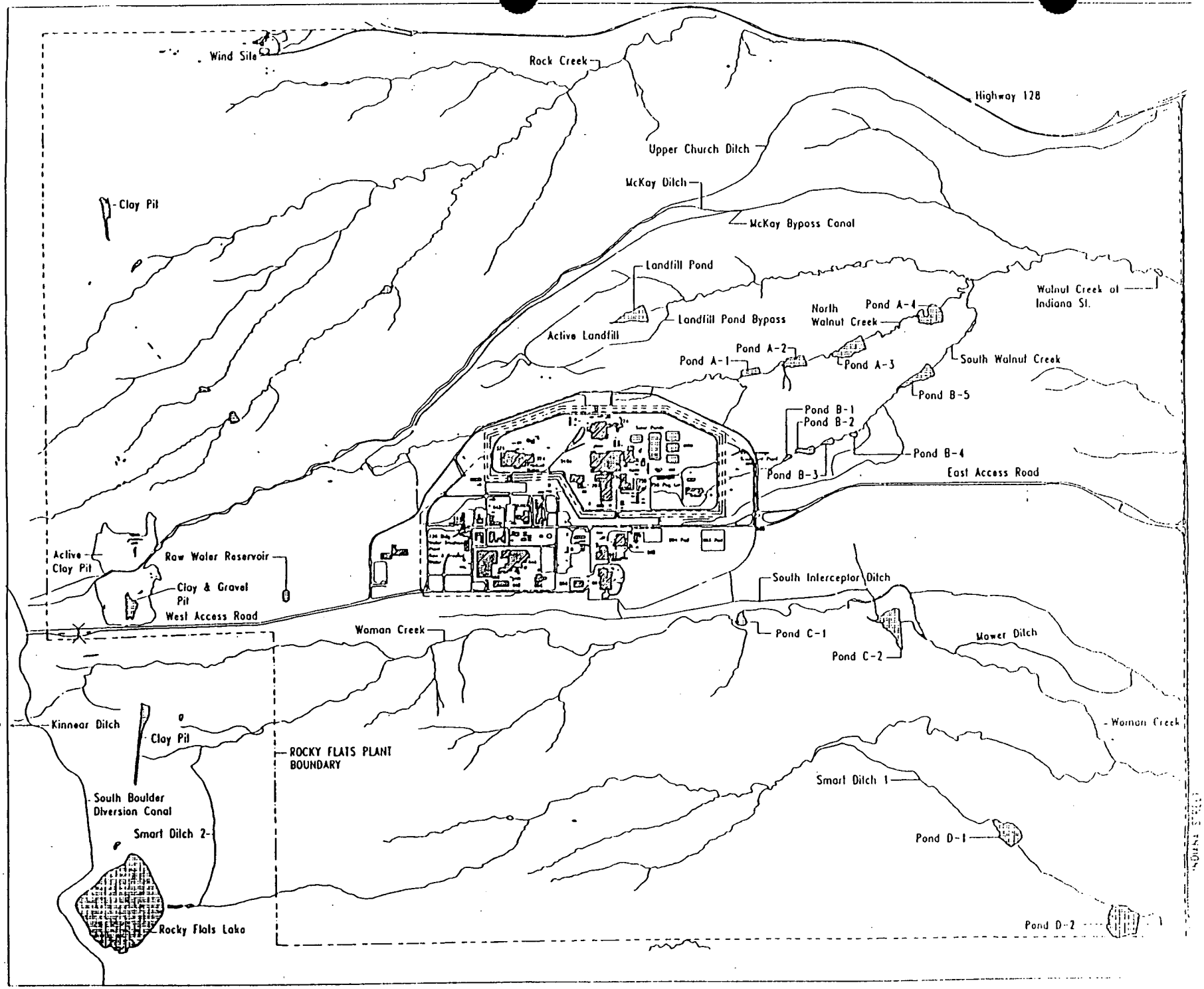
Surface water quality is routinely monitored at over 100 locations for radionuclides, organics, metals and other substances to meet specific regulatory requirements, assist with operations, and provide needed information on water quality. Wastewater, stormwater, streamflow and sediment data are analyzed. In addition, meteorologic and hydrologic measurements are taken at various locations on the RFP site (Rehmann, et al. 1991).

Treated and untreated pond waters comply with standards for Big Dry Creek Segment 4 for most constituents most of the time. The most frequent exception is gross beta in Pond C-2. However, the upper 95-percent confidence limit for gross beta (total) in Pond C-2 (untreated) is 7.8 pCi/l. This is less than the drinking water standard of 50 pCi/l for the State of Colorado. Occasional exceedances in treated water of other radionuclides have also occurred, but both the average concentration and upper 95-percent confidence limits are well below the standards for all radionuclides (Rehmann, et al. 1991).

Section 2.0, Site History and Nature of Contamination, and specifically Section 2.1.4, describes previous investigations leading to the designation of the IHSSs and OUs at RFP. Section 2.2 provides general discussion of the OUs, and subsequent sections describe the nature and extent of contamination in each of the OUs. The discussions in those sections include the chemicals involved, media affected, and extent of contamination. Specific surface water discussions will reference the information given in Section 2.0.

3.5.1.2 Environmental Setting and Characteristics

Surface water features of RFP include creeks, ditches, ponds, lakes and reservoirs, existing both onsite and offsite (**Figure 3.5-1**) (DOE 1992l).



EG&G ROCKY FLATS PLANT, INC.
ROCKY FLATS PLANT
GOLDEN, COLORADO

Figure 3.5-1

Surface Water Features

3.5.1.2.1 Drainage Basins

Rocky Flats is located within four drainage basins, as shown in **Figure 3.5-2**. These basins include: Woman Creek, Walnut Creek, Rock Creek, and a small basin associated with an unnamed tributary to Big Dry Creek. The Big Dry Creek and Great Western Reservoir basins lie on the periphery of the RFP boundaries.

The drainage system for the undeveloped portion of RFP consists of both natural and manmade channels. Runoff from upstream of the developed portion of the RFP is routed around the developed portion of RFP via the Walnut Creek Diversion Canal. The drainage system for the developed portion of the RFP consists of swales, ditches, culverts, and storm sewers. RFP site runoff is routed through swales and ditches and either to creeks in the undeveloped portion or to storm sewers in the interior of the RFP site that discharge to the creeks on the undeveloped portion of the site.

Most of the land surrounding RFP is presently undeveloped. However, the City of Arvada has annexed considerable land around RFP site for planned future development. RFP surface water activities do not directly affect the Rock Creek and Big Dry Creek tributary basins; therefore, only the Walnut and Woman Creek drainage basins are addressed below.

The Walnut Creek drainage basin consists of North Walnut Creek and South Walnut Creek. The North Walnut Creek system drains the northern portion of the RFP manufacturing area and, along with unnamed tributaries, drains the northeastern RFP Buffer Zone including the landfills. The A-series Ponds 1-4 (IHSSs 142.1 through 142.4) are located in the North Walnut Creek drainage. The Indiana Street-Walnut Creek Pond (IHSS 142.12) is located east of the confluence of North and South Walnut Creeks and west of Indiana Street (DOE 1992o).

The South Walnut Creek system drains eastern and central portions of the RFP manufacturing area and also receives effluent from the Sewage Treatment Plant. The B-Series Ponds 1-5 (IHSSs 142.5 through 14.9) are located in this drainage. Terminal pond B-5 discharges to Terminal Pond A-4 which, after treatment and/or agency approval, is discharged to the Indiana Street-Walnut Creek Pond and diverted around Great Western Reservoir. A more detailed description of the A-Series and B-Series Pond operations is presented in Section 3.5.7.

The Woman Creek system drains the southern nonindustrialized portion of RFP and contains Pond C-1. Woman Creek discharges into Standley Lake to the east. Pond C-2, which does not discharge into Woman Creek, collects water from the South Interceptor Ditch. Discharges from Pond C-2 are pumped through an 8,000-ft pipeline into the Broomfield Diversion Ditch, or potentially the other terminal ponds (B-5 or A-4) (DOE 1992n). A more detailed description of the C-Series Pond operations is presented in Section 3.5.6.

3.5.1.2.2 Creeks

As shown in Figure 3.5-1, three intermittent creeks exist on the RFP site: Walnut, Woman, and Rock Creeks. Walnut and Woman Creeks are tributaries to Great Western Reservoir and Standley Lake, respectively, and ultimately tributary to Big Dry Creek. Rock Creek flows to Coal Creek, which is a tributary of Boulder Creek.

Rock Creek, in the north and northwest area of the RFP Buffer Zone, is physically separated from RFP site facilities and has been maintained in an undisturbed condition since the RFP boundaries were established in 1952. Results of analytical testing indicate that no contamination from the RFP occurs in Rock Creek. North and South Walnut Creeks receive runoff from the RFP site. South Walnut Creek also receives treated effluent from the Sanitary Sewage Treatment Plant (STP). Woman Creek is located to the south of the RFP core.

3.5.1.2.3 Ditches

Seven water-conveyance ditches exist on or near Rocky Flats property. These include the South Boulder Diversion Canal, Upper Church Ditch, McKay Ditch, Kinnear Ditch, Smart Ditch 1, Smart Ditch 2 (Figure 3.5-1), and Mower Ditch (Figure 3.5-2). Details concerning use and conveyance in these ditches is provided in the SWMP (DOE 1991bb).

3.5.1.2.4 Ponds

Eleven detention ponds have been built along these creeks for spill control and surface water management. The A- and B-Series ponds are located in North and South Walnut Creek (see Section 3.5.7); the two C-Series ponds are located in Woman Creek on the south side of the plant (see Section 3.5.6).

In addition to the eleven detention ponds, the D-series of ponds are in the southeastern Buffer Zone on Smart Ditch (Hurley and Hunt 1979). The lower pond, D-2, is dry, except during thunderstorms and the uppermost pond, D-1, was characterized for aquatic life and has a well-developed emergent plant community and aquatic regime.

A number of contaminant sources may impact the ponds (Rehmann, et al. 1991). These include wind-dispersed soils containing low levels of radionuclides from source areas, past fires in productions buildings, and runoff. The runoff may contain contaminants from uncharacterized areas on the plant site upstream of the ponds.

In terms of aquatic life, minnows have been observed in several of the ponds. Sunfish have been observed in one of the ponds on Woman Creek and large-mouth bass have been seen in the ponds on Walnut Creek. All of the ponds contain aquatic vegetation. Sections 3.3.1.2 and 3.3.2 describe aquatic life/water quality investigations.

Five solar ponds are located in the northeast section of the RFP Industrial Area. They are not part of the surface water management system. Once used for evaporating process wastewater, the solar ponds are currently being decommissioned as part of the RFP Environmental Restoration effort.

The Present Landfill pond is in the northern buffer zone downstream of the RFP Present Landfill (Figure 3.5-1). The pond is designed to contain runoff and leachate from the landfill and is not a part of the surface water management system.

3.5.1.2.5 Wetlands

Figure 3.5-3 shows the location of wetlands on RFP. Wetlands occur along portions of the drainages on the site, around the perimeters of ponds and at numerous seep areas. Many of these latter wetlands occur on relatively steep slopes and are well stabilized. Wetland vegetation includes cattails, willows, cottonwoods and some grasses and forbs.

3.5.1.2.6 Lakes and Reservoirs

Great Western Reservoir, Standley Lake, Rocky Flats Lake and Mower Reservoir are the lakes and reservoirs on or around the RFP property (DOE 1992l). Great Western Reservoir is located on Walnut Creek to the east of the Rocky Flats eastern boundary on Walnut Creek (Figure 3.5-1). Great Western Reservoir has been classified High Quality 2 by the Colorado Water Quality Control Commission (WQCC), and use includes water supply.

Water from Rocky Flats is currently routed around Great Western Reservoir in the Great Western Diversion Ditch. Standley Lake is southeast of RFP on Woman Creek (Figure 3.5-1). Standley Lake is a designated water supply, and is classified by the WQCC as High Quality 2. No RFP surface water is currently routed to Standley Lake.

Rocky Flats Lake is upstream of RFP, outside the southwest corner of the buffer zone (Figure 3.5-1). This lake is not affected by RFP. Mower Reservoir, directly south of Great Western Reservoir (Figure 3.5-1) is used for irrigation. Woman Creek waters fill the reservoir.

3.5.1.2.7 Incidental Water

Incidental water is that which accumulated, for example, in ground depressions made during construction activities on RFP property outside the drainage system. The most common source for incidental waters is natural precipitation. Seeps may also be a source (DOE 1992l). Incidental waters are considered potentially contaminated until they have been sampled for radioactive content and the analytical results reviewed. If contamination is detected in the water, or if the water must be removed before the analytical test results are available, it is sent to process water treatment rather than to the STP.

3.5.1.3 Analytes Present

Both the sitewide TSP (DOE 1991cc) and the Annual Treatability Studies Report (DOE 1994c) present analyte concentrations for combined OUs 1 through 16 and the South Interceptor Ditch (SID). The SID was installed to intercept seepage and runoff from the OU1 area. Specific or historic data within given OUs were available, at the time of preparation of the TSP, only for those areas (DOE 1994c).

Maximum values (DOE 1994c) of inorganic analyte concentrations in surface water exceeded potential ARARs for ammonia, chloride, cyanide, fluoride, nitrate (as N), nitrate + nitrite, sulfate, and sulfide. Values for pH both higher and lower than the potential ARAR values of 8.5 for a high pH and 6.5 for a low pH were recorded.

Total dissolved solids (TDS) at a maximum concentration of 47,000 mg/l exceeded the potential ARAR of 250 mg/l. Metals exceeding potential ARARs in surface water included aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, and zinc.

Volatile compounds exceeding the potential ARARs in surface water included 1,1-dichloroethene, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, 1,2-dichloroethene (total), 1,2-dichloropropane, 1,3-dichloropropene, benzene, carbon tetrachloride, chloroform, methylene chloride, tetrachloroethene, trichloroethene, and vinyl chloride.

Semivolatiles exceeding potential ARARs in surface water included aldrin, alpha-chlordane, atrazine, beta-BHC, bis(2-ethylhexyl)phthalate, ethyl parathion, naphthalene, N-nitro sodiphenylamine, phenol, and simazine.

Polychlorinated biphenyls (PCB) compound Aroclor -1254, detected at a maximum value of 12 mg/l, exceeded the potential ARAR of 1.0 mg/l. Gross alpha and beta activity exceeded potential ARARs.

Radionuclides exceeding the potential ARARs in surface water included americium 241, plutonium 239+240, radium 226, radium 228, strontium 90, tritium, and total uranium.

Tables D-19 to D-46 of the Background Geochemical Characterization Report (DOE 1993e), list summary statistics (minimum, maximum, and mean) for naturally occurring constituents in surface waters, seeps and springs, surface water sediments, and sediments for seeps/springs. The analyte suites include:

- total and dissolved metals (streams and seeps/springs),
- total and dissolved radionuclides (streams and seeps/springs),
- water-quality parameters (streams and seeps/springs),
- volatile organic compounds (streams and seeps/springs),
- semi-volatile organic compounds (streams and seeps/springs),
- pesticides (streams and seeps/springs),
- herbicides (streams),
- metals (stream sediments and seeps/springs sediments),
- radionuclides (stream sediments and seeps/springs sediments),
- water-quality parameters (stream sediments and seeps/springs sediments),
- volatile organic compounds (stream sediments and seeps/springs sediments),
- semi-volatile organic compounds (stream sediments and seeps/springs sediments),
- and pesticides (seeps/springs sediments).

Following are some examples of mean concentrations with standard deviations in brackets:

- The concentrations of four metals (both dissolved and total) exceeded 1,000 µg/l in streams: calcium = 23,622 [11,475] µg/l (dissolved) and 23,601 [11,100] µg/l (total); magnesium = 4,736 [2,174] µg/l (dissolved) and 4,902 [2,108] µg/l (total); potassium = 1,427 [927] µg/l (dissolved) and 1,670 [1,072] µg/l (total); and sodium = 16,603 [7,508] µg/l (dissolved) and 16,060 [7,621] µg/l (total). These metals are major nutrient species.

- The concentrations of five radionuclides in streams: americium-241 = 0.07 [0.13] pCi/l (dissolved) and 0.00 [0.01] pCi/l (total); gross beta = 4.69 [6.78] pCi/l (dissolved) and 4.55 [5.52] pCi/l (total); gross alpha = 0.69 [1.12] pCi/l

(dissolved) and 1.51 [2.24] pCi/l (total); plutonium-239/240 = 0.12 [0.20] pCi/l (dissolved) and 0.00 [0.01] pCi/l (total), and uranium-233/234 = 0.36 [0.36] pCi/l (dissolved) and 0.49 [0.55] pCi/l (total).

- The concentration of one volatile organic compound exceeded 5.0 µg/l in streams: acetone = 7.28 [5.16] µg/l. [Acetone is recognized as a common laboratory contaminant. Consequently, this may not be indicative of true background (EG&G 1994h).]

- The concentrations of five metals (both dissolved and total) exceeded 1,000 µg/l in seeps/springs: calcium = 50,222 [34,498] µg/l (dissolved) and 94,330 [128,636] µg/l (total); iron = 1,927 [4,083] µg/l (dissolved) and 175,075 [518,672] µg/l (total); magnesium = 7,002 [5,198] µg/l (dissolved) and 10,371 [7,644] µg/l (total); potassium = 1,390 [1,641] µg/l (dissolved) and 3,386 [3,070] µg/l (total); and sodium = 12,297 [5,586] µg/l (dissolved) and 12,006 [5,017] µg/l (total). These metals are major nutrient species.

- The concentrations of five radionuclides in seeps/springs: americium-241 = 0.13 [0.28] pCi/l (dissolved) and 0.01 [0.02] pCi/l (total); gross beta = 5.94 [10.09] pCi/l (dissolved) and 2.15 [1.50] pCi/l (total); gross alpha = 2.78 [5.21] pCi/l (dissolved) and 42.52 [89.77] pCi/l (total); plutonium-239/240 = 0.10 [0.16] pCi/l (dissolved) and 0.08 [0.21] pCi/l (total), and uranium-233/234 = 0.91 [0.73] pCi/l (dissolved) and 0.64 [1.29] pCi/l (total).

- The concentration of one volatile organic compound exceeded 5.0 µg/l in seeps/springs: acetone = 6.67 [6.38] µg/l. [Acetone is recognized as a common laboratory contaminant. Consequently, this may not be indicative of true background (EG&G 1994h).]

- The concentrations of four metals exceeded 1,000 mg/kg in stream sediments: aluminum = 5,888 [4,913] mg/kg; calcium = 3,555 [4,720] mg/kg; iron = 8,853 [6,263] mg/kg; and magnesium = 1,404 [1,253] mg/kg. These metals are contained in major rock-forming minerals.

- The concentrations of five radionuclides in stream sediments: americium-241 = 0.07 [0.19] pCi/g; gross beta = 35.35 [9.98] pCi/g; gross alpha = 22.98 [20.46] pCi/g; plutonium-239/240 = 0.17 [0.59] pCi/g; and uranium-233/234 = 1.68 [1.15] pCi/g.

- The concentrations of three volatile organic compounds exceeded 5.0 [0.59] µg/kg in stream sediments: 2-butanone = 13.04 [28.75] µg/kg; acetone = 50.50 [107.09] µg/kg; and methylene chloride = 9.81 [10.62] µg/kg. [Methylene chloride is recognized as a common laboratory contaminant. Consequently, this may not be indicative of true background (EG&G 1994h).]

- The concentrations of six metals exceeded 1,000 mg/kg in seeps/spring sediments: aluminum = 10,354 [5,011] mg/kg; calcium = 19,408 [16,060] mg/kg; iron = 20,764 [22,674] mg/kg; magnesium = 2,249 [1,153] mg/kg; potassium = 1,051 [617] mg/kg; and silicon = 1,699 [2,117] mg/kg. These metals are contained in major rock-forming minerals.

- The concentrations of five radionuclides in seeps/spring sediments: americium-241 = 0.05 [0.15] pCi/g; gross beta = 23.73 [5.08] pCi/g; gross alpha = 19.71 [14.00] pCi/g; plutonium-239/240 = 0.21 [0.59] pCi/g; and uranium-233/234 = 0.82 [0.38] pCi/g.

- The concentrations of five volatile organic compounds that exceeded 5.0 µg/kg in seeps/spring sediments: 2-butanone = 70.14 [105.49] µg/kg; acetone = 317.20 [353.08] µg/kg; methylene chloride = 40.00 [72.55] µg/kg; trichloroethene = 9.22 [6.18] µg/kg; and toluene = 24.80 [34.87] µg/kg.

3.5.1.4 Concentration of Analyzed Constituents

Concentrations of analyzed constituents in surface water are described above. Section 2.0 of this report lists constituents present in surface water in each of the OUs.

3.5.1.5 Constituent Dispersion and Movement

Section 2.0 of this report discusses the presence or absence of chemical, metal, and/or radionuclide constituents in surface water in each of the OUs. Sections 3.5.2 through 3.5.15 address constituent characterization in surface water in each of the OUs.

3.5.1.6 Specific Operable Units (OUs)

The following sections detail surface water features and impacts in each of the 16 OUs. The locations of these OUs and the Individual Hazardous Substance Sites (IHSSs) in each OU were presented in Section 2.0 of this ERTSD (Figures 2.3-1 through 2.18-1).

3.5.2 Operable Unit 1 - 881 Hillside

Surface water runoff affected by spills in OU1 and groundwater seepage containing contaminants present in soils and groundwater have contaminated surface water in the South Interceptor Ditch while having a minimal impact of Woman Creek. As described in Section 2.3.3 of this report, tetrachlorethene and trichloroethane are the principal volatile organic compounds that have been detected in surface water samples in the area.

Numerous metals (aluminum, beryllium, cadmium, copper, mercury, lead, strontium, zinc, chromium, selenium, and vanadium) and other inorganic compounds were occasionally detected above background. Gross alpha, gross beta, uranium, and plutonium exceeded background in many of the surface water samples. The South Interceptor Ditch (SID) intercepts seepage and runoff from the 881 Hillside area.

3.5.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

South Walnut Creek originates near Building 991 and flows into the B-series ponds, comprised of Ponds B-1 through B-5. Pond B-5 water is transferred to Pond A-4 for eventual discharge. Water from South Walnut Creek, Walnut Creek, and an unnamed tributary combines downstream of Pond B-5 and flows offsite to be diverted around the Great Western Reservoir.

Woman Creek headwaters begin in the Rocky Flats Alluvium on the south side of the plant. The creek flows into Pond C-1, is diverted around Pond C-2, and eventually flows offsite to Standley Lake. The South Interceptor Ditch (SID) collects stormwater runoff and surface seepage and then flows into Pond C-2. Water from C-2 is transferred to the Broomfield Diversion Ditch (possibly to Ponds A-4 or B-5 in an emergency) for diversion around Great Western Reservoir.

Seeps in the OU2 area contain a contaminant composition that is similar to groundwater in OU2. Organic contaminants include PCE, TCE, CCl_4, and their degradation products. Radionuclides recorded are plutonium and americium.

Comparisons between OU2 surface and ground water found that plutonium and americium activity in groundwater is generally lower than in surface water and that these radionuclides appear to largely reside on particles that are retained on a 0.45μ filter used for either groundwater or surface water.

3.5.4 Operable Unit 3 - Off-Site Releases

Operable Unit 3 is unique among RFP Plant OUs in that it is located outside the RFP boundaries. Sections 2.5.2 and 2.5.3 of this report describe the location, size, IHSS's, history and past uses, nature of contamination, and extent of contamination in this OU.

The Federal Facility Compliance Agreement (FFCA) requires, and the final RFI/RI Work Plan for OU3 (DOE 1992l) presents, site characterization plans for surface water and other media in OU3. The site characterization information contained in the RFI/RI Work Plan includes descriptions of the site physical characteristics, histories and previous investigations, available information concerning the nature and extent of contamination, and conceptual models for each of the four IHSS's.

Great Western Reservoir is fed primarily by Clear Creek via Lower Church Ditch. Walnut Creek (formed by the north and south branches) is diverted via the Broomfield Diversion Ditch around the reservoir to prevent the introduction of the RFP water into the reservoir. Downstream of the reservoir, Walnut Creek water enters the Big Dry Creek.

Standley Lake was built in 1909 and 1919 and is owned by the Farmers Reservoir and Irrigation Company of Brighton, Colorado. Its volume is approximately 43,000 acre-feet. Two-thirds of the water is used to service Westminster, Northglenn and Thornton. The remaining water is used for agricultural purposes. Approximately 96% of the water is received from Clear Creek via an irrigation ditch. Woman Creek also flows into Standley lake. Mower Reservoir is privately owned and is fed by water from Woman Creek that is diverted via Mower Ditch. The reservoir is primarily used for cattle and irrigation. Discharge from the reservoir flows into Standley Lake.

Sediment studies in Great Western Reservoir found that plutonium concentrations over the entire reservoir exceeded the baseline concentration of <0.1 pCi/g. In 1993 sediment cores found discrete layers of plutonium at depths of 7.5 inches and 17 inches; the concentration was near 5.0 pCi/g. Standley Lake contains sediment having plutonium concentrations exceeding the baseline concentration. A maximum concentration in 1984 of 0.61 pCi/g was detected at 6.3 to 7.1 inches. Surface sediment has a concentration of 0.55 pCi/g. Sediment samples taken from Mower Reservoir in 1970 found an average concentration of 0.14 pCi/g which slightly exceeds the baseline.

Water and sediment sampling has been completed for OU3 drainages and the three reservoirs (EG&G 1994k). Water parameters evaluated include plutonium, americium, uranium, gross alpha, and beta, target analyte list (TAL) cations/anions, dissolved oxygen, pH, and specific

conductance. Sediment parameters evaluated would include plutonium, americium, uranium, target compound list volatiles; in Mower Reservoir, TAL metals, TOC, bulk density, and grain size would be investigated.

3.5.5 Operable Unit 4 - Solar Evaporation Ponds

Runoff from the north portion of OU4 area is collected in Ponds A-1, A-2, and A-3. South Walnut Creek collects water from the southern portion of OU4 which is eventually conveyed to the B-series Ponds. Seeps are located on the hillside north of the solar ponds. Water from these seeps appears to either evaporate or transpire (DOE 1994a).

It was determined that water collected by the interceptor trench, which will be routed to the modular tanks and subsequently evaporated, will not have a net effect on the flows within the South Platte River drainage (DOE 1992m).

3.5.6 Operable Unit 5 - Woman Creek Priority Drainage

According to the OU5 Work Plan, the natural drainage of Woman Creek has been somewhat modified within OU5 by the construction of Ponds C-1 (1955) and C-2 (1979) and the South Interceptor Ditch (1980) (DOE 1992n).

Woman Creek begins west of the RFP property boundary, flows through the southern Buffer Zone, and eventually drains into Standley Lake. Woman Creek flows through Pond C-1 and is, then, diverted around Pond C-2 by way of the Woman Creek Bypass Canal. Pond C-1 is an onchannel detention pond, used to measure flows in Woman Creek, while Pond C-2 is an off-channel detention pond used for sampling, flood control, and treatment, as necessary (DOE 1993l).

Surface water runoff from the southern portion of the IA is collected in the South Interceptor Ditch (SID) and conveyed to Pond C-2. Water is impounded in Pond C-2 and held for water quality analysis. Discharge occurs only after laboratory analysis shows that state water quality standards have been met and after obtaining concurrence from CDH and NPDES Permit bypass approval from EPA. Water is discharged from Pond C-2 by pump pipeline to the Broomfield Diversion Ditch. The Broomfield Diversion Ditch bypasses Great Western Reservoir and discharges to Walnut Creek, then to Big Dry Creek downstream of Standley Lake (DOE 1993l).

A pipeline was constructed in 1992 to transfer water from Pond C-2 to Ponds B-5 and A-4 for emergency treatment, if necessary. The pipeline has yet to be used (DOE 1993l). In addition,

NEPA documentation pertaining specifically to *Construction of the Pond C-2 Discharge Minimization Project* is currently under review by DOE. The proposed project would recycle Pond C-2 water to the cooling tower water supply system.

According to a recent pond management study, the operation of Ponds C-1 and C-2 does not create significant contaminants that adversely affect the water quality (DOE 1993l). The source of any low concentration of contaminants entering the ponds is RFP activities. Rather, the major function of the current pond management plan is to provide best management practices for achieving state water quality standards. RFP consistently meets Segment 4 Standards for waters discharged offsite.

Pond management operations are conducted in such a way that water quality is maintained or improved. Detention of water in the pond system for a designated period allows sedimentation to occur. Sedimentation effectively settles potentially contaminated suspended solids, removing them from the water column for as long as the sediments are not resuspended by disturbance (DOE 1980). This is true for radionuclides. Radionuclides are highly insoluble, tend to bond to soil particles (DOE 1980), and migrate at an extremely slow rate (DOE 1980). Through volume management, potentially contaminated sediments are kept covered with water so that sediments are not exposed to wind erosion.

Construction activities in certain pond areas could resuspend sediments within the water column; a pond closure or complete discharge could expose sediments to wind erosion.

Sampling has shown occasional plutonium concentrations greater than the Segment 4 Standards. Since it is possible to transfer Pond C-2 water by pipeline to either Pond B-5 or Pond A-4, transferring may have an adverse effect on water quality in Pond B-5 or Pond A-4 . However, a transfer of this type is limited to emergency operations only. Typically, volume management on Pond C-2 involves discharge to Broomfield Diversion Ditch only after sampling shows that state water quality standards have been met and after obtaining concurrence from CDH and NPDES Permit bypass approval from EPA.

Discharge operations are implemented only after sampling shows that state water quality standards have been met and after obtaining CDH concurrence. In addition, the outlet works at most ponds are no longer used for discharge because their use would pull water off the bottom of the ponds. This action has the potential of resuspending sediments from the bottom of the pond into the discharge. Since 1990, discharge operations have been conducted with a

suspended intake line attached to a pump that discharges water from the surface and mid-level portions of the ponds.

3.5.7 Operable Unit 6 - Walnut Creek Priority Drainage

The Walnut Creek drainage basin consists of North Walnut Creek and South Walnut Creek. North and South Walnut Creeks are intermittent streams that receive surface runoff from the northern and eastern portion of the Industrial Area (IA) and the adjoining Buffer Zone. An unnamed tributary (located 1/2 mile north of the IA and north of North Walnut Creek) receives surface runoff from the northern Buffer Zone. All three of these creeks merge into Walnut Creek within the Buffer Zone about 1 mile northeast of the Protected Area (DOE 1992o).

The headwaters of North Walnut Creek originate within the Upper Church Ditch, approximately 1 1/2 miles west of Highway 93, near Coal Creek. This ditch splits within the western buffer zone forming McKay Ditch and Church Ditch. North Walnut Creek continues for approximately 3 miles before converging with South Walnut Creek to form Walnut Creek (DOE 1992o).

South Walnut Creek originates near the center of the RFP Protected Area and bisects the eastern half of the Protected Area. South Walnut Creek converges with North Walnut Creek approximately 1 mile east of the Protected Area. The original headwaters of South Walnut Creek were backfilled during construction of the Plant's facilities; therefore, flow now begins near a buried culvert west of Building 991. The natural drainage of both North and South Walnut Creeks have been modified in OU 6 by the construction of the detention ponds. (DOE 1992o).

The four A-series ponds (A-1, A-2, A-3, A-4) lie northeast of the Industrial Area (IA) along North Walnut Creek; while the five B-series ponds (B-1, B-2, B-3, B-4, B-5) lie east of the IA along South Walnut Creek (DOE 1993l).

The reach of North Walnut Creek, below the diversion structure at the west side of the IA, collects runoff from the northern areas of the IA, as well as portions of the north buffer zone, including the firing range , an electrical substation, and miscellaneous storage areas (DOE 1993l).

South Walnut Creek begins on RFP property and receives the majority of stormwater runoff from the IA, including that from the main drainage ditch along Central Avenue. The natural channel of South Walnut Creek, inside of the RFP fence, has been extensively modified by past construction activities (DOE 1993l).

Current surface water management practices involving the ponds is presented below. However, these practices may be subject to change based on the outcome of an interim action. RFP has prepared an Interim Measure/Interim Remedial Action Decision Document (IM/IRA) regarding surface water management involving the detention pond system. The IM/IRA was in response to a CDH and EPA concern about the potential spread of contaminants. At the time of this writing, the final draft had been submitted to the regulatory agencies and a stop-work order was issued on the IM/IRA pending dispute resolution over this particular requirement for interim action.

Ponds A-1 and A-2 receive water only from their immediate drainage areas. For storm events larger than the 2-year event, these ponds may receive some flow from the runoff in upstream basins. Ponds A-1 and A-2 are nondischarging ponds and provide emergency capacity for diversion of suspect water within North Walnut Creek. If a spill should occur within certain portions of the IA, potentially impacting the creek, the spill can be diverted to Pond A-1 by opening the appropriate valve, thus keeping spills from reaching the downstream discharge ponds (A-3 and A-4).

Under routine circumstances, the water contained within Ponds A-1 and A-2 is direct precipitation and a minor amount of runoff. Pond A-2 also receives water from Pond B-2 for spray evaporation, which, in turn, can receive effluent discharge from the sewage treatment plant (STP) if effluent quality is unsuitable for discharge. Pond A-1 is routinely transferred to Pond A-2 by way of a controlled outlet valve. Pond A-2 volume is maintained by spray evaporation. During the evaporation procedure, spray from fog nozzles is directed over the surface of the pond (DOE 1993l).

Ponds B-1 and B-2 are also nondischarging ponds and are maintained for emergency control of suspect water running off the central portion of the IA. In the event of a spill emergency, the gate valves at the B-1 bypass are closed to divert South Walnut Creek flows to Pond B-1 and succeeding overflow to Pond B-2. In addition, STP effluent can be diverted via existing pipe to Ponds B-1 and B-2 in the event of an upset condition at the STP (DOE 1993l).

Pond A-3 is used to impound normal surface water collected from North Walnut Creek and the northern IA. Some sampling occurs prior to its discharge to Pond A-4.

Pond A-4 is the designated terminal pond on North Walnut Creek and serves as the point of discharge for RFP surface water from both North and South Walnut Creeks. Pond A-4 receives pumped water from Pond B-5 and direct discharge from Pond A-3. Extensive water quality sampling is conducted in Pond A-4 prior to release in order to assure the Colorado

Department of Health and local cities that water quality standards for Segment 4 of Big Dry Creek are met.

A particulate filtration and granulated activated carbon treatment system is located at Pond A-4 for use if sampling indicates water quality to be inadequate (DOE 1993l). When RFP receives approval from CDH to discharge from Pond A-4, the water is discharged into the Broomfield Diversion Ditch; the Ditch bypasses Great Western Reservoir and discharges to Walnut Creek, which discharges to Big Dry Creek downstream of Standley Lake (DOE 1993l).

The timing of release from Pond A-4 depends on the anticipated volume of stormwater runoff, STP inflow, and current storage levels of Ponds A-3, A-4, and B-5. Following sampling and laboratory analysis to ensure that Segment 4 standards are met, and after receiving approval from DOE (with concurrence from CDH), water from Pond A-4 is discharged to North Walnut Creek (DOE 1993l).

Pond B-3 receives treated sanitary effluent discharges from the STP. Pond B-3 water is impounded during evening hours and is released to Pond B-4 during daylight hours on a daily basis (DOE 1993l).

Pond B-4 is a controlled flow-through pond with no operational holding capacity. A valved bypass beginning above Pond B-1 conveys surface runoff water from South Walnut Creek through an underground pipeline to Pond B-4 and subsequently to Pond B-5. Pond B-4 provides secondary monitoring and control during normal flow and flood conditions (DOE 1993l).

Pond B-5 is the terminal pond for the B-series ponds on South Walnut Creek. Limited, indicator-type water quality sampling and analysis similar to Pond A-3 is conducted on water from Pond B-5 prior to transfer to Pond A-4 for treatment (if needed) and final discharge off site (DOE 1993l).

According to a recent pond management study, the operation of the ponds does not create significant contaminants that adversely affect the water quality (DOE 1993l). The source of any low concentration of contaminants entering the ponds is RFP activities. Rather, the major function of the current pond management plan is to provide best management practices for achieving state water quality standards. RFP consistently meets Segment 4 Standards for waters discharged offsite.

Pond management operations are conducted so that water quality is maintained or improved. Detention of water in the pond system for a designated period allows sedimentation to occur.

Sedimentation effectively settles potentially-contaminated suspended solids, removing them from the water column for as long as the sediments are not resuspended by disturbance (DOE 1980). This is true for radionuclides. Radionuclides are highly insoluble, tend to bond to soil particles (DOE 1980), and migrate at an extremely slow rate (DOE 1980). Through volume management, potentially-contaminated sediments are kept covered with water so that sediments are not exposed to wind erosion.

Construction activities in certain pond areas could resuspend sediments within the water column; a pond closure or complete discharge could expose sediments to wind erosion.

Sampling has shown occasional plutonium concentrations greater than the Segment 4 Standards. Since it is possible to transfer Pond C-2 water by pipeline to either Pond B-5 or Pond A-4, transferring may have an adverse effect on water quality in Pond B-5 or Pond A-4 . However, a transfer of this type is limited to emergency operations only. Typically, volume management on Pond C-2 involves discharge to Broomfield Diversion Ditch only after sampling shows that state water quality standards have been met and after obtaining concurrence from CDH and NPDES Permit bypass approval from EPA.

Use of Ponds A-1, A-2, B-1, and B-2 for spill containment is an emergency measure. Tanks, pipes, material transfers, and other potential origins of a spill from RFP activities poses authorized secondary containment or are subject to measures set forth in the RFP Spill Prevention Control and Countermeasure Plan and related documents. The impact on water released offsite is not expected to be detrimental since these ponds can be isolated from the rest of the surface water management system.

Discharge operations are implemented only after sampling shows that state water quality standards have been met and after obtaining CDH concurrence. In addition, the outlet works at most ponds are no longer used for discharge because their use would pull water off the bottom of the ponds. This action has the potential of resuspending sediments from the bottom of the pond into the discharge. Since 1990, discharge operations have been conducted with a suspended intake line attached to a pump that discharges water from the surface and mid-level portions of the ponds.

3.5.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

Current surface water management practices involving the pond is presented below. However, these practices may be subject to change based on the outcome of an interim action. RFP has prepared an Interim Measure/Interim Remedial Action Decision Document (IM/IRA) regarding surface water management involving the detention pond system. The IM/IRA was in response to a CDH and EPA concern about the potential spread of contaminants. At the time of this writing, the final draft had been submitted to the regulatory agencies and a stop-work order was issued on the IM/IRA pending dispute resolution over this particular requirement for interim action.

The landfill pond is located in the north buffer zone, downstream of the existing RFP landfill. The landfill and associated pond are in a drainage that is tributary to Walnut Creek below the confluence of North and South Walnut Creeks. The landfill pond is designed to provide detention for intercepted noncontaminated groundwater leachate from the landfill site. The landfill pond is a nondischarging pond. Standard practice is to control pond water levels through spray evaporation over the pond surface during favorable weather conditions; although water may be transferred to Ponds A-1 and A-2 if the water quality meets Segment 5 stream standards (DOE 1993l).

3.5.9 Operable Unit 8 - 700 Area

Surface water runoff could become contaminated due to contact with contaminants in this OU. Since previous investigations have not been conducted at these units, the nature and extent of contamination is based on evaluation of process knowledge, current materials stored at the sites, and previous uses. A description of these materials is provided in Section 2.10.3 of this report.

3.5.10 Operable Unit 9 - Original Process Waste Lines

Low-level radioactive aqueous wastes with high nitrate concentrations were a primary Original Process Waste Line (OPWL) waste stream (DOE 1992q). Volatile and semivolatile organics were transferred through the OPWL in small quantities of other liquids. Releases may have occurred as a result of leakage, deterioration of pipes, breakage, and overflows. The lateral and vertical extent of releases are not precisely known but are expected to be largely confined to

the pipeline trench backfill materials and adjacent soils. Surface runoff contacting these soils could become contaminated.

3.5.11 Operable Unit 10 - Other Outside Closures

Section 2.12.3 of this report details analytical results for contaminants present in soil samples in several IHSSs in this OU. Surface runoff contacting these soils may become contaminated. In addition, analysis of surface water samples taken in the area of IHSS 213 indicate levels above background for nitrate, cyanide, and cadmium (DOE 1991a).

3.5.12 Operable Unit 11 - West Spray Field

Section 2.13.3 of this report describes the contaminants present in soils in this OU. Surface water contamination may potentially occur in this OU due to surface runoff contacting these soils. Surface water sampling has not been performed at the West Spray Field.

3.5.13 Operable Unit 12 - 400/800 Area

The OU12 Work Plan indicates that the majority of the unit is located on an east-west trending interfluve that separates Walnut Creek from Woman Creek (an "interfluve" is the area between adjacent streams that are flowing in the same direction). Consequently, portions of OU12 drain into Walnut Creek, others into Woman Creek. The majority of OU12 runoff flows into the B-series ponds along Walnut Creek. The extreme western and southern portions of the 400, 600, and 800 building areas drains to Woman Creek.

Analytical data from only one surface water sampling location was available for the OU12 Work Plan. Concentrations of radionuclides, metals, and ions were relatively low and consistent with those detected at other surface water monitoring stations at RFP.

Surface water drainage within OU12 is controlled primarily with ditches, pavements, gutters, drains, and culverts, according to the OU12 Work Plan. The largest ditches are (1) the Central Avenue ditch, which empties into South Walnut Creek (which, in turn, drains into the B-series ponds); and (2) the South Interceptor Ditch, which prevents runoff from the southern industrial area from entering Woman Creek (which drains into pond C-2). Discharge from these ponds is

initiated only after sampling shows that State water quality standards have been met and after obtaining concurrence from CDH and NPDES Permit bypass approval from EPA (DOE 1993l).

3.5.14 Operable Unit 13 - 100 Area

The water channels flowing through OU13 are generally man-made diversions such as storm sewers, culverts and open ditches that convey runoff to North and South Walnut Creek. The effect of the OU13 IHSSs on surface water quality in these conveyances may not be uniquely associated with the OU13 IHSSs because of the proximity of other OUs. IHSSs in these other OUs may also contribute some effect to the surface water quality.

IHSS 117.1 would probably not have an effect on surface water quality. Water sampling sites on North and South Walnut Creek are too far away (1,300 - 4,100 feet) to determine the effect of the IHSS on water quality accurately.

IHSS 117.2 may not contribute any contaminants to South Walnut Creek. A surface monitoring station is too far away (4,100 feet) to determine the effect of the IHSS on water quality adequately.

The effect of IHSS 117.3 on surface water can not be accurately determined because (1) the monitoring stations are too far away (1,250 and 3,500 feet) and (2) other IHSSs contribute runoff.

The effect of IHSSs 128, 134, and 171 on North Walnut Creek can not be determined because of the distance (1,800 feet) to the monitoring station and the runoff contribution from other IHSSs.

The effect of IHSS 148 on South Walnut Creek can not be determined because of the distance (800 feet) to the monitoring station and the contribution of runoff from other IHSSs.

In 1990, gross alpha and beta, 1.40 pCi/l and 6:65 pCi/l respectively, were recorded at a monitoring station approximately 200 feet downstream from IHSS 157.1. The results can not be linked to IHSS 157.1 because other IHSSs also contribute runoff to the drainage.

The effect of IHSS 158 on North Walnut Creek can not be accurately determined because of the distance (1,300 and 4,300 feet) to the monitoring station and the contribution of runoff from other IHSSs.

IHSS 169 and 191 should not have any contaminants that would currently persist.

The effect of IHSS 186 on the North Walnut Creek can not be determined because of the distance (1,300 feet) to the monitoring station and the contribution of runoff from other IHSSs.

The effect of IHSS 190 on Walnut Creek is on Walnut Creek can not be determined because monitoring stations are 400, 1,200, 4,500, and 5,100 feet downstream and other IHSSs contribute runoff.

No site-specific information was located showing the status of contamination of surface water attributed to IHSS 197.

3.5.15 Operable Unit 14 - Radioactive Sites

Surface water from OU14 will be directed toward either South Walnut Creek via Central Avenue Ditch (and other diversions), or the South Interceptor Ditch, on the south side of the Plant, which directs water toward Pond C-2.

3.5.16 Operable Unit 15 - Inside Building Closure

OU15 surface water is diverted to either Central Avenue Ditch which transfers water to the South Walnut Creek or to the South Interceptor Ditch which transfers the water to Pond C-2. No OU15 site-specific information regarding surface water quality was located for inclusion in this report.

3.5.17 Operable Unit 16 - Low-Priority Sites

No site-specific information was located showing the status of contamination of surface water attributed to IHSSs 185, 193, 195.

Following the IHSS 192 release, Pond B-1 received and contained both the 155 gallons of ethylene glycol and 5,000 gallons of water used to flush the drain. Pond B-1 is being investigated as part of OU6. Surface water concentrations of tritium contributed to IHSS 194 do not exceed background levels based primarily on sampling in Ponds B-1 and B-4.

* * *

3.6 GROUNDWATER

3.6.1 Sitewide Conditions

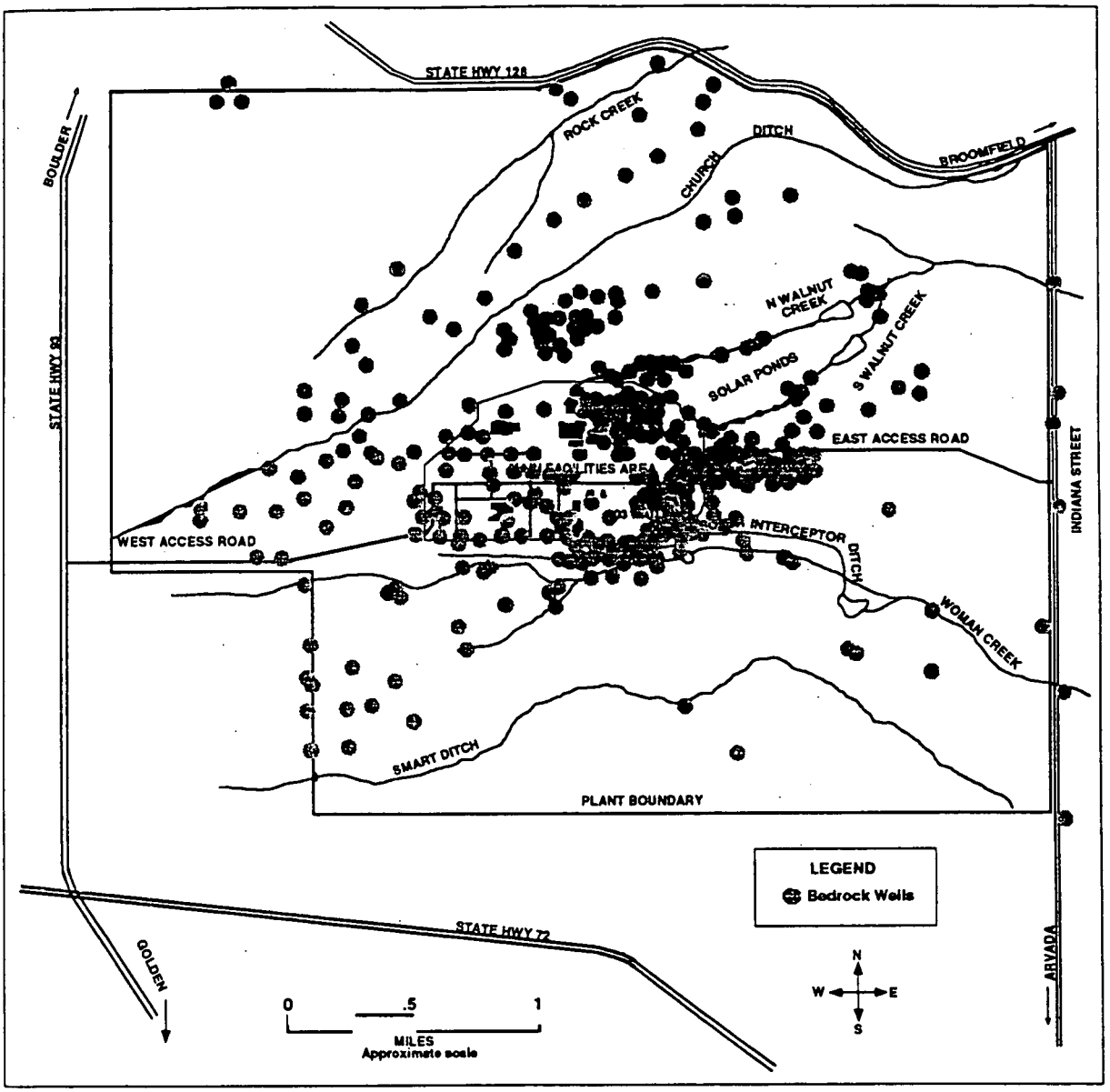
The information on general sitewide hydrogeologic conditions was obtained from the Final Groundwater Protection and Monitoring Plan (EG&G 1991c). Hydrogeologic information for OU4 (Solar Evaporation Ponds), OU7 (Present Landfill) and OU11 (West Spray Field) for the purposes of this document was obtained from the Final Groundwater Assessment Plan (DOE 1992w). The hydrogeologic information contained in this document for the remaining OUs was summarized from RFI/RI Work Plans prepared for each specific OU.

In addition to the general hydrogeologic information presented in this section, specific information on the history of groundwater monitoring at the RFP including monitoring wells, and sampling and analysis can be found in the Final Groundwater Assessment Plan (DOE 1992w). The following paragraph summarizes the number of wells installed for the groundwater monitoring program at RFP. Sitewide hydrogeologic conditions are summarized in the subsequent paragraphs.

Groundwater monitoring has been conducted at RFP since 1960. RCRA requirements were first applied to mixed wastes at RFP in July 1986 at which time a total of 56 monitoring wells existed. All of these wells have been abandoned or are scheduled for abandonment because of incomplete or insufficient information regarding completion. During 1986, an additional 70 wells (53 alluvial and 17 bedrock) were installed to characterize the hydrogeology and groundwater quality at RFP and to satisfy requirements of the compliance agreement (**Figure 3.6-1**).

An additional 67 wells (45 alluvial and 22 bedrock) were installed in 1987 to characterize the groundwater quality and flow directions at various IHSSs and at RCRA or CERCLA units. In 1989, 163 wells (98 alluvial and 65 bedrock) were installed to provide data for RCRA closure units, remedial and feasibility studies for OU, background geochemical studies, and the geological characterizations.

An additional 17 alluvial wells and piezometers were installed in 1990 as part of the ongoing characterization work at OU1 and in conjunction with a new landfill siting study. One hundred and thirty nine wells (86 alluvial, seven alluvial/bedrock, and 46 bedrock) were installed in 1991, 20 wells (10 alluvial, one alluvial/bedrock, and nine bedrock) were installed in 1992, and 33 wells were installed in 1993. Three hundred and seventy one of the wells and 84 piezometers are still used. (EG&G 1993c)



Source: EG&G 1992c

Figure 3.6-1

Location of Groundwater Sampling Wells

Two distinct hydrostatigraphic units are present at Rocky Flats (**Figure 3.6-2**): the upper hydrostratigraphic unit (UHSU) and the lower stratigraphic unit (LHSU). The upper unit is comprised of Rocky Flats Alluvium, colluvium, valley fill alluvium, weathered bedrock of the Arapahoe/Laramie Formations, and all sandstones within the Arapahoe and Laramie Formations that are in hydraulic connection with overlying unconsolidated deposits or the ground surface.

The lower unit is comprised of unweathered bedrock of the Laramie Formation and includes unweathered portions of the Arapahoe Formation if present. Some reports will distinguish between Rocky Flats Alluvium and valley fill alluvium, and classify wells as either alluvium or bedrock independent of hydrostratigraphic units. (EG&G 1993b)

The UHSU ranges in thickness from 15 feet to more than 100 feet. Recharge is from infiltration of precipitation, storm runoff and snow melt, with seepage from streams, ponds, and ditches. Discharge is by evaporation and evapotranspiration, through seeps, and directly into streams, ditches, and ponds. The flow is generally towards the east. The hydraulic conductivities in the Rocky Flats Alluvium and valley fill alluvium ranges from 10^{-3} cm/sec to 10^{-4} cm/sec, whereas the conductivity range is 10^{-5} cm/sec to 10^{-6} cm/sec in the Arapahoe and Laramie Formations. (EG&G 1993b)

Recharge to the LHSU occurs via leakage from the saturated upper hydrostratigraphic unit. Discharge occurs where bedrock units are incised by stream valleys. The flow is also generally eastward. Hydraulic conductivity is unweathered claystone ranging from approximately 10^{-6} cm/sec to 10^{-8} cm/sec. (EG&G 1993b)

Tables D-1 to D-12 of the Background Geochemical Characterization Report (DOE 1993e), list background geochemistry summary statistics (minimum, maximum, and mean) by geologic unit and groundwater flow system. The geologic units are Rocky Flats Alluvium (RFA), valley-fill alluvium (VFA), colluvium (COL), weathered claystone or upper Arapahoe/Laramie Formations (WCS) and undifferentiated Arapahoe/Laramie Formations (KAR). The upper flow-system (equivalent to UHSU) is comprised of the RAF, VFA, COL, and WCS. The lower flow-system (equivalent to LHSU) consists of the KAR.

The analyte suites for groundwater include total and dissolved metals, total and dissolved radionuclides, water-quality parameters, and volatile organic compounds. Following are some example mean concentrations with standard deviations in brackets for the upper and lower flow-systems:

- The concentrations of four metals (both dissolved and total) exceeded 1,000 µg/l in the upper flow-system: calcium = 55,415 [32,564] µg/l (dissolved) and 55,030 [31,668] µg/l (total); magnesium = 10,038 [8,309] µg/l (dissolved) and 10,316 [7,956] µg/l (total); potassium = 1,372 [1,069] µg/l (dissolved) and 1,731 [1,177] µg/l (total); and sodium = 32,013 [43,668] µg/l (dissolved) and 30,082 [40,020] µg/l (total). These metals are major nutrient species.

- The concentrations of five radionuclides in the upper flow-system: americium-241 = 0.01 [0.01] pCi/l (dissolved) and 0.01 [0.01] pCi/l (total); gross beta = 4.89 [12.23] pCi/l (dissolved) and 24.95 [53.34] pCi/l (total); gross alpha = 8.35 [32.32] pCi/l (dissolved) and 43.50 [94.28] pCi/l (total); plutonium-239/240 = 0.01 [Not Listed] pCi/l (dissolved) and 0.00 [0.02] pCi/l (total); and uranium-233/234 = 6.23 [23.94] pCi/l (dissolved) and 15.62 [38.75] pCi/l (total).

- The concentrations of one volatile organic compound exceeded 5.0 µg/l in the upper flow-system: acetone = 5.42 [1.97] µg/l. [Acetone is recognized as a common laboratory contaminant. Consequently, this may not be indicative of true background (EG&G 1994h).]

- The concentrations of four metals (both dissolved and total) exceeded 1,000 µg/l in the lower flow-system: calcium = 34,536 [23,553] µg/l (dissolved) and 36,382 [23,881] µg/l (total); magnesium = 6,072 [4,068] µg/l (dissolved) and 6,679 [5,031] µg/l (total); potassium = 2,713 [1,612] µg/l (dissolved) and 2,846 [1,726] µg/l (total); and sodium = 142,013 [135,521] µg/l (dissolved) and 139,228 [134,404] µg/l (total). These metals are major nutrient species.

- The concentrations of five radionuclides in the lower flow-system: americium-241 = 0.03 [Not Listed] pCi/l (dissolved) and 0.01 [0.02] pCi/l (total); gross beta = 3.23 [2.84] pCi/l (dissolved) and 12.01 [13.45] pCi/l (total); gross alpha = 3.13 [6.24] pCi/l (dissolved) and 11.08 [16.63] pCi/l (total); plutonium-239/240 = Not Listed [Not Listed] pCi/l (dissolved) and 0.00 [0.01] pCi/l (total), and uranium-233/234 = 1.64 [2.85] pCi/l (dissolved) and 0.77 [0.57] pCi/l (total).

- The concentration of one volatile organic compound exceeded 5.0 µg/l in the lower flow-system: acetone = 5.35 [2.03] µg/l. [Acetone is recognized as a common laboratory contaminant. Consequently, this may not be indicative of true background (EG&G 1994h).]

3.6.2 Operable Unit 1 - 881 Hillside

The hydrogeologic information contained in this section was obtained from the Phase III RFI/RI Work Plan for OU1-881 Hillside Area (DOE 1991e). Specific information on the geology, and nature and extent of contamination for OU1 is contained in Section 4.1 and Section 2.0, respectively, of this document.

The groundwater beneath OU1 occurs in the Rocky Flats Alluvium, colluvium, valley fill alluvium and subcropping sandstones under unconfined conditions. Confined groundwater flow occurs in the lower sandstone units. The groundwater flow direction is generally southeast toward Woman Creek and is generally influenced by topographic conditions. Water levels generally decline during the summer and fall, at which time some wells go dry. The shallow groundwater flow system supports ephemeral flow in the creeks.

Groundwater flows from the Rocky Flats Alluvium at the top of 881 Hillside through colluvial materials toward Woman Creek. At the Rocky Flats Pediment edges, groundwater emerges as seeps and springs at the contact between the alluvium and claystone bedrock. Groundwater flow in the Arapahoe Formation occurs in the sandstones contained within the claystones.

Recharge to the water table occurs as infiltration of incident precipitation and as seepage from ditches and creeks. In addition, retention ponds along Woman Creek likely recharge the valley fill alluvium. Alluvial groundwater discharges to seeps, surface water drainages, colluvium and bedrock. Seeps occur along the hillside where alluvial materials are thin. Groundwater in valley fill materials discharges to Woman Creek.

The values for hydraulic conductivities in the colluvium at 881 Hillside range from 9×10^{-4} cm/s to 7×10^{-5} cm/s for the gravel layers and 4×10^{-5} cm/s for the sandy clay. Based on the geometric mean (1×10^{-4} cm/s) of hydraulic conductivities a hydraulic gradient of 0.15 and an effective porosity of 0.1, the mean groundwater flow velocity is 155 ft./yr. Hydraulic conductivity for the Woman Creek valley fill alluvium has a geometric mean of 7.7×10^{-4} cm/s and a maximum conductivity of 3×10^{-3} cm/s.

Using the geometric mean and the maximum value for hydraulic conductivity, a hydraulic gradient of 0.021, and an assumed effective porosity of 0.1, groundwater flow velocities

ranged from 167 to 652 ft/yr. Hydraulic conductivity values for weathered claystone range from 2.3 x 10^{-3} cm/s to 3.6 x 10^{-7} cm/s, with a geometric range of 2.1 x 10^{-6} cm/s to 3.4 x 10^{-7} cm/s. Values for hydraulic conductivity of the unweathered claystone range from 3 x 10^{-6} cm/s to 1 x 10^{-8} cm/s, with a geometric mean of 9.5 x 10^{-8} cm/s.

Groundwater is contaminated in both the eastern and western portion of the 881 Hillside. The most pronounced organic contamination is in the eastern portion of the Hillside Area, with tetrachloroethene (PCE), trichloroethene, 1,1-dichloroethene, 1,1-dichloroethane, 1,1,1-trichloroethane, 1,1,2-trichloroethane, and carbon tetrachloride reaching several thousand micrograms per liter in many samples. Organic contamination in the western portion of the 881 Hillside Area occurs at much lower concentrations. Detections of metals and inorganic constituents in the eastern portion of the study area include numerous occurrences of nickel, strontium, selenium, zinc, copper, and uranium above background.

A performance monitoring plan was requested by EPA and CDH to evaluate the effectiveness of the Interim Measure/Interim Remedial Action (French Drain). The program will use a groundwater monitoring system of eleven wells (eleven new and two existing). This monitoring system will evaluate the potential for alluvial groundwater migration around the French Drain and alluvial flow beneath the drain. This same program will use surface water stations to evaluate flow and water quality in the South Interceptor Ditch and runoff from the Building 850 parking lot. (DOE 1992s)

3.6.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

The hydrogeologic information contained in this section was obtained from the Preliminary Draft Phase II Work Plan for Operable Unit 2 - 903 Pad, Mound, and East Trenches Areas (DOE 1993c). Specific information on the geology, and nature and extent of contamination of this OU can be found in Section 4.1 and Section 2.0, respectively, of this document.

The hydrogeologic system is comprised of two distinct zones: the upper (UHSU) and lower (LHSU) hydrostratigraphic units. The UHSU "consists of saturated portions of unconsolidated surficial deposits (Rocky Flats Alluvium, high terrace deposits, colluvium, and disturbed ground). The Arapahoe No. 1 Sandstone that is in hydraulic communication with saturated surficial materials, and weathered claystones of the Arapahoe and/or Laramie Formation." The majority of water flow is in the Rocky Flats Alluvium and in the Arapahoe No. 1 Sandstone.

Alluvial groundwater recharge occurs by direct infiltration from precipitation and seepage from surface features such as ditches. Alluvial groundwater generally flows northeast with a mean hydraulic gradient, measured in 1992, of approximately 0.02 feet/foot. The mean hydraulic

conductivity, measured in 1992, is 8×10^{-4} cm/s. Estimated linear water velocity is 120 feet/year.

Sandstone recharge occurs as water passes through overlying deposits to the sandstone. For the No. 1 Sandstone, the mean hydraulic conductivity, measured in 1992, is 4.8×10^{-4} cm/s, the hydraulic gradient is 0.028 to 0.1 feet/foot and flow velocity is 730 to 200 feet/year. Many seeps are also found that derive from alluvial or sandstone groundwater.

The LHSU is comprised of Laramie Formation clayey-silty sandstones, claystones, and siltstones that are not in substantial communication with the UHSU. Recharge occurs as water moves downward through the UHSU to the LHSU. The mean hydraulic conductivity, measured in 1993, was 2×10^{-6} cm/s.

The following chemicals have been detected in the UHSU:

tetrachloroethene (up to 14,000 µg/l)
toluene (up to 60 µg/l)
total xylenes (up to 5 µg/l)
trans-1,2-dichloroethene (up to 34 µg/l)
trans-1,3-dichloropropene (up to 8.1 µg/l)
trichloroethene (up to 140,000 µg/l)
trichlorofluoromethane (up to 10.2 µg/l)
vinyl chloride (up to 860 µg/l-this is a dilution result)

Semivolatile organic compounds (VOCs) detected include:

benzoic acid
bis(2-ethylhexyl)phthalate
diethyl phthlate
di-n-butyl phthlate
heptachlorepoxide (generally at 70 µg/l)

Diethylphthlate and benzoic acid had maximum concentrations of 310 and 56 µg/l, respectively. Benzoic acid does not appear to be waste-related and the phthlate compound may be a laboratory contaminant. No PCBs or pesticides were detected. Several metals although detected were not considered waste-related contaminants including antimony, zinc, barium, chromium, manganese, strontium, lead, manganese, and mercury. Uranium, plutonium, and americium were detected.

Few volatile organic compounds were recorded above detection limits in the LHSU groundwater. One hit of carbon tetrachloride was recorded at 14 µg/l. Detected americium and plutonium in groundwater is suspected of being caused by contamination during drilling or sampling activities.

3.6.4 Operable Unit 3 - Off-Site Releases

No groundwater monitoring wells have been installed in OU3. Limited information reported from the Colorado Division of Water Resources on privately-owned wells drilled immediately east of RFP suggest that the surficial deposits range from 15 to 50 feet in thickness and are underlain by the Arapahoe Formation. Groundwater-level information reported from one well located north of IHSS 199 indicates a static water level at 20 feet below ground surface (BGS) in a private well completed in the shallow alluvium. Additional information reported suggests that most private wells have been completed in sandstone units of the Arapahoe Formation. Static water-level information in these bedrock wells suggests that groundwater in the bedrock is under moderate pressure head (DOE 1992l).

Although no additional site-specific groundwater data are available, conditions at OU3 are likely to be similar to those present at OU5 - Woman Creek and are likely similar to the sitewide conditions discussed in Section 3.6.1.

3.6.5 Operable Unit 4 - Solar Evaporation Ponds

The hydrogeologic information contained in this section was obtained from the *OU4 Solar Evaporation Pond Interim Measures/Interim Remedial Action Environmental Assessment Decision Document* (DOE 1994a). Specific information on the geology, and nature and extent of contamination of this OU can be found in Section 4.1 and Section 2.0, respectively, of this document.

Two hydrostratigraphic units (HSUs) have been certified for the Rocky Flats Plant, the upper (UHSU) and lower (LHSU). These two units are present under OU4. The UHSU is comprised of Rocky Flats Alluvium, colluvium, valley fill alluvium, disturbed ground, artificial fill, and subcropping sandstones. Groundwater movement in the Rocky Flats Alluvium is west to east as an unconfined flow. Recharge occurs in the industrial area from precipitation, snowmelt, and infiltration from ditches.

The LHSU includes sandstones of the Arapahoe Formation and the Laramie/Fox Hills aquifer. Recharge of the confined aquifers occurs in the western portion of Rocky Flats where the bedrock outcrops.

Hydraulic conductivity values calculated for the valley fill alluvium range from 5 x 10^{-6} cm/s to 3 x 10^{-3} cm/s (velocity 2 to 947 meters/year). The hydraulic conductivity ranges from 7 x 10^{-5} cm/s to 1 x 10^{-2} cm/s (velocity 22 to 3,154 meters/year). The subcropping Arapahoe sandstone (which also forms a part of the UHSU) ranges from 2 x 10^{-6} cm/s to 4 x 10^{-5} cm/s (velocity 1 to 13 meters/year).

Hydraulic conductivity values for the Arapahoe claystones (weathered and unweathered) ranges from 1 x 10^{-8} cm/s to 1 x 10^{-7} cm/s (velocity 0.3 to 3 meters/year). Potentially confined LHSU sandstones, in the Arapahoe Formation have hydraulic conductivities that range from 4 x 10^{-8} cm/s to 2 x 10^{-6} cm/s (velocity 1 to 63 meters/year).

Groundwater found in the UHSU downgradient of the solar ponds contains higher TDS than upgradient locations, which appears to be the result of contamination from the solar ponds. The TDS levels seem to have decreased in the UHSU during the last several years reflecting either a decrease in or total elimination of solar pond leakage.

Groundwater in the LHSU is chemically similar throughout OU4 and generally reflects the Cretaceous Arapahoe/Laramie groundwater.

An alluvial groundwater well upgradient of the solar ponds was found to contain VOCs including carbon tetrachloride (750 mg/l), chloroform (120 µg/l), 1,2-DCE (33 µg/l) and TCE (660 µg/l). These contaminants may be attributed to either another source or the solar pond because of alterations in gradient patterns around the ponds. Elevated solvent-related compounds were detected 1,000 feet downgradient of the solar ponds. Low levels of toluene, xylenes, disulfite, and acetone were detected in wells south, east, and northeast of the solar ponds.

These results may be indicative of other sources, such as laboratory contamination, rather than actual groundwater contamination. Nitrate/nitrite and sulfate were detected up to 510 mg/l and 360 mg/l, respectively. Metal concentrations were consistently high. One suite (calcium, chromium, copper, lithium, magnesium, potassium, sodium, vanadium, and zinc) is consistent with waste disposed of in the ponds. Uranium is also found in groundwater in the area around the solar ponds; the ponds are presumed to be the source of the radionuclides.

Weathered bedrock was found to contain, generally, the same organic contaminants as the alluvium with the exception of vinyl chloride and 1,1,1-TCA. Halogenated compounds were at generally higher concentrations (e.g., TCE, 4,600 µg/l). Radionuclides are detected at the magnitude and extent of the radionuclides in alluvial groundwater. Metals found in bedrock groundwater is consistently high and representative of wastes associated with the solar ponds.

Metals detected include barium, cadmium, calcium, chromium, copper, lead, lithium, magnesium, potassium, sodium, vanadium and zinc.

Unweathered bedrock groundwater was also sampled. VOC contaminants included acetone (30 µg/l), methylene chloride (9 µg/l), benzene (0.2 µ/l), toluene (6 µg/l), xylenes (23 µg/l), TCE (6 µg/l), 1,1,2-TCA (0.3 µg/l), 2-butanone (4 µg/l),, and carbon disulfide (0.9 µg/l). Acetone and methylene chloride may be laboratory contaminants. Radionuclides detected include americium, tritium, gross alpha and beta, radon, strontium, uranium, cesium, and plutonium. Uranium-233/234 concentrations are 1.1 to 5.8 pCi/l which is similar to background concentrations. Nitrate/nitrite (7.1 mg/l), sulfate (1,600 mg/l), and fluoride (1.2 mg/l) were detected. The sulfate is suspected of being naturally occurring. The suite of metals is similar to both the alluvial and weathered bedrock metal suites.

3.6.6 Operable Unit 5 - Woman Creek Priority Drainage

The OU5 Work Plan (DOE 1992n) notes that there are few monitoring wells in the vicinity of the 11 IHSSs and that further characterization is required to evaluate the hydrogeologic conditions reliably. However, the Work Plan indicates, based on the lithology of the wells present and existing geologic data for RFP, that the uppermost aquifer underlying OU5 is likely colluvium/Rocky Flats Alluvium and valley fill alluvium.

Limited characterization of the Arapahoe Formation, which underlies the surficial geologic units, has been done. Therefore, the hydraulic communication between the bedrock and the aquifer is not known. In other drainage areas at RFP, however, the formation is known to outcrop.

Groundwater occurs 4-8 feet below ground surface in the lower areas and 10-20 feet near the upper plateau. Groundwater flow is probably similar to the surface drainage in the Woman Creek drainage (i.e., north/south toward Woman Creek; adjacent to Woman Creek, the flow direction changes to the east).

Further groundwater investigation is required for IHSS 196.

3.6.7 Operable Unit 6 - Walnut Creek Priority Drainage

The hydrogeologic information contained in this section was obtained from the Final Phase I RFI/RI Work Plan for Walnut Creek Priority Drainage (OU6) (DOE 1992o). Specific information on the geology, and nature and extent of contamination of this OU can be found in Section 4.1 and Section 2.0, respectively, of this document.

Groundwater occurs in the valley fill alluvium and is encountered at depths of 2.5 to 5.5 feet BGS. The groundwater flow direction is generally toward the east. However, the flow direction is locally affected by recharge from the A- and B-Series ponds. Groundwater discharge occurs in drainage along the contact with Arapahoe Formation claystones.

Groundwater quality data indicate detectable concentrations of metals are present throughout the operable unit. Where analyzed, radionuclides and volatile organic compounds have been detected in downgradient wells of the individual IHSSs in the Walnut Creek Priority Drainage.

3.6.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

The hydrogeologic information contained in this section was obtained from the Final Ground Water Assessment Plan for RFP (DOE 1992w). Additional OU-specific hydrogeologic information can be found in the Draft Phase I RFI/RI Work Plan for the Present Landfill (OU7) (DOE 1991y). Specific information on the geology, and nature and extent of contamination of this OU can be found in Section 4.1 and Section 2.0, respectively, of this document.

Groundwater beneath the Present Landfill in OU7 occurs in the surficial material (Rocky Flats Alluvium, colluvium, valley-fill alluvium, and artificial fill material) and in subcropping sandstones and claystones. Bedrock underlying the surficial material is either the Cretaceous Arapahoe or Laramie Formation. However, for the purposes of the referenced report, the two formations are not differentiated and are referred to as Cretaceous bedrock.

The depth to groundwater ranges from 5- to 35-ft BGS and varies up to 8 feet seasonally. Typically the groundwater elevations in wells completed in the bedrock units is below the top of bedrock, suggesting a downward hydraulic gradient ranging from 1.109 ft/ft to 1.505 ft/ft between the surficial materials and bedrock. A downward migration of groundwater from the weathered bedrock to unweathered bedrock is also likely.

The groundwater flow direction in the surficial material is generally in an eastward direction toward the Present Landfill. The local groundwater flow direction in the vicinity of the East

Landfill Pond is toward the southeast and northeast. However, the groundwater flow system near the Present Landfill has been impacted by the installation of a groundwater diversion and leachate collection system, and slurry walls excavated to bedrock.

Groundwater flow data in the weathered bedrock units are more limited than that of the surficial material; however, groundwater flow in these units appears to be similar in nature to that of the overlying surficial material. The horizontal hydraulic gradient of the surficial material is 0.05 ft/ft based on 1991 data. Based on regional data, the horizontal gradient of the bedrock material is approximately .009 ft/ft.

Values for hydraulic conductivity in the Rocky Flats Alluvium range from 1.8×10^{-5} cm/s to 4.6×10^{-4} cm/s with values for unweathered claystone being two to three orders of magnitude less (6.2×10^{-7} cm/s). The hydraulic conductivity values in sandstones range from 2.3×10^{-8} cm/s to 5.8×10^{-6} cm/s.

The groundwater quality of the surficial material (from data collected in and adjacent to the Present Landfill) indicates that concentrations of major inorganic ions, dissolved metals, dissolved radionuclides, and volatile organic compounds exceed RFP background levels. Several of the inorganic ions and metals are naturally occurring, but are at elevated levels. Volatile organic compounds frequently detected include TCE, 1,1,1-trichloroethane (1,1,1-TCA), and 1,2-dichloroethene (1,2-DCE). Of these compounds, TCE has been detected outside the groundwater barrier systems.

3.6.9 Operable Unit 8 - 700 Area

No groundwater investigations have been conducted for this operable unit. However, groundwater conditions are likely to be similar to sitewide groundwater conditions discussed in Section 3.6.1.

3.6.10 Operable Unit 9 - Original Process Waste Lines

The original process waste lines primarily exist within the area encompassed by 881 Hillside (OU1) and the Solar Evaporation Ponds (OU4) (DOE 1992q). The available information on groundwater conditions for OU9 is similar to that in Section 3.6.2 (OU1) and Section 3.6.5 (OU4).

3.6.11 Operable Unit 10 - Other Outside Closures

The hydrogeologic information contained in this section was obtained from the Draft Final Phase I RFI/RI Work Plan Volume I for Other Outside Closures - Operable Unit 10 (DOE 1991a). Specific information on the geology, and nature and extent of contamination of this OU can be found in Section 4.1 and Section 2.0, respectively, of this document.

Groundwater occurs in the Rocky Flats Alluvium, Valley Fill material, and in the Arapahoe Formation under unconfined conditions. Depth to groundwater ranges from approximately 5 to 25 feet BGS. The general groundwater flow direction is toward the east and northeast, following the weathered bedrock surface intercepting the Walnut Creek drainage.

Very limited groundwater quality data are available for this operable unit, with the exception of IHSS 213 and IHSS 176. Groundwater sampling in monitoring well upgradient of IHSS 213, indicated the presence of several metals, inorganic compounds, and radionuclides above background concentrations.

The metals and other inorganics detected included barium (0.244-0.281 mg/l), calcium (.36-162 mg/l), iron (1.06-5.82 mg/l), magnesium (36.4-41.0 mg/l), manganese (0.941-3.33 mg/l), nickel (0.229-0.370 mg/l), sodium (9.13-117 mg/l), zinc (0.260 mg/l), and sulfate (96.0-120 mg/l). Americium-241 and uranium-233 and -234 were the two radionuclides detected at concentrations above background levels at 0.030 pCi/l and 8.40 pCi/l to 14.7 pCi/l, respectively.

Analysis of groundwater samples collected upgradient and within IHSS 176 indicates several metals and other inorganics, and radionuclides at concentrations equal to or above background levels. The metals and inorganics detected at concentrations at or above background levels include aluminum (7.34-8.92 mg/l), beryllium (0.006 mg/l), calcium (89.1-131 mg/l), lead (0.040 mg/l), magnesium (66.3-142 mg/l), sodium (103-211 mg/l), cyanide (0.0100-0.025 mg/l), and sulfate (93.0-290 mg/l).

Radionuclides detected above background levels include americium 241 (0.096 pCi/l), plutonium-239 and -240 (0.195 pCi/l), tritium (360-700 pCi/l), and uranium-233 and -234 (9.32-12.0 pCi/l).

The groundwater sample analysis of wells within IHSS 176 detected additional metals and other inorganic compounds above background levels. Leakage from the solar ponds may be the source of the contamination (EG&G 1994a).

3.6.12 Operable Unit 11 - West Spray Field

The hydrogeologic information contained in this section was obtained from the Final Ground Water Assessment Plan for RFP (DOE 1992w). Groundwater quality information was also obtained from the 1990 Annual RCRA Groundwater Monitoring Report for Regulated Units at Rocky Flats Plant (EG&G 1991c).

Additional OU-specific hydrogeologic information can be found in the Final Draft Phase I RFI/RI Work Plan for the West Spray Field (OU11) (DOE 1992a). Specific information on the geology, and nature and extent of contamination of this OU can be found in Section 4.1 and Section 2.0, respectively, of that report of this document.

Groundwater beneath the West Spray Field occurs in the Rocky Flats Alluvium and/or the underlying bedrock sandstone subcrops and is unconfined in nature. The underlying bedrock consists of various units of the Laramie Formation under confined conditions. Unconfined conditions in the Laramie Formation occur only in sandstone subcrops or in areas where the Laramie Formation crops out in drainages. The alluvial material is likely under saturated conditions throughout the year. Recharge to the Laramie Formation is the result of downward infiltration from the overlying Rocky Flats Alluvium; however, little, if any, hydraulic connection is thought to exist between the two water-bearing units.

Depth to groundwater ranges between 40- and 50-feet BGS and varies from 2 to 4 feet seasonally. Groundwater flow direction is toward the east-northeast and follows the regional surface topography. South of the West Spray Field, in the vicinity of the Woman Creek drainage basin, the groundwater flow direction changes toward the southeast and discharges into Woman Creek. The hydraulic gradient across the West Spray Field is between 0.009 and 0.013.

Horizontal hydraulic conductivity values calculated for the Rocky Flats Alluvium range from 2.1×10^{-5} cm/s to 5.3×10^{-4} cm/s. The hydraulic conductivity values calculated for the Laramie Formation vary depending on the material type. The Laramie sandstones and claystones have hydraulic conductivity values of 6×10^{-8} and 4×10^{-8} cm/s, respectively. The Laramie siltstone has a hydraulic conductivity value ranging from 5×10^{-8} to 1.6×10^{-7} cm/s.

Results from a slug test conducted over an interval of 5 feet of siltstone and 10 feet of clayey sandstone give a hydraulic conductivity value of 5.4×10^{-7} cm/s. Based on the above information, the horizontal groundwater flow velocity for the Laramie Formation in the West Spray Field varies from 0.013 to 0.18 ft/yr.

Information on groundwater quality at the West Spray Field suggests that the alluvial groundwater has been affected by metals, radionuclides, nitrate/nitrite, cyanide, and volatile organic compounds. In general, the concentrations detected were just above background levels, and not consistently so during the year.

Nitrate/Nitrite has been reported at concentrations ranging from 3.4 mg/l to 5.6 mg/l, and TDS has been detected at concentrations up to 530 mg/l. Cyanide has been reported once in one well concentration of 11.3 µg/l, slightly above background concentrations. The radionuclide uranium-233 and -234 has been reported at concentrations ranging from 0.6751 pCi/l to 1.974 pCi/l. Groundwater samples of the bedrock aquifer indicate that a few anions, metals, and radionuclides; one indicator parameter; and possibly one organic compound have been measured above the range accepted as background for the RFP.

3.6.13 Operable Unit 12 - 400/800 Area

Currently, there are ongoing hydraulic conductivity studies being conducted on both a sitewide and OU-specific basis. Hydraulic conductivity values presented in past studies are being validated and new parameter testing is being conducted (DOE 1992b).

The OU12 Work Plan indicates that because OU12 is located in the industrial area at RFP, which is primarily paved, infiltration into the shallow soils is prevented and, as a result, most of the monitoring wells in OU12 are dry. Monitoring wells upgradient and downgradient of OU12 are located too far apart to be representative of groundwater quality in OU12. Therefore, the work plan determined that the existing groundwater analytical database for the IHSSs within OU12 is not adequate to determine the nature and extent of groundwater contamination; however, OU-specific groundwater data will be collected as part of the Phase I RFI/RI Investigation.

According to the OU12 Work Plan, unconfined groundwater occurs in the Rocky Flats Alluvium, the disturbed ground, and artificial fill. Where the Arapahoe sandstone subcrops directly beneath the surficial material, it is in hydraulic connection with the Alluvium and can act as an unconfined aquifer. Recharge to shallow groundwater areas is likely restricted (within OU12) by the pavement and structures.

Generally, "unconfined" groundwater flows west to east along the contact of the surficial material and the Arapahoe. It may discharge into streams and ditches at seep points in slopes. There is "confined" groundwater present in the sandstone units of the Arapahoe throughout most of OU12's area. Recharge to this confined groundwater is thought to occur from

infiltration of alluvial groundwater and from infiltration from precipitation where the bedrock outcrops in the western portion of RFP.

Much of the groundwater within the bedrock aquifer becomes surface water as it leaves the groundwater system at downgradient seep points, none of which occur within OU12. As part of the RFI/RI Investigation, the potential of infrastructure trenching providing migration pathways to or from the aquifers will be evaluated.

3.6.14 Operable Unit 13 - 100 Area

Unconfined groundwater flows easterly in the upper most hydrostratigraphic unit which is composed of surficial materials and Rocky Flats Alluvium. Groundwater levels in the area of OU13 fluctuates quickly in response to weather conditions. Localized recharge occurs in the unpaved areas of OU13. The Arapahoe Sandstone is not in direct contact with these surficial materials.

Well samples collected near each IHSS have found contaminants that are not representative of what was assumed to be the potential material released into the IHSS. Proximity to other non-OU13 IHSSs may be a contributing factor to the finding of anomalous contaminants. Contaminants recorded above background include uranium, plutonium, acetone, benzene, toluene, xylene, aluminum, copper, lead, and vanadium.

IHSS 117.1 had no groundwater monitoring. However, a well approximately 1,050 feet downgradient had methylene chloride, bicarbonate, chloride, nitrate/nitrite, and sulfate, uranium concentrations exceeding background. It may be difficult to link the well contaminants to the IHSS.

IHSS 117.3 had no groundwater monitoring. A well approximately 750 feet downgradient detected acetone, calcium, magnesium, sodium, chromium, lead, bicarbonate, chloride, nitrite/nitrate, and sulfate, cesium, strontium, and uranium above background.

IHSS 148 had no groundwater monitoring. A monitoring well is located 600 feet downgradient. Refer to results for IHSS 157.1.

IHSS 152 had no groundwater monitoring. A monitoring well is located approximately 700 feet downgradient. Refer to results for IHSS 117.3.

At IHSS 157.1 a groundwater monitoring well is located approximately 10 feet west of Building 442. Sampling found uranium, calcium, magnesium, sodium, chromium, and mercury, bicarbonate, chloride, nitrite/nitrate and sulfate concentrations above background.

No contaminants should currently persist at IHSS 169.

Water samples at IHSS 186 found gross alpha activity of 1.0×10^3 pCi/l to 1.7×10^5 pCi/l, gross beta activity of 5.0×10^2 pCi/l to 5.0×10^4 pCi/l. Uranium-238 activity was 1.0×10^4 pCi/l to 9×10^4 pCi/l and Americium-241 was 3.3×10^2 pCi/l to 2.4×10^2 pCi/l. Groundwater monitoring does not take place in this IHSS currently.

Groundwater in IHSS 190 is expected to exceed background for sodium, aluminum, and sulfate. Samples from a well approximately 150 feet from the site have contained aluminum and sulfate concentrations exceeding background; however, the contaminants are natural and may not be a by-product from the contamination incidents.

No contaminant should currently persist at IHSS 191. Further groundwater investigation is required for IHSS 197.

3.6.15 Operable Unit 14 - Radioactive Sites

Unconfined groundwater occurs in the Rocky Flats Alluvium, disturbed ground, and artificial fill. The Arapahoe sandstone underlies the alluvium and is, in some cases, in hydraulic contact with upper strata. Recharge in OU14 is limited because of restrictions on infiltration caused by surfaces covered with material such as asphalt. Confined groundwater is found in the Arapahoe Formation; infiltration occurs in the western part of the Plant. Water movement is generally eastward with hydraulic conductivity of 1×10^{-6} cm/s in sandstone, 1×10^{-7} cm/s in claystone, and 6×10^{-5} cm/s in the Rocky Flats Alluvium.

A borehole upgradient of IHSS 156.1 had tetrachloroethylene and carbon tetrachloride. Groundwater movement from this location could possibly bring VOCs into IHSS 156.1.

A groundwater monitoring well downgradient of IHSS 160 contained trichloroethylene, tetrachloroethylene, and trans-1,2-dichloroethylene. However, the resulting contaminants are probably not exclusively the results of IHSS 160.

A groundwater monitoring well located downgradient of IHSS 161 contained several constituents; including trichloroethylene, tetrachloroethylene, and trans-1,2-dichloroethylene. However, because of the potential effect of other sources (the monitoring well lies within OU1)

the contaminants are not fully attributable to IHSS 161. There is potential for VOC contamination of groundwater underlying IHSS 161.

Results from a groundwater monitoring well within IHSS 164.3 do not indicate the presence of contaminants.

3.6.16 Operable Unit 15 - Inside Building Closures

Unconfined groundwater is present in surficial material under OU15. Flow is generally towards the east or southeast. Recharge of the groundwater occurs but is restricted because of the effects of the surface materials (e.g., structures and road pavement) that are common in the industrialized area. The groundwater elevation will fluctuate widely as a result of precipitation. Reported hydraulic conductivity plantwide is 1×10^{-2} cm/s to 4×10^{-8} cm/s for Rocky Flats Alluvium, and 1×10^{-6} cm/s for Arapahoe Formation sandstones. No OU15 site-specific information regarding groundwater quality was located for inclusion in this report.

3.6.17 Operable Unit 16 - Low-Priority Sites

There is no contamination in groundwater associated with IHSSs in OU16 (EG&G 1994d).

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3.7 AIR QUALITY

According to the current Air Quality Management Plan (EG&G 1992a), air monitoring programs have been in existence at RFP since the early 1950s. The Plant currently incorporates progressive air quality programs that protect the plant employees, the general public, and the environment through appropriate engineering, administrative controls, and subsequent monitoring and assessment of the impact to the air from both radiological and nonradiological sources.

Air quality management is implemented by both the Air Quality Division (AQD) and the Emergency Preparedness Offsite Systems (EPOS) branch of the Health and Safety Department.

3.7.1 Sitewide Conditions

According to the 1992 Air Quality Management Plan, the major processes during full production at RFP that resulted in, or had the potential to result in, the release of pollutants to the atmosphere involved 1) fabricating, painting, cleaning, and assembling aluminum (Al) and stainless steel components; 2) plutonium (Pu) recovery; 3) americium (Am) separation; 4) resuspension of soil containing nonradioactive and radioactive particulate from remedial activities; 5) combustion of fossil fuels for steam generation and emergency power; 6) various research and development programs, and 7) restoration activities.

Due to the RFP mission change, production activities are significantly reduced or no longer conducted; however, RFP continues to monitor emissions from these sources through various regulatory programs (EG&G 1992a).

Routine atmospheric emissions may occur at more than 100 buildings at RFP. The types of air emissions range from radioactive to nonradioactive air pollutants (EG&G 1992a). These pollutants are emitted from stacks, vents, tanks, ponds, and landfills. Seventeen buildings with 63 stacks emit trace quantities of various radionuclides, including Pu, Am, U, and Tritium (H-3). The potential nonradioactive emissions include criteria and some hazardous air pollutants. These emissions primarily consist of:

- particulate matter (PM),
- oxides of nitrogen (NO_x) [fossil fuel combustion],
- sulfur dioxide (SO_2) [fossil fuel combustion],
- hydrocarbons [fossil fuel combustion],
- beryllium (Be),
- asbestos,

- carbon tetrachloride (CCl_4) [historical],
- Freon-113 ($ClCF_3$) [historical],
- hydrogen fluoride (HF) [historical],
- nitric acid,
- phosphoric acid,
- sulfuric acid (H_2SO_4),
- 1,1,1-trichloroethane (TCA) [historical], and
- and other volatile organic compounds (VOCs) associated with surface coating and maintenance operations [historical].

Although nuclear material production at RFP has been reduce or stopped, RFP continues to evaluate the emissions from nonnuclear production and support activities generating potential air emissions.

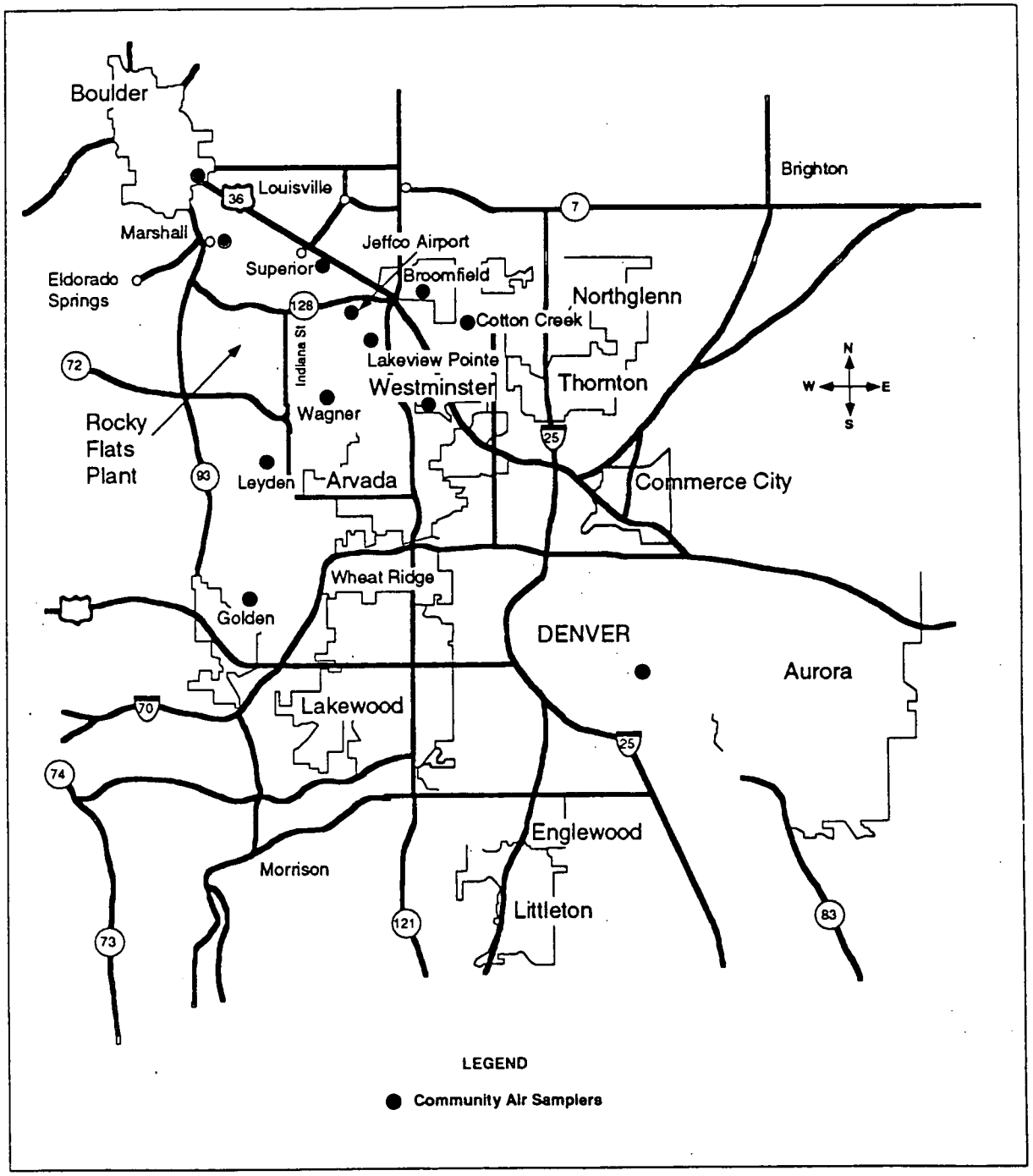
Plutonium concentrations for RFP onsite, perimeter, and community samplers are summarized and presented in Table 4.7-1 of the OU2 RFI/RI Report (DOE 1993c). The overall mean plutonium concentration for onsite samplers during 1991 was 0.073 x 10^{-15} µCi/ml. The overall mean plutonium concentration for perimeter samplers was 0.001 x 10^{-15} µCi/ml. The overall mean plutonium concentrations for community samplers was 0.001 x 10^{-15} µCi/ml.

The overall mean concentration of onsite samplers in OU2 was 0.0704 x 10^{-15} µCi/ml. All mean concentrations are much less than one percent of the Derived Concentration Guide (DCG) value of 20 x 10^{-15} µCi/ml for air inhalation of Pu-239/240. This secondary radioactivity concentration guide value is calculated from primary radiation dose standards and is used as a comparison value for measured radioactivity concentrations.

3.7.1.1 Radionuclide Emissions

The 1992 Air Quality Management Plan relates that radioactive effluent monitoring data are collected to demonstrate compliance with the EPA's National Emission Standards for Hazardous Air Pollutants, also known as NESHAP (40 CFR 61, Subpart H), which dictates a yearly limit of 10 millirem (mrem/yr) effective dose equivalent (EDE) to any member of the public (**Figure 3.7-1** and **Figure 3.7-2**).

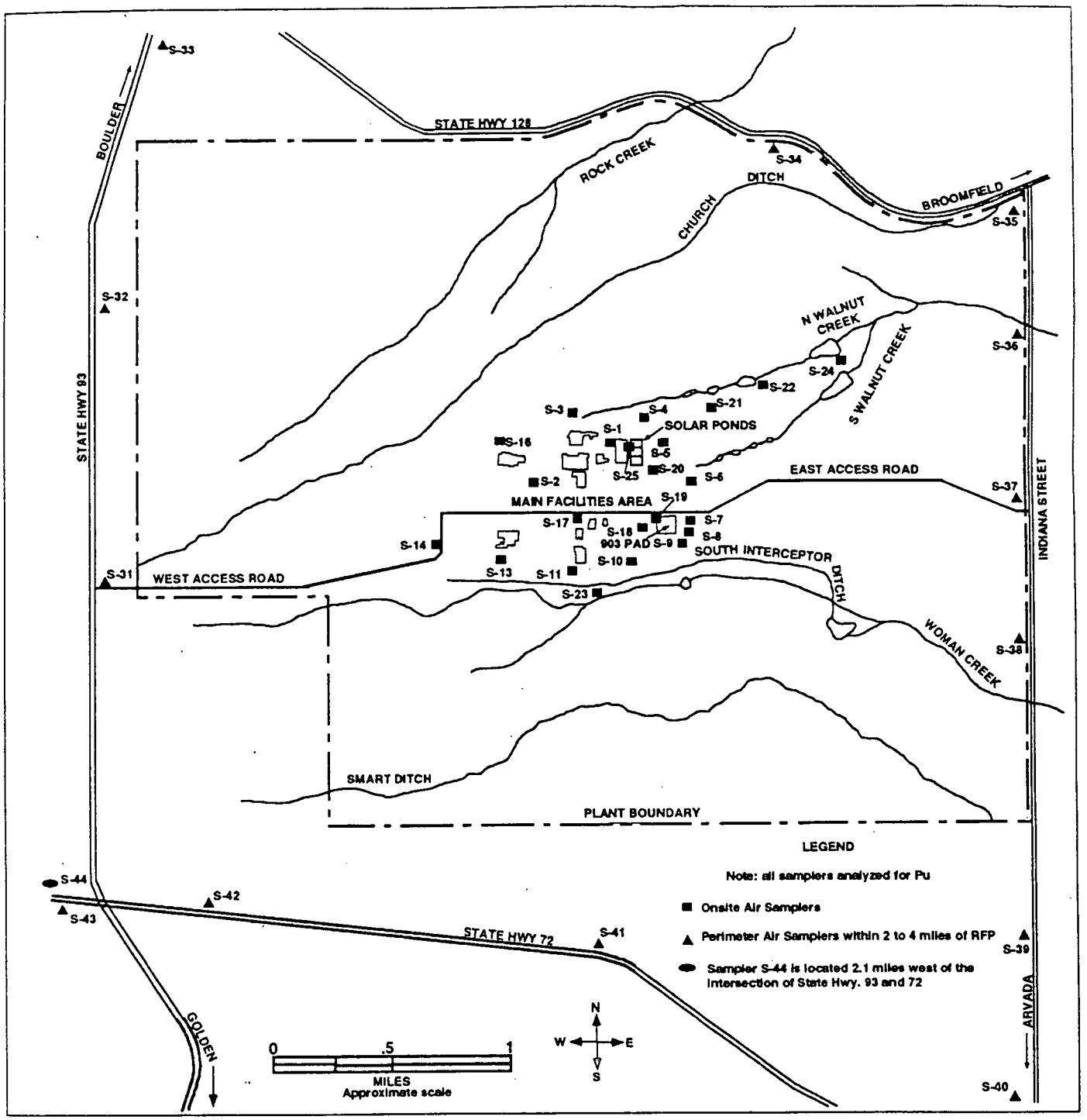
40 CFR 61, Subpart H and DOE Order 5400.1 mandate continuous monitoring of radionuclide air effluent emission points that could result in an EDE to the public greater than 0.1 mrem/yr. *Radiation doses to the public from RFP operations are currently well-below any regulatory limit and far less than are received from naturally occurring radiation sources in the Denver Metropolitan Area* (EG&G 1992a).



Source: EG&G 1992e

Figure 3.7-1

Community Ambient Air Samplers



Source: EG&G 1992e

Figure 3.7-2

Onsite and Perimeter Ambient Air Samplers

RFP continuously monitors radionuclide effluent air emissions at 63 locations in 17 buildings. The radiological effluent surveillance program uses a three-tier approach, comprised of Selective Alpha Air Monitors (SAAMs), Total Long-Lived Alpha (TLLα), and Beta screening of routine duct effluent sample filters, and radiochemical analysis of effluent particulate samples (EG&G 1992a).

On December 15, 1989, the EPA established new emissions standards and monitoring requirements for DOE facilities in 40 CFR 61, Subpart H. These rules become effective March 15, 1990. Since all of the current stack effluent monitoring systems at RFP were installed prior to this date, a step-by-step approach to assessing compliance with these regulations was implemented (EG&G 1992a).

The EPA Region VIII issued EG&G Rocky Flats Inc., an Administrative Compliance Order (ACO) on March 3, 1992, for alleged noncompliance with the effluent monitoring protocol contained in the Clean Air Act Regulation 40 CFR 61, Subpart H. The ACO required EG&G to complete several air quality studies, submit compliance documentation, and achieve compliance by March 15, 1993. EG&G completed all of the tasks required by the ACO and submitted all requested information to the EPA on December 18, 1992 (EG&G 1994l).

EG&G determined that only 9 of 63 radionuclide emission points have a sufficient emission potential to warrant continuous air effluent sampling. Of these nine, two locations did not meet the air effluent flow rate measurement protocol contained in the regulation. EG&G completed physical modifications at one location to achieve compliance and received EPA approval of alternate methodology for the other location. Therefore, EG&G believes that RFP is in full compliance with the monitoring protocol of the regulation.

In September 1993, the EPA requested additional technical information that it believed was necessary to complete its review and deliver a compliance documentation. The compliance determination is expected in the first quarter of Calendar Year 1994 (EG&G 1994l).

The Radioactive Ambient Air Monitoring Program (**RAAMP**) consists of an array of monitors used to assess radioactive particulate matter dispersion at RFP and in surrounding communities (EG&G 1992a). This ambient air monitoring is required by DOE Order 5400.1. A total of 51 samplers are located at RFP and throughout the surrounding communities, although more may be added as special monitoring requirements for OUs are determined necessary. RAAMP filters are collected biweekly and composited monthly for each location prior to isotopic analysis.

All routine ambient air filters are analyzed for Pu-239 and -240. An annual compliance report, known as the "Annual Air Emissions Report" (DOE 1993a) with dose calculations is provided

to EPA in June of each year for the previous calendar year. According to the Rocky Flats Plant Site Environmental Report for 1992 (EG&G 1992e), the 1991 Annual Air Emissions Report showed an EDE to the public of 0.00934 mrem from building-related and diffuse emissions; preliminary 1992 data indicate an EDE of 0.0017 mrem from those same sources.

In addition to the RAAMP program, a Community Ambient Air Monitoring Program is ongoing in association with RFP activities. Other special studies include the 1) Alpha Recoil from Plutonium Particles; 2) HEPA Filter Chemical and Isotopic Analysis; and 3) HEPA Filter Collection Efficiency for Submicron Particles.

3.7.1.2 Air Pollution Emission Notice (APEN)

The Colorado Air Pollution Prevention and Control Act of 1992 (also known as Colorado Senate Bill 105) addresses the use, emission, and reporting of hazardous air pollutants (HAPs) to be reported through the Air Pollution Emission Notice (APEN) program, and gives the Colorado Air Quality Control Commission (CAQCC) the leverage to set reporting levels for HAPs (EG&G 1992a).

Colorado Air Regulation No. 3 requires that the Colorado Department of Health, Air Quality Control Division must receive an APEN for any existing or new source of air pollutants resulting from construction or alteration of any facility, process, or activity from which regulated air pollutants are emitted (EG&G 1992e). APENs provide 1) source-specific data, 2) an estimate of the quantity and composition of the air emissions generated from source operations, and 3) supporting information for Colorado Air Permit regulations.

According to the 1992 Site Environmental Report, approximately 240 APENs were filed with the state during the last 3 years, including the baseline air emission inventory completed in June 1991. A list of buildings and operations for which APEN reports were submitted in December 1992 are presented in the *Rocky Flats Plant Site Environmental Report for 1992*. A total of 116 APEN Update Forms for criteria pollutants and 46 supporting APEN Reports were submitted to the Air Pollution Control Division on December 23, 1992 (EG&G 1992e).

In response to the revised reporting thresholds or *de minimis* levels, the revised chemical lists and the expanded reporting requirements of Regulation No. 3 promulgated in June 1993, 12 APEN Update Forms for Hazardous Air Pollutants (HAPs) and 25 revised APEN Reports were submitted to the Air Pollution Control Division on December 3, 1992 (EG&G 1994l).

3.7.1.3 Volatile Organic Compound (Chlorinated Solvent) Emissions

Colorado Air Regulation No. 7 sets forth requirements for reporting volatile organic compound (VOC) emissions, identification of the source of those emissions, and determination of reasonably available control technologies (RACTs) to reduce those emissions (EG&G 1992a). At RFP, emission sources and their calculated emissions are integrated into the APEN inventory and reporting process (EG&G 1994l).

3.7.1.4 Beryllium Emissions

Colorado Air Regulation No. 8 requires continuous monitoring of beryllium (Be) emissions. At RFP, this monitoring is achieved through analysis of the 63 radioactive particulate filters collected biweekly and composited on a monthly basis for each sample location (EG&G 1992a).

Beryllium has been machined and processed at RFP. The most recent issue of the RFP Site Environmental Report indicates that the emissions standard is 10 grams (g) of Be over a 24-hour period. Beryllium emissions did not exceed this standard in 1992 (EG&G 1992e). Compliance tests, using EPA methodology, were to be conducted on five air effluent ducts that had the highest potential for Be emissions, pending resumption of plutonium operations in 1991. Plutonium operations were not resumed; therefore, this compliance testing was not pursued. Negotiations with CDH are in progress, as of this writing, to refine the applicability of Regulation No. 8 to RFP's current plant operations (EG&G 1994l).

3.7.1.5 Operable Unit Special Projects

The AQD manages the ambient air monitoring, meteorological monitoring, and dispersion modeling projects in support of remedial activities at RFP (EG&G 1992a). At present, special air studies and monitoring are being conducted, or will be conducted, on two of the 16 operable units. The complexity of the studies depend on the type of remedial activities conducted, potential exposure pathways, and the contaminants of concern.

The potential exists that a release of material could occur during remedial activities (e.g., digging test pits, installing groundwater monitoring wells, or excavating contaminated soils for disposal). To ensure that such activities do not adversely impact the environment, the *Plan for Prevention of Contaminant Dispersion* (PPCD) was mandated by the IAG and finalized in late 1991. The PPCD (DOE 1992aa) is applicable to intrusive field activities conducted as part of RFI/RI actions. It provides project-specific procedures for managing even minor excavations. Primarily, these procedures involve the implementation of worker safety sampling as part of the project-specific health and safety plan (EG&G 1994l).

The special air studies for the two operable units involve installation of temporary radiological air samplers, as requested by the regulatory agencies.

OU3 - Off-site Releases: Air samplers will be installed at specific locations south and west of RFP. Installation is currently delayed as details continue to be finalized (e.g., eagles are present near one proposed location). In addition, the *OU3 Wind Tunnel Study* has recently been completed [see Section 3.7.4].

OU5 - Woman Creek Priority Drainage: Three samplers have been installed to monitor activities from OU5 and to develop baseline ambient data. The locations are: 1) on the north side of the west access road, directly west of the raw water storage pond; 2) 200-400 meters west of RAAMP sampler #23; and 3) 200-400 meters southeast of the old ash pits.

In addition to the temporary samplers noted above, the Air Quality Management Plan notes that ambient air monitoring of OU remediation activities will use a number of existing RAAMP samplers located in the vicinity of each respective OU to fully characterize and document radioactive particulate releases from these sites. Monitoring programs from other OUs may be developed as remedial action plans for each OU are formulated and approved. Ambient monitoring for radiological particulates were evaluated for both environmental protection and restoration needs. Based on this evaluation, the RAAMP network upgrade project is including the siting of permanent samplers that will service future OU operational needs (EG&G 1994l).

The existing OU high-volume ambient air samplers are operated continuously (24-hours per day). Filters for the OU special projects are/will be collected weekly or biweekly and composited monthly by location. The filters are routinely analyzed for isotopic Pu-239, -240, and Am-241. Analysis of OU5 samples will be completed for isotopic uranium-234 and -238, and americium-241.

The following sections present information on air quality regarding **individual operable units**. Status of emissions relative to each OU is constantly evolving. This information is updated annually in the *Rocky Flats Plant Site Environmental Report* or in OU-specific human health risk assessment reports.

3.7.2 Operable Unit 1 - 881 Hillside

Four high volume particulate samplers were installed on the 881 Hillside for continuous air monitoring, during installation of the French Drain. The results were recorded in monthly monitoring reports and the OU1 RFI/RI Report. Health and safety monitoring was conducted using photoionization detectors (PIDs), flame ionization detectors (FIDs) and Minirams. The

PID and FID were used to detect VOCs during borehole drilling. No VOCs were detected. The Miniram was used to detect particulate concentrations (0.01 to 100 mg/m^3) during operations (DOE 1991e). These particulate readings were used as a screening device to evaluate potential real-time radiological exposure (EG&G 1994l).

Health and safety air sampling was proposed during additional soil sampling (see Section 3.1.2) to evaluate potential suspended particulates concentration in air. (DOE 1992f)

3.7.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

Five Radioactive Ambient Air Monitoring Program (RAAMP) samplers are located within OU2, while four RAAMP samplers are located on the western perimeter of OU2 along Indiana Street. Tables 4.7-1 and 4.7-2 of the OU2 RFI/RI Report (DOE 1993c) summarize RAAMP plutonium concentrations measured in 1991 and 1992. The maximum monthly and mean annual plutonium concentrations of 0.461 x 10^{-15} µCi/ml and 0.082 x 10^{-15} µCi/ml, respectively, were measured at a sampler located just southeast of 903 Pad. These monthly and annual concentrations were the third highest concentrations measured by the onsite samplers.

The nonradiological TSP and PM_{10} particulate samplers are located on top of the air quality trailer, which is located near OU2, north of the East Access Road, north of the 903 Pad.

The highest TSP value recorded in 1991 (24-hour sample) was 82.3 micrograms per cubic meter (µg/m^3), which represents 32 percent of the CDH ambient air quality standard (AAQS) of 260 µg/m^3. The annual geometric mean TSP value for 1991 was 39.8 µg/m^3 which represents 53 percent of the CDH AAQS of 75 µg/m^3.

Annual TSP concentrations have varied from 31.4 µg/m^3 to 53.5 µg/m^3 since 1987. The observed 24-hour maximum for PM_{10} during 1991 was 26.4 µg/m^3, which represents 18 percent of the standard of 150 µg/m^3. The annual arithmetic mean concentration was 13.6 µg/m^3 which represents 27 percent of the NAAQS of 50 µg/m^3. Annual average PM_{10} concentrations have varied from 9.8 µg/m^3 to 20.9 µg/m^3 since monitoring began in 1988.

Prior to installation and operation of the surface water IM/IRA it was not expected that significant amounts of VOCs would be emitted during installation and that operation of the treatment system would not produce measurable quantities of VOC emissions because of the low concentrations of VOCs in the surface water (DOE 1991f).

VOCs that may be released during installation of a vapor extraction system are not expected to significantly affect the air quality. Higher than expected dust emissions during installation will lead to dust suppression actions such as soil wetting, changes in drilling activities, placing surfactants on roads, and work stoppage. Granular activated carbon and HEPA filters will be used to remove VOCs and radionuclides, respectively, while operating the vapor removal system.

3.7.4 Operable Unit 3 - Off-Site Releases

Air monitoring is conducted at numerous sites on plantsite. In response to the lawsuit against Rocky Flats, nine monitoring stations were installed in or near IHSS 199 acreage. These were removed in 1978 when it was found that the data was not significantly different than that generated by several nearby onsite monitors. Two continuous high-volume samplers are also proposed for installation near Standley Lake. The air samples collected will be analyzed for plutonium, americium, and uranium deposits. Potential impacts to the bald eagle will have to be evaluated before installation of the samplers occurs (DOE 1992l).

The *OU3 Wind Tunnel Study* has recently been completed (DOE 1994d). The study documents portable wind tunnel tests conducted to quantify wind resuspension emissions of particulate matter from the soils and sediments of OU3. The test sites were concentrated within three locations: the shore around Standley Reservoir, the shore around Great Western Reservoir, and the terrestrial sites between the two. The report describes the sampling equipment and procedures used in field testing, as well as the results of the study. The results (i.e., resuspension values) will be used in air modeling to provide more accurate projections. This information, in turn, will be presented within Technical Memoranda #1 of the Final RFI/RI Work Plan for OU3.

3.7.5 Operable Unit 4 - Solar Evaporation Ponds

Radioactive Ambient Air Monitoring Program (RAAMP) sampling in the solar pond areas found plutonium concentrations low and consequently, do not pose a threat to workers in the area. Two samplers in the pond area recorded average concentrations of 1.6×10^{-4} pCi/m^3 (maximum 7.7×10^{-4} pCi/m^3) and 7.0×10^{-6} pCi/m^3 (1.5×10^{-5} pCi/m^3) (DOE 1994a).

3.7.6 Operable Unit 5 - Woman Creek Priority Drainage

According to the OU5 Work Plan, the Woman Creek drainage includes several existing Radioactive Ambient Air Monitoring Program samplers (DOE 1992n). Environmental sampling of ambient air within OU5 is limited to radionuclide parameters.

Seven sampling stations currently exist in the Woman Creek drainage area. In its follow-up comments on the Draft OU5 Work Plan, the EPA requested additional air monitoring locations for OU5. The three additional special samplers are noted in *Figure 7-2: Sediment and Surface Water Sampling Sites and Air Monitoring Sections Along Woman Creek and the South Interceptor Ditch* of the Final work plan. These samplers were installed in late 1992 at the following locations:

- S100 is located downwind of the Original Landfill;
- S101 is located downwind of the Ash Pits;
- S102 is located between OU5 and OU11.

According to a recent study of pond management (DOE 1993l), air emissions from current pond management operations are very limited. Overall, air quality is benefitted by the pond function of sedimentation. Contaminants present in the stormwater runoff and wastewater are, primarily, settled out on pond bottoms and kept submerged by volume management so that they do not become airborne.

3.7.7 Operable Unit 6 - Walnut Creek Priority Drainage

The Walnut Creek drainage includes several existing RAAMP samplers. Environmental sampling of ambient air within OU6 is limited to radionuclide parameters (EG&G 1994l).

According to a recent study of pond management (DOE 1993l), air emissions from current pond management operations are very limited. Overall, air quality is benefitted by the pond function of sedimentation. Contaminants present in the stormwater runoff and wastewater are, primarily, settled out on pond bottoms and kept submerged by volume management so that they do not become airborne.

As part of the current pond management practices, volume management operations on Pond A-2 and the Landfill Pond may create air emissions from spray evaporation activity. Volatile organics may be emitted during actual spray procedures and nitrogen oxide (NOx) emissions may arise from diesel-fueled generators and water pumps (DOE 1993l).

Typical spray evaporation operations take place from May to September, during daylight hours only, seven days a week, evaporating approximately 1,000 gallons per minute at each location. Estimated actual water evaporation at each location is 12,000 to 14,000 gallons per day. Analytical sampling for volatile organic and semi-volatile organic compounds (VOCs) was conducted at both locations in the spring of 1993. These samples were analyzed by General Laboratory, an EPA-registered laboratory (DOE 1993l).

Results from this analysis were used by Air Quality Division personnel to project total emissions from spray evaporation operations (DOE 1993l). Maximum concentration levels of each compound were added together. Emissions were calculated based on the total concentration level of the compounds and pertinent operating parameters. Estimated maximum VOC emissions for the two locations were found to be as follows:

Landfill Pond	13 pounds/year
Pond A-2	11 pounds/year

Colorado air quality regulations require reporting if total VOC emissions exceed 2,000 pounds per year. In addition, several compounds listed in the sampling data are also "non-criteria reportable pollutants" as set forth in the regulations. These compounds must be reported if they exceed 250 pounds per year individually. The 250 pounds per year *de minimis* level is based on a reporting scenario established in Appendix A of the *Colorado Air Quality Control Regulation No. 3* that takes into account the distance the source is from the property boundary (DOE 1993l).

Spray evaporation operations are significantly below both of these reporting levels. Because of their small size, total emissions from spray evaporation operations do not contribute materially to cumulative RFP total emissions because the operations are considered to be insignificant sources (DOE 1993l).

3.7.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

The drainage of the Landfill Pond includes existing RAAMP samplers. Environmental sampling of ambient air within OU7 is limited to radionuclide parameters (EG&G 1994l).

According to a recent study of pond management (DOE 1993l), air emissions from current pond management operations are very limited. Overall, air quality is benefitted by the pond function of sedimentation. Contaminants present in the stormwater runoff and wastewater are, primarily, settled out on pond bottoms and kept submerged by volume management so that they do not become airborne.

As part of the current pond management practices, volume management operations on Pond A-2 and the Landfill Pond may create air emissions from spray evaporation activity. Volatile organics may be emitted during actual spray procedures and nitrogen oxide (NOx) emissions may arise from diesel-fueled generators and water pumps (DOE 1993l).

Typical spray evaporation operations take place from May to September, during daylight hours only, seven days a week, evaporating approximately 1,000 gallons per minute at each location. Estimated actual water evaporation at each location is 12,000 to 14,000 gallons per day. Analytical sampling for volatile organic and semi-volatile organic compounds (VOCs) was conducted at both locations in the spring of 1993. These samples were analyzed by General Laboratory, an EPA-registered laboratory (DOE 1993l).

Results from this analysis were used by Air Quality Division personnel to project total emissions from spray evaporation operations (DOE 1993l). Maximum concentration levels of each compound were added together. Emissions were calculated based on the total concentration level of the compounds and pertinent operating parameters. Estimated maximum VOC emissions for the two locations were found to be as follows:

Landfill Pond	13 pounds/year
Pond A-2	11 pounds/year

Colorado air quality regulations require reporting if total VOC emissions exceed 2,000 pounds per year. In addition, several compounds listed in the sampling data are also "non-criteria reportable pollutants" as set forth in the regulations. These compounds must be reported if they exceed 250 pounds per year individually. The 250 pounds per year *de minimis* level is based on a reporting scenario established in Appendix A of the *Colorado Air Quality Control Regulation No. 3* that takes into account the distance the source is from the property boundary (DOE 1993l).

Spray evaporation operations are significantly below both of these reporting levels. Because of their small size, total emissions from spray evaporation operations do not contribute materially to cumulative RFP total emissions because the operations are considered to be insignificant sources (DOE 1993l).

3.7.9 Operable Unit 8 - 700 Area

An integration of work efforts within the Industrial Area OUs is currently underway. The Industrial Area Interim Measure/Interim Remedial Action Decision Document is being developed, as of this writing, and will include air monitoring program evaluations and recommended upgrades (EG&G 1994l).

3.7.10 Operable Unit 9 - Original Process Waste LInes

An integration of work efforts within the Industrial Area OUs is currently underway. The Industrial Area Interim Measure/Interim Remedial Action Decision Document is being

developed, as of this writing, and will include air monitoring program evaluations and recommended upgrades (EG&G 1994l).

3.7.11 Operable Unit 10 - Other Outside Closures

An integration of work efforts within the Industrial Area OUs is currently underway. The Industrial Area Interim Measure/Interim Remedial Action Decision Document is being developed, as of this writing, and will include air monitoring program evaluations and recommended upgrades (EG&G 1994l).

3.7.12 Operable Unit 11 - West Spray Field

No site-specific information regarding air quality or monitoring was located for inclusion in this report.

3.7.13 Operable Unit 12 - 400/800 Area

An integration of work efforts within the Industrial Area OUs is currently underway. The Industrial Area Interim Measure/Interim Remedial Action Decision Document is being developed, as of this writing, and will include air monitoring program evaluations and recommended upgrades (EG&G 1994l).

3.7.14 Operable Unit 13 - 100 Area

An integration of work efforts within the Industrial Area OUs is currently underway. The Industrial Area Interim Measure/Interim Remedial Action Decision Document is being developed, as of this writing, and will include air monitoring program evaluations and recommended upgrades (EG&G 1994l).

3.7.15 Operable Unit 14 - Radioactive Sites

An integration of work efforts within the Industrial Area OUs is currently underway. The Industrial Area Interim Measure/Interim Remedial Action Decision Document is being developed, as of this writing, and will include air monitoring program evaluations and recommended upgrades (EG&G 1994l).

3.7.16 Operable Unit 15 - Inside Building Closures

No site-specific information regarding air quality or monitoring was located for inclusion in this report.

3.7.17 Operable Unit 16 - Low-Priority Sites

No site-specific information regarding air quality or monitoring was located for inclusion in this report.

* * *

3.8 GEOLOGY, PALEONTOLOGY, AND MINERAL RESOURCES

3.8.1 Sitewide Conditions

The Rocky Flats Plant (RFP) is situated approximately four miles east of the Front Range section of the Southern Rocky Mountain province on the western edge of the Colorado Piedmont section of the Great Plains Physiographic Province. The RFP is located on a mountain front pediment that dips at approximately 1.5 degrees to the east. The pediment and alluvial cover are dissected by several small eastward-flowing streams.

The geology of RFP is described in the Geologic Characterization (EG&G 1991b), which is a compilation and summary of previous geologic work in the area. Additional information is provided in the Phase II Geologic Characterization Data Acquisition report (DOE 1992v) and Phase II Geologic Characterization Data Acquisition, Task 2 Deep Seismic report (DOE 1993j)

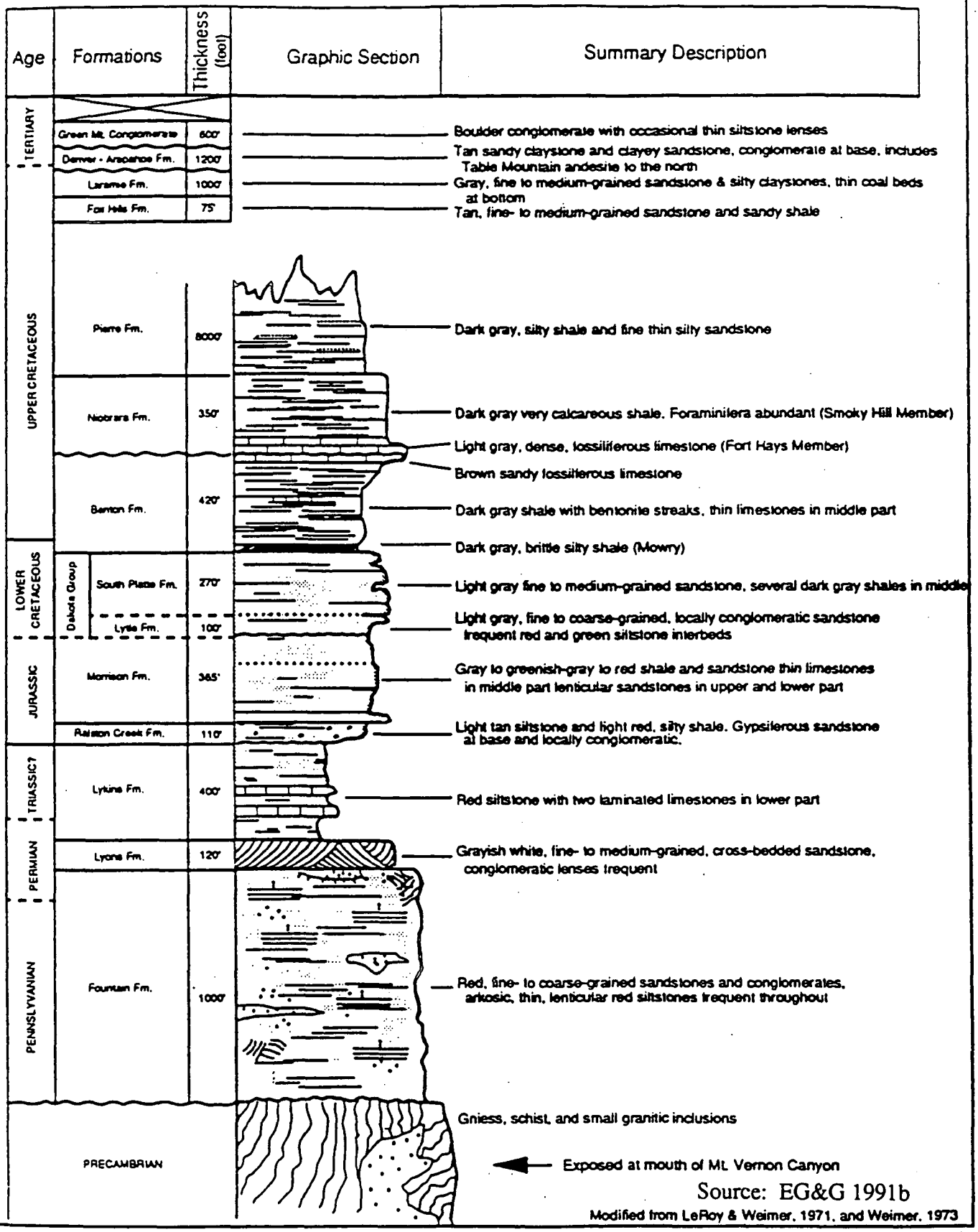
3.8.1.1 Sitewide Stratigraphy

The stratigraphic section in the vicinity of the RFP extends from the Precambrian to the Quaternary. **Figure 3.8-1** depicts a generalized stratigraphic section of the Golden-Morrison area, while **Figure 3.8-2** illustrates a site-specific stratigraphic section of the geology beneath the RFP. **Figure 3.8-3** is a surficial geology map of the RFP and vicinity.

West of the plant, rocks from Pennsylvanian/Permian to Late Cretaceous age are exposed along the western limb of a prominent monoclinal fold. Outcropping strata are progressively older from the east toward the west, with the Fountain Formation resting unconformably on Precambrian rocks of the Front Range. (EG&G 1991b)

3.8.1.1.1 Precambrian

Along the Front Range, the Precambrian rocks are made up of microcline gneiss, with varying amounts of amphibolite, hornblende gneiss, layered cal-silicate gneiss, biotite gneiss, and quartz gneiss. The microcline gneiss is comprised of fine- to medium-grained microcline, quartz, plagioclase, and biotite. (DOE 1992v)



Source: EG&G 1991b

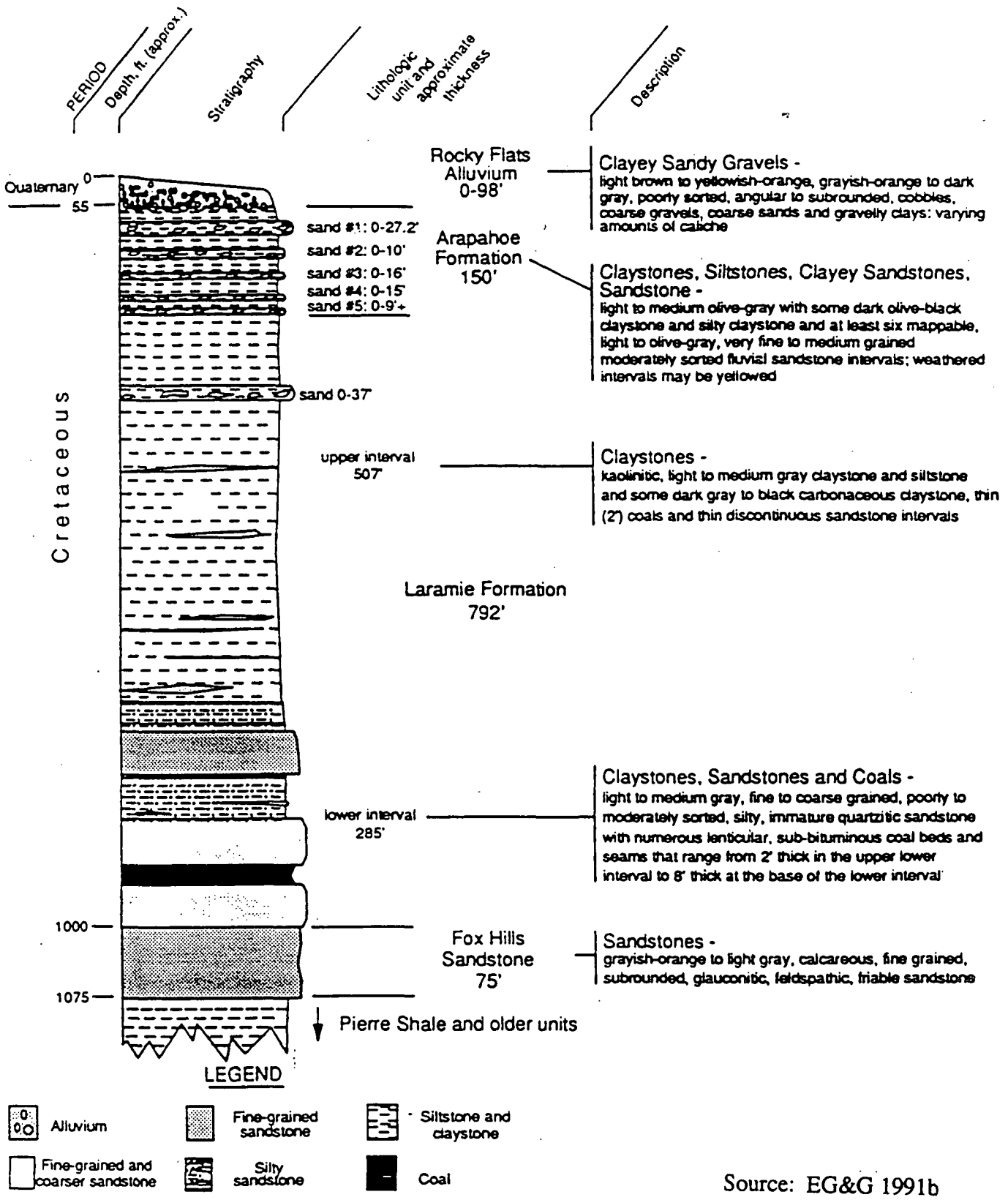
Modified from LeRoy & Weimer, 1971, and Weimer, 1973

GENERALIZED STRATIGRAPHIC SECTION, GOLDEN-MORRISON AREA

GEOLOGIC CHARACTERIZATION

Figure 3.8-1

ROCKY FLATS PLANT
GOLDEN, COLORADO



Source: EG&G 1991b

ROCKY FLATS PLANT SITE SPECIFIC STRATIGRAPHIC SECTION

GEOLOGIC CHARACTERIZATION
ROCKY FLATS PLANT
GOLDEN, COLORADO

Figure 3.8-2

3.8.1.1.2 Paleozoic and Mesozoic Sedimentary Section

The total Paleozoic and Mesozoic stratigraphic section in the RFP area is estimated to be roughly 13,000 feet thick, assuming that each formation is approximately as thick in the subsurface as it is in the Front Range outcrop. The formations are described briefly in ascending order. (EG&G 1991b)

The Fountain Formation (Pennsylvanian/Permian) is approximately 800 feet thick and is comprised of interbedded conglomeratic, cross-bedded arkosic, sandstone, and conglomeratic interbedded with micaceous silty mudstones. The Lyons Sandstone (Permian) is approximately 150 feet thick, conformably overlies the Fountain Formation, and is comprised primarily of sandstone with occasional interbeds of siltstones, mudstones, and conglomerates.

The Lykins Formation (Permian/Triassic), which is approximately 450 feet thick, unconformably overlies the Lyons Sandstone, and is comprised of interbedded calcareous mudstone and dolomitic limestones. The Ralston Creek Formation (Jurassic) is about 110 feet thick, unconformably overlies the Lykins Formation, and is comprised of claystones with limestones, siltstones, and chert.

The Morrison Formation (Jurassic) is approximately 250 feet thick, conformably overlies the Ralston Creek Formation, and is comprised of interbedded claystones and siltstones with sandstones, mudstones, and limestones. The Dakota Group (Early Cretaceous), which is approximately 300 to 350 feet thick, unconformably overlies the Morrison Formation, and is generally composed of sandstones, siltstones, and claystones. The Benton Shale (Upper Cretaceous) ranges from 450 to 500 feet thick, conformably overlies the Dakota Group, and is primarily comprised of shale interbedded with siltstone, bentonite, and limestone.

The Niobrara Formation (Upper Cretaceous) is approximately 350 feet thick, unconformably overlies the Benton Shale, and is comprised of a limestone member and a shale member. (DOE 1992v)

The Pierre Shale Formation (Upper Cretaceous) is approximately 7,500 feet thick and conformably overlies the Niobrara Formation. The lower portion is bentonitic claystone with noncalcareous siltstone beds. The upper portion is silty bentonitic shale with limestone concretions and sandstone beds. The Pierre Shale contains foraminifera and ammonite fossils indicating that the Pierre was deposited in a marine environment. The contact between the Pierre Shale and the overlying Fox Hills Sandstone is delta-front environments of deposition. (EG&G 1991b)

The Fox Hills Sandstone Formation (Upper Cretaceous) is approximately 90 to 140 feet thick and conformably overlies the Pierre Shale. The lower portion is silty sandstone that contain calcareous sandstone concretions; the lower part is also silty sandstone. (DOE 1992v) The environment of deposition is interpreted as a delta-front sandstone in facies relationship with the underlying Pierre Formation and the overlying Laramie Formation. (EG&G 1991b)

The Laramie Formation (Upper Cretaceous) is approximately 600 to 800 feet thick and is comprised of two units: a lower sandstone and coal unit, and an upper claystone interval. (DOE 1992v) The Laramie Formation was deposited in a delta plain to shallow marine environment. Fragments of oyster shells and fossil leaf and bark imprints are abundant in some sandstones and claystones of the Laramie Formation (DOE 1992v).

The Upper Cretaceous rocks, which unconformably underlie the surficial material at the Rocky Flats Plant, consist dominantly of claystones and silty claystones with sandstone bodies present. According to the Geologic Characterization Report for RFP (EG&G 1991b), the youngest Cretaceous unit is the Arapahoe Formation, and its thickness beneath the central portion of the Plant is 150 feet. The Arapahoe Formation lithologies here are described as claystones and sandstones, with at least five identifiable lenticular sandstone bodies present. The uppermost sandstone unit of the Arapahoe Formation there is referred to as the Number One Sandstone.

However, results from recent field mapping (DOE 1992v) and biostratigraphic evaluation indicate that the Arapahoe Formation, if present, is relatively thin (less than 50 feet thick) and only locally present under the RFP area. The Number One Sandstone as described in the Geologic Characterization Report either correlates to the Basal Arapahoe Sandstone or an upper Laramie sandstone.

The claystone bedrock identified as Arapahoe Formation in the Geologic Characterization Report (EG&G 1991b) actually belongs to the Laramie Formation. Therefore most, if not all, of the bedrock subcropping at the alluvial/bedrock unconformity actually belong to the upper Laramie Formation. Usage of the term Arapahoe Formation should be restricted to what has been previously defined as the Number One Sandstone; even though this unit might actually belong to the Laramie Formation.

The basal Arapahoe sandstone, or Number One Sandstone, beneath the post-Cretaceous unconformity is of concern as a potential contamination pathway. Most of the bedrock sandstones are very fine- to medium-grained, poorly to moderately sorted, subangular to subrounded, silty, and clayey. Some coarse-grained conglomeratic sandstones have been identified in the Arapahoe Number One Sandstone unit. Generally, all Arapahoe-Laramie

sandstones are laterally discontinuous and have lenticular geometries. The Number One Sandstones have been interpreted as meandering channel, point bar, and overbank deposits.

3.8.1.1.3 Mesozoic and Cenozoic Sedimentary Section - Latest Cretaceous/Tertiary

None of the Latest Cretaceous/Tertiary formations are present in the immediate RFP area. They are referenced herein because they are mentioned in the "Tectonic" section of this report.

The Denver Formation (Latest Cretaceous/Paleocene) ranges from 900 to 1,200 feet thick and is composed of mudstones, lava flows, sandstones, conglomerates, and breccias which contain volcanic lithic fragments. (EG&G 1991b)

The Dawson Formation (Latest Cretaceous/Eocene) is an arkose derived from the Pikes Peak Granite to the west. Both the Arapahoe and Denver Formations intertongue southward with the Dawson Formation. (EG&G 1991b)

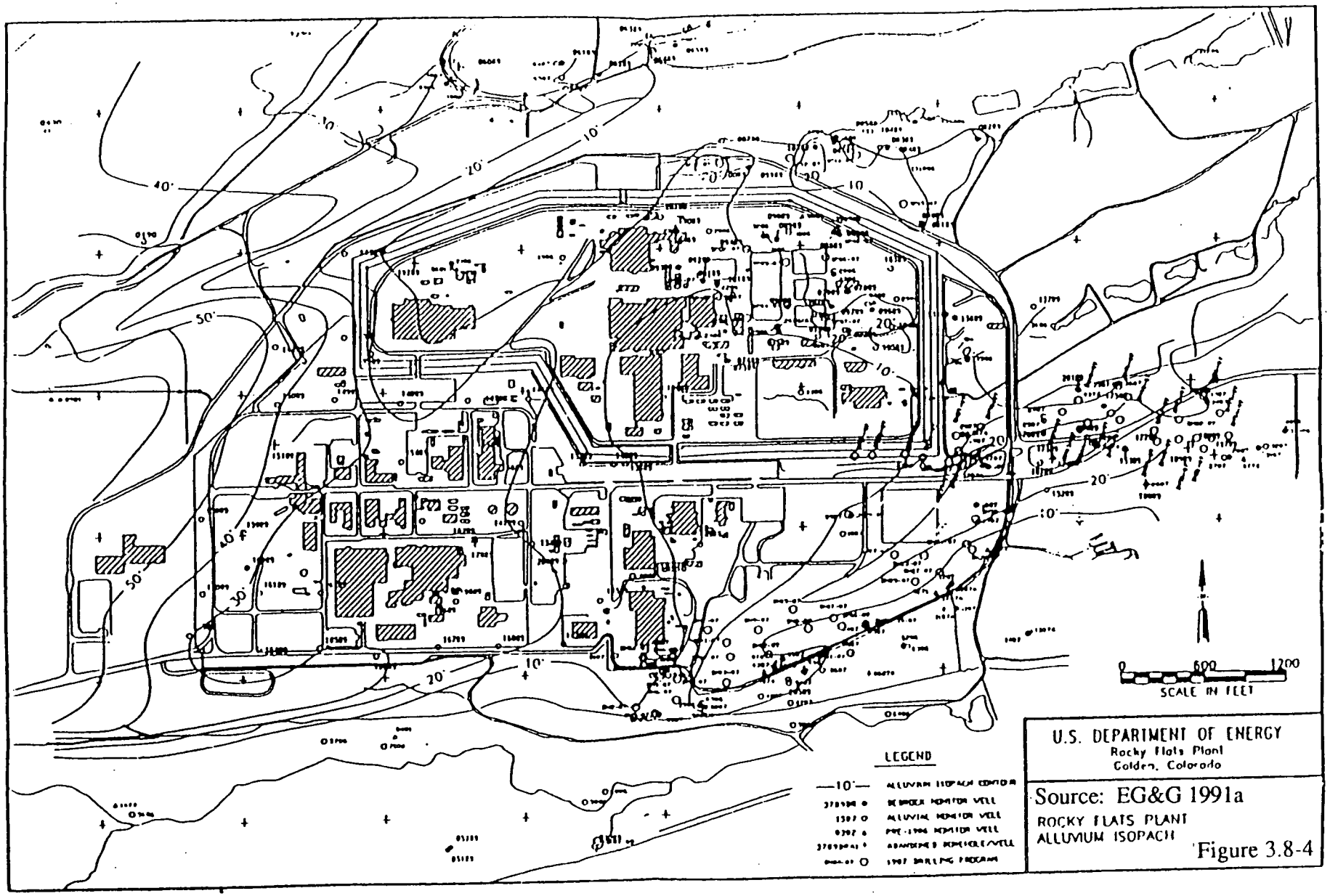
Resting unconformably on the Denver Formation, the Green Mountain Conglomerate (Paleocene) is 600 feet thick and is a coarse conglomerate. (EG&G 1991b)

3.8.1.1.4 Quaternary Alluviums

The Quaternary alluviums have been divided into two main types depending on whether they cover pediments or are valley fills. All of the Quaternary alluviums have been correlated along the Front Range by their height above modern drainages and major streams. Each height represents a stable geomorphic level in the Quaternary. **Figure 3.8-4** presents the thickness of alluvial deposits at the RFP. (EG&G 1991b)

The Rocky Flats, Verdos, and Slocum Alluviums are all gravelly pediment covers. The Rocky Flats Alluvium (Nebraskan or Aftonian in age) ranges (in the vicinity of Rocky Flats) from one to 100 feet in thickness and occurs about 250 to 380 feet above modern streams. (DOE 1992v)

The Rocky Flats Alluvium, which is the predominant alluvium in the vicinity of Rocky Flats, was deposited on a Pre-Wisconsin Pleistocene pediment and has been dissected by east-west trending, small, intermittent streams. It is composed of poorly sorted, angular to rounded, coarse gravels, sands, and gravelly clays. The amount of caliche mineralization in the interstices of the Rocky Flats Alluvium ranges from 0 to almost 100 percent.



Source: EG&G 1991a

ROCKY FLATS PLANT
ALLUVIUM ISOPACH

Figure 3.8-4

In the buffer zone west of the plant, where sedimentary strata are steeply tilted, it is quite possible that water is able to percolate through the alluvium and move into the subsurface sandstones. In the area east of the monoclinal fold axis, the bedrock is primarily claystone. Percolating groundwater moves through the claystone slowly; it tends to remain in the Rocky Flats Alluvium and Arapahoe Sandstone No. 1.

Because the alluvium is much thinner in the central portion of RFP, the vadose zone groundwater is subject to a great amount of surface evaporation and, consequently, deposits caliche in the pore spaces. Variations on this action may occur in the other alluviums and terraces found along the flanks of the stream drainages. (EG&G 1991b)

The Verdos Alluvium (Kansan or Yarmouth in age) is comprised of well-stratified, coarse gravel and coarse sand. This Alluvium ranges from 15 to 35 feet in thickness and occurs about 200 to 250 feet above modern streams. (EG&G 1991b)

The Slocum Alluvium (Illinoisan or Sangamonian in age) is composed of well-stratified, clayey, coarse gravel and coarse sand. Ranging from 10 to 90 feet in thickness, the Slocum Alluvium occurs around 80 to 120 feet above modern streams. (EG&G 1991b)

3.8.1.1.5 Valley Alluviums

Composed of well-stratified, coarse sand and gravel, the Louviers Alluvium (Early Wisconsin in age) ranges from 15 to 25 feet in thickness and forms well-developed terraces 40 to 80 feet above modern streams. (EG&G 1991b)

The Broadway Alluvium (Late Wisconsin in age) is comprised of coarse, pebbly sand and cobbly gravel. Ranging from 10 to 25 feet in thickness and forming widespread terraces 25 to 45 feet above modern streams, the Broadway Alluvium commonly occurs in channels cut into the Louviers Alluvium. (EG&G 1991b)

3.8.1.1.6 Recent Deposits

Among the most recent deposits in the Denver area are the Pre-Piney Creek, Piney Creek, and Post-Piney Creek Alluviums. The Pre-Piney Creek Alluvium (Early Recent in age) is composed of silt and sand, but contains thin lenses of pebbles. It occurs 25 feet above modern ephemeral and smaller permanent streams in fill terraces up to 40 feet. (EG&G 1991b)

The Piney Creek Alluvium (Late Recent in age) is composed of humic clay, silt, sand, and some

pebble beds in layers ranging from 0.5 to 10 inches. It occurs 10 to 25 feet above modern streams in low fill terraces 4 to 25 feet thick. (EG&G 1991b)

The Post-Piney Creek Alluvium (Late Recent in age) is composed of two types of interbedded sandstones: one is poorly consolidated, humic, and fine- to medium-grained; the other is magnetite rich. These deposits form the lowest terraces and floodplains of major streams. They are no more than 12 feet thick and are found from 0 to 12 feet above stream level. (EG&G 1991b)

3.8.1.2 Sitewide Structural Geology

Structurally, the RFP is located along the western margin of the Denver Basin about four miles to the east of the Front Range uplift. The Front Range is the most easterly range of mountains in the Southern Rocky Mountain province. The Denver Basin has a steep western flank and a broad, gentle eastern flank. The basin is an asymmetric synclinal downwarp that is bounded on one side by a related uplift. The basin contains over 13,000 feet of Paleozoic, Mesozoic, and Cenozoic sedimentary rocks that rest on a Precambrian basement. (EG&G 1991b)

The most conspicuous structural feature of the Rocky Flats area is a monoclinal fold which formed west of RFP during the Laramide Orogeny. The fold developed at the juncture where sedimentary rocks contact the Front Range border thrust. (EG&G 1991b)

3.8.1.2.1 Pre-Laramide Tectonics

During the Pennsylvanian period, a major tectonic upheaval occurred in several places throughout the continental interior platform (western, central, and northern Colorado, north-central New Mexico, and south-central Wyoming). This uplift is generally referred to as the Ancestral Rockies.

By the beginning of the Triassic period, the Ancestral Rockies were almost totally eroded. During their destruction, volumes of sediment were supplied to the surrounding areas and became incorporated into the rock record. Along the eastern margin of the Ancestral Rockies, these sediments are represented by the Fountain Formation. (EG&G 1991b)

During the Late Jurassic to Late Cretaceous the Morrison Formation and Pierre Shale were deposited in a foreland basin which received sediments from thrust belts to the west and the North American craton to the east (EG&G 1991b).

3.8.1.2.2 Laramide Tectonics

The term "Laramide" describes the orogenic events that occurred between Late Campanian Cretaceous and Late Eocene time. The Front Range uplift probably took place approximately 67.5 million years ago. In a period of approximately 1.5 million years, erosion stripped off 3,000 feet of sedimentary cover exposing the Precambrian core. The erosion of the Front Range uplift resulted in deposition of the Laramie, Arapahoe and Denver Formations, the Green Mountain Conglomerate and the Dawson Arkose. (EG&G 1991b)

Recent investigations of Laramide tectonic structures of the Front Range have indicated that Laramide uplifts and bounding thrust faults are the result of compressional forces. As part of the Geologic Characterization Data Acquisition program, a seismic reflection survey was conducted to provide information on Rocky Flats geologic structures and features between depths of 500 and 12,000 feet (DOE 1993j).

The processed seismic data revealed the presence of a major west-dipping mountain-front thrust fault with approximately 5,000 feet of displacement. This fault originates in the Precambrian basement, cuts the sedimentary section from the Fountain Formation through the Niobrara Formation, and becomes a sole bedding plane fault within the Niobrara Formation. Blind imbricate thrust faults and associated backthrusts originate on the sole thrust and extend through the Pierre Shale. The upward extent of these faults is still under investigation.

3.8.1.2.3 Post-Laramide Tectonics

Between the end of the Laramide Orogeny 45 million years ago and the end of the Eocene 37 million years ago, erosion reduced the Front Range uplift to a landscape that probably resembled the western part of the present Great Plains. During the Oligocene, the Eocene erosional surface was only slightly altered by channeling and, in places, was buried under alluvial and lacustrine deposits. (EG&G 1991b)

Eventually, another period of uplift began about 25 million years ago in the early Miocene and continued through the Pliocene. This event drastically changed the Eocene surface and uplifted the Front Range as much as 10,000 feet (DOE 1988f). The resulting tectonic style of horst and graben block faulting was caused by extensional forces (EG&G 1991b).

3.8.1.2.4 Faulting

A 1981 investigation (Dames & Moore 1981) of the Golden Fault concluded that there is no compelling evidence for tectonic activity of the Golden Fault and no evidence to suggest that the

graben structure located 800 feet east of the Golden Fault is tectonically or structurally related to the Golden Fault. (EG&G 1991b)

The Eggleston Fault was originally defined as a northwest-trending fault present at the Eggleston Reservoir. The fault was interpreted as a west-dipping high-angle reverse fault with about 300 feet of throw. The Eggleston Fault was projected into the Rocky Flats Plant area on the basis of surface features. The 1981 investigation (Dames & Moore 1981) concluded that the Eggleston Reservoir Fault does not exist and that surficial features did not reveal any faulting in RFP area. (EG&G 1991b)

Current investigations are evaluating the faulting under the Rocky Flats Plant. Potential interests associated with faulting are seismic risks and groundwater flow. The results should be available in late 1994. (EG&G 1994c)

3.8.1.3 Sitewide Mineral Resources

Mineral resources in the RFP are described in the Final Environmental Impact Statement, Rocky Flats Plant Site (DOE 1980). Mineral resources that have been developed in the vicinity of the RFP include sand, gravel, crushed rock, clay, coal, and uranium. Subbituminous coal occurs in several lenticular bodies in the lower part of the Laramie Formation.

Coal was mined at the Caprock Mine outside the southwest corner of the RFP until 1953 (Caprock Fuel Company 1953). An estimated 10 million tons of coal has been removed from 13 mines in the Golden quadrangle south of RFP. Assuming an average thickness of 6 feet of minable coal, 250 million tons of coal still lie within 1,000 feet of the surface. In 1961, it was estimated that the total coal production from the Louisville quadrangle was 20 million tons and that few sizable areas remain where coal is of sufficient thickness and quality to justify mining.

No commercial production of oil or natural gas has yet been attained in the area around the RFP. The nearest oil field is a small field north of Boulder. Possible producing units below the RFP include the Lyons Sandstone, Dakota Group, the equivalent of the Carlile Shale in the Benton Shale, Fort Hays Limestone Member of the Niobrara Formation, and sandstone or siltstone beds in the Pierre Shale (Van Horn 1976).

There are extensive deposits of sand and gravel in the Rocky Flats area. The Rocky Flats Alluvium has been a source of sand and gravel at RFP site. Van Horn (1976) estimated that there are about 250 million cubic yards of sand and gravel suitable for concrete and mineral aggregate in the Golden quadrangle. The nearest sand and gravel mine currently operating is located just west of the RFP western boundary.

Clay has been mined from both the Laramie Formation and the Pierre Shale in a narrow strip from Coal Creek south to Golden. Three pits in clay and claystone beds of the steeply dipping lower part of the Laramie Formation are presently being mined. The clay produced is best suited for brick, tile, and sewer pipe.

Clay from the upper part of the Pierre Shale was mined and treated to form a lightweight aggregate at a plant operated by the Idealite Cement Company near the northwest corner of RFP site. This operation was closed in 1976. Western Aggregate is currently operating this facility.

Several quarries have extracted rock from the Precambrian interlayered gneiss and the Tertiary igneous rock exposed in the Golden quadrangle. Both of these materials have been used for concrete aggregate and riprap. At the present time, rock is being quarried from the Ralston dike, which is about four miles southwest of RFP site, for use as riprap, concrete aggregate, and road material.

The Schwartzwalder uranium mine, which is four miles southwest of the Plant site, has been the largest vein-type producer of uranium ore in Colorado and ranks among the six largest of this type in the United States. Ore shipments of this high-grade ore have yielded more than 11,500,000 pounds of U_3O_8. Unmined reserves are believed to be sufficient to supply 600 tons of ore per day for the next 10 years (DOE 1980). The mine was closed in 1989 (Colorado Division of Mines 1992).

Figure 3.8-5 shows the mineral rights boundaries in the Buffer Zone. **Table 3.8-1** lists the owners of the mineral rights for the specific tracts in the Buffer Zone.

TABLE 3.8-1[1]

MINERAL RIGHTS OWNERS

TRACT INFORMATION SHEET
ROCKY FLATS PLANT BUFFER ZONE

TRACT 29 - 446.36 Acres	Union Pacific Railroad has coal rights.
TRACT 30 - 27.61 Acres	Union Pacific Railroad has coal rights. Reservation of coal iron, and mineral rights and 1/2 of oil and gas with right of ingress and egress for gas and oil production, including coal, iron and other minerals to Andrew M. Patten.
TRACT 31 - 352.46 Acres	Union Pacific Railroad has coal rights. Proprietor of vein or lode to extract and remove ore, should it penetrate or intersect. Coal, gas, oil and other minerals reserved by A. M. Patten and granted by A. M. Patten to A. Reamer Patten, Margaret Musgrove, and Ivan M. Patten.
TRACT 32 - 619.09 Acres	Union Pacific Railroad has coal rights. Grantors received all coal, oil, gas, clay and gravel. Proprietor of vein or lode to extract should the same penetrate or intersect the premises. Many 19/120th interest for coal, oil and other mineral rights.
TRACT 33 - 160.00 Acres	Grantor reserved oil, gas and other minerals. T.N. Jordan, Jr. from Rocky Mountain Fuel Company.
TRACT 34 - 160.00 Acres	Union Pacific Railroad has coal rights. Oil and gas reserved to Martha Eberharter.
TRACT 35 - 310.65 Acres	Union Pacific Railroad has coal rights. Coal, oil, gas, clay, gravel and rock reserved to grantor.
TRACT 36 - 480.00 Acres	Union Pacific Railroad has coal rights. All coal, oil and gas reserved, without the right to enter upon or over the land. Right of proprietor of a vein or lode to extract and remove his ore therefrom.
TRACT 37 - 141.47 Acres	Grantor has all minerals.
TRACT 38 - 18.13 Acres	Grantor has all minerals.
TRACT 39 - 660.00 Acres	Union Pacific Railroad has coal rights. All coal, oil and gas reserved but without the right to enter upon or over surface of said land.
TRACT 41 - 317.84 Acres	Mineral rights reserved to grantor. Right of proprietor of a vein or lode to remove his ore therefrom, should the same be found to penetrate or intersect premises hereby said.
TRACT 42 - 160.00 Acres	Mineral interests reserved to grantor. Right of proprietor of a vein or lode remove his ore therefrom, should the same be found to penetrate or intersect premises hereby said.
TRACT 43 - 150.76 Acres	Grantor has oil and gas. Union Pacific Railroad has coal rights.

[1] This table was reproduced precisely from a previous report. Source: EG&G 1992d

3.8.2 Operable Unit 1 - 881 Hillside

Surficial Geology

Surficial materials at the 881 Hillside Area consist of the Rocky Flats Alluvium, colluvium, valley fill alluvium, and artificial fill unconformably overlying bedrock. In addition, there are a few isolated exposures of claystone bedrock. The study area is located on the south-facing hillside which slopes down from the Rocky Flats terrace toward Woman Creek on the south side of the RFP. Rocky Flats Alluvium caps the top of the slope, and colluvium covers the hillside. The colluvium ranges from two feet to twenty-two feet in thickness.

Colluvium consists predominantly of clay with common occurrences of sandy clay and gravel. Artificial fill (composed of sandy clay with gravel zones) and disturbed surficial materials are present around Building 881 and south of the building to the South Interceptor Ditch. Artificial fill, ranging from five to ten feet in thickness, is comprised of clayey sand with cobbles and overlies colluvium at IHSS 130. Surficial materials are disturbed in the vicinity of IHSSs 119.1 and 119.2.

A Quaternary terrace alluvium is present on the north side of the Woman Creek valley fill alluvium. This terrace is approximately five to ten feet above the present stream level, indicating that it is probably Holocene in age. The thickness of the deposit ranges from approximately three to seven feet. The terrace alluvium is composed of very poorly sorted gravelly sand. The most recent alluvial deposit in the 881 Hillside Area is the valley fill alluvium along Woman Creek. This alluvium is derived from reworked and redeposited older alluviums and bedrock. Alluvium thickness ranges from approximately six feet to nine feet. The unconsolidated valley fill alluvium consists of granite and quartzite cobbles, pebbles, and gravels in a silty sand matrix. (DOE 1990b)

Bedrock Geology

The Cretaceous Arapahoe Formation underlies surficial materials at the 881 Hillside Area. The bedrock beneath the 881 Hillside consists of claystones with interbedded lenticular sandstones, siltstones, and occasional minor lignite deposits. The claystones are generally thinly bedded and contain occasional laminae and interbeds of fine-grained sand and silt. Weathering appears to penetrate between approximately 2 and 60 feet into bedrock.

Unweathered bedrock occurs between 37.7 and 56 feet below ground surface. The sandstones are generally poor to moderately sorted, very fine- to medium-grained, quartz sands with up to 10 percent lithic fragments. Leaf fossils, organic matter, and lignite beds were encountered

within the claystones during drilling at the 881 Hillside. Based on preliminary results of the ongoing high resolution seismic reflection program at RFP, bedrock in the 881 Hillside Area is dipping less than two degrees to the east. (DOE 1990b)

3.8.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

Surficial Geology

Surficial geologic units within the OU2 area consist of alluvial, hillslope, and man-made deposits. Alluvial deposits include the Pleistocene age Rocky Flats Alluvium, high terrace alluviums, and various Pleistocene to Holocene age valley-fill alluviums. Hillslope deposits consist of Holocene age colluvium, debris fans and slumps. Man-made deposits are artificial fill, soil and debris dumps, and areas of disturbed surficial soil. (DOE 1993c)

Bedrock Geology

The bedrock studied consists of claystones, siltstones, and sandstones of the Arapahoe Formation and Upper Laramie Formation. The No. 1 Sandstone is considered part of the Arapahoe which is underlaid by the Laramie Formation.

A shallow, high resolution seismic investigation of OU2 conducted in 1991 defined three zones interpreted as sandstone intervals. Further, the absence of coarse conglomerates suggested that the shallow bedrock is wholly Laramie in age. The Arapahoe Formation may be eroded or not deposited under OU2. (DOE 1993c)

3.8.4 Operable Unit 3 - Off-Site Releases

No site-specific information is available for geologic conditions at IHSS 199, Contamination of the Land's Surface. The geology of IHSS 199 is expected to be similar to those described for Great Western Reservoir and Standley Lake.

In two boreholes near Great Western Reservoir (IHSS 200), alluvium surficial deposits are underlain by Arapahoe Formation bedrock at depths of 5 and 16 feet. Bedrock consists of claystone with minor interbedded sandstone and siltstone lenses, and dips slightly to the east. In the RFP area the Arapahoe Formation average thickness is 250 feet. Below the Arapahoe Formation is several hundred feet of shale comprising the upper Laramie Formation (DOE 1992l).

At Standley Lake (IHSS 201), bedrock outcrops at various locations around the lake consist of claystone with interbedded sandstone lenses, probably of the Arapahoe Formation, These units dip gently to the northeast. Overlying the bedrock are surficial deposits averaging 15 to 20 feet thick, consisting of a series of alluvial terraces, colluvium, and minor other deposits. No faults have been identified in the area. Other conditions are assumed to be similar to Great Western Reservoir (DOE 1992l).

No site-specific information is available for geologic conditions at Mower Reservoir (IHSS 202). The geology of Mower Reservoir is expected to be similar to that described for Great Western Reservoir and Standley Lake (DOE 1992l).

3.8.5 Operable Unit 4 - Solar Evaporation Ponds

Surficial Geology

Surficial materials at the Solar Ponds Area consist of the Rocky Flats Alluvium, colluvium, valley fill alluvium, disturbed ground, and artificial fill. Most of the Solar Ponds Area has been disturbed by construction of the ponds and the Interceptor Trench System (ITS), as well as nearby buildings and other infrastructures. Rocky Flats Alluvium (ranges from less than 10 feet to slightly more than 50 feet) often occurs below the limits of the disturbed ground, according to borehole logs. The thickness of the entire unconsolidated interval ranges from 0 to 27 feet, with an average of 10 feet.

The Rocky Flats Alluvium occurs on top of the erosional bedrock highs in the Solar Ponds Area and generally contains a range of clay, silt, sand, and gravel deposits. Colluvium occurs on the hill slopes northeast and southeast of the Solar Ponds descending to North and South Walnut Creeks. It consists of unconsolidated clay with silty clay, sandy clay, and gravel layers. The valley fill alluvium occurs in the drainages of North and South Walnut Creek and consists of unconsolidated sand, gravel, and pebbles in a silty clay matrix.

Disturbed ground overlies the Rocky Flats Alluvium in the ponds area, and the colluvium on the hill slopes in the ITS area. Disturbed ground is comprised of unconsolidated clay, silt, sand, gravel, and pebbles. Artificial fill occurs in close proximity of the ponds and contains materials that have obviously been transferred from other locations. The fill consists of poorly sorted sandy clay and gravels, with fragments of claystone and concrete (DOE 1994a).

Bedrock Geology

The Cretaceous Arapahoe Formation unconformably underlies the unconsolidated deposits in the Solar Ponds Area. The Arapahoe Formation primarily consists of claystones and silty claystones. Recent studies suggests the Arapahoe Formation is generally less than 50 feet thick. A subcropping sandstone has been mapped in the vicinity of Pond 207-C and along South Walnut Creek.

Sandstones in the Arapahoe Formation are clayey, silty, and very fine- to medium-grained. The sandstones are lenticular and interlayered with thin lenses of clay and silt. The subcropping sandstones dip approximately 2 degrees to the east and are generally weathered within 30 to 40 feet of the base of the alluvium. A total of four sandstone intervals have been identified in the Arapahoe Formation in the Solar Ponds Area, although some uncertainty exists as to whether the lower sand intervals occur as Arapahoe or Laramie sandstones.

The Arapahoe Sandstone No. 1 unit outcrops and subcrops in the Solar Ponds Area. The Arapahoe claystones and silty claystones are massive and blocky, containing thin laminae and stringers of sands, silt, and lignite. The weathered zone in this material extends 30 feet below the base of the alluvium. The Arapahoe Formation is unconformably underlaid by the Laramie Formation which is estimated to be 200 feet thick at RFP. The formation is divided into two intervals. The upper is approximately 500 feet thick and comprised of claystone. The lower interval is approximately 300 feet thick and comprised of sandstone, siltstone, and claystones with coal layers (DOE 1994a).

3.8.6 Operable Unit 5 - Woman Creek Priority Drainage

According to the Work Plan, the geology within OU5 is currently believed to consist of four geologic units: Recent Valley Fill, Colluvium, Rocky Flats Alluvium, and the Arapahoe Formation. The presence of these units is a function of location within the drainage (i.e., plateau, slope, valley).

Surficial Geology

Recent valley fill and colluvium is found nearest to Woman Creek and Ponds C-1 and C-2. The deposits are thought to be about 7 to 9 feet of silty clayey gravel to clayey sand. The deposits sit directly atop the Arapahoe Formation due to geologic erosion processes. According to the OU5 Work Plan, it is believed that the base of Ponds C-1 and C-1 sits directly atop the Arapahoe Formation, since 5 to 10 feet of material was removed to construct the ponds.

Colluvial deposits are thought to exist beneath the slopes of the Woman Creek drainage based on their presence on similar sloping areas at RFP. The colluvium is typically deposited by slope wash and downslope creep of the Rocky Flats Alluvium and/or the Arapahoe Formation. The deposits tend to be poorly-sorted mixtures of soil and debris from bedrock clay and sand, mixed with alluvial gravel and cobbles.

The plateau and the upper slopes tend to be underlain by 20-25 feet of Rocky Flats Alluvium. This alluvium is the oldest and topographically-highest alluvial deposit at RFP. It was formed by a series of coalescing alluvial fans deposited by braided streams and is made up of unconsolidated deposits of poorly-sorted cobbles, gravel, sands, and gravelly-clays. Generally, it is coarser-grained to the west and becomes finer-grained toward the east.

Bedrock Geology

The youngest bedrock unit beneath OU5 is the Upper Cretaceous Arapahoe Formation. Recent interpretations of this unit at RFP (DOE 1992v), indicate a 15-25 foot thickness, consisting of claystone and silty claystone interbedded with a medium-grained conglomerate frosted sandstone. Within the Woman Creek drainage, the formation is thought to become shallower to the south toward Woman Creek. In wells nearby the creek, the formation has been encountered from 6 to 30 feet below the ground surface.

3.8.7 Operable Unit 6 - Walnut Creek Priority Drainage

Surficial Geology

Surficial materials at the Walnut Creek Priority Drainage consist of Rocky Flats Alluvium, Slocum Alluvium, Louviers Alluvium, colluvium, and valley-fill alluvium. For the A-series Ponds Area (IHSSs 142.1 through 142.4 and 142.12), the surficial materials are colluvium and valley-fill alluvium. The valley-fill alluvium is approximately 11 feet thick in this area, and the colluvium is approximately 12 feet thick. The lithologies of both these units are similar and are described as silty gravelly clays to gravelly sandy clays with fine to coarse sands and quartzite gravels.

Surficial materials at the B-series Ponds and within the drainage area of South Walnut Creek include valley-fill alluvium and colluvium. The valley-fill alluvium is approximately 5.5 to 7 feet thick here and is comprised of sandy clay to clayey gravel. At the North Area, Pond Area and South Area Spray Fields (IHSSs 167.1, 167.2 and 167.3), the surficial materials are Rocky Flats Alluvium and colluvium.

The Rocky Flats Alluvium underlies IHSS 167.3 and the western half of IHSS 167.1. The Rocky Flats Alluvium is described as gravelly sandy clay to gravelly clayey sand with scattered cobbles. Colluvium is likely to be present beneath the eastern half of IHSSs 167.1 and 167.3. The colluvium is approximately three feet thick and is a silty sandy gravel to gravel with cobbles and clay. Fill and possibly colluvial deposits underlie IHSS 167.2. The fill in this area is approximately five feet thick and is a sandy clay to sand.

The surficial unit below the East Area Spray Field (IHSS 216.1) is the Rocky Flats Alluvium. The Rocky Flats Alluvium is estimated to be 5 to 10 feet thick and is described as gravelly silty sand. At Trenches A, B, and C (IHSSs 166.1, 166.2, and 166.3), the surficial units are topsoil and Rocky Flats Alluvium. Approximately 1.5 feet of topsoil has developed on the Rocky Flats Alluvium at IHSS 166.1 and may be present in the vicinity of Trenches B and C. The Rocky Flats Alluvium has a thickness of about six feet and is a sand and gravel unit.

For the Sludge Dispersal Area (IHSS 141), the surficial unit is the Rocky Flats Alluvium. This alluvium is approximately five feet thick and consists of a gravelly silty sand. The surficial unit at the Triangle Area (IHSS 165) is also the Rocky Flats Alluvium. The thickness of the alluvium beneath the site ranges from 8.5 to 12 feet and is described as a silty clayey sand to sandy gravelly clay.

The surficial materials at the Old Outfall (IHSS 143) are likely to be valley fill alluvium and colluvium. At the Soil Dump Area (IHSS 156.2), the surficial unit is the Rocky Flats Alluvium. The Rocky Flats Alluvium is about six feet thick and is described as a sandy clay.

Bedrock Geology

The Arapahoe Formation at the A-series Ponds (IHSSs 142.1 through 142.4 and 142.12) is approximately 1 to 11 feet below ground surface. The Number 4 sandstone interval of the Arapahoe Formation underlies the valley fill alluvium, pond sediments, and colluvium. This sandstone unit, which is approximately 10 to 15 feet thick, indicates a sandstone channel may be present immediately beneath Ponds A-3 and A-4. The Arapahoe Formation consists of siltstone and claystone.

At the B-series Ponds (IHSSs 142.5 through 142.9), the Arapahoe Formation approximately 5.5 to 7 feet below ground surface is described as a claystone. The Arapahoe Formation is approximately four to six feet below ground surface at the North, South, and Pond Area Spray Fields (IHSSs 167.1, 167.2, and 167.3). The formation is described as a silty claystone to claystone and is highly weathered near the top of the unit.

At the East Area Spray Field (IHSS 216.1), the Arapahoe Formation is weathered near the top and consists of claystone with some interbedded sandstone units. The depth to the Arapahoe Formation at Trenches A, B, and C (IHSSs 166.1, 166.2, and 166.3) is approximately 6 to 7.5 feet, and the unit is principally a claystone.

The Arapahoe Formation and potentially the Arapahoe No. 1 sandstone unit are present below the Sludge Dispersal Area (IHSS 141). The Arapahoe No. 1 sandstone is approximately 2.5 feet thick and is about 8.5 feet below ground surface. The Arapahoe below the sandstone unit is a clayey sandstone, and the uppermost section is highly weathered. At the Triangle Area (IHSS 165), the Arapahoe Formation is approximately 8.5 to 12 feet below ground surface. The unit is a silty claystone and is weathered near the top. A 10-foot thick sandstone unit (Arapahoe Sandstone No. 1) has been encountered in this area.

At the Old Outfall (IHSS 143), the Arapahoe Formation is a claystone to silty claystone. The Arapahoe Formation at the Soil Dump Area (IHSS 156.2) is a calcareous weathered clayey sandstone to claystone. The depth to the Arapahoe is approximately 6 feet (DOE 1992o).

3.8.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

Surficial Geology

Surficial materials in the Present Landfill area consist of the Rocky Flats Alluvium, colluvium, valley fill alluvium and artificial fill or disturbed ground, which unconformably overlie the bedrock units. In addition, there are a few isolated exposures of Cretaceous Arapahoe claystone located along the side slopes of the drainage in which the Present Landfill is located. Rocky Flats Alluvium caps the top of the slopes on the north and south sides of the drainage.

The Rocky Flats Alluvium in the Present Landfill area is described as an unconsolidated deposit of clay, silt, sand, gravel, and cobbles. It ranges between 6 and 27 feet thick with an average thickness of approximately 18 feet where undisturbed. Colluvium covers the hillsides down to the drainage. Colluvium consists predominantly of clay with common occurrences of sandy clay and gravel layers. Valley fill alluvium is present along the unnamed tributary channel. The unconsolidated valley fill consists of sand, gravel, and pebbles in a silty clay matrix. Valley-fill thickness ranges from four feet to eight feet in the landfill area. The valley fill materials are generally finer-grained downstream of the landfill.

Artificial fill or disturbed surficial materials are present within the boundaries of the Present Landfill, along man-made drainage ways surrounding the present landfill, and northwest of the

Present Landfill. One type of fill is comprised of soil materials, a significant amount of which were derived from excavations of Church Ditch located northwest of the Present Landfill. The second type of artificial fill consists of waste and cover soil materials.

This fill is described as a mixture of clay, gravel, coarse sand, asphalt fragments, wire, plastics, surgical gloves, wood particles, and other materials associated with the Present Landfill activities. Thicknesses of this fill material ranges from approximately 1.5 feet to 27 feet in the center of the present landfill.

Bedrock Geology

The Cretaceous Arapahoe Formation underlies surficial materials in the vicinity of the Present Landfill. The Arapahoe Formation beneath the present landfill consists mostly of claystone with some interbedded channel sandstones and siltstones. Weathering penetrates approximately 11 feet into bedrock. Sandstone thicknesses range from approximately 2.5 feet to 20 feet (DOE 1991y).

3.8.9 Operable Unit 8 - 700 Area

Surficial Geology

The geology of the industrial area is generally consistent among OUs 8, 9, 10, 12, 13, and 14. Refer to Section 3.8.13 for a description of the surficial geology.

Bedrock Geology

The geology of the industrial area is generally consistent among OUs 8, 9, 10, 12, 13, and 14. Refer to Section 3.8.13 for a description of the bedrock geology.

3.8.10 Operable Unit 9 - Original Process Waste Lines

Surficial Geology

The geology of the industrial area is generally consistent among OUs 8, 9, 10, 12, 13, and 14. Refer to Section 3.8.13 for a description of the surficial geology.

Bedrock Geology

The geology of the industrial area is generally consistent among OUs 8, 9, 10, 12, 13, and 14. Refer to Section 3.8.13 for a description of the bedrock geology.

3.8.11 Operable Unit 10 - Other Outside Closures

Surficial Geology

The geology of the industrial area is generally consistent among OUs 8, 9, 10, 12, 13, and 14. Refer to Section 3.8.13 for a description of the surficial geology.

Bedrock Geology

The geology of the industrial area is generally consistent among OUs 8, 9, 10, 12, 13, and 14. Refer to Section 3.8.13 for a description of the bedrock geology.

3.8.12 Operable Unit 11 - West Spray Field

Surficial Geology

The surficial deposit at the West Spray Field consists of the Rocky Flats Alluvium which unconformably overlies the bedrock. The alluvium is unconsolidated and is composed of cobbles, gravels, sands, and gravelly clays. The Rocky Flats Alluvium ranges in thickness from 65 to greater than 75 feet.

Bedrock Geology

The uppermost bedrock unit at the West Spray Field is the Upper Cretaceous Laramie Formation. The apparent absence of the younger Arapahoe Formation, present in other areas of the RFP, indicates that it was eroded prior to deposition of the Quaternary Alluvium in this area. The Laramie Formation dips approximately nine degrees to the east beneath the West Spray Field. The upper claystone unit of the Laramie Formation has been encountered in this area. This claystone unit consists of silty claystone with occasional zones of sandstone or siltstone interbeds up to 0.5 feet thick. Weathering appears to have penetrated from 31 to 61 feet into bedrock (DOE 1992a).

3.8.13 Operable Unit 12 - 400/800 Area

Surface Geology

As described in the OU12 Work Plan, the surficial geologic unit is the Quaternary Rocky Flats Alluvium. It is the oldest and topographically highest alluvial deposit at RFP. It was formed by a series of coalescing alluvial fans deposited by braided streams, and is made up of

unconsolidated deposits of poorly sorted cobbles, gravels, sands, and gravelly clays - generally; it is coarser-grained to the west and becomes finer-grained toward the east. The Alluvium ranges in thickness from 10 to almost 50 feet, with the greater thickness to the west.

Caliche (calcium carbonate) is contained in some of the pore space of the alluvium. It is believed that the amount of caliche generally increases as the thickness of the alluvium decreases. The presence of caliche may be useful in determining localized changes in hydraulic conductivity and groundwater flow directions.

Bedrock Geology

The youngest bedrock unit beneath is the Upper Cretaceous Arapahoe Formation. Recent interpretations of this unit (DOE 1992v) indicate a 15-25 foot thickness, consisting of claystone and silty claystone interbedded with medium-grained conglomerate frosted sandstone. The formation is underlain by the Laramie Formation. The two formations may attain a thickness of 600-800 feet and dip gently to the east at about 1-2 degrees. The contact with the overlying surficial deposits generally parallels surface topography.

3.8.14 Operable Unit 13 - 100 Area

Surface Geology

The geology of the industrial area is generally consistent among OUs 8, 9, 10, 12, 13, and 14. Refer to Section 3.8.13 for a description of the surficial geology.

Bedrock Geology

The geology of the industrial area is generally consistent among OUs 8, 9, 10, 12, 13, and 14. Refer to Section 3.8.13 for a description of the bedrock geology.

3.8.15 Operable Unit 14 - Radioactive Sites

Surface Geology

The geology of the industrial area is generally consistent among OUs 8, 9, 10, 12, 13, and 14. Refer to Section 3.8.13 for a description of the surficial geology.

Bedrock Geology

The geology of the industrial area is generally consistent among OUs 8, 9, 10, 12, 13, and 14. Refer to Section 3.8.13 for a description of the bedrock geology.

3.8.16 OU15 - Inside Building Closures

The surficial deposits consist of Rocky Flats Alluvium, colluvium, valley fill alluvium, disturbed ground and artificial fill. Upper Cretaceous Arapahoe and Laramie Formations unconformably underlie the surface material. The Arapahoe Formation is predominately claystone, silty claystone, and clayey sandstones and is approximately 15-25 feet thick underneath the plant. The Laramie Formation is approximately 600-800 feet thick, the lower portion is sandstone and the upper portion claystone (DOE 1993b).

3.8.17 OU16 - Low-Priority Sites

No site-specific information regarding geology was located for inclusion in this report.

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This section summarizes baseline conditions for minor disciplines/environmental media at Rocky Flats Plant. These disciplines have less relevance and importance to the study of remediation effects; although it is recognized that these resources may be affected in some manner. The minor disciplines addressed in this section are: meteorology, noise, transportation, visual resources, land use, energy, and cultural resources.

Some disciplines traditionally addressed in NEPA documentation have not been addressed within this ERTSD (e.g., recreation and socioeconomics). For the purpose of this report, it is assumed that such disciplines will be affected principally from offsite with regard to future RFP activities.

4.1 METEOROLOGY

4.1.1 Sitewide Conditions

The climate of RFP can be classified as a highland or mountain climate of continental location. Wide variations in climate occur due to differences in elevation and the orientation of mountain ranges and valleys with respect to general air movements. Generally, temperatures decrease and precipitation increases with increasing elevation.

The RFP is noted for its strong wind events. Strong winds can occur at RFP with thunderstorms and the passage of weather fronts. However, strong winds at RFP are most commonly associated with "chinook" windstorms. The windstorm season at RFP runs from late November to mid-April; the height of the season usually occurs in January. Windstorms at RFP typically last 8 to 16 hours and are very gusty in nature. RFP experiences windstorms with gusts exceeding 75 mph in almost every season; gusts exceeding 100 mph are experienced every three to four years (Hodgin, et al. 1990). Winds, though variable, are predominately northwesterly. **Table 4.1-1** is the 1992 annual summary of the percent frequency of wind directions, divided into four wind categories. **Figure 4.1-1** provides a 1992 wind rose for RFP.

TABLE 4.1-1[1]
RFP WIND DIRECTION FREQUENCY (PERCENT)
BY FOUR WIND-SPEED CLASSES
(15 - Minute Averages -- Annual 1992)

Direction	Calm	1.0-2.5 m/s (2.2-5.6 mph)	2.5-4.0 m/s (5.6-9.0 mph)	4.0-8.0 m/s 9.0-18 mph	>8.0 m/s >18 mph	Total
	1.69					1.69
N	--	2.13	2.69	2.70	0.24	7.75
NNE	--	1.96	2.04	1.75	0.16	5.91
NE	--	1.66	1.70	0.78	0.09	4.23
ENE	--	1.49	1.23	0.42	0.01	3.16
E	--	1.94	1.17	0.21	0.00	3.32
ESE	--	1.94	1.59	0.20	0.00	3.73
SE	--	1.96	2.20	0.82	0.00	4.98
SSE	--	1.84	2.21	1.19	0.03	5.26
S	--	1.95	2.03	1.15	0.01	5.14
SSW	--	1.78	2.07	0.92	0.02	4.79
SW	--	1.90	2.56	1.70	0.05	6.20
WSW	--	1.91	2.72	2.74	0.30	7.67
W	--	2.53	2.37	2.24	1.28	8.42
WNW	--	2.63	2.03	3.95	2.86	11.47
NW	--	2.47	2.53	2.93	0.85	8.78
NNW	--	2.09	2.79	2.48	0.14	7.50
TOTALS	1.69	32.18	33.92	26.17	6.04	100.0

Source: EG&G 1992e.

[1] This table was reproduced from a previous report.

TABLE 4.1-2[1]
RFP MONTHLY PRECIPITATION TOTALS
(Inches -- Annual 1992)

Month	Total
January	0.31
February	0.02
March	3.37
April	0.53
May	1.53
June	2.19
July	1.30
August	2.97
September	0.00
October	0.59
November	1.25
December	0.43
Total	14.49

Source: EG&G 1992e.

[1] This table was reproduced from a previous report.

Wind resuspension of contaminants from bare soil seems to be minimal, while resuspension from grass appears to be the dominant process. Rain splash was also found to be a significant resuspension process. More than 90 percent of the resuspended Pu from the 903 Pad in OU2 is associated with soil and grass litter particles larger than 3 μm. Resuspension of respirable particles in the field is very limited; this respirable concentration is about the same as that due to nuclear fallout in and around the Denver area. Maximum transport of the Pu extends to 1.5 km from the 903 field. The total resuspension is very low, approximately 200 μCi/yr (Langer 1991).

During 1992, RFP recorded 14.49 inches of precipitation. The most precipitation recorded on a single day was 1.97 inches on August 24, 1992. **Table 4.1-2** describes monthly precipitation totals for 1992. The average annual precipitation at RFP is estimated at 15.16 inches (DOE 1991x). Normally, more than 80 percent of the precipitation falls from April through September. At times, heavy runoff occurs, particularly during thunderstorms and spring thaws, along creeks that traverse the RFP site. Some flooding due to poor drainage from broken/plugged storm sewers has occurred at RFP. However, streambeds are considerably lower than RFP buildings and the terrain provides excellent drainage; therefore, major flooding of plant facilities is not considered possible, although urban street flooding is possible (DOE 1991f).

Temperatures at RFP exhibit large diurnal and annual ranges. In January, the average minimum and maximum temperatures recorded at locations in the vicinity of RFP (Boulder and Lakewood, Colorado) are approximately 19°F and 45°F, respectively. The average minimum and maximum temperatures in July are approximately 59° F and 88°F, respectively. Temperatures as low as -25°F and as high as 105°F have been recorded at these monitoring locations. The mean annual temperatures for Boulder and Lakewood over a 30-year-period were 51.2°F and 51.2°F respectively (NOAA 1980).

The primary source for meteorological data representative of RFP site is the 61-meter meteorological tower. Located in the western buffer zone of RFP facility, the tower continuously monitors wind direction, wind speed, and temperature at three levels (10, 25, and 60 meters). The tower also continuously monitors dew point, atmospheric pressure, and solar radiation (DOE 1991f). Hand-held devices are used, on behalf of worker safety, to take wind direction/wind speed measurements, during intrusive activities (EG&G 1994l).

Wind Rose for the Rocky Flats Plant

Annual 1992

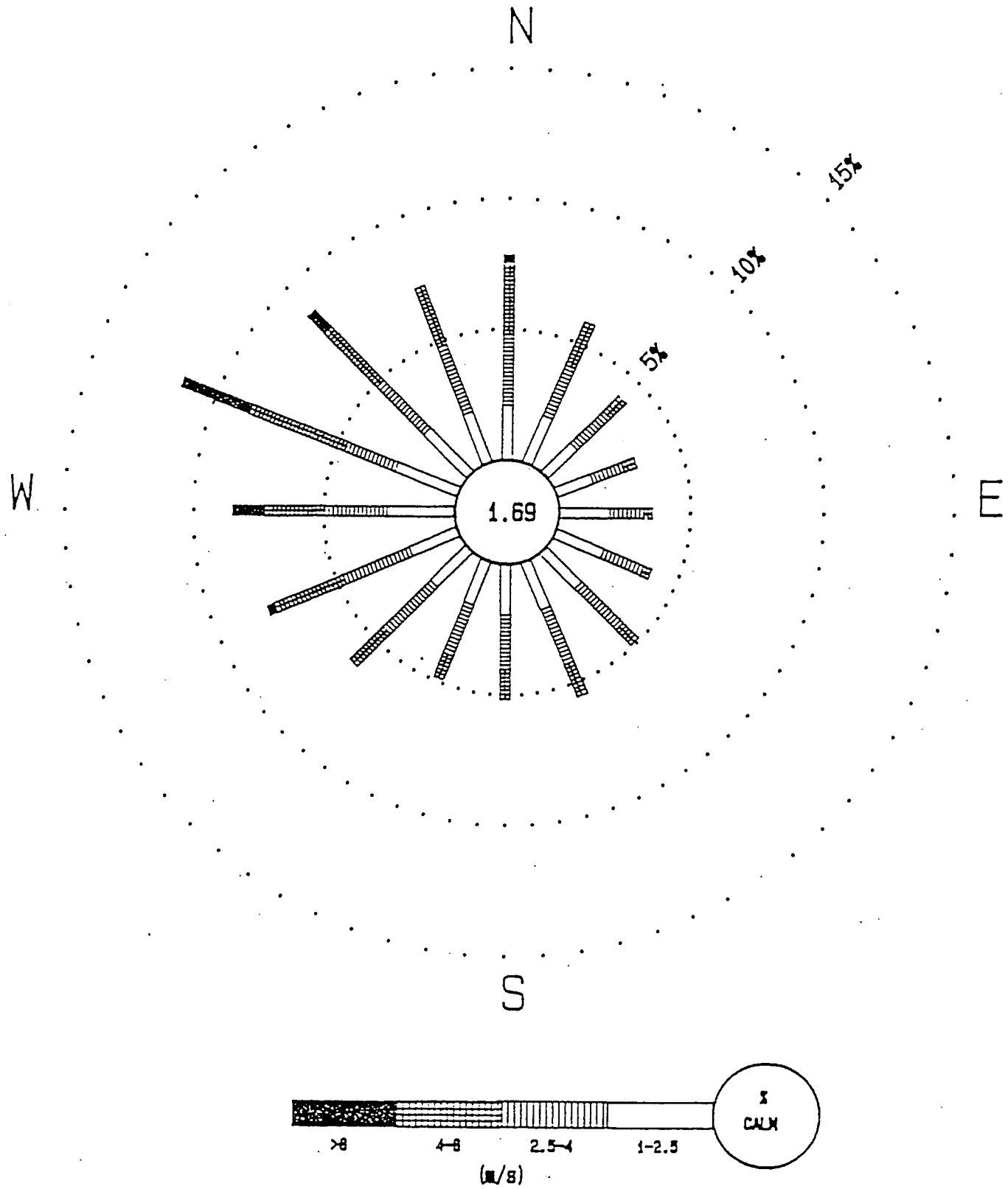


Figure 4.1-1

Source: EG&G 1992e

4.1.2 Operable Unit 1 - 881 Hillside

Meteorological monitoring is not performed at OU1, because installation of the French drain and treatment facility is completed (EG&G 1994l).

4.1.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

Meteorological equipment has not been installed, nor is it presently required for this operable unit (EG&G 1994l).

4.1.4 Operable Unit 3 - Offsite Releases

A 10-meter meteorological tower should be installed by the end of 1994 (EG&G 1994l).

4.1.5 Operable Unit 4 - Solar Evaporation Ponds

Meteorological equipment has not been installed, nor is it presently required for this operable unit (EG&G 1994l).

4.1.6 Operable Unit 5 - Woman Creek Priority Drainage

Meteorological equipment has not been installed, nor is it presently required for this operable unit (EG&G 1994l).

4.1.7 Operable Unit 6 - Walnut Creek Priority Drainage

No site-specific information regarding meteorological monitoring was located for inclusion in this report.

4.1.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

Meteorological equipment has not been installed, nor is it presently required for this operable unit (EG&G 1994l).

4.1.9 Operable Unit 8 - 700 Area

No site-specific information regarding meteorological monitoring was located for inclusion in this report.

4.1.10 Operable Unit 9 - Original Process Waste Lines

No site-specific information regarding meteorological monitoring was located for inclusion in this report.

4.1.11 Operable Unit 10 - Other Outside Closures

No site-specific information regarding meteorological monitoring was located for inclusion in this report.

4.1.12 Operable Unit 11 - West Spray Field

No site-specific information regarding meteorological monitoring was located for inclusion in this report.

4.1.13 Operable Unit 12 - 400/800 Area

No site-specific information regarding meteorological monitoring was located for inclusion in this report.

4.1.14 Operable Unit 13 - 100 Area

No site-specific information regarding meteorological monitoring was located for inclusion in this report.

4.1.15 Operable Unit 14 - Radioactive Sites

Meteorological equipment has not been installed, nor is it presently required for this operable unit (EG&G 1994l).

4.1.16 Operable Unit 15 - Inside Building Closures

Meteorological equipment has not been installed, nor is it presently required for this operable unit (EG&G 1994l).

4.1.17 Operable Unit 16 - Low-Priority Sites

No site-specific information regarding meteorological monitoring was located for inclusion in this report.

4.2 NOISE

According to the Nonnuclear Consolidation Environmental Assessment (DOE 1992z), major noise sources within RFP include various facilities, equipment, and machines (e.g., cooling towers, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles.

The environmental assessment indicates that while no sound-level measurements have been made around RFP, considering the large land area and the distance from the source of most of the industrial facilities to the site boundary, noise from these facilities, equipment, and machines would be barely distinguishable from the background noise levels. Noise from construction activities would have similar effect; this type of noise is short-term and can also be mitigated.

Thus, the acoustic environment along the RFP boundary and in the nearby residential areas (those away from traffic noise) is assumed to be that of a rural location with typical day-night sound levels (DNL) in the range of 35 to 50 dBA (EPA 1974).

The primary source of noise at the plant boundary and at nearby residences is traffic. Except for the prohibition of nuisance noise, neither the State of Colorado, nor its local governments have established environmental noise standards applicable to RFP (DOE 1992z).

The EA also noted that noise levels at some residences along roads near RFP may exceed, albeit at a minor level, the EPA guidelines level for residential areas (DOE 1992z). Based on the changed mission, an anticipated reduction in staff would, in turn, reduce traffic noise levels. However, the EA adds that transitional activities (such as, remediation and/or pilot-project activities) may offset such noise reductions.

4.3 TRANSPORTATION

Information regarding transportation is available in three documents: Final Environmental Impact Statement, Rocky Flats Plant Site (DOE 1980); Environmental Assessment, New Sanitary Landfill (DOE 1991x); and the Sitewide Evaluation of Transportation Risks for the Rocky Flats Plant, Volume I (EG&G 1992f).

4.3.1 Sitewide Conditions

Sitewide conditions are addressed in the Sitewide Evaluation of Transportation Risks for the Rocky Flats Plant (EG&G 1992f). That report contains two tables showing employee and contractor commuting mileage projections for a full production year, by community.

4.3.2 Off-Site Conditions

The Rocky Flats Plant is bounded on the north by State Highway 128, on the west by State Highway 93, on the south by State Highway 72, and on the east by Jefferson County Highway 17 (Indiana Street).

State Highway (SH) 93 is a paved, two-lane highway west of RFP with left-turn lanes and passing lanes on some of the hills, and a traffic control light at the entrance to RFP. The 1988 estimate of traffic volume from the plant gate to SH 72 was 9,400 average daily vehicle trips (ADT). SH 93 crosses SH 72 south of the plant site at an intersection with traffic control lights.

The ADT on SH 93 south of the intersection was 8,850. The 1988 ADT on SH 72 west of the intersection was 3,500, and east of the intersection, it was 3,350 ADT. The heaviest traffic volume is on weekdays during the morning and evening hours. The twenty-year traffic projection north of the SH 93/72 intersection is 15,040 ADT; south of the intersection the projection is 12,390 ADT (DOE 1991x).

SH 93 south of RFP crosses the mainline Denver and Rio Grande Western Railroad and the spurline to the Rocky Flats Plant. A grade separation exists at the mainline crossing; the railroad passes under the highway. The spurline crosses SH 93 at a grade crossing equipped with traffic control lights.

Access to the RFP property is accomplished by turning west off Indiana Street onto the East Access Road or by turning east off Colorado Highway 93 onto the West Access Road. These access roads have posted speed limits and signs exhorting safe driving within the RFP

complex. Signs alert the observer that an armed security force is on duty. All commercial vehicles and non-security badged personnel vehicles must exit to a security post for a visitor's badge and submit to a vehicle inspection procedure. All such persons must state and sign a document that they are not transporting certain items, such as explosives and firearms.

In the case of commercial hazardous and toxic chemical transport vehicles, the vehicles are typically inspected, given directions to their points of delivery, and when appropriate, escorted by Protective Force personnel to their delivery destinations.

The driving experience of a roadway can be expressed using a Level of Service (LOS) measurement. The LOS expression includes six levels, ranging from A to F. LOS A describes a very relaxed, free-flowing operation at or above posted speed limits. LOS F is a situation of extreme delays, even gridlock. The Denver Regional Council of Governments and local transportation agencies accept LOS D. This means that when traffic conditions fall below LOS D it would trigger some response by the appropriate transportation agency.

At this level, the traffic flow pattern borders on unstable. Speeds are below posted limits, freedom to maneuver is severely limited, and drivers can experience drastically reduced physical and psychological comfort levels. For a two-lane highway with left turn lanes, the LOS D is defined as the 15,000 ADT level (Jeffco 1990). Existing travel flow on SH 93 is well below this level.

4.3.3 Operable Unit 1 - 881 Hillside

No site-specific transportation information was located for inclusion in this report.

4.3.4 Operable Unit 2 - 903 Pad, Mound, and East Trenches

Installation of the surface water treatment unit was predicted to have no noticeable impact on regional transportation patterns; although, construction would require deliveries of materials from within a 50-mile radius of the Plant. Plant traffic may sustain a slight increase of vehicles.

Maintenance activity travel would probably total less than 50 miles per week. Travel should not be frequent enough to produce an increased risk of one additional latent cancer fatality or one additional traffic fatality. Travel requirements associated with replacement of carbon units or offsite shipment of solidified filter sludge should have negligible effects on human health (DOE 1991g).

4.3.5 Operable Unit 3 - Offsite Releases

No site-specific transportation information was located for inclusion in this report.

4.3.6 Operable Unit 4 - Solar Evaporation Ponds

No site-specific transportation information was located for inclusion in this report.

4.3.7 Operable Unit 5 - Woman Creek Priority Drainage

No site-specific transportation information was located for inclusion in this report.

4.3.8 Operable Unit 6 - Walnut Creek Priority Drainage

No site-specific transportation information was located for inclusion in this report.

4.3.9 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

No site-specific transportation information was located for inclusion in this report.

4.3.10 Operable Unit 8 - 700 Area

No site-specific transportation information was located for inclusion in this report.

4.3.11 Operable Unit 9 - Original Process Waste Lines

No site-specific transportation information was located for inclusion in this report.

4.3.12 Operable Unit 10 - Other Outside Closures

No site-specific transportation information was located for inclusion in this report.

4.3.13 Operable Unit 11 - West Spray Field

No site-specific transportation information was located for inclusion in this report.

4.3.14 Operable Unit 12 - 400/800 Area

No site-specific transportation information was located for inclusion in this report.

4.3.15 Operable Unit 13 - 100 Area

No site-specific transportation information was located for inclusion in this report.

4.3.16 Operable Unit 14 - Radioactive Sites

No site-specific transportation information was located for inclusion in this report.

4.3.17 Operable Unit 15 - Inside Building Closures

No site-specific transportation information was located for inclusion in this report.

4.3.18 Operable Unit 16 - Low-Priority Sites

No site-specific transportation information was located for inclusion in this report.

4.4 VISUAL RESOURCES

4.4.1 Sitewide Conditions

Information about visual resources for the RFP is summarized from three documents: Draft Environmental Assessment, New Sanitary Landfill (DOE 1991x); Jefferson County Open Space Master Plan (Jeffco 1989); and The North Plains Community Plan (Jeffco 1990).

A description of visual resources at the RFP had not been performed prior to the Draft Environmental Assessment, Sanitary Landfill (DOE 1991x). The description of existing visual resources used standardized techniques developed by the U.S. Forest Service (USFS 1974). The evaluation was carried out for proposed alternate landfill sites situated in the Buffer Zone and did not evaluate the entire RFP site.

The Forest Service inventory components include scenic quality, visual sensitivity, visual quality objective (VQO), and visual absorption capability (VAC). The key inventories are VQO and VAC. The study area for visual resources includes all of the area where activities associated with the RFP can be observed by persons involved in travel, recreation, or

residential living. Depending on topography and vantage points, this distance may extend up to seven miles from the project area.

The existing visual quality is determined by a number of factors, including topography, rock forms, color, water features, buildings, and other structures. The RFP is located on the Colorado Piedmont of the Great Plains physiographic province (Fenneman 1931). The area contains moderately varied terrain including a broad gentle bench cut by drainages with rolling side hills having significant slopes. These adjacent slopes form spatial definition which offers some visual relief from flatness.

Some exposed rock forms are present but are not of significant size or definition. Some distinctive small outcrops exist in the northwest section of the RFP. Vegetation is slightly varied. Most of the area is dominated by grassland. Small patches of riparian communities and shrubs provide some visual relief. Seasonal colors are homogeneous and include green in wet periods and tawny during dry weather and winter. Waterforms in the area consist of small drainages and springs that offer visual diversity and interest.

Common to most views within the RFP is the adjacent scenery which dominates visual interest, particularly views to the west toward the steeply sloping Flatirons near Boulder. Cultural modifications, including building structures, electrical powerlines, an existing landfill, access roads, fences and clay pit spoil piles have created significant visual change to the landscape. A berm which serves as a backstop for a firing range has spatially screened the existing landfill activities and waste materials.

Overall, the RFP does not contain landscape features with a distinctive combination of landforms, waterforms, rock forms, or vegetation distinguishing it from adjacent landscapes. The landscape scenic quality for the RFP is "common" in classification.

A number of recreation areas and major travel routes are present and may affect the visual sensitivity of activities in the RFP. The nearest park is Standley Lake County Park, approximately four miles southeast of RFP. Boulder Mountain Park is located six miles to the northwest with elevations up to 2,500 feet higher than the RFP; White Ranch County Park is located six miles southwest with elevations up to 1,400 feet higher; and Golden Gate Canyon State Park is located seven miles to the southwest, with elevations up to 3,000 feet higher.

The higher elevation of these parks would, barring any intervening topography, make the RFP visible to viewers within the parks. Several existing and proposed recreational hiking and nature trails are located two miles north of the main RFP building complex, at about the same elevation. State Highway 128 is along portions of the northern boundary of RFP; State

Highway 93 is .25 mile west; Indiana Street is aligned along the eastern boundary; and State Highway 72 is two miles south of the main complex.

Bicycling is popular along State Highways 128 and 93, Indiana Street, and to a lesser extent, on State Highway 72 toward Coal Creek Canyon.

Policies regarding protection of visual resources in Jefferson County are given in The North Plains Community Plan and in the Jefferson County Open Space Master Plan (Jeffco 1990, Jeffco 1989). In those planning documents, State Highways 93 and 72 are identified as being visual corridors which should be protected. It is the general policy of Jefferson County that when development proposals are reviewed, potential impacts to visual resources will be assessed.

4.4.2 Operable Unit 1 - 881 Hillside

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.4 Operable Unit 3 - Offsite Releases

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.5 Operable Unit 4 - Solar Evaporation Ponds

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.6 Operable Unit 5 - Woman Creek Priority Drainage

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.7 Operable Unit 6 - Walnut Creek Priority

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.9 Operable Unit 8 - 700 Area

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.10 Operable Unit 9 - Original Process Waste Lines

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.11 Operable Unit 10 - Other Outside Closures

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.12 Operable Unit 11 - West Spray Field

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.13 Operable Unit 12 - 400/800 Area

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.14 Operable Unit 13 - 100 Area

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.15 Operable Unit 14 - Radioactive Sites

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.16 Operable Unit 15 - Inside Building Closures

No site-specific information regarding visual resources was located for inclusion in this report.

4.4.17 Operable Unit 16 - Low-Priority Sites

No site-specific information regarding visual resources was located for inclusion in this report.

4.5 LAND USE

The Rocky Flats Plant (RFP) is located in Jefferson County, Colorado approximately 10 miles south-southwest of Boulder, and approximately 16 miles northwest of Denver. The RFP covers approximately 6,550 acres (about 11 sq. mi.) of land in Sections 1 through 4 and 9 through 15 of T2S, R70W, 6th Principal Meridian. Major buildings are located within the Security Zone of 384 acres, which is surrounded by the Buffer Zone of approximately 6,150 acres.

4.5.1 Sitewide Conditions

The Northeast Land Use Inventory map (Jeffco 1988) defines the RFP as an A-2 zoning area with industrial land use. The North Plains Community Plan (Jeffco 1990) calls out the RFP as a Special Use Area. Most of the actual industrial activities take place within the 384 acre Protected Area.

Developments in the 6,150 acre Buffer Zone include firebreaks, detention ponds on three water courses, environmental monitoring stations, existing sanitary landfill, salvage yard, utility lines, wind energy test towers, gravel pits, small arms target range and access roads (DOE 1980). One of the primary purposes of the Buffer Zone is to preserve a substantial band of unoccupied land in an open, underdeveloped state to minimize the types of problems which can often arise from the close proximity of industrial facilities to other nonindustrial land uses.

The *FY93 Systems Engineering Analysis Facility/Land Use Component* (DOE 1993g) identifies the various factors that may affect land use decisions, and is also a tool for comparing potential endstates for Rocky Flats. The *EG&G Rocky Flats Plant Land Use Manual* (EG&G 1993d) divides Rocky Flats into 16 quadrants and provides brief information regarding various features (e.g., soils, geology, archeology, IHSSs, and wildlife habitat).

4.5.2 Off-Site Conditions

The area within 10 miles of the Rocky Flats Plant is located in three counties: Adams, Boulder, and Jefferson County. Adams County, east of RFP, includes portions of the cities of Arvada, Broomfield, and Westminster. Most of this area is under the jurisdiction of the cities.

The Rocky Flats site and most of the area within 10 miles to the east, south, and west is located in Jefferson County. Land directly west of RFP is planned, primarily, for industrial use with possible residential expansion further west. Land adjacent to the Plant's southern boundary is planned for industrial expansion, with some low density residential development.

To the east of RFP, the land is planned for commercial/industrial in the northeast corner adjacent to the area near the proposed 96th Street interchange. Open space will extend south the rest of the length of the Plant with planned recreational uses further east. The area immediately surrounding Standley Lake is planned for open space with limited residential use.

The area north of RFP is in Boulder County from Foothills Highway (#93) to McCaslin Blvd. The county government follows guidelines established in the Boulder Valley Comprehensive Plan which projects limited residential expansion although there is a 3-mile deep stretch of open space immediately adjacent to Highway 128. The northeast corner of the land adjacent to RFP is planned commercial development.

A detailed inventory of existing land uses within 50 miles of RFP is given in a recent document (DOE 1990d). The following inventory of land uses within 10 miles of the RFP is compiled from that document. The general land use classifications incorporated in this inventory are the following:

- Residential
- Commercial
- Industrial
- Parks and open spaces
- Agricultural and vacant
- Institutional

Residential

The residential land-use category includes all levels of densities for residential dwellings. In rural areas, only the locations of the homes were identified as residential. Large parcels of land adjacent to the home sites were not classified as residential.

Minimal development occurs within three miles of RFP with the majority of residential land use north of the plant in the newly developed Rock Creek area. The proposed 96th Street interchange will bring new commercial industry to the area adjacent to the northeast corner of RFP

The presence of residential land use increases significantly between 5 and 10 miles from the RFP. Currently, the greatest amount of residential development within 10 miles of the RFP is located in the southeast quadrant, within the city limits of Arvada, Westminster, and Wheat Ridge. Most of this development is single-family residential, with a few scattered parcels of multi-family dwellings.

Additionally, single-family land uses are found immediately to the east of the RFP in the City of Broomfield and to the northeast in the cities of Louisville and Lafayette. Significant residential land uses are also located to the north-northwest of the RFP in the southern portion of the City of Boulder. The new Rock Creek housing development near Superior in southeast Boulder County will add 8,000 new residences.

To the west, residential land use is limited to dispersed, low-density developments. The densities of these subdivisions typically are between one dwelling per 10 acres to as low as one dwelling per 50 acres. The largest concentration of low-density development is located in the foothills approximately eight miles immediately west of the RFP.

Commercial and Industrial

For the purposes of this analysis, commercial land use includes retail and wholesale sales, offices, hotels, motels, cultural and entertainment activities, and other businesses. Industrial land use incorporates both light and heavy industry.

Limited commercial development occurs within five miles of the plant. The primary exception is the commercial activity servicing the Jefferson County Airport to the east. Some business development exists along Highway 72 south of the RFP.

Inasmuch as business location is generally dependent on an available market, it follows that the majority of nearby commercial activity is located to the southeast of the RFP and generally east and south of Standley Lake in the cities of Westminster and Arvada. Supporting commercial land uses are also found in Broomfield to the east, and in the cities of Lafayette and Louisville to the northeast. Boulder to the north-northwest also includes a major concentration of commercial activity.

Industrial land uses within five miles of the RFP are mostly limited to quarrying and mining operations. The largest concentration of industrial land is located about eight miles south of the RFP, immediately east of the City of Golden. This area includes the Coors Brewery and extensive gravel operations along Clear Creek. Other large industrial lands are located in Arvada to the southeast, Broomfield immediately to the east, and in Boulder to the north.

Parks and Open Space

The parks and open space land use category includes municipal, state, and federal parks; open space; green belts; and National Forest.

The largest parcel of open space within the 10-mile radius is located about six miles to the northwest of the RFP and is owned by the City of Boulder. Golden Gate State Park, located about seven miles to the west, and White Ranch Park, situated about 5.5 miles to the southwest of the Rocky Flats Plant, also represent large blocks of open public land. Jefferson County Open Space owns a block of land immediately east of the RFP, but this land is not open for public use.

Northeast of the RFP, the only major parcels of open space are located close to Broomfield. Standley Lake Park is located five miles to the southeast of the RFP. Further to the southeast, in the cities of Westminster and Arvada, open space and park land are best described as small parcels adjoining major drainages and small neighborhood parks.

Agriculture

The majority of cropland, both irrigated and non-irrigated, is located to the northeast of the RFP. This area includes the cities of Louisville and Lafayette, and the northern portion of Broomfield. Several scattered parcels of cropland are directly east of the RFP throughout the City of Westminster. The major crop types grown in the 10-mile radius are wheat and barley. Irrigated corn and oats are grown north of the RFP toward Louisville and just east of the south end of Boulder.

The area three to seven miles south of the RFP in unincorporated Jefferson County can best be described as semi-rural. Several horse operations and many small hayfields are in this area. Much of the vacant land adjacent to the RFP could be classified as rangeland. The mountainous area to the southwest is also likely to be utilized for grazing.

Vacant Land

Vacant land is land that has not been developed with urban uses and is not classified as a park or open space because it has the potential to be developed. Certain agricultural lands fall into this category, if they have not been specifically identified as cropland by the Agricultural Soil Conservation Service (ASCS). Some areas, such as in unincorporated Jefferson County, have been classified as vacant even though there are several houses in the area.

Most of the vacant land in the zero to 10-mile area is within five miles of the RFP to the southwest in unincorporated Jefferson County. The majority of the vacant land in this area is privately owned and is used for rangeland and/or held for future urban uses. Specifically, the scattered parcels of vacant land to the north, east, and southeast around the City of Boulder and throughout the cities of Louisville, Lafayette, Broomfield, and Arvada have potential for development.

Institutional

Institutional facilities that were identified include public schools, hospitals, nursing homes, jails, and drinking water treatment and storage facilities.

Over half (51 percent) of the 93 public schools in the zero- to 10-mile study are located in the southeast quadrant. This area includes portions of the cities of Westminster, Arvada, and Wheat Ridge. The northeast and the northwest quadrants contain 19 and 20 public schools, respectively.

Schools in the northeast are found in the cities of Lafayette, Louisville, and Broomfield, while schools in the northwest are predominantly found in the City of Boulder. Only one school in the northwest quadrant is situated outside the City of Boulder, along Coal Creek Canyon. Three schools, including the Colorado School of Mines, are located in Golden, in the southwest quadrant.

Four major hospitals are within 10 miles of the RFP. Two hospitals are located in Louisville, one in Westminster, and one in Boulder. One hospital in Louisville and the hospital in

Westminster are psychiatric treatment hospitals. There are 202 total hospital beds within 10 miles of the RFP.

Eight nursing homes are located in the 10-mile study area. Five of these facilities are located in Boulder, two in Arvada, and one in Wheat Ridge.

Jail information does not include detention centers or diagnostic facilities, but rather identifies institutions with permanent residential capacities. Only one correctional facility is situated in the 10-mile study area. It is a juvenile detention home located to the south of downtown Golden, just off South Golden Road.

Nine water treatment plants and five surface water reservoirs are within 10 miles of the RFP. Surface water reservoirs receive their water from creeks and rivers as opposed to groundwater. Four water treatment plants are located in the southwest quadrant; three in the northeast quadrant, two in the southeast quadrant, and one in the northwest quadrant.

The surface water reservoirs in the zero- to 10-mile area include Gross Reservoir, Baseline Reservoir, and Marshall Lake (northwest quadrant); Ralston Reservoir (southwest quadrant); Standley Lake (southeast quadrant); and Louisville Reservoir, Great Western Reservoir, Harper, Lake, and Wanaka Reservoir (northeast quadrant).

4.5.3 Operable Unit 1 - 881 Hillside

No site-specific information regarding land use was located for inclusion in this report.

4.5.4 Operable Unit 2 - 903 Pad, Mound, and East Trenches

The OU2 area adjacent to both the industrial area and the buffer zone. Possible future uses are industrial development or an ecological preserve.

4.5.5 Operable Unit 3 - Offsite Releases

Following the 1985 Settlement Agreement, a 250-acre tract of land was transferred to Jefferson County for use in the Open Space Program. Broomfield received 100 adjoining acres for expansion of Great Western Reservoir. The agreement specified that all of the acreage would be remediated at the request of the owner.

Currently, remediation actions have only occurred on the Jefferson County property. Because full remediation has not occurred, Jefferson County prohibits access to the property.

Broomfield has not requested remediation. The City also prohibits access to the property (DOE 1992l)

4.5.6 Operable Unit 4 - Solar Evaporation Ponds

No site-specific information regarding land use was located for inclusion in this report.

4.5.7 Operable Unit 5 - Woman Creek Priority Drainage

No site-specific information regarding land use was located for inclusion in this report.

4.5.8 Operable Unit 6 - Walnut Creek Priority

No site-specific information regarding land use was located for inclusion in this report.

4.5.9 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

No site-specific information regarding land use was located for inclusion in this report.

4.5.10 Operable Unit 8 - 700 Area

No site-specific information regarding land use was located for inclusion in this report.

4.5.11 Operable Unit 9 - Original Process Waste Lines

No site-specific information regarding land use was located for inclusion in this report.

4.5.12 Operable Unit 10 - Other Outside Closures

No site-specific information regarding land use was located for inclusion in this report.

4.5.13 Operable Unit 11 - West Spray Field

No site-specific information regarding land use was located for inclusion in this report.

4.5.14 Operable Unit 12 - 400/800 Area

No site-specific information regarding land use was located for inclusion in this report.

4.5.15 Operable Unit 13 - 100 Area

No site-specific information regarding land use was located for inclusion in this report.

4.5.16 Operable Unit 14 - Radioactive Sites

No site-specific information regarding land use was located for inclusion in this report.

4.5.17 Operable Unit 15 - Inside Building Closures

No site-specific information regarding land use was located for inclusion in this report.

4.5.18 Operable Unit 16 - Low-Priority Sites

No site-specific information regarding land use was located for inclusion in this report.

4.6 ENERGY

4.6.1 Sitewide Conditions

Various energy resources are consumed by utilities and transportation uses necessary for daily RFP operations. These resources include electricity, natural gas, gasoline, diesel fuel, fuel oil and propane. Information on the type, amount and use of energy at the RFP came mainly from two documents: FEIS, Rocky Flats Plant Site (DOE 1980), and Rocky Flats Plant Ten-Year Energy Management Plan (EG&G 1992g).

Public Service Company of Colorado provides the Rocky Flats Plant with two independent sources of electrical power via transmission lines, each with 115 kilo volts (kV) capacity. The continuous rating of each of these overhead feeders, one of which enters the RFP site from the north and one from the south, is 54 million volt amperes (MVA). The utility company calculates that its capability at the three-phase primary distribution point, in the event of a fault or short (often referred to as the fault-level contribution), is 2,400 MVA from the north feeder and 2,130 MVA from the south feeder. These fault levels may increase in the future. In 1991, Rocky Flats consumed 188,598 megawatt hours of electricity supplied by Public Service Company.

The following information is based on the previous FEIS (DOE 1980). These details were not updated in the more recent reports (EG&G 1992g). In 1980, there were four primary

substations. Each main substation is constructed so that each half of the transformer can sustain all normally connected loads, and the loads can be transferred if one of the two 115-kV sources should fail. Since both sources of power are available at both ends of each primary substation through manual switching, one substation can also be considered primary-selective in addition to secondary-selective.

Voltage is stepped down at the primary substations to 13.8 kV, and power within RFP is distributed at that level through 25 miles of lines to the building substations. Most of these building substations are fed through aerial distribution; however, three principal buildings are fed from underground lines. Voltage is stepped down again from 13,800 volts to 2,400 or 480 volts at the building substations.

Transformers at the substations are not protected from the weather; they are designed for use under these conditions. However, the switching gear at each substation is protected from the weather.

Building substations for critical-system loads are double-ended and equipped for manual or automatic secondary-selective operation. In some cases, primary-selective capabilities are also provided. Building substations for noncritical loads are single-ended and primary-selective, with manual transfer switches.

A 2,300-volt series lighting system, automatically turned on and off by photo-electric cells, illuminates the nine exclusion-area fences and the Plant-perimeter security fence. Emergency circuits powered by diesel generators can illuminate every alternate light during a loss of normal power. Streets are illuminated by standard overhead lamps mounted on power-line poles. Like the fence lighting, the street lights and some building lights are automatically turned on and off by light-sensing devices. To improve night visibility from the east and west guard posts, high-intensity mercury-vapor lamps, mounted about 35 feet high, were placed along the east and west approaches to the Plant's two main gates.

In the event of a total power loss from off-site sources, on-site emergency generators can power critical functions such as ventilation, humidity control, public address capabilities, alarm systems, and building lighting for at least 24 hours.

Natural gas is purchased from Energy Pipeline Services, Inc. The RFP purchases its natural gas on an interruptible basis, which means that during periods of high usage or need by the citizens served by the gas company, the Plant's gas-burning equipment is switched to an alternate fuel, such as fuel oil or propane. The gas that the Plant would otherwise consume is then available for non-interruptible purposes, such as homes and hospitals.

An eight-inch pipe carries the natural gas, at a pressure of 250 to 300 pounds per square inch (psi), from a metering station south of the Plant to a gas reducing station in the 800 complex on-site. At this station, the pressure is reduced to 65 psi, and mercaptan is added at the rate of one pound per million standard cubic feet for early detection of leaks. Natural gas consumption in fiscal year 1991 was 649.3 million cubic feet.

Fuel oil serves as the standby boiler fuel when natural gas is not available. No. 6 or residual oil is used in the main plant boilers. Fuel oil flows are metered at the burner when oil is being burned in a boiler furnace.

Diesel fuel is used to power most of the Plant's emergency electrical generators, as a backup fuel for hot-water-heating boilers in a Research and Development facility, and for diesel-driven vehicles and construction equipment. Individual storage tanks are provided for each stationary engine; mobile equipment is supplied by a storage tank and pumps at the Garage and Fire Station. Periodic generation of the diesel-powered emergency generators and firing of the R&D facility's heating boilers account for most of the consumption during normal RFP operations. Total storage capacity for diesel fuel is 115,430 gallons.

Gasoline is used as fuel for one of the emergency electrical generators, for various Plant vehicles, and for miscellaneous Plant equipment. A 14,000-gallon underground storage tank and pumps are provided at the Garage.

Propane is used as a backup fuel to the preferred natural gas for manufacturing, R&D, and maintenance activities in a major manufacturing building. An 18,000-gallon storage tank is provided near the building to meet anticipated maximum requirements.

The following information is summarized from the more recent energy management plan (EG&G 1992g). There are statutory requirements, executive orders and other federal requirements regarding the management of energy use in DOE facilities. The Ten-Year Energy Management Plan for the Rocky Flats Plant describes program elements implemented to improve the use of energy in conformance with those requirements.

The DOE also has a Ten-Year In-House Energy Management Plan (IHEM) which establishes goals for reducing energy consumption. Programs available through the IHEM plan cover all areas of energy conservation and use. The program is divided into eight distinct elements and include: Surveys and Studies, Retrofit Projects, New Buildings, Central Plant, Awareness, Incentive, Transportation, Utility Contract Improvement and Load Management, and Metering.

Surveys and Studies funded through the IHEM program are conducted to identify areas of energy waste or mismanagement associated with operational and maintenance practices at the Plant's facilities. These studies are also used to identify potential energy retrofit projects that require extensive engineering man-hours to perform system analysis and research in order to calculate their economic viability.

Since FY 1986, seven studies have been completed (EG&G 1992g). These studies have identified 29,600 Million British thermal units (MMBtu) that could be saved annually by implementing the recommendations of these studies. These savings equate to 1.0 percent reduction from the FY 1985 energy consumption.

Eighteen retrofit projects and central plant improvement projects, funded through the IHEM program and with operating expense funds, have been initiated. When all projects are operational, their estimated energy reduction is 11.4 percent of total FY 1985 usage.

Under the new buildings program, eighteen buildings have been constructed in the last seven years. Since FY 1985, 456,100 square-feet of facilities have been added. These new buildings were constructed in accordance with the energy conservation features outlined in DOE Order 6430 as revised and have had the most significant impact on meeting the ten-year energy reduction goals.

Employees participating in the transportation program are utilizing 51 vanpool routes between RFP and various cities in the front range area. Over 1500 employees are registered in the Rocky Flats/Denver Regional Council of Governments carpool matching service.

Only major production buildings currently have reliable steam and electrical metering. To further enhance the metering capabilities at Rocky Flats, the IHEM metering program funded the installation of 21 steam meters and four new electric meters in FY 1988 for monitoring additional buildings. Due to funding limitations, these meters were installed without totalizing capabilities. Through supplemental IHEM funding and the plant's electrical system upgrade line item project, such data acquisition systems are expected to be completed by the end of FY 1994. The IHEM goals call for a ten percent reduction in energy consumption between fiscal year (FY) 1986 and FY 1995, compared to FY 1985, for three energy categories: metered process, building, and vehicular and equipment. **Table 4.6-1** shows the changes in energy consumption per square footage of buildings at RFP in Fiscal Year 1991 compared to the Baseline, Fiscal Year 1985.

TABLE 4.6-1[1]

CHANGES IN ENERGY CONSUMPTION AT ROCKY FLATS PLANT
FY 1991 vs. FY 1985

Category	Change Since FY 85
Metered Process (Energy/SF)	3% Increase
Building (Energy/SF)	51% Decrease
Combined (Total Energy/Gross SF)	14% Decrease
Vehicular & Equipment	10% Decrease
Gross Building Area	18% Increase

Source: EG&G 1992g.

[1] This table was reproduced from a previous report.

The RFP has met the ten-year energy reduction goals in the building and vehicular and equipment categories, but has increased energy consumption in the metered process category. This increase in reported metered process energy is due to the method of calculation mandated in FY 1985 at the beginning of this ten-year period, wherein a large percentage of the energy consumed in new on-site office buildings is designated to the metered process category, while all of the associated square footage is added to the divisor of the building energy category. Combining the two categories (metered process and building) results in a 14 percent decrease in energy consumption on a gross square-footage basis. This combination more accurately reflects RFP progress in maximizing the efficient use of energy at Rocky Flats.

4.6.2 Operable Unit 1 - 881 Hillside

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.4 Operable Unit 3 - Offsite Releases

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.5 Operable Unit 4 - Solar Evaporation Ponds

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.6 Operable Unit 5 - Woman Creek Priority Drainage

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.7 Operable Unit 6 - Walnut Creek Priority

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.9 Operable Unit 8 - 700 Area

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.10 Operable Unit 9 - Original Process Waste Lines

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.11 Operable Unit 10 - Other Outside Closures

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.12 Operable Unit 11 - West Spray Field

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.13 Operable Unit 12 - 400/800 Area

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.14 Operable Unit 13 - 100 Area

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.15 Operable Unit 14 - Radioactive Sites

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.16 Operable Unit 15 - Inside Building Closures

No site-specific information regarding energy resources was located for inclusion in this report.

4.6.17 Operable Unit 16 - Low-Priority Sites

No site-specific information regarding energy resources was located for inclusion in this report.

4.7 CULTURAL RESOURCES

4.7.1 Sitewide Conditions

A cultural resource inventory for RFP was completed in July, 1991 (*Cultural Resources Class III Survey of the Department of Energy Rocky Flats Plant, Northern Jefferson and Boulder Counties, Colorado, Dames & Moore, Inc., August, 1991 [Dames & Moore 1991]*). The study located six previously-identified historic sites and identified 45 new cultural resources on the RFP site. The report concluded that none of the sites was eligible for the National Register of Historic Places, and recommended that no further work be done on any of the cultural resources. The Colorado State Historic Preservation Officer concurred with that recommendation.

In addition, current pond management operations do not involve any activity, such as construction, that would unearth any undiscovered historic sites. Therefore, it is not anticipated that adverse effects to historic properties would occur due to implementation of current pond management.

There have been two recent, large-scale cultural resources surveys of the Rocky Flats Plant, and at least two small surveys covering over 5,900 acres. The two comprehensive reports are Cultural Resources Class III Survey of the Department of Energy Rocky Flats Plant, Northern Jefferson and Boulder Counties, Colorado (Dames & Moore 1991); and An Archaeological and

Historical Survey of Selected Parcels within the Department of Energy, Rocky Flats Plant, Northern Jefferson County, Colorado (Burney, et al. 1989).

The earlier report covered a survey of approximately 1,780 acres, and the latter survey covered 4,120 acres. Areas excluded from survey included the inner RFP (previously called the "controlled area," now called the "security area") and all designated solid waste management units (SWMUs) at that time. The Colorado State Historic Preservation Officer was consulted concerning exclusion of these areas from survey. These surveys resulted in the recordation of 37 cultural resource sites and 26 isolated finds. Both reports contain historic and prehistoric overviews of RFP and surrounding area. They also include brief summaries of other investigations in the general vicinity.

The vast majority of the sites recorded (35) are identified with the historic period, dating from the 1870s through the mid-twentieth century. The sites are mainly associated with ranching and agricultural pursuits that dominated the area prior to 1951, when the Atomic Energy Commission acquired much of the plant site. Some of the sites were probably in use after 1951, as the Department of Energy did not purchase the remaining buffer zone property until the mid-1970s. Recorded site types include ditches, stock ponds, building remains, a trash dump, rock piles, corrals, and an orchard. Other historic site types recorded on RFP include an abandoned railroad grade and a gravel pit.

Only two sites identified with an American Indian occupation of the area have been recorded on RFP. One site consisted of eight low circular rock piles or rings, and the other site included a series of interlocking ovate, arcuate, and linear stone alignments. Neither site had any cultural material (artifacts) associated with the stone features. The sites' American Indian association was based on a similarity with other Front Range sites with similar features containing cultural material. It is unknown with what cultural affiliation or time period these sites are associated. Human occupation of the Front Range has occurred for at least 10,000 years; however, these two sites were probably occupied after A.D. 500.

Recommendations have been offered by previous investigators concerning the eligibility of the recorded sites for the National Register of Historic Places. None of 35 historic sites were recommended as eligible for the Register under any of the criteria listed in 36 CFR 60.4. Either the site's integrity was not intact, or the site did not make a significant contribution to understanding the history of the area. No definitive eligibility recommendations have been offered for the two American Indian sites. One of the sites was originally recommended as eligible to the National Register (Jennings 1978). However subsequent investigators (Burney, et al. 1989, Dames & Moore 1991) have listed these sites as needing further investigation

before eligibility recommendations can be made. By definition, none of the recorded isolated finds are eligible for the National Register.

Two reports (Burney, et al. 1989 and Dames & Moore 1991) have speculated on the small number of American Indian sites recorded at RFP. Both believe the heavy vegetation obscures some of the evidence of prehistoric occupation. However, these researchers have also noted that other investigators have reported a low site density in the general vicinity. A combination of vegetation cover and low intensity of prehistoric use probably contributes to the low site density.

4.7.2 Operable Units 1 - 881 Hillside

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

The State Office of Archeology and Historic Preservation has determined that any action in the vicinity of OU2 will not impact cultural resources (DOE 1992i).

4.7.4 Operable Unit 3 - Offsite Releases

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.5 Operable Unit 4 - Solar Evaporation Ponds

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.6 Operable Unit 5 - Woman Creek Priority Drainage

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.7 Operable Unit 6 - Walnut Creek Priority

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.9 Operable Unit 8 - 700 Area

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.10 Operable Unit 9 - Original Process Waste Lines

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.11 Operable Unit 10 - Other Outside Closures

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.12 Operable Unit 11 - West Spray Field

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.13 Operable Unit 12 - 400/800 Area

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.14 Operable Unit 13 - 100 Area

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.15 Operable Unit 14 - Radioactive Sites

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.16 Operable Unit 15 - Inside Building Closures

No site-specific information regarding cultural resources was located for inclusion in this report.

4.7.17 Operable Unit 16 - Low-Priority Sites

No site-specific information regarding cultural resources was located for inclusion in this report.

* * * * *

This section presents information on previous, current, and/or proposed assessments of, first, human, then, ecological risks. This information is discussed at both the sitewide and OU levels.

5.1 HUMAN RISK

5.1.1 Sitewide Conditions

Sitewide risks have been addressed in a variety of documents. A fact sheet has been prepared by the DOE Public Affairs Office and EG&G's Community Relations Office summarizing health studies conducted at the Rocky Flats Plant (DOE/EG&G 1991).

Other Studies

An independent study that is currently under way is the Dose Reconstruction Project being performed by the Colorado Department of Health (CDH 1992). It has been divided into eight tasks. Task 1 identified about 2,500 chemicals that were classified as being of moderate to high toxicity. The objective of Task 2 was to select chemicals and radionuclides that were most likely to have posed an off-site health hazard under historical routine operation of RFP.

In the report for Task 2, detailed information on storage locations, annual usage rates, nature of usage, nature of toxicity and environmental fate of the chemicals selected in Stage 2 was reviewed. Based on this individual evaluation of each chemical, a total of 20 industrial chemicals and pesticides and herbicides as a group were identified as having been of potential concern for off-site impacts. An historical activities profile of RFP will be constructed under Task 3.

Tasks 4, 5, and 6 will address the identification of where in the facility activities took place, how much of the materials of concern were released to the environment, and where these materials went after the releases. Task 7 addresses historic land-use in the vicinity of RFP and the location of off-site populations potentially affected by releases from Rocky Flats. Task 8 activities will quantify the doses of the materials of concern received by off-site populations (CDH 1992).

Other studies that address human health risks at the Rocky Flats Plant include: EPA (1989), Rockwell (1985), Hogdin et al. (1990), Johnson (1980, 1977), and Johnson et al. (1976). A number of epidemiological studies have also been reported. These include the following: Gilbert et al. (1989), Goldsmith (1990), Cobb et al. (1983), Johnson (1987, 1981), Chinn (1981), Howe (1991), Cobb (1982), Dreyer et al. (1982), HHS (1990), and Voelz et al. (1981).

Operable Unit Studies

The Incremental Risk Assessment Methodology (EG&G 1992c) will assess incremental and cumulative human health risks across OUs. In addition, the 1991 IAG directs that baseline risk assessments will be conducted as part of the RCRA Facility Investigations/Remedial Investigations (RFI/RI) process. Generally, each OU Work Plan outlines proposed procedures for the baseline risk assessment. *The status of the risk assessments are reported in Section 6.0: Remediation of this ERTSD.* Currently, requirements and schedules are being developed that will combine the ecological portion baseline risk assessments (i.e., Environmental Evaluation) for the operable units within the Industrial Area (OUs 8, 9, 10, 12, 13, and 14).

5.1.2 Operable Unit 1 - 881 Hillside

A risk assessment was prepared for high priority sites in OU1 as part of the 1988 Feasibility Study Report for High Priority Sites 881 Hillside Area (DOE 1988b). In addition, risk assessments and human health were discussed in several additional documents located during the ERTSD review. The following is a summary of the documents on OU1 reviewed for human health risk information.

The Remedial Investigation Report for High Priority Sites 881 Hillside Area (DOE 1988c) summarizes the findings of this report and the risk assessment prepared in the feasibility study, as follows:

> Based on an analysis of potential public health impacts, it is concluded that there is no immediate public health threat. This is because neither surface water nor air are contaminated by the SWMUs and because a travel time on the order of 80 years has been predicted for ground-water transport of dissolved chemical species to the property boundary in the valley fill alluvium. However, a risk assessment ... indicates that the potential for future exposure via the ground-water pathway may pose an unacceptable risk to the public....

The chemicals of concern (COCs) selected for the risk assessment (DOE 1988b) included bis(2-ethylhexyl)phthalate, carbon tetrachloride, 1,2-dichloroethane, 1,1-dichloroethene, trans-1,2-dichloroethene, tetrachloroethene, trichloroethene, selenium, strontium, uranium-233,234, uranium-235, and uranium-238. According to the risk assessment, "the greatest potential for off-site exposure to these chemicals is posed by groundwater migration."

The risk assessment concluded that the only currently exposed population was onsite workers. The report stated that, "workers currently are not expected to be exposed to media 'containing high contaminant concentrations (i.e., groundwater)' and worker exposure via air and surface water pathways is expected to be low."

Two risk scenarios involving hypothetical future exposed populations showed estimated total lifetime cancer risks of up to 2.16×10^{0} (maximally exposed individual, Scenario A) and up to 5.66×10^{-2} (maximally exposed individual, Scenario B). Scenario A postulated residences being built on the 881 Hillside site without remediation; Scenario B assumed that housing would be constructed hydrologically downgradient of the Rocky Flats Plant at the plant boundary.

For noncarcinogenic health effects, the estimated daily intakes for all of the chemicals of concern (referred to as indicator chemicals per earlier EPA risk assessment guidance) exceeded the acceptable chronic intake for one or more exposure situations. As summarized in the risk assessment, "the major part of the noncarcinogenic and carcinogenic risks potentially posed by the indicator chemicals were found to be associated with groundwater usage (i.e., drinking water ingestion, showering/bathing, and the ingestion of vegetables irrigated with groundwater)."

A draft version of a document entitled "881 Hillside Environmental Assessment" (DOE 1988a) was prepared to examine "the environmental impact of ground water collection from identified sources and a french drain, treatment of the ground water, and return of the ground water to the alluvial aquifer."

The document summarizes the results of the risk assessment prepared as part of the feasibility study (DOE 1988b) and concludes that remedial action is required. According to the document, "hazardous material exposure of personnel, both worker and non-worker, both on and off site, will result in insignificant health risks during installation and operation of the remedial action as well as any credible accidents."

The Final Phase III RFI/RI Work Plan, Revision 1, 881 Hillside Area (DOE 1991e) describes the baseline risk assessment to be conducted as part of this investigation. As described in the work plan, the assessment would include a human health risk assessment and an environmental evaluation. The conceptual model for the human health risk assessment is presented in the document.

The assessment would be comprised of contaminant identification, exposure assessment, toxicity assessment, risk characterization and uncertainty analysis. The document also includes a description of the conceptual site model. The model will "summarize suspected sources of contamination, types of contamination, affected media, contaminant migration pathways, and environmental receptors."

In describing the conceptual model, the Phase III RFI/RI Work Plan states that "the actual pathways of significance will be determined during the risk assessment." The report suggests that pathways of importance may include direct inhalation of contaminated dust and ingestion of contaminated soils, surface water or groundwater. Sources of contamination at the 881 Hillside "include radionuclide contaminated surface soils (originated from the 903 Pad Area) and subsurface contaminated soil and buried wastes." Specific contaminants cited in the conceptual site model include plutonium, americium, uranium, toluene, and chlorinated volatile organic compounds.

The *Public Health Risk Assessment 881 Hillside Area (OU1) Technical Memorandum No. 6 Exposure Scenarios, Revision 4.0*, (DOE 1992g) identifies five land use scenarios that will be included in a quantitative exposure assessment: (1) current offsite residential use, (2) current onsite commercial/industrial use, (3) future onsite residential use, (4) future onsite commercial/industrial use, (5) future onsite ecological reserve use.

Description of Models for the Public Health Evaluation, Operable Unit One, Rocky Flats Plant, Technical Memorandum No. 7, Revision 2.0, (DOE 1992h) identifies the contaminate transport models selected to perform the public health evaluation. The Jury and Johnson model will be used for soil gas transport, the Universal Soil Loss Equation (and associated equations) will be used for surface water transport to the South Interceptor Ditch, and the MILDOS-AREA model will be used for transport in air.

5.1.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

A quantitative risk assessment for surface water interim measures/interim remedial actions at the OU2 site (903 Pad, Mound, and East Trenches Area) was located in the ERTSD review. Elements of the OU2 conceptual site model, potential exposure pathways, chemicals of

concern, and receptors are presented in several documents. The following is a summary of the documents on OU2 reviewed for information on risk assessment and human health.

Technical Memorandum 1, Final Phase II RCRA Facility Investigation Remedial Investigation Work Plan (Alluvial) for OU2 (DOE 1991h) briefly describes the baseline risk assessment to be conducted as part of this investigation. As described in the work plan, the assessment would include a human health risk assessment and an environmental evaluation. The conceptual site model for the human health risk assessment is presented. Elements of the site conceptual model are suspected sources of contamination, types of contamination, affected media, contaminant migration pathways, and environmental receptors.

Technical Memorandum No. 5, Human Health Risk Assessment, 903 Pad, Mound and East Trenches Areas, Operable Unit 2, Draft Final (DOE 1993d) expands upon these elements. The document also includes a description of the Baseline Risk Assessment and compares site maximum values for potential contaminants to various state and federal standards. This baseline risk assessment was scheduled to be completed in August 1993. Elements of the risk assessment are data collection/contaminant identification, exposure assessment, toxicity assessment, risk characterization, and analysis of uncertainties.

Elements of risk assessment, including the conceptual site model, potential exposure pathways, chemicals of concern, and receptors are presented in somewhat more detail in two environmental assessments contained in interim measure/interim remedial action documents (surface water and subsurface) for the site. The first document describes measures to remediate surface water in the South Walnut Creek Basin downstream of Operable Unit No. 2 (DOE 1991f). The second document describes the use of interim measures to gain site-specific information on volatile organic compound and radionuclide contamination in OU2 (DOE 1992i).

The dosage from fugitive dust for workers assigned to Buildings 988 and 995 during construction of the surface water treatment facility was conservatively estimated at 0.4 mrem Committed Effective Dose Equivalent (CEDE) during the 60-day construction period. The calculated cancer risk attributed to phthlates and metals in the soil was 3×10^{-6}. The corresponding dose to the public from fugitive dust and metal contamination was conservatively estimated at 2×10^{-3} mrem CEDE, and the cancer risk, attributed to phthlates was estimated at 6×10^{-8}.

The models selected for the human health risk assessment are the U.S. Geological Survey Modflow numerical model for groundwater flow; the MT3D numerical model for groundwater contaminant fate and transport in the Rocky Flats Alluvium and Arapahoe Formation No. 1

Sandstone, and the ONED3 model for groundwater contaminant fate and transport in the colluvium; the Universal Soil Loss Equation, Soil Conservation Service Curve Number Equation, and Mass Balance Equation for surface water fate and transport; and the Superfund Exposure Assessment Manual (SEAM) model for soil gas fate and transport, a box model for onsite ambient air contaminant fate and transport, and Fugitive Dust Model (FDM) for offsite ambient air contaminant fate and transport of OU2 source air emissions.

The surface water interim measures involve collection and treatment of surface water at one seep and two in-stream locations on South Walnut Creek upstream of the existing detention ponds, to reduce the potential for further downstream contamination. The environmental evaluation of the surface water interim measure states that "the results of this evaluation illustrate that the potential negative impacts to air and water quality, land, and short- and long-term land productivity, as well as exposure of personnel, are minimal compared to the benefits of the resulting water quality improvements to the surface waters of the area."

In evaluating the effects of personnel exposure to hazardous chemicals as a result of the alternatives, "analyses were done separately for those directly involved in remedial actions (workers), other RFP personnel not directly involved in remedial actions (site employees), and off-site individuals (general public). Pathways of exposure to OU2 contaminants include the following: airborne exposure to volatile organic compounds; dermal exposure to organic and inorganic chemicals or radioactive materials; or inhalation of organic chemicals, inorganic chemicals, or radioactive materials on fugitive dust. The risk of exposure was judged low for on-site workers, with less risk to site employees and least risk to off-site individuals." Protective procedures to reduce risks for each group are described (DOE 1992j).

The environmental evaluation presented in the subsurface interim measures document qualitatively evaluates these same elements for proposed subsurface remedial actions (well drilling and pilot-scale vapor extraction studies) and concludes that the risks to personnel (primarily onsite remedial workers) will be low and limited by health and safety measures.

5.1.4 Operable Unit 3 - Off-Site Releases

Preliminary, "generic" risk assessments for the OU3 site (Offsite Releases) were reviewed for the four IHSSs and are summarized in the OU3 RFI/RI Work Plan (DOE 1992l). OU3 documents also include an Environmental Assessment for the proposed Standley Lake Diversion Project. The following is a summary of the documents on OU3 reviewed for information on human health risks.

The preliminary risk assessment for IHSS 199 (Contamination of the Land Surface - approximately 350 acres east of the RFP boundary) is presented in the Final Past Remedy Report, Operable Unit No. 3 - IHSS 199 (DOE 1991l). The conceptual model considers the contaminant source to be the plutonium-contaminated soils of IHSS 199. Airborne dust inhalation was judged to be the most significant exposure pathway for human health risk under current site conditions, although "under a future residential use scenario, the soil ingestion pathway may also be significant." According to the qualitative assessment, "the magnitude of risk from a no further action alternative is judged to be low to negligible." Future residential use of IHSS 199 was predicted to "result in a similar low to negligible risk."

Preliminary risk assessments for IHSS 200 (Great Western Reservoir), 201 (Standley Lake), and 202 (Mower Reservoir) are presented in the Final Historical Information Summary and Preliminary Health Risk Assessment, Operable Unit No. 3 (DOE 1991w). The site conceptual model describes the contaminant source as the sediment and water of the reservoirs and their drainages (limited to offsite reaches of drainages flowing from the RFP). The report concludes that "plutonium and americium (a decay product of plutonium) are the only known contaminants in the reservoirs attributable to RFP releases."

Further, "of the many potential exposure pathways identified for the reservoirs, the airborne pathway from re-entrainment of exposed sediments is considered the most significant pathway that can convey plutonium to human receptors from Sites 200-202." According to the "generic risk assessment" (Appendix C in that document), the theoretical calculated lifetime cancer risk to residents downwind of the reservoirs from plutonium in the sediments ranges from 1×10^{-9} to 1×10^{-6}, based on average sediment concentrations ranging from 0.01 to 10.0 pCi/g plutonium.

The RFI/RI Work Plan for OU3 (DOE 1992l) summarizes the findings of the above reports. Further, it presents the exposure pathways conceptual model. The model will evaluate contaminants and the exposure pathways for differing media. A complete pathway is comprised of the following components: contaminant source, release mechanism, transport medium, exposure route, and receptors. The risk assessment will evaluate the potential human health risk produced by contaminants within various media. The components of the assessment are: contaminant description, exposure assessment, toxicity, assessment, risk characterization, and uncertainty analysis. Lastly, the work plan identifies the specific remediation objectives.

The Draft Environmental Assessment, Standley Lake Diversion Project (DOE 1992bb) describes the potential human health effects of a diversion facility to carry stormwater flows and potential releases of surface water from the RFP around Standley Lake. As the assessment

states, "the human health issues for this diversion project focus on the potential exposure of humans to toxic or radioactive contaminants in the water and sediments in the area, and to radionuclides in soils in the project area." The human health evaluation focuses on potential risks from radionuclides in soils and sediments in the area where the diversion would be constructed. Potential risks to human health from these sources are qualitatively judged to be low to very low, provided construction is undertaken under conditions that control airborne dust.

5.1.5 Operable Unit 4 - Solar Evaporation Ponds

A preliminary health evaluation of the potential risks of failure of the solar ponds is contained in the 1980 Final Environmental Impact Statement (FEIS) (DOE 1980), and qualitative statements regarding human health impacts are presented in the Environmental Assessment and Decision Documents for the proposed interim measure/interim remedial action for OU4 (discussed below). The following is a summary of the documents on OU4 reviewed for information on human health risk.

The 1980 Final Environmental Impact Statement describes the potential hazards to human health of a failure of the solar ponds (DOE 1980). According to the FEIS, the risk of cancer mortality over 70 years following a failure of the solar evaporation ponds totals 3.5×10^{-6}. This excludes "the risk of thyroid cancer, which is generally not fatal." The actual risk, defined as the total risk following an actual occurrence multiplied by the probability of occurrence over 70 years, was given as 2.5×10^{-6}. These risk estimates were based on the dispersion of contaminants downwind, by the air pathway.

Appendix A-7 of the Exposure Information Report (Weston 1986) describes the potential for human exposure to contaminants from the solar ponds, present landfill, and west spray field. For the solar ponds, the report briefly summarizes the potential for human exposure via surface water, ground water, air, subsurface gas release, and soil pathways. In addition, the potential for exposure from transportation-related and worker-management practices are very briefly discussed. The report indicates that the potential for exposure to hazardous contaminants from the solar ponds is low to very low. The report notes there is some potential for contact with contaminated soil in the ponds area limited to workers involved with the closure of the unit.

The Draft Final Phase I RFI/RI Work Plan, Solar Evaporation Ponds (DOE 1991p) describes the baseline risk assessment to be conducted as part of this investigation. As described in the work plan, the assessment would include a human health risk assessment and an environmental evaluation. A description of the conceptual site model for the human health risk assessment is also presented in the work plan.

As indicated in Figure 3-1 of that same document, the media by which humans and biota may be exposed to contaminants from the solar ponds include air, surface water and sediments, and ground water. The conceptual site model shows that the process fluids piped to the ponds for disposal are the major source of contaminants in the ponds. The primary release mechanisms are windblown aerosols, pipeline leakage, and pond bottom leakage.

The Environmental Assessment, Dewatering and RCRA Partial Closure Action on Solar Evaporation Ponds (DOE 1991m) contains a short discussion of human health impacts and potential accidents and hazards. This document fulfills requirements of the National Environmental Policy Act (NEPA) and the U.S. Department of Energy (DOE) in support of the proposed actions to enhance evaporation from the ponds, removal of sludge, and solidification of evaporator concentrate. The document summary concludes that:

> The potential for impacts would be associated with air quality, water quality, soils, and human health issues. Temporary impacts to air quality and human health factors could potentially result from inhalation or ingestion of resuspended dust from the dewatered solar evaporation ponds and of dust or silt from tank pad construction. This potential would, however, be controlled through dust suppression techniques, erosion protection, air monitoring, and personnel protection measures and, for the tank pads, from site selection.

The potential for human health impacts, according to the document, concerns, "the possibility of worker ingestion and/or inhalation of resuspended materials....The potential for impacts on the general public health and safety would be insignificant."

Based on the findings in the above environmental assessment, DOE prepared a Finding of No Significant Impact (FONSI) (DOE 1991n). The FONSI reaffirmed the conclusions of the environmental assessment. Specifically, the FONSI states that during routine operation, "potential human health impacts would be limited to those associated with possible ingestion and/or inhalation of resuspended materials by the workers. There would also be possible ingestion and/or inhalation of dust or silt from the construction of pads for the surge tanks. The overall potential for impacts on the general public health and safety would be insignificant."

The *OU4 Solar Evaporation Pond Interim Measures/Interim Remedial Action, Environmental Assessment Decision Document* (DOE 1994a) describes the selected IM/IRA, which is being taken to facilitate site closure. The decision document briefly discusses chemicals of concern at OU4. In addition, the document summarizes site risks.

The potential contaminants of concern for the qualitative risk assessment are (1) certain radionuclides such as Pu-239 and Am-241, (2) certain heavy metals such as beryllium, cadmium and chromium, and (3) a limited number of volatile organic compounds such as carbon tetrachloride and trichloroethylene. As this document emphasizes, "a key assumption of this pathway-based qualitative risk assessment is that the ground water pathway is not complete....Specifically, there currently is no human receptor exposed to ground water containing contaminants released from the SEPs (solar evaporation ponds)."

In addition to the groundwater pathway (found to be incomplete, as noted above), two potential air pathways to offsite receptors or nearby workers were qualitatively evaluated. Neither air pathway was judged to present an appreciable exposure source to the offsite public or workers, because of (1) low concentrations of most potential chemicals of concern in pond water, and (2) the presence of high efficiency particulate air (HEPA) filters in the flash evaporator system.

The OU4 Solar Evaporation Ponds IM/IRA/EA (DOE 1994a) identifies the components of a human health risk, including identifying contaminants of concern, exposure assessment, toxicity assessment, risk characterization, and uncertainty analysis.

5.1.6 Operable Unit 5 - Woman Creek Priority Drainage

The Final Phase I RFI/RI Work Plan, Woman Creek Priority Drainage (DOE 1992n) describes the conceptual site model for the baseline health risk assessment which will be completed as part of the investigation. In addition, the work plan presents a conceptual site model and compares maximum surface water values to various federal and state water quality standards.

The conceptual site model presented in the work plan states that contaminants may potentially be contributed to the Woman Creek Drainage by the Original Landfill, the Incinerator, Ash Pits, and Concrete Wash Pad, Detention Ponds C-1 and C-2, and possibly by the Surface Disturbance to the drainage. The primary potential exposure media include air (both particulates and gaseous emissions), surface water, groundwater, and direct contact with contaminated soil, sediment, or water. The Work Plan states that potential human receptors are located both onsite and offsite, and that onsite humans are more likely to have direct contact exposures.

The chemicals of concern will be identified using available historical data and results of the Phase I field sampling program. When compared to various federal and state surface water quality standards, some chemicals (organics, metals, and radionuclides) exceed water quality standards.

5.1.7 Operable Unit 6 - Walnut Creek Priority Drainage

The Final Phase I RFI/RI Work Plan, Walnut Creek Priority Drainage (DOE 1992o) describes the conceptual site model for the baseline health risk assessment, which will be completed as part of the investigation. In addition, the Work Plan presents an outline of a potential conceptual site model and compares maximum surface water values to various federal and state water quality standards.

The conceptual site model presented in the Work Plan states that contaminants may potentially be contributed to the Walnut Creek Drainage by the A-series ponds; B-series ponds; North, South, East, and Pond Area Spray Fields; Trenches A, B, and C; the Sludge Dispersal Area; Triangle Area; Old Outfall; and Soil Dump Area. Potential exposure media include air (both particulates and gaseous emissions), surface water, groundwater, and direct contact with contaminated soil, sediment, or water. The Work Plan states that potential human receptors are located both onsite and offsite, with onsite humans more likely to have for direct contact exposures.

The chemicals of concern will be identified using available historical data and results of the Phase I field sampling program. When compared to various federal and state surface water quality standards, some chemicals (organics, metals, and radionuclides) exceed water quality standards.

5.1.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

Appendix A-7 of the Exposure Information Report (Weston 1986) describes the potential for human exposure to contaminants from the solar ponds, present landfill, and west spray field. For the present landfill, the report briefly summarizes the potential for human exposure via surface water, groundwater, air, subsurface gas release, and soil pathways.

In addition, the potential for exposure or potential exposures from transportation-related and worker-management practices are very briefly discussed. The report indicates that the potential for exposure to hazardous contaminants from the present landfill is low to very low. The report notes that the only exception may be onsite workers directly involved in disposal operations.

The Closure Plan, Present Landfill (DOE 1988e) contains a section entitled, "Protection of Human Health and the Environment." This section states that "threats to human health and the

environment are prevented by the routine monitoring activities conducted at Rocky Flats and by restricted access to the facility." Routine monitoring programs are briefly described, along with security measures that limit access to the existing landfill.

The Draft Final Phase I RFI/RI Work Plan, Present Landfill (SWMU 114) and Inactive Hazardous Waste Storage Area (SWMU 203), Operable Unit No. 3 [now OU7], Rocky Flats (DOE 1990c) describes the conceptual site model for the baseline health risk assessment, which will be completed as part of the investigation. In addition, the Work Plan presents an outline of the conceptual site model.

The conceptual site model presented in the Work Plan states that potential exposure media include alluvial and bedrock groundwater, wind-dispersed contaminated dust or soil gas, surface water runoff, and sediment. The Work Plan states that potential human receptors include area residents and site visitors. Humans are potential receptors to contaminants from OU7 via all exposure pathways.

The specific chemicals of concern will be identified using available historical data and results of the Phase I field sampling program. According to the Work Plan, "groundwater monitoring has indirectly identified a number of potential contaminants in the existing landfill. Groundwater at the existing landfill appears to have elevated concentrations of 1,1,1-trichloroethane, trichloroethylene, barium, calcium, iron, magnesium, manganese, sodium, strontium, zinc, sulfate, chloride, TDS [total dissolved solids], tritium, and uranium."

5.1.9 Operable Unit 8 - 700 Area

The Draft Phase I RFI/RI Work Plan for OU8 (DOE 1992p) proposes the baseline risk assessment be conducted to evaluate potential threats to human health and the environment from constituents associated with OU8 and/or IHSSs contained with the OU boundary. Soil at OU8 has been shown to contain VOCs, semivolatiles, metals, and some radionuclides. Aromatic and halogenated VOCs have been found at low concentrations in the shallow groundwater.

The baseline risk assessment will be conducted in four phases including 1) an identification of compounds of potential concern; 2) an exposure assessment; 3) a toxicity assessment; and 4) a risk characterization with an uncertainty analysis.

5.1.10 Operable Unit 9 - Original Process Waste Lines

The Final Phase I RFI/RI Work Plan, Rocky Flats Plant, Original Process Waste Lines (DOE 1991s) describes the conceptual site model for the baseline health risk assessment. The conceptual site model presented in the Work Plan states that contaminant sources are the original process waste pipelines and tanks, from which there were leaks, spills, and overflows during their operating history. Specific chemicals of concern will be identified using available historical data and results of the Phase I field sampling program.

Potential exposure pathways include "inhalation of airborne particles or vapors and ingestion of or dermal contact with contaminated source or transport media. Potential human receptors include RFP workers and visitors to the site." The work plan states that "it is reasonable to conclude that contamination from OU9 will not affect offsite populations before characterization and any necessary remediation are performed under the IAG [Interagency Agreement]."

5.1.11 Operable Unit 10 - Other Outside Closures

The Draft Final Phase I RFI/RI Work Plan, Rocky Flats Plant, Other Outside Closures (DOE 1991a) describes the preliminary conceptual site model for the baseline health risk assessment. The preliminary conceptual site model presented in the Work Plan states that potential contaminants (including metals, acids, inorganics, or organics) may emanate from spills and leakage at 19 different IHSSs.

The specific chemicals of concern will be identified using available historical data and results of the Phase I field sampling program. Potential exposure pathways vary with the IHSS and type of contamination, but generally "dermal contact or ingestion of contaminated soil,...through inhalation of contaminated windblown dust or volatile emissions, ...ingestion or dermal contact with storm water runoff or contaminated sediments, [and]...ingestion or dermal contact with contaminated groundwater" (DOE 1991a).

5.1.12 Operable Unit 11 - West Spray Field

The Final Phase I RFI/RI Work Plan for OU11, Rocky Flats Plant (DOE 1992a) describes the conceptual site model for the baseline health risk assessment. In addition, the Work Plan presents brief descriptions of preliminary conceptual site models.

The preliminary conceptual site model presented in the Work Plan states that the source of contamination (including radionuclides, metals, nitrates, and trace organics) at the west spray fields is the historical spray-application of excess liquids from the Solar Evaporation Ponds. Specific chemicals of concern will be identified using available historical data and results of the Phase I field sampling program.

According to the Work Plan, "the primary potential pathways for contaminant migration are air, surface water, groundwater, and flora and fauna." The Work Plan states that "Human receptors may be exposed to windblown contaminated soil, external radiation, contaminated groundwater, or surface water. The three potential exposure routes to a receptor include: ingestion, inhalation, and dermal contact."

Appendix A-7 of the Exposure Information Report (Weston 1986) describes the potential for human exposure to contaminants from the solar ponds, present landfill, and west spray field. For the west spray field, the report briefly summarizes the potential for human exposure via surface water, groundwater, air, subsurface gas release, and soil. In addition, the potential for exposure from transportation-related and worker-management practices are briefly discussed. The report indicates that the potential for exposure to hazardous contaminants from the west spray field is low to very low.

5.1.13 Operable Unit 12 - 400/800 Area

The Phase I RFI/RI Work Plan (DOE 1992b) proposes to conduct a baseline risk assessment, as required by the IAG. The assessment will be performed as part of the RFI/RI and will address risks associated with OU12 sources and affected media. The assessment will aid in the preliminary screening of site remedies based on the contaminants of concern and associated environmental media.

The baseline risk assessment consists of both a Human Health Risk Assessment (HHRA) and an Environmental Evaluation; the former will be concerned with potential health risks. The quantitative HHRA will evaluate risk due to soil injection, inhalation and dermal contact. Exposure pathways involving surface water, groundwater, air, and/or biota as transport media will also be quantitatively evaluated, if necessary. A risk characterization of current, future, or potential site condition scenarios will be developed.

5.1.14 Operable Unit 13 - 100 Area

Pursuant to the Phase I RFI/RI Work Plan, a Human Risk Assessment will be prepared. This document will include the following: contaminant description, exposure assessment, toxicity

assessment, risk characterization, and uncertainty analysis. Media to be evaluated include soils, surface water, groundwater, and air. (DOE 1992c)

5.1.15 Operable Unit 14 - Radioactive Sites

Pursuant to the OU14 RFI/RI Work Plan a human health risk assessment will be conducted to evaluate the impacts on the human health and environment. The risk assessment will analyze different media including soils, surface water, groundwater, and air. The analysis will consist of five parts: (1) contaminant identification, (2) exposure assessment, (3) toxicity assessment, (4) risk characterization, and (5) uncertainty analysis. (DOE 1992d)

5.1.16 Operable Unit 15 - Inside Building Closures

Pursuant to the OU15 RFI/RI Work Plan (DOE 1993b) a human health risk assessment will be prepared which evaluates potential risk from radioactive contaminants associated with the individual IHSSs. The risk assessments evaluates; (1) presence of radioactive materials, (2) release and transport mechanisms, (3) potential human receptors, (4) potential exposure pathways, (5) extent of expected impact or threat, and (6) levels of uncertainty.

5.1.17 Operable Unit 16 - Low-Priority Sites

Potential human health and environmental risk has been mitigated for IHSSs 185, 192, 193, 194, and 195. No further action is needed. (DOE 1992e)

5.2 ECOLOGICAL RISK

5.2.1 Sitewide Conditions

The Incremental Risk Assessment Methodology for the Rocky Flats Plant (EG&G 1992c) provides a recommended methodology by which the results of the risk assessments for the separate OUs can be combined to evaluate cumulative risk. In addition, a large number of studies have been conducted at RFP relating to plutonium contamination, dispersal pathways, and ecological effects. Although the primary release was from the 903 Pad (OU2), these studies are applicable sitewide. They are summarized in the previous Final EIS (DOE 1980), Rockwell (1986), and subsequent documents.

Ecological risk assessments (a.k.a., Environmental Evaluations) for the individual OUs are to be completed as part of the RFI/RI process. Environmental Evaluations (EE) are outlined in

the OU work plans and are scheduled to be completed over the next few years. Each EE generally involves ten tasks including preliminary planning, data collection evaluation and preliminary risk assessment, ecological field investigation, contamination assessment, ecotoxicological field investigations, and preparation of an Environmental Evaluation Report. Proposed field sampling plans are also developed as part of the work plan.

5.2.2 Operable Unit 1 - 881 Hillside

Information relevant to ecological risks at OU1 are available in the documents summarized below. DOE (1988b), Vol. 1, concluded that, "there are no ecological impacts due to contamination at the 881 Hillside Area." However, an estimate of exposure point concentrations based on different remediation scenarios, as well as information on indicator chemicals and the selection process involved in their determination, are presented. Supplement B of this report provides toxicity profiles for animals exposed to the various indicator chemicals. More recent documents indicate that additional evaluations will be conducted concerning ecological risk.

The Phase III RFI/RI Environmental Evaluation Work Plan provides a framework for evaluating ecological risk. The evaluation will be conducted according to guidance in the "Risk Assessment Guidance for Superfund," Volume II, Environmental Evaluation Manual (EPA 1989) and the Final Environmental Impact Statement (DOE 1980). Surface water, soils, sediment and other biologically important parameters measured during activities of the RI will be used, as well, to assess current and future ecological impacts from OU1.

The analysis will be comprised of 10 tasks: (1) preliminary planning, (2) data collection/evaluation and conceptual model development, (3) ecological field investigation, (4) toxicity assessment, (5) exposure assessment and pathways model, (6) contamination characterization, (7) uncertainty analysis, (8) planning, (9) ecotoxicological field investigations, and (10) environmental evaluation report. (DOE 1991d)

Additional information relevant to ecological risk are presented in the following: DOE (1988c) identifies source characterization, surface and ground water pathways, and potential receptor information; DOE (1990a) outlines the effects of proposed action alternatives and source concentrations; and DOE (1991t) identifies species of concern and an analysis of potential impacts.

5.2.3 Operable Unit 2 - 903 Pad, Mound, and East Trenches

Information relevant to ecological risk for OU2 are available in the documents summarized below. DOE (1991h) and DOE (1991z) provide an outline of activities to be addressed during the baseline risk assessment. DOE (1991z) provides a detailed work plan for completion of the environmental evaluation.

DOE (1991f) and (1992i) provide information on site conceptual models, potential exposure pathways, potential contaminants of concern, and receptors. In DOE (1991z), affected and sensitive environments are disclosed and contaminant descriptions and sources are identified. A more in-depth discussion of remedial impacts states, "Terrestrial environments that may be impacted by the proposed IM/IRA include animal life, plant life, and land forms (including wetlands)," however, these "impacts are expected to be minimal." Environs affected by RFP operations and contaminant descriptions and sources are identified in DOE (1992i).

Terrestrial, aquatic, and threatened and endangered species are discussed in DOE (1992i). During the evaluation of possible technical remedies, potential ecological impacts are discussed according to the technology utilized. In addition to these documents, DOE (1991h) identifies the nature and extent of contamination and discusses an environmental evaluation work plan and tasks. Elements of the environmental evaluation are preliminary planning, data collection/evaluation and conceptual model development, ecological field investigations, toxicity assessment, exposure assessment and pathway model, preliminary contamination characterization, uncertainty analysis, planning, ecotoxicological field investigation, and environmental evaluation report.

Numerous documents exist that address quantitative ecological impacts relating to plutonium contamination at OU2. A number of the studies are summarized in Rockwell (1986). Ongoing studies are being conducted by the Radiological Health Sciences Department at Colorado State University. Although these studies were not conducted as ecological risk assessments, relevant quantitative information exists and is summarized below. Jarvis (1991) provides information on plutonium concentrations in crop and native plant species through uptake from the soils of OU2.

Reports provided by Whicker et al. (1990) and (1991), and Whicker and Ibrahim (1991), evaluate standards for plutonium and americium in soil at Rocky Flats; they also summarize the distribution and transport of radionuclides, discuss soil, plant, and animal sampling and plutonium concentrations in tissue samples. Antonio (1992) also discusses the distribution and concentration of plutonium in small mammals. Little et al. (1980) survey the effects of

plutonium in a grassland ecosystem at RFP. The reports prepared by Langer (1984, 1986, and 1991) evaluate the dynamics of resuspended soil particles and are relevant to a contaminant pathway discussion.

5.2.4 Operable Unit 3 - Off-Site Releases

Site characterizations, site conceptual models, human risk assessment, and an Environmental Evaluation (EE) plan are presented in DOE (1991f). Contaminant sources for OU3 are identified in the conceptual models discussed in that report. Sources are identified as the surface soils at IHSS 199 and the sediment and surface water of IHSS 200, 201 and 202. The human risk assessment of that report discusses contaminant fate and transport, exposure pathways, and exposure point concentrations. These discussions would also apply to ecological risk. A work plan for environmental evaluation tasks is provided. According to the work plan, the objectives of the EE will be to:

- Characterize the ecosystem and biological receptors in OU3.
- Determine the types, forms, and quantities of contaminants of concern within OU3.
- Define the extent of contamination.
- Identify the complete exposure pathways between contaminant sources and biological receptors.
- Quantify, where possible, the migration of the contaminants of concern through the ecosystem and the uptake of these contaminants by receptors.
- Access population, community, or ecosystem level endpoints to determine potential or actual ecological effects.
- Conduct toxicity tests and measure bioaccumulation of contaminants in biota to verify exposure and evaluate potential adverse effects (DOE 1991k).

The specific tasks are (1) Initial Planning and Conceptual Model Development, (2) Data Evaluation and Preliminary Risk Assessment, (3) Ecological Investigations, (4) Toxicity Assessment, (5) Exposure Assessment, (6) Risk Assessment, (7) Uncertainty Analysis, (8) Final Planning, (9) Ecotoxicological Investigations, and (10) Risk Characterization and Report. Both aquatic and terrestrial ecosystems will be evaluated.

A qualitative human health risk assessment is discussed for IHSSs 200-202 in DOE (1991w). This report states that current quality control standards have not been met to support a quantitative risk assessment with current data. Nevertheless, elements of this document apply to ecological risk. This document, in conjunction with DOE (1991k), provides qualitative information relevant to a future ecological risk study. Appendix C of the work plan provides an outline of what will be covered in the ecological risk assessment.

Quantitative information on contaminant concentration on IHSS 199 was found in DOE (1991l). Like the previously referenced documents, qualitative information is available, but it does not address additional issues of a quantitative nature, other than the discussion of contamination.

An environmental assessment of the Standley Lake Diversion Project is available in draft form in DOE (1992bb). Descriptions of the affected environment, environmental consequences, and mitigation measures are discussed with biological resources sections under each heading. This document discusses the potential impact on human health and the environment from the construction of a diversion project diverting water around Standley Lake.

A Colorado Department of Health Study (CDH 1990a) provides quantitative information on a number of fish species. "Composites of raw fillets for each species were analyzed for selected metals, radioactive substances and priority organic pollutants." Detected contaminants were not considered unique to RFP.

Quantitative information for plutonium concentrations in Great Western Reservoir and sediment analysis of Standley Lake are provided in Sackschewsky (1985) and Sackschewsky (1986), respectively. Additional documents that contain aspects of an ecological risk assessment include DOE (1991j) which discusses the effects of herbicide use in OU3 and, thus RFP as another source of contamination; EG&G (1991f), an assessment of wetlands on site which are considered potential receptors; and USACE (1989) which discusses the effects of expanding Great Western Reservoir's holding capacity, which may affect the stability of plutonium in the sediments of the reservoir.

5.2.5 Operable Unit 4 - Solar Evaporation Ponds

Relevant qualitative information is summarized below. DOE (1991p) provides information on the site conceptual model, which presents potential contaminant migration pathways from OU4 to other media or receptors. Figures 3-1 and 3-2 in that report provide additional insight into the site conceptual model, which indicates that the process fluid pipes are the major source of contaminants in the ponds.

A baseline risk assessment plan is presented in the Work Plan. This baseline risk assessment includes the following: toxicity and levels of hazardous substances present in relevant media, environmental fate and transport mechanisms, potential environmental receptors, potential exposure routes, risk characterization, and levels of uncertainty associated with the study.

Contaminants associated with OU4 are identified in DOE (1991o). Additional information on site characterization is provided in this report, as is a summary of site risks. Pathway exposure assessments, chemicals of concern, radionuclides, toxicity assessments, and risk characterizations are among the subjects covered. Some quantitative information is included as well in reference to contaminant concentrations.

A waste composition inventory is presented with laboratory results and tables in Section 1.3.2 and Appendices 3 and 4 of DOE (1988d). This information is useful in identifying potential contaminants of concern and their concentrations in the solar ponds. Appendix 6 of this document discusses the hydrogeology of the solar ponds and is pertinent to fate and transport modeling.

The OU4 Solar Evaporation Pond IM/IRA/EA (DOE 1994a) identifies 10 tasks that will be conducted as part of the Environmental Evaluation. These tasks are: (1) preliminary planning, (2) data collection/evaluation and preliminary risk assessment, (3) ecological field investigations, (4) toxicity assessment, (5) exposure assessment and pathways model, (6) contamination characterization, (7) uncertainty analysis, (8) planning, (9) ecotoxicological field investigations, and (10) environmental evaluation report.

5.2.6 Operable Unit 5 - Woman Creek Priority Drainage

Relevant information concerning ecological risk is summarized below. A preliminary site characterization which included nature of contamination is presented in DOE (1991q). Conceptual models of each IHSS are described; however, these generic models will be refined as appropriate to each IHSS in the forthcoming RFI/RI report. The potential exposure pathways discussed include air, surface water, groundwater, and direct contact. A detailed ten-step work plan for environmental evaluation of OU5 is provided and includes a preliminary risk assessment and field sampling plan.

5.2.7 Operable Unit 6 - Walnut Creek Priority Drainage

The environmental evaluation work plan describes ten tasks and provides a field sampling plan (DOE 1992o). The following summary reviews other relevant information that is available concerning ecological risk for OU6.

The site characterization for North and South Walnut Creeks, and all associated IHSSs, are discussed in DOE (1992o). Investigation tasks including field investigations, data evaluation, and a baseline risk assessment are discussed in the report. A more in-depth description of the

baseline health risk assessment plan is furnished. This plan includes potential receptors, exposure pathways, exposure point concentrations, and estimation of intakes.

Although this plan is for a human health risk assessment, components of it are relevant to ecological risk. The potential site conceptual model indicates IHSS locations and sources, and their contaminant contributions to the Walnut Creek Drainage. The potential exposure pathways include contact with both particulates and gaseous emissions into the air, surface water, and groundwater; and direct contact with contaminated soil, sediments, or water. Potential receptors include both onsite and offsite locations, primarily downgradient locations. Onsite locations are considered the most likely sources of direct contact potential with contaminants or contaminated media.

Historical data and the results of the Phase I field sampling program will be used to identify chemicals of concern. Additional information about surface and groundwater flow mechanics for the "south spray field" were discussed in Koffer (1989). This document will prove useful in delineation of contaminant sources and in modeling the fate and transport of contaminants.

5.2.8 Operable Unit 7 - Present Landfill and Inactive Hazardous Waste Storage Area

The following documents summarize the available information concerning ecological risk. DOE (1988e) discusses the protection of human health and the environment, and states that restricted access to the facility and routine monitoring prevents threats to the environment. A brief discussion of the routine monitoring program is depicted, as are the security measures employed to limit access to the existing landfill. Re-vegetation of the closed landfill is discussed. It also provides information on downgradient bedrock chemistry which may apply to a fate and transport model of OU7.

A discussion of the nature of contamination at OU7 is presented in DOE (1990c). Sources of contaminants include products from 338 waste streams, of the approximately 1,500 waste streams identified at RFP, that end at the existing landfill; 97 of these have hazardous waste or hazardous components. Additional discussion is provided on soils, groundwater, surface water, and air.

A site conceptual model describes known and suspected sources of contaminants, types of contamination, affected media, contaminant migration pathways, and environmental receptors. Specific chemicals of concern will be identified using available historical information and results from the Phase I field sampling program.

5.2.9 Operable Unit 8 - 700 Area

The Draft Phase I RFI/RI Work Plan for OU8 was completed in May 1992, and the Final Phase I RFI/RI Work Plan in December 1992. The Phase I RFI/RI Work Plan (DOE 1992p) proposes to conduct a baseline risk assessment, as required by the IAG. This assessment will be performed as part of the OU8 RFI/RI, will address risks from OU8 sources and affected media, and will aid in remediation efforts.

As part of this baseline risk assessment, an Environmental Evaluation (EE) will be conducted. The EE addresses potential ecological risks. For OU8, the EE has been developed in conjunction with the other OUs within the industrial area (OUs 8, 9, 10, 12, 13, and 14) and is to be included in the final document, *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993f).

5.2.10 Operable Unit 9 - Original Process Waste Lines

The Phase I RFI/RI Work Plan (DOE 1992q) proposes to conduct a baseline risk assessment, as required by the IAG. This assessment will be performed as part of the OU9 RFI/RI, will address risks from OU9 sources and affected media, and will aid in remediation efforts.

As part of this baseline risk assessment, an Environmental Evaluation (EE) will be conducted. The EE addresses potential ecological risks. For OU9, the EE has been developed in conjunction with the other OUs within the industrial area (OUs 8, 9, 10, 12, 13, and 14) and is to be included in the final document, *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993f).

5.2.11 Operable Unit 10 - Other Outside Closures

The Phase I RFI/RI Work Plan (DOE 1991a) proposes to conduct a baseline risk assessment, as required by the IAG. This assessment will be performed as part of the OU10 RFI/RI, will address risks from OU10 sources and affected media, and will aid in remediation efforts.

As part of this baseline risk assessment, an Environmental Evaluation (EE) will be conducted. The EE addresses potential ecological risks. For OU10, the EE has been developed in conjunction with the other OUs within the industrial area (OUs 8, 9, 10, 12, 13, and 14) and is to be included in the final document, *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993f).

5.2.12 Operable Unit 11 - West Spray Field

A preliminary risk assessment was included in Final Draft version of the OU11 Work Plan (DOE 1991c). The Final RFI/RI Work Plan (DOE 1992a) proposes to conduct a baseline risk assessment, as required by the IAG. As part of this baseline risk assessment, an Environmental Evaluation (EE) will be conducted. The EE addresses potential ecological risks. The baseline risk assessment for OU11 is currently scheduled for completion in February 1995.

A site conceptual model for the risk assessment is presented in the Work Plan. This model is a qualitative description of the nature and distribution of potential contaminants, as well as possible mechanisms and pathways for migration of these contaminants. Identification of potential contaminants of concern will be made on the basis of their occurrence in environmental media, ecotoxicity, and the extent of contamination.

The site conceptual model will be modified to account for all pathways and will include the following: a source and mechanism of release, an environmental transport medium, a point of potential biological contact, and a biological uptake mechanism at the point of exposure. Target taxa will be investigated and chosen during the development of the site conceptual model, and both flora and fauna species will be represented.

5.2.13 Operable Unit 12 - 400/800 Area

As noted in Section 5.1.13 in Human Risk, the Phase I RFI/RI Work Plan (DOE 1992b) proposes to conduct a baseline risk assessment, as required by the IAG. This assessment will be performed as part of the OU12 RFI/RI, will address risks from OU12 sources and affected media, and will aid in remediation efforts.

As part of this baseline risk assessment, an Environmental Evaluation (EE) will be conducted. The EE addresses potential ecological risks. For OU12, the EE has been developed in conjunction with the other OUs within the industrial area (8, 9, 10, 12, 13, and 14) and is to be included in the document final, *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993f).

5.2.14 Operable Unit 13 - 100 Area

The Phase I RFI/RI Work Plan (DOE 1992c) proposes to conduct a baseline risk assessment, as required by the IAG. This assessment will be performed as part of the OU13 RFI/RI, will address risks from OU13 sources and affected media, and will aid in remediation efforts.

As part of this baseline risk assessment, an Environmental Evaluation (EE) will be conducted. The EE addresses potential ecological risks. For OU13, the EE has been developed in conjunction with the other OUs within the industrial area (OUs 8, 9, 10, 12, 13, and 14) and is to be included in the document final, *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993f).

5.2.15 Operable Unit 14 - Radioactive Sites

The Phase I RFI/RI Work Plan (DOE 1992d) proposes to conduct a baseline risk assessment, as required by the IAG. This assessment will be performed as part of the OU14 RFI/RI, will address risks from OU14 sources and affected media, and will aid in remediation efforts.

As part of this baseline risk assessment, an Environmental Evaluation (EE) will be conducted. The EE addresses potential ecological risks. For OU14, the EE has been developed in conjunction with the other OUs within the industrial area (OUs 8, 9, 10, 12, 13, and 14) and is to be included in the document final, *Phase I RFI/RI: Industrial Area Environmental Evaluation* (DOE 1993f).

5.2.16 Operable Unit 15 - Inside Building Closures

All of the IHSSs are located within buildings. Inadequate habitat is found in OU15 to justify a comprehensive ecological risk assessment. Further, OU15 fully resides within the OU9 study area. Consequently, the information contained within OU9 will be sufficient to eliminate the need for an OU15 EE.

5.2.17 Operable Unit 16 - Low-Priority Sites

No site-specific information regarding ecological risk was located for inclusion in this report.

* * * * *

6.1 SITEWIDE CONDITIONS

6.1.1 Treatability Studies Plan

A treatability studies plan is part of the comprehensive, phased program of remedial investigations, feasibility studies, and corrective/remedial actions currently in progress to address contamination at the Rocky Flats Plant (RFP). It was developed in 1991 to meet the requirements of Article XI of the Federal Facility Agreement Statement of Work [Attachment 2 of the Final IAG, January 22, 1991].

The Plan identifies candidate technologies for evaluation in the Treatability Studies Program and covers a range of technologies that will be evaluated during the alternative analysis in the Corrective Measure Studies/Feasibility Studies. The methodology for selection screening of potential technologies is also outlined in the Plan.

In parallel with the Treatability Studies Program (TSP), Corrective Measure Studies/Feasibility Studies (CMS/FS) for each OU will be conducted. The information obtained from the TSP and the specific OU feasibility studies will provide data to support the final remedy selection and design process.

Various treatment technologies were initially identified in the Final Treatability Studies Plan (DOE 1991cc). The media addressed were water and soil/sediments. Five water treatment technologies were selected for bench or laboratory scale testing. Ion exchange, oxidation/ reduction, and adsorption were selected for treatability testing for treatment of both metals and radionuclides in surface water or groundwater. TRU/Clear™ and ultrafiltration/ microfiltration were selected for treatability testing for treatment of radionuclides alone in surface water or groundwater.

No semivolatile organic compounds were identified as exceeding potential Applicable or Relevant and Appropriate Requirements (ARARs) for surface water or groundwater in two or more OUs (Section 3.5); therefore, no technologies applicable to treatment of these compounds were selected.

No technologies applicable to treatment of volatile organic compounds or inorganics were selected for testing at the bench/laboratory scale, since they have been demonstrated at that scale. However, ozonation, peroxide oxidation, ultraviolet oxidation, and ultraviolet phytosis technologies (which are applicable to treatment of volatile organic compounds in water) were identified for pilot testing.

Eight soil/sediment treatment technologies were selected for bench or laboratory scale testing. Physical separation, soil washing, and the stabilization/fixation technologies (epoxy polymerization, polyester polymerization, and portland cement) were selected for bench/laboratory treatability testing for treatment of metals and radionuclides in soils or sediments. TRU Clean™, magnetic separation, and fixation/stabilization with masonry cement were selected for bench/laboratory treatability testing for treatment of radionuclides in soil or sediments.

In January 1994, DOE and the regulatory agencies reprioritized the treatability studies program in order to meet data needs identified for the CMS/FS reports for Operable Units 1-6. This reprioritization is reflected in **Table 6.1-1**, reproduced from the *Annual Report for Treatability Studies Program* (DOE 1994c).

6.1.2 Treatability Studies Program

An *Annual Report for Treatability Studies Program* is prepared each fiscal year in accordance with agreements between DOE and EPA (over and above the IAG). The annual reports provide a status of activities pertaining to the program. The most recent report addresses fiscal year 1993 (DOE 1994c). Contents of this report include the following:

- A summary of new environmental site characterization data from the Rocky Flats Environmental Database System (RFEDS).
- A complete review of preliminary chemical-specific Treatability Study Benchmarks, which are used in developing sitewide Applicable or Relevant and Appropriate Requirements.
- A literature search review to identify new and/or innovative treatment technologies.

TABLE 6.1-1
TREATABILITY STUDIES PROGRAM
SUBMITTAL DATES AND PROJECT SCHEDULE

Treatability Study	Workplan to RFO	Workplan to Agencies	Agency Approval of Workplans	Testing	Report to RFO	Report to Agencies	Comments
				Completed			
STATUS							
Soil Washing-NRT *	Jul-92	Jul-92	Yes	Aug-93	16-May-94	30-May-94	Revised schedule will be submitted after contract negotiation is completed.
TRUclean**	Nov-91	Feb-92	Feb-93	Sep-93	15-Apr-94	29-Apr-94	
EPA SITE Demo	N/A	N/A	N/A	Sep-93		3-Oct-94	Document to be issued by EPA SITE Program.
Plasma Melter	N/A	N/A	N/A	Jan-94	30-May-94	13-Jun-94	
Adsorption*	Jun-93	Yes	Yes	Jul-94	11-Oct-94	25-Oct-94	
Ion Exchange*	Jun-93	Yes	Yes	Aug-94	11-Oct-94	25-Oct-94	
TRUclear*	Feb-94	Open	Open	Aug-94	27-Oct-94	10-Nov-94	
Magnetic Separation*	Nov-91	Nov-91	Yes *	Jul-94	1-Jul-94	15-Jul-94	
Chemically Enhanced Steam Stripping	Mar-94	Open	Open	Oct-94	21-Nov-94	6-Dec-94	Phase 1 (FY 94) Report.
Bioremediation	Mar-94	Open	Open	Sep-94	17-Nov-94	1-Dec-94	Phase I and II.
Solvent Extraction	Jul-94**			Oct-94	24-Nov-94	8-Dec-94	Schedule being developed.
Physical Separation *	Nov-91	Feb-92	Feb-93				Samples from TRUclean* to be resubmitted for metals analysis.
Stabilization/Solidification *4 of the 13	Sep-94						Workplan to cover four studies.
Oxidation/Reduction*	Dec-91	Jan-92	Open	1995			Revised Workplan to DOE/RFO - Aug-94.
Ultra/Microfiltration*	N/A	N/A	N/A	1993	2-May-94	16-May-94	Report to be issued by the USGS to DOE.
Rad Discharge Control	Sep-91	Yes	Yes	Yearly	Yearly		Phase III completed in Sep-94; results presented in Annual TS Report.
Soil Washing - LANL	N/A	N/A	N/A	1993	21-Mar-94	4-Apr-94	
Solar Detoxification	May-94	Open	Open	Apr-95	17-Jul-95	31-Jul-95	

* Original 13 T.S.

** Tentative Date

OUTSTANDING ISSUES

a) Plasma Melter - Issuance of EG&G Rocky Flats report to DOE/RFO delayed until approximately May 1994 when EG&G Idaho completes proprietary evaluation of Lockheed technology report for Pit 9 remediation program expected in April 1994.

NOTE: This schedule is a draft schedule. DOE/RFO, EPA, and CDH are negotiating the schedule for these treatability studies.

Source: DOE 1994c

- A complete review of active and/or planned RFP treatability studies and Interim Measures/Interim Remedial Actions, including:

  - OU1 groundwater treatment under an IM/IRA.
  - OU2 surface water IM/IRA.
  - OU2 subsurface IM/IRAP.
  - OU3 portable wind tunnel studies.
  - Current status of OU4 treatability studies.
  - Water treatment using a colloid polishing filter as part of the Superfund Innovative Technologies Evaluation program.
  - Various plutonium-in-soils treatability studies.
  - Colloidal and solution-phase transport of plutonium and americium in groundwater.
  - A sitewide treatability study for commercially-available adsorbents for water treatment.
  - A treatability study to evaluate thermally-enhanced aqueous extraction of radionuclides.
  - A discussion of the Comprehensive Treatment Management Plan.
  - The sitewide treatability study/feasibility study integration at RFP.
  - A proposed oxidation/reduction (redox) processes treatability study plan.
  - A proposed photocatalytic detoxification process for aqueous waste using ultraviolet light.
  - Issues surrounding secondary residues from treatability studies.
  - A comprehensive review of the RFP technology screening process, as presented in the Treatability Studies Plan (DOE 1991cc), by an outside review committee.

- A review of future plans, priorities, and schedules for RFP treatability projects.
- A screening and selection of potentially-applicable treatment technologies for use at RFP in the future. Four treatment technologies newly identified during preparation of the Annual Report are:

  - Ultrasonic degradation of volatile organic compounds in aqueous media.
  - Membrane-based oil extraction for metal ion isolation in aqueous media.
  - X-ray treatment for volatile organic compounds in aqueous media.
  - Biosorption for capture/degradation of pesticides in aqueous media.

The 1993 Annual Report also presents a reevaluation of technologies initially evaluated in the Treatability Studies Plan, the 1991 Annual Report, and the 1992 Annual Report. The

reevaluation included a review of reasons stated for eliminating certain technologies from further consideration in the RFP Treatability Studies Program.

6.1.3 Environmental Restoration Program

The RFP Environmental Restoration Program implements and tracks the progress of the commitments outlined in the January 22, 1991 Interagency Agreement. The commitments include preparation of the documents (and their associated actions) noted in **Table 6.1-2**. The status of program commitments is summarized in the Program's monthly report (DOE 1994b). The following sections discuss the status of remedial efforts as noted in this monthly report.

The August-September issue of EG&G Rocky Flats' *Environmental Management* newsletter notes that a Stop-Work Order has been authorized by CDH and EPA on the following portions of the Baseline Risk Assessments being conducted for Operable Units 1, 2, 3, 4, 5, 6, and 7 [remaining OUs have not initiated risk assessments yet]:

- Aggregation of RFI/RI data for the purpose of comparing to background concentrations;
- Selection of the contaminants of concern for both the Human Health Risk Assessments and the Environmental Evaluations;
- Aggregation of data for the purpose of conducting an exposure assessment;
- Statistical comparisons of RFI/RI data to background data;

Once a mutual agreement has been reached between CDH, EPA, and DOE, work will continue according to prearranged extended schedules. Although work has been stopped on the aforementioned portions of the Baseline Risk Assessment, work continues on the Interim Measures/Interim Remedial Actions.

TABLE 6.1-2
ENVIRONMENTAL RESTORATION PROGRAM
IAG PRIMARY AND SECONDARY DOCUMENTS[1]

PRIMARY DOCUMENTS (Require CDH and EPA Concurrence):

- RCRA Facility Investigations/Remedial Investigations (RFI/RI) Work Plans[2].
- RCRA Facility Investigations/Remedial Investigations (RFI/RI) Reports[2].
- Corrective Measures Studies/Feasibility Studies (CMS/FS) Reports[2].
- Proposed Plan.
- Interim Measures/Interim Remedial Actions (IM/IRA) Decision Documents[2].
- Responsiveness Summaries.
- Corrective Action Decisions/Records of Decisions[2].
- Corrective/Remedial Design Plans[2].
- Corrective Design/Remedial Design Work Plans[2].
- Community Relations Plans.
- Sampling and Analysis Plan.
- Plan for Prevention of Contaminant Dispersion.
- Background Study Plan.
- Treatability Study Plan.
- Work Plan to Implement Discharge Limits for Radionuclides
- Interim Measures/Interim Remedial Actions (IM/IRA) Implementation Document[2].
- Certification of Completion.

SECONDARY DOCUMENTS (Provided to CDH and EPA for Their Information):

- Historical Release Report.
- Monthly Progress Reports.
- Health and Safety Plan.
- Baseline Risk Assessment Technical Memoranda (TM).
- Corrective Measures Studies/Feasibility Studies (CMS/FS) Technical Memoranda (TM)[2].
- RCRA Facility Investigations/Remedial Investigations (RFI/RI) Technical Memoranda (TM)[2].
- Priority Proposal for OUs 3, 5, 6, 8, 12, 13, 14, 15, and 16.

1 See IAG, 1991 (Table 4).

2 Integrated document: Resource Conservation and Recovery Act (RCRA) document/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) document.

6.2 OPERABLE UNIT 1 - 881 HILLSIDE

The OU1 - 881 Hillside Area was designated as a high-priority site for remediation because of the elevated concentrations of VOCs in groundwater, the relatively permeable soil, and the proximity of the site to a surface water drainage (Woman Creek). The nature and extent of the contamination is outlined in Section 2.3.3.

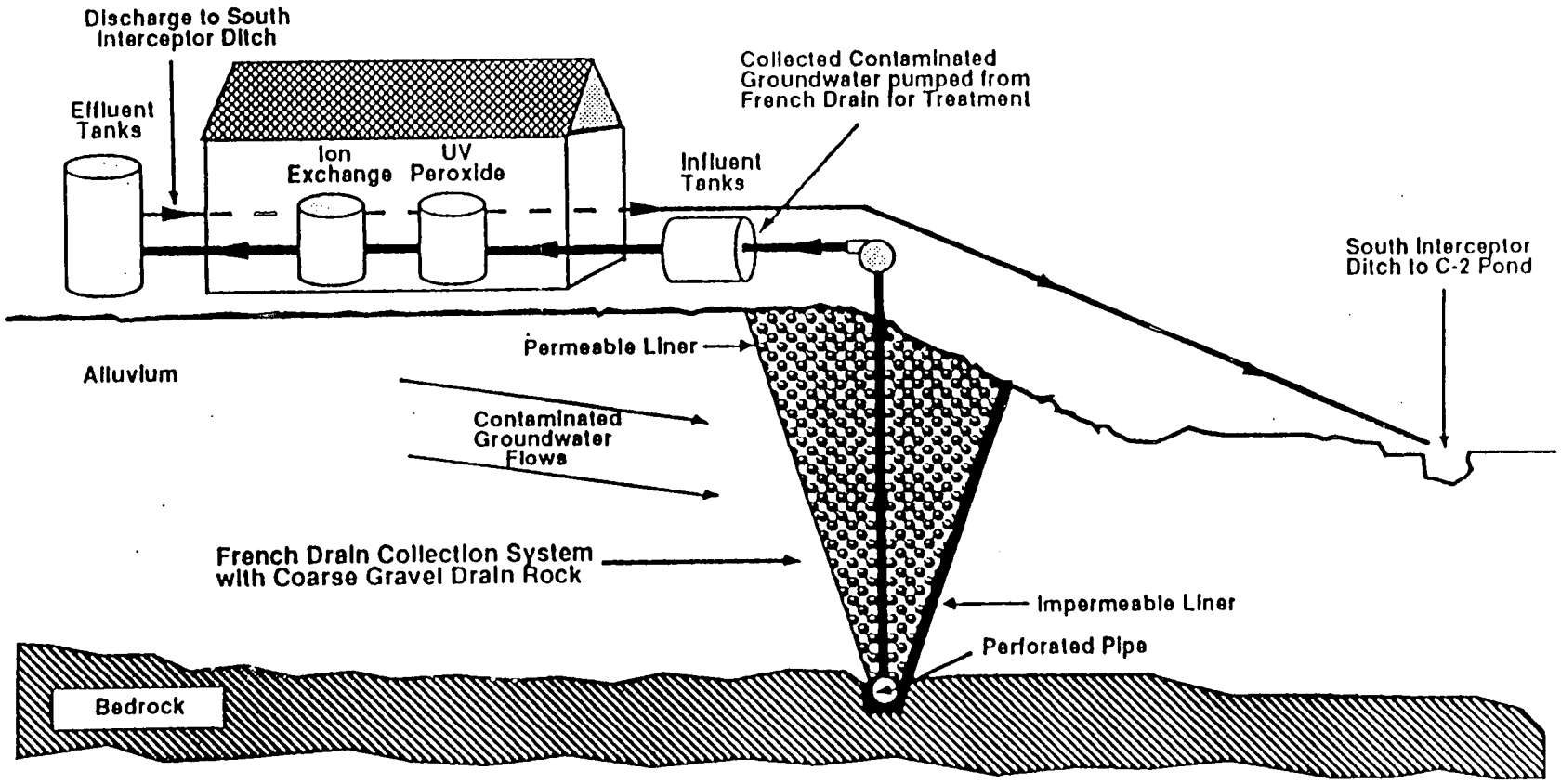
Following Phase I and Phase II Remedial Investigations (RI) (DOE 1988b), the Phase I Feasibility Study (FS) (DOE 1988c) was initiated to analyze remedial actions to prevent the release and migration of alluvial groundwater contaminants downgradient, and to clean up the alluvial groundwater contamination to acceptable levels. The Phase I FS report recommended three possible remedial technologies and the "no action" alternative.

Based on the Feasibility Study, DOE proposed an Interim Remedial Action. The selected Interim Remedial Action (IRA) at OU 1 involved construction of an underground drainage system called a French drain (**Figure 6.2-1**). This drain intercepts and contains near-surface groundwater flowing from the OU1 area. The near-surface water is treated at the 891 treatment facility, which was designed specifically for this purpose in conjunction with the French drain. The water is then released on plantsite into the South Interceptor ditch (SID), located along Woman Creek, which flows into Pond C-2. Water in Pond C-2 undergoes secondary analysis prior to release. IRA construction was completed in April 1992 and is currently in operation.

Documentation for OU1 will include the following: Phase III RFI/RI Work Plan, Phase III RFI/RI Report, CMS/FS Report, Proposed Plan (PP), Responsiveness Summary, CAD/ROD, and Title II Design. The Final Phase III RFI/RI Work Plan has been approved and the regulatory agencies are expected to complete their review of the Final Phase III RFI/RI Report in early 1994. However, work on OU1 Baseline Risk Assessment is currently being affected by the Stop-Work Order.

Much of the CMS/FS is contingent upon the final results of the Phase III RFI/RI Report (e.g., *TM #10: Preliminary Remediation Goals* and *TM #11: Alternatives Array*). DOE met with the regulatory agencies in late 1993 to discuss the scope of activities in the CMS/FS and to explore ways to accelerate the program.

In late 1993, DOE met with its contractor and the EPA to present plans for evaluating the suitability of the dense non-aqueous phase liquids (DNAPL) site at IHSS 119.1 for the Six-Phase Ohmic Soil Heating/Soil Vapor Extraction Demonstration Project. However, it was determined from the results of a soil-gas survey that there were not sufficient DNAPLs in this area for the site to be suitable for such a project.



OU 1 881 HILLSIDE
INTERIM REMEDIAL ACTION (IRA)

ERTSD FIGURE 6.2-1

ERTSD SOURCE: 1991b

6.3 OPERABLE UNIT 2 - 903 PAD, MOUND, AND EAST TRENCHES

A program of remedial investigation, feasibility studies, and remedial actions is underway at OU2. The sites encompass three areas (903 Pad, Mound, and East Trenches areas) located on the eastern side of the site's security area. A total of 20 contamination sites are included in the three investigative areas, as described in Section 2.4.

Routine groundwater investigations at RFP to date indicate the presence of VOCs in the shallow and bedrock groundwater systems in the vicinity of these sites. A portion of the surface water contamination results from seeps, which are areas where groundwater emerges at the surface. If not collected, water from the seeps eventually flows to either Walnut Creek or Woman Creek and then to a series of detention ponds. Water in the ponds is treated and sampled prior to and during release to ensure compliance with the current Rocky Flats National Pollutant Discharge Elimination System (NPDES) permit and other applicable standards.

An IM/IRA initiated collection, treatment, and discharge of surface water in source areas of contamination (**Figure 6.3-1**). Operation of this field-scale treatability unit (FTU) for the South Walnut Creek drainage began in May 1991. The effectiveness of the treatment process is evaluated at three locations: 1) the entrance to the treatment facility, 2) several points within the facility, and 3) at the discharge point. After completion of the field-scale treatability tests, the unit is anticipated to remain in service until the final remediation is operational. The Draft Surface Water IM/IRA Treatability Study Report was sent to the regulatory agencies in late 1993. A Final will be generated in early 1994.

A second IM/IRA was established in late 1991. This Subsurface Investigation Interim Measure/Interim Remedial Action Plan/Environmental Assessment (IM/IRA/EA) concerns an area north of Woman Creek and encompasses most of OU2. The IM/IRA evaluates remedial technology actions for removal of residual free-phase VOC-contamination from three distinct subsurface environments at OU2. (The three sites proposed are IHSS 112, IHSS 113, and IHSS 111.1 [DOE 1992u]). Each of the VOC-removal actions involve in situ vacuum-enhanced vapor extraction technology. The information generated from this IM/IRA will also aid in the selection and design of the final remedial actions concerning this issue. The Field Report for the OU2 Detailed Soil Vapor Survey Data is undergoing internal review; the Draft will be submitted in early 1994.

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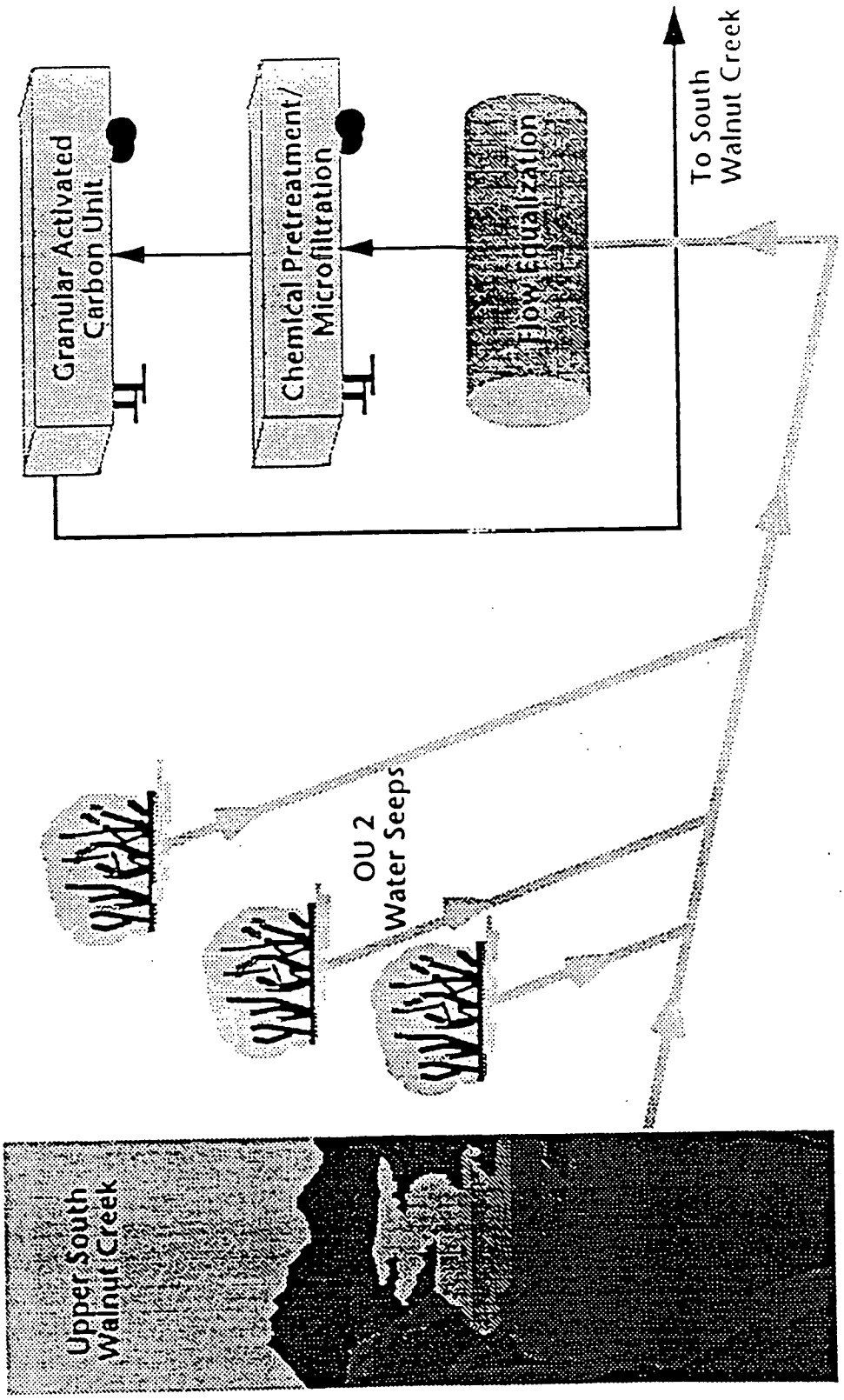

ERTSD SOURCE: DOE 1991b

ERTSD FIGURE 6.3-1

OU2 903 PAD, MOUND, AND EAST TRENCHES INTERIM REMEDIAL ACTION (IRA)

The remedial investigation currently underway at OU2 will characterize the nature and extent of contamination in both the alluvial and bedrock subsurfaces. Final Phase II RFI/RI Work Plans for both the alluvial and bedrock have been approved. The Preliminary Draft of the Phase II RFI/RI Report was delivered to the regulatory agencies in late 1993. Comments are expected in early 1994. The Draft Final Contaminants of Concern Technical Memoranda was delivered to DOE and the regulatory agencies in late 1993; however, work on OU2 Baseline Risk Assessment is currently being affected by the Stop-Work Order.

A revised schedule for a Treatability Study/Feasibility Study was presented to DOE in late 1993. In addition, an Evaluation of the Data Sufficiency Report in undergoing internal review and work is continuing on a Comprehensive List of Technologies.

6.4 OPERABLE UNIT 3 - OFF-SITE RELEASES

OU3 activities involve two main issues, The first involves the assessment of plutonium contamination in offsite areas including the land surface, Great Western Reservoir, Standley Reservoir, and Mower Reservoir, as described in Section 2.5.

The Final Past Remedy Report, the Final Historical Information/Preliminary Health Risk Assessment Report, and the Final Phase I RFI/RI Work Plan have been submitted and approved. The Draft Phase I RFI/RI Report is currently being prepared, with an anticipated submittal in early 1994. However, work on OU3 Baseline Risk Assessment is currently being affected by the Stop-Work Order. A planning strategy is being developed for the Feasibility Study Planning Agreement.

The second issue involves a 1985 out-of-court lawsuit settlement (McKay vs. United States 1985), which directed that 350 acres of surface soil be remediated. The Settlement Agreement required (a) deep plowing of contaminated land containing plutonium at concentrations exceeding a CDH plutonium in soil standard (0.9 pCi/g) in order to place the plutonium contamination deep beneath the surface; and (b) revegetation to control wind and water erosion of the soil.

To date, 120 acres of land have been tilled and partially revegetated. The plutonium levels have been reduced to below the CDH standard. The disturbance resulting from remediation is being revegetated with mediocre success; primarily due to insufficient amounts of precipitation, extremely rocky surfaces and clayey soils, competition from weeds, expanding prairie dog populations, and the effects of the slope on soil moisture. The overall schedule for this activity is determined by the year-to-year success of the revegetation effort and the requirements of the

landowners. The plowing was subsequently stopped after it was determined that it was in direct violation of CERCLA/SARA guidance.

Remediation and revegetation activities are currently required on approximately 200 of the 350 acres covered under the Settlement Agreement (DOE 1993h). Remedial activities will not be required on the remaining 150 acres until requested by the landowner. One hundred acres are in active remediation and revegetation. In 1991, about 80 acres of the soil disturbed by the 1985 remediation tilling were revegetated with native seed mix and mulched to protect the soil surface. The site is monitored for weed control and revegetation success.

Semi-annual reports (January, July) to the landowner document Settlement Agreement activities. Semi-annual reports are also transmitted to Jefferson County, Colorado. Future actions regarding this portion of OU3 will be based on these reports and results of negotiations with the landowner (DOE 1993h).

6.5 OPERABLE UNIT 4 - SOLAR EVAPORATION PONDS

The Solar Evaporation Ponds consist of a series of five evaporation ponds located in the central portion of the site, as detailed in Section 2.6. The Solar Evaporation Ponds Subproject (SPP) was scoped to 1) remove water from the ponds; 2) provide a treatment facility to replace the ponds as treatment and storage units for ponds-related contaminated groundwater; 3) remove and dispose of pond sludge in compliance with all regulations such as the "land disposal restrictions" of RCRA; 4) assess the nature and extent of contamination at the ponds; 5) complete a RCRA closure of the impoundments; and 6) remediate the ponds area as needed.

Pond sludge processing is being addressed according to the Agreement in Principle between DOE and CDH. A water management/treatment is being addressed according to that IM/IRA Decision Document signed by CDH, EPA, and DOE. The OU4 assessment and remedial action is being conducted according to the 1991 IAG, which identified the solar ponds as one of sixteen OUs to be remediated (thereby superseding the 1988 Ponds-Closure Plan previously submitted to the regulatory agencies). In addition, pad operations and storage activities are necessary to meet RFP's RCRA interim status and permit requirements with regard to storage of pond wastes.

The pond-sludge cleanout and water management are necessary precursors to the OU4 assessment and remediation; pad operations are necessary activities at least until the disposal of pond-sludge waste is completed. Revisions to scope in these areas are being implemented in accordance with the recent dispute resolution for OU4.

Recently, the approach for cleaning out and stabilizing the liquids and sludges present in the ponds was reevaluated. Consequently, the Phase I RFI/RI Work Plan is being revised to incorporate the results of the OU4 dispute resolution. The revised SPP program has the following major features (DOE 1993i):

- Consolidate the contents of the five ponds into two ponds;
- Transfer the pond contents to tanks for interim storage (this will be accomplished via vacuum truck to sets of aboveground high-density polyethylene tanks enclosed in HVAC-controlled Tents 3 and 4 at the 750 Pad);
- Pursue a treatability study (on the existing, stored pondcrete and saltcrete) to be prepared to accelerate the schedule for processing (current plan is cementation) and offsite disposal if a site becomes available sooner than anticipated;
- Close the ponds and remediate OU4; and
- Continue the current actions underway to treat contaminated groundwater and store wastes safely.

At the time of this writing, Phase I RFI/RI activities were ongoing (e.g., report preparation, core logging, and data analysis, which will also be used for IM/IRA report development). However, work on OU4 Baseline Risk Assessment is currently being affected by the Stop-Work Order. In 1994, work will begin on the Phase II RFI/RI Work Plan.

DOE, in agreement with the regulatory agencies, has selected an alternative for the Phase I IM/IRA Program (pond closure). The alternative includes an engineering barrier for closing the ponds; the removal of a limited amount of contaminated soil from the North Hillside and placement of this soil media into a selected pond impoundment; and remediating any potential "hotspots."

6.6 OPERABLE UNIT 5 - WOMAN CREEK PRIORITY DRAINAGE

The OU5 Phase I RFI/RI Investigation is underway (DOE 1992n). The Phase I RFI/RI Work Plan has been approved. The Draft Phase I RFI/RI Report is currently being prepared (geology, hydrology, nature and extent of contamination sections). At present, approximately 80 percent of the analytical data is in the Rocky Flats Environmental Database Systems (RFEDS), with approximately 50 percent validated.

Fourteen Technical Memoranda (TM) have been, are being, or are scheduled to be prepared for OU5. A number of these TMs are being reviewed by CDH and EPA at the time of this writing. However, work on OU5 Baseline Risk Assessment is currently being affected by the Stop-Work Order.

6.7 OPERABLE UNIT 6 - WALNUT CREEK PRIORITY DRAINAGE

The Phase I RFI/RI Work Plan has been approved. The Draft Phase I RFI/RI Report is currently being prepared (geology, hydrology, nature and extent of contamination sections). At present, approximately 99 percent of the analytical data is in the Rocky Flats Environmental Database Systems (RFEDS), with approximately 85 percent validated.

Field operations have been completed; stream sediment, pond sediment, surface soil, subsurface soil, surface water, and groundwater media have all been sampled. Eleven new groundwater monitoring wells have been installed to supplement five existing wells, and will be sampled each quarter for one year. Geophysical surveys and radiation surveys were performed in selected areas to supplement the sampling activities.

The regulatory agencies have proposed a new IM/IRA on the operation of these retention ponds. If approved, this decision document would alter management of the ponds within OU6, placing the water under CERCLA rather than the National Pollution Discharge Elimination System (NPDES) permit currently in effect.

Five Technical Memoranda (TM) have been, are being, or are scheduled to be prepared for OU6. A number of these TMs are being reviewed by CDH and EPA at the time of this writing. However, work on OU6 Baseline Risk Assessment is currently being affected by the Stop-Work Order.

6.8 OPERABLE UNIT 7 - PRESENT LANDFILL AND INACTIVE HAZARDOUS WASTE STORAGE AREA

IHSS 114 is presently operating as a nonhazardous sanitary landfill; however, the facility is considered an inactive hazardous waste disposal unit undergoing RCRA closure. Action and documentation, therefore, reflect this. The Final Phase I RFI/RI Work Plan was submitted in 1991. Ongoing negotiations between DOE and the regulating agencies have resulted in a streamlined schedule for OU7. Phase I and Phase II RFI/RI Reports will be combined within the scope of the OU7 Interim Measure/Interim Remedial Action Decision Document (EG&G 1994e).

OU7 personnel are refining a strategy to assess risk at the landfill. A draft framework document was completed to form a baseline strategy and will be transmitted to the regulatory agencies. CDH and EPA agreed to the concept of breaking up OU7 into three components: the Present Landfill; East Landfill Pond, and surrounding surface soils, subsurface soils, and

groundwater. Risk at the Present Landfill will be addressed at a summary level for "direct ingestion/residential only" as the bounding scenario. The East Landfill Pond and surrounding soils will be risk based. Groundwater will be addressed through Applicable Relevant and Appropriate Requirements (ARARs) comparison, providing these ARARs demonstrate protectiveness.

An approved data aggregation methodology has not been finalized. Draft DOE proposals for data aggregation indicate that potential cost and schedule impacts exist because of multiple risk assessments. Four Technical Memoranda (TM) have been, are being, or are scheduled to be prepared for OU 7. A number of these TMs are being reviewed by CDH and EPA at the time of this writing. However, work on OU7 Baseline Risk Assessment is currently being affected by the Stop-Work Order.

6.9 OPERABLE UNIT 8 - 700 AREA

Operable Unit 8 is located within the Industrial Area (IA) and is being managed collectively with the other OUs located within the IA (i.e., OUs 8, 9, 10, 12, 13, and 14). These OUs are being investigated together because of proximity to each other and similar field investigation needs (e.g., surface soil sampling, radiation survey). This management method improves oversight, coordination, and reduces costs.

The OU8 Phase I RFI/RI Work Plan is awaiting approval from the regulatory agencies. The Draft Phase I RFI/RI Industrial Area Environmental Evaluation is undergoing internal review at present. It addresses the ecological risk portion of the Baseline Risk Assessment and is inclusive of all IA OUs. DOE received the bird survey addendum and the Phase II Data Summary for review and comment in early Fiscal Year 94. A draft of Technical Memoranda #1: Footing/Under Drains Data Compilation is expected to be submitted in Fiscal Year 94.

6.10 OPERABLE UNIT 9 - ORIGINAL PROCESS WASTE LINES

As with OU8, OU9 is located within the Industrial Area (IA) and is being managed collectively with the other OUs located within the IA (i.e., OUs 8, 9, 10, 12, 13, and 14). Therefore, the Draft Phase I RFI/RI Industrial Area Environmental Evaluation, currently undergoing internal review, also addresses OU9.

The Phase I RFI/RI Work Plan for OU9 has been approved and the Phase I RFI/RI Report is being prepared for a 1994 submittal. A Phase II RFI/RI Work Plan and a Phase I Proposed IM/IRA Decision Document are expected in 1995.

The preliminary draft of Final OU9 Technical Memoranda #1: Field Sampling Plan Part 1 - Outside Tanks was submitted to DOE for review in 1993 and will be submitted to the regulatory agencies following DOE input.

6.11 OPERABLE UNIT 10 - OTHER OUTSIDE CLOSURES

Operable Unit 10 is located within the Industrial Area (IA) and is being managed collectively with the other OUs located within the IA (i.e., OUs 8, 9, 10, 12, 13, and 14). Therefore, the Draft Phase I RFI/RI Industrial Area Environmental Evaluation, currently undergoing internal review, also addresses OU10.

The Phase I RFI/RI Work Plan for OU10 has been approved; the Phase I RFI/RI Report is expected to be completed in 2015 (EG&G 1994a). A Phase II RFI/RI Work Plan and a Phase I Proposed IM/IRA Decision Document are expected in 1997.

6.12 OPERABLE UNIT 11 - WEST SPRAY FIELD

The Final Phase I RFI/RI Work Plan was approved, but is being amended by Technical Memoranda #1: Revised Field Sampling Plan (FSP) and Data Quality Objectives (DQO), which is undergoing internal DOE review. Results from the supplemental statistical tests for comparison of Contaminants of Concern to background data were completed in late 1993, are undergoing internal review, and will be incorporated in the final TM #1. A Categorical Exclusion has been submitted to address the field sampling work associated with site characterization. Approval is expected in early 1994. In addition, preliminary administration on the Phase I RFI/RI Report has been initiated.

6.13 OPERABLE UNIT 12 - 400/800 AREA

Operable Unit 12 is located within the Industrial Area (IA) and is being managed collectively with the other OUs located within the IA (i.e., OUs 8, 9, 10, 12, 13, and 14). Therefore, the Draft Phase I RFI/RI Industrial Area Environmental Evaluation, currently undergoing internal review, also addresses OU12.

6.14 OPERABLE UNIT 13 - 100 AREA

As with OU8, OU13 is located within the Industrial Area (IA) and is being managed collectively with the other OUs located within the IA (i.e., OUs 8, 9, 10, 12, 13, and 14). Therefore, the Draft Phase I RFI/RI Industrial Area Environmental Evaluation, currently undergoing internal review, also addresses OU13.

The Phase I RFI/RI Work Plan for OU13 has been approved and the Phase I RFI/RI Report is being prepared for a 1999 submittal (EG&G 1994j). Work began on preliminary tasks associated with the OU13 Readiness Review. Preparation of the Technical Memoranda will not begin until Fiscal Year 1995, due to the proposed integration of the Industrial Area OUs.

Limited sampling has been completed and other field work is anticipated in Fiscal Year 1994. A nonintrusive TM will be prepared in late Fiscal Year 1994 and early Fiscal Year 1995 summarizing the limited field work and recommending Stage II sampling activities for the remedial investigation.

6.15 OPERABLE UNIT 14 - RADIOACTIVE SITES

As with OU8, OU14 is located within the Industrial Area (IA) and is being managed collectively with the other OUs located within the IA (i.e., OUs 8, 9, 10, 12, 13, and 14). Therefore, the Draft Phase I RFI/RI Industrial Area Environmental Evaluation, currently undergoing internal review, also addresses OU14.

The Phase I RFI/RI Work Plan for OU14 has been approved. Work continues on tasks necessary to facilitate the OU14 Readiness Review. Maps of the High Purity Germanium (HPGe) survey coverage outside of the OU14 areas have been generated. A strategic plan is being developed to locate low-level (not RCRA regulated) waste storage for Decontamination and Decommissioning (D&D) activities. An addendum to the Field Sampling Plan (per the Phase I RFI/RI Work Plan) is being prepared and submitted to the regulatory agencies as a

TM. The TM will outline the results of the HPGe and NaI radiation surveys and the visual inspection in order to locate the precise surficial sampling locations.

6.16 OPERABLE UNIT 15 - INSIDE BUILDING CLOSURES

The Phase I RFI/RI Work Plan for OU15 has been approved and the Phase I RFI/RI Report is being prepared for a 1995 submittal. Stages I and II of the field work inside of the buildings has been completed. Approximately 95 percent of the results of the chemical analyses are available for evaluation. It is anticipated, based on Stage I and II results that four of the OU15 IHSSs may not require further work. A No Further Action would be justified with the Phase I RFI/RI.

An agreement with the regulatory agencies will allow Technical Memoranda #1 to address both Contaminants of Concern and Exposure Pathways; this in order to assist in determining the need to conduct Stage III investigations outside of OU15 buildings. Stage III work may be conducted as part of a Phase II RFI/RI for OU15, or those IHSSs requiring further work may be transferred to another appropriate OU.

6.17 OPERABLE UNIT 16 - LOW PRIORITY SITES

The Revised Final No Further Action Justification Document for the five IHSSs was approved by the regulatory agencies and the Record of Decision process was initiated to close OU16 as an operable unit. Assessment activity determined that remediation was not needed because the potential effects of the IHSSs had been mitigated by past response actions.

A public comment period for the *Proposed Plan/Draft Modification (PP/DM) of Colorado Hazardous Waste Permit for RFP OU 16: Low Priority Sites* will end in early 1994. A Responsiveness Summary on the PP/DM and a Record of Decision will be prepared upon receipt of public comments from CDH (DOE 1994b).

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Abbreviation	Citation
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Arthur 1977.	Arthur, W.J, III. Plutonium Intake by Mule Deer at Rocky Flats, Colorado. MS Thesis. Colorado State University, Fort Collins, Colorado. ERDA Contract E(11-1)-1156. January 1, 1977.
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Bly and Whicker 1979.	Bly, J.A. and F.W. Whicker. *Plutonium Concentrations in Arthropods at a Nuclear Facility.* Health Physics. 37:331-336. June 12, 1978.
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CBO 1994.	Colorado Bird Observatory. *Preliminary Report on the Behavioral Ecology and Habitat Use of the Standley Lake Bald Eagle Pair, October 16 through December 31, 1993.* December 31, 1993.
CDH 1990a.	Colorado Department of Health (CDH). *Standley Lake Fish Toxics Monitoring Report.* Denver, Colorado. January 1, 1990.
CDH 1990b.	Colorado Department of Health (CDH). *Rocky Flats Surface Soil Survey 1970-1989.* Colorado Department of Health, Radiation Control Division. February 1, 1990.
CDH 1990c.	Colorado Department of Health (CDH). *1989 Surface Soil Data; Radionuclide Concentrations at 13 Sectors around the Rocky Flats Plant.* [Tabulated Data sent to the City of Westminster by CDH, Denver, CO. Special Report 1989 Surface Soil Survey Results.] April 1, 1990.
CDH 1991.	Colorado Department of Health (CDH). *Task 2 Report - Selection of the Chemicals and Radionuclides of Concern.* June 1, 1991.

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CDH 1993.	Colorado Department of Health (CDH), Hazardous Waste Control Program. Correspondence from G.W. Gaughman, Unit Leader, to R.J. Schassburger, U.S. Department of Energy, Rocky Flats Office. *RE: Modification to Work in the IAG.* May 27, 1993.
Chinn 1981.	Chinn, Stephen. *The Relation of the Rocky Flats Plant and Other Factors to 1969-1971 Cancer Incidence in the Denver Area.* September 29, 1981.
Cobb 1982.	Cobb, J.C., et al. *Plutonium Burdens in People Living Around the Rocky Flats Plant.* 600/S4-82-069. University of Colorado. November 1, 1982.
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DOE 1980.	U.S. Department of Energy (DOE). *Final Environmental Impact Statement, Rocky Flats Plant, Golden, Colorado. (Final Statement to ERDA 1545-D).* 3 volumes. DOE/EIS-0064, UC-2, 11. April 1, 1980.
DOE 1986a.	U.S. Department of Energy (DOE). *Comprehensive Environmental Assessment and Response Program (CEARP), Phase I Installation Assessment.* Rocky Flats Plant, Albuquerque Operations Office. April 1, 1986.
DOE 1986b.	U.S. Department of Energy (DOE). *Resource Conservation and Recovery Act (RCRA), Part B Operating Permit Application for Rocky Flats Plant Hazardous and Radioactive Mixed Wastes.* CO7890010526. January 1, 1986.

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DOE 1987a.	U.S. Department of Energy (DOE). *Environmental Survey Preliminary Report. Rocky Flats Plant, Golden, Colorado.* June 1, 1987.
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DOE 1988a.	U.S. Department of Energy (DOE). *881 Hillside Draft Environmental Assessment. Rocky Flats Plant, Golden, Colorado.* Draft, incomplete, FBI File #81200. June 20, 1988.
DOE 1988b.	U.S. Department of Energy (DOE). *Feasibility Study Report for High Priority Sites (881 Hillside Area).* Rocky Flats Plant, Golden, Colorado. March 1, 1988.
DOE 1988c.	U.S. Department of Energy (DOE). *Remedial Investigation Report for High Priority Sites (881 Hillside Area).* Rocky Flats Plant, Golden, Colorado. March 1, 1988.
DOE 1988d.	U.S. Department of Energy (DOE). *Closure Plan, Solar Evaporation Ponds. Rocky Flats Plant, Golden, Colorado.* July 1, 1988.
DOE 1988e.	U.S. Department of Energy (DOE). *Present Landfill Closure Plan. Rockwell International Corporation, North American Space Operations, Rocky Flats Plant, Golden, Colorado.* July 1, 1988.
DOE 1988f.	U.S. Department of Energy (DOE). *RCRA Post-Closure Care Permit Application for U.S. DOE-Rocky Flats Plant Hazardous & Radioactive Mixed Wastes.* October 5, 1988.
DOE 1989.	U.S. Department of Energy (DOE). *Proposed Interim Measures/Interim Remedial Action Plan and Decision Document, 903 Pad, Mound, and East Trenches Areas, Medium Priority Sites.* Rocky Flats Plant, Golden, Colorado. October 1, 1989.
DOE 1990a.	U.S. Department of Energy (DOE). *Environmental Assessment for 881 Hillside (High Priority Sites) Interim Remedial Action.* Rocky Flats Plant, Golden, Colorado. DOE/EA - 0413. November 1, 1990.

Abbreviation	Citation
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DOE 1990c.	U.S. Department of Energy (DOE). *Draft Final Phase I RFI/RI Work Plan, Present Landfill (SWMU 114) and Inactive Hazardous Waste Storage Area (SWMU 203), Operable Unit No. 3 (now OU7).* Rocky Flats Plant, Golden, Colorado. June 4, 1990.
DOE 1990d.	U.S. Department of Energy (DOE). *Population, Economic and Land Use Data Base for Rocky Flats Plant.* August 1, 1990.
DOE 1991a.	U.S. Department of Energy (DOE). *Draft Final Phase I RFI/RI Work Plan, Rocky Flats Plant Other Outside Closures (Operable Unit No. 10).* Rocky Flats Plant, Golden, Colorado. November 1, 1991.
DOE 1991b.	U.S. Department of Energy (DOE). *Final Draft Phase I RFI/RI Work Plan for the West Spray Field (Operable Unit No. 11).* Rocky Flats Plant, Golden, Colorado. April 1, 1991.
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DOE 1991e.	U.S. Department of Energy (DOE). Final Phase III RCRA Facility Investigation/Remedial Investigation, Work Plan, Revision 1, Rocky Flats Plant, 881 Hillside Area (Operable Unit No. 1). March 1, 1991.
DOE 1991f.	U.S. Department of Energy (DOE). *Final Surface Water Interim Measures/Interim Remedial Action Plan/Environmental Assessment and Decision Document Walnut Creek Basin (Operable Unit No. 2).* Rocky Flats Plant, Golden Colorado. March 8, 1991.
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DOE 1991i.	U.S. Department of Energy (DOE). *Phase II RFI/RI/FS Work Plan (Alluvial), 903 Pad, Mound, and East Trenches Areas (Operable Unit 2).* Rocky Flats Plant, Golden, Colorado. August 1, 1991.
DOE 1991j.	U.S. Department of Energy (DOE). *Draft Environmental Assessment Herbicide Weed Control in Operable Unit No. 3.* Rocky Flats Plant, Golden, Colorado. August 1, 1991.
DOE 1991k.	U.S. Department of Energy (DOE). *Final RFI/RI Work Plan for Operable Unit 3.* Rocky Flats Plant, Golden, Colorado. December 6, 1991.
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DOE 1991m.	U.S. Department of Energy (DOE). *Environmental Assessment, Dewatering and RCRA Partial Closure Action on Solar Evaporation Ponds.* Rocky Flats Plant, Golden, Colorado, DOE/EA-0487. June 1, 1991.
DOE 1991n.	U.S. Department of Energy (DOE). *Finding of No Significant Impact, Dewatering and RCRA Partial Closure: Solar Evaporation Ponds.* Rocky Flats Plant, Golden, Jefferson County, Colorado. June 1, 1991.
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DOE 1991r.	U.S. Department of Energy (DOE). *Final Phase I RFI/RI Work Plan, Rocky Flats Plant Walnut Creek Priority Drainage (Operable Unit No. 6).* Rocky Flats Plant, Golden, Colorado. September 1, 1991.

Abbreviation	Citation
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DOE 1991t.	U.S. Department of Energy (DOE). *Endangered Species Act Compliance. Proposed South Interceptor Ditch (SID) Maintenance Project. Final Biological Survey Report.* Rocky Flats Plant, Golden, Colorado. October 1, 1991.
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DOE 1992e.	U.S. Department of Energy (DOE). *Final No Further Action Justification Document, Rocky Flats Plant, Low Priority Sites (Operable Unit 16).* October 1, 1992.
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DOE 1992j.	U.S. Department of Energy (DOE). *Draft Proposed Subsurface Interim Measures/Interim Remedial Action Plan/Environmental Assessment and Decision Document (Operable Unit No. 2).* Rocky Flats Plant, Golden, Colorado. March 2, 1992.
DOE 1992k.	U.S. Department of Energy (DOE). *Draft Treatability Studies Report - 903 Pad, Mound, and East Trenches Areas (Operable Unit No. 2).* Rocky Flats Plant, Golden, Colorado. December 6, 1992.

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DOE 1992m.	U.S. Department of Energy (DOE). Correspondence from EG&G to DOE (JEE-0291-92) dated April 20, 1992.
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DOE 1992v.	U.S. Department of Energy (DOE). *Phase II Geologic Characterization Data Acquisition: Surface Geologic Mapping of the Rocky Flats Plant and Vicinity, Jefferson and Boulder Counties, Colorado.* Final Report. March 1, 1992.
DOE 1992w.	U.S. Department of Energy (DOE). *Final Groundwater Assessment Plan.* Rocky Flats Plant, Golden, Colorado. February 1, 1992.

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DOE 1992y.	U.S. Department of Energy (DOE). *Report of Findings: Ute Ladies'-Tresses, Rocky Flats Buffer Zone, Jefferson Co., Colorado.* September 30, 1992.
DOE 1992z.	U.S. Department of Energy (DOE). *Nonnuclear Consolidation Environmental Assessment: Nuclear Weapons Complex Reconfiguration Program.* DOE/EA-0792. Volume I [text] and II [appendices]. Preapproval Review Copy. December 1, 1992.
DOE 1992aa.	U.S. Department of Energy (DOE). *Plan for Prevention of Contaminant Dispersion.* Final. February 1, 1992.
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DOE 1992cc.	U.S. Department of Energy (DOE). *Final Work Plan for the Control of Radionuclide Levels in Water Discharges from the Rocky Flats Plant.* September 1, 1991.
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DOE 1993d.	U.S. Department of Energy (DOE). *Technical Memorandum No. 5, Human Health Risk Assessment, 903 Pad, Mound and East Trenches Areas, OU2.* Draft Final. December 1, 1993.
DOE 1993e.	U.S. Department of Energy (DOE). *Background Geochemical Characterization Report: Rocky Flats Plant, Golden, Colorado.* September 30, 1993.

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DOE 1993g.	U.S. Department of Energy (DOE). *Predecisional Draft, Executive Summary for the Rocky Flats Plant, FY93 Systems Engineering Analysis Facility/Land Use Component.* June 11, 1993.
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This section contains a discussion of the computer database. The database is on Macintosh FileMaker Software and includes all documents (Levels 1, 2, or 3) reviewed during the Environmental Restoration Technical Support Document (ERTSD) research effort. The following subsection contains (a) a description of the database, (b) how it was constructed, (c) its potential utility, (d) a brief description of the ERTSD bibliography, and (e) a complete table that provides abbreviated bibliographic listings, sorted by Operable Unit (OU), of all documents in the database.

8.1 COMPUTER DATABASE

8.1.1 Description

The ERTSD database is a listing of 876 published articles and proprietary reports regarding activities at the Rocky Flats Plant. The original database had 631 documents; 251 more were added while revising the document. Its intended purpose is to provide a summary of information currently available at the Rocky Flats Plant for each OU and for the entire plant. The database allows for key word searches and for sorts by title, author, and publication date. The database represents a compilation of previous studies at RFP and includes published and unpublished reports, data summaries, analyses, memoranda, letters, and databases.

Subjects addressed within the database include soils, terrestrial wildlife, human risk, cultural resources, geology/topography, site history/nature of contamination, energy, vegetation, surface water, air, ecological risk, transportation, visual resources, land use/recreation, aquatic wildlife, groundwater, remediation, and noise. The full range of the documents in the database were not used to compile the ERTSD for the following reasons:

1. Many documents may provide equivalent information and there is no need to cite more than a few (possibly one) documents.
2. Several documents are iterations of the same document. For example, a specific operable unit work plan may have one or more draft versions and a final version. Generally the latest version is cited under these circumstances.
3. A document may consolidate information from several sources and there is no need to cite all of the sources.

Although, several documents may meet one of the criteria above, none were omitted from the database if the documents were reviewed and found to contain appropriate information.

The database is currently stored on Ecology and NEPA Division's (END's) "E.N.D. File Server", AppleTalk Zone 130 J (contact the Manager of END for directions regarding the password). It is available (through read access only) to MacIntosh users with access to RFP's Appleshare Network. Users requiring a copy of the database on a diskette should contact the Manager of END.

8.1.2 History

The original database was developed in early 1992. That database was expanded, during revision of the ERTSD in early 1994, when 251 more documents were added. No documents were omitted from the original list. Because of the way the document titles may have been originally input into the database, it is possible that the database may contain documents that are listed under more than one title.

8.1.3 Features

The ERTSD database was constructed using FileMaker Pro on the Macintosh for consistency with other applications currently in use at RFP. FileMaker Pro makes ample use of the mouse and allows the user of the database to select from many menu-driven options that include file backup, editing, sorting, word search, and report generation.

The ERTSD database provides the functionality to sort for documents by author, document title, and publication date. Additionally, subsets of data can be extracted to provide customized reports. All documents that relate to a specific OU can be grouped together, or all documents that have the same keyword (e.g., soils) can be extracted from the database for review.

The flexibility of the FileMaker Pro application allows for any view of the data to serve simultaneously as a report screen and a data entry screen. Subsequently, data can readily be edited or reported on in several different formats. The most frequently used report (Data Entry Fax) was designed to provide a concise list, by title, of all documents searched to date.

Each subject of interest has a report format of the same name (e.g., soils, terrestrial wildlife), to provide a subset of the database for evaluation by the discipline leader. Occasionally, a chronological listing by publication date would be required for a particular subject. The same subject report form would be used in this instance, but only after performing a sort by date.

To a limited degree, "scripts" have been implemented as a step-saving mechanism which allow one or two keystrokes to take the place of several keystrokes. Scripts shorten the normally tedious process of retyping the same sequence of keys again and serve to automate working with hundreds of records. Scripts are available for doing quick sorts and printouts by author, title, or batch number, and can be easily customized to perform other labor-intensive tasks related to the data.

8.1.4 QA/QC

The process of quality assurance/quality control (QA/QC) as a function of the FileMaker Pro application was principally performed by means of a four-digit control number for the original document or a three-digit control number preceded by "94-" for Revision 1. A control number was assigned to each document reviewed so that one, and only one, unique control number exists for each document in the database. During the process of editing and checking, the control number was used to clarify whether, in fact, a duplication of documents being searched actually existed.

To ensure the integrity of the database, a daily backup of the database was performed and a second copy of the backup was made. During the peak data entry periods, backups were created at midday and at the end of each day.

8.2 ERTSD BIBLIOGRAPHY

Table 8.1-1 presents all 876 entries in the bibliographic listing in the FileMaker computer database for the ERTSD report. These entries are sorted in the following order:

1. Entries for which all OUs are listed.
2. Entries for which no OU is listed.
3. Entries for which relevant OUs 1 through 16 are listed.
4. Entries for which multiples OUs and/or sitewide are listed.

As noted in Section 8.1, the database can also sort documents in almost any fashion, for example, by:

- Author
- Title
- Key words
- Dates
- Research batch and approximate date

The 876 entries are intended to represent the best and most comprehensive NEPA support documents from among approximately 70,000 written records available for the Rocky Flats Plant. However, the list is only a snapshot of available documents. Any user should supplement their use of the database with an active search for other available documents.

* * * * *

TABLE 8.1-1

ERTSD BIBLIOGRAPHY

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REVISION 1
March 31, 1994

ERTSD BIBLIOGRAPHY

OUS	PUBLICATION DATE	TITLE	CONTROL NO.	PHYSICAL LOCATION	AVAILABLE AT	LOCATION
ALL	01/01/01	SOIL DECONTAMINATION AT ROCKY FLATS	0806	RFP	T130B	LARRY WOODS' OFFICE
ALL	01/01/55	SURFICIAL GEOLOGY OF THE LOUISVILLE QUADRANGLE, COLORADO	1579	USGS LIBRARY	USGS	(200) E
ALL	01/01/61	BEDROCK GEOLOGY OF THE LOUISVILLE QUADRANGLE, COLORADO. U.S.G.S. MAP GQ-151	1382	U.S.G.S.	LIBRARY	M(200) ALL GQ 151
ALL	1/1/67	GEOLOGY OF THE ELDORADO SPRINGS QUADRANGLE BOULDER AND JEFFERSON COUNTIES, COLORADO	0709	RFP	T130B	SHELF 5
ALL	06/01/74	SEISMIC AND GEOLOGIC INVESTIGATIONS AND DESIGN CRITERIA FOR ROCKY FLATS PLUTONIUM RECOVERY AND WASTE TREATMENT FACILITY	1330	RFP	EMF / T130C	FOLDER 524 / ICN 00006995
ALL	07/31/74	A BOTANICAL INVENTORY OF THE ROCKY FLATS A.E.C SITE FINAL REPORT	0534	WOODWARD CLYDE	DENVER	LAUREL PYE'S OFFICE BOOKSHELF
ALL	09/01/75	Pu-239 IN SNAKES INHABITING THE ROCKY FLATS PLANT SITE. MASTERS THESIS, COLORADO STATE UNIVERSITY	1329	RFP	EMF / T130C	FOLDER 563 / ICN 00007303
ALL	1/1/76	GEOLOGY OF THE GOLDEN QUADRANGLE, COLORADO, USGS PROFESSIONAL PAPER 872	0710	RFP	T130B	SHELF 5
ALL	01/01/76	PLUTONIUM IN THE AQUATIC ENVIRONMENT AROUND THE ROCKY FLATS FACILITY	0622	RFP	T130B	KATHERINE TAYLOR'S LIBRARY
ALL	01/01/76	THE DISTRIBUTION OF PLUTONIUM AND AMERICIUM WITH DEPTH IN SOIL AT ROCKY FLATS	0442	RFP	T130B	KATHERINE TAYLOR'S OFFICE
ALL	03/01/76	HYDROLOGY OF A NUCLEAR PROCESSING PLANT SITE, ROCKY FLATS, JEFFERSON COUNTY, COLORADO	1248	RFP	T130C	EMF LIBRARY / FOLDER 641 / ICN
ALL	01/01/77	THE SIGNIFICANCE OF FROST ACTION AND SURFACE SOIL CHARACTERISTICS TO WIND EROSION AT ROCKY FLATS, THIRD PROGRESS REPORT	1328	RFP	EMF / T130C	FOLDER 582 / ICN 0007427
ALL	07/29/77	THE VEGETATION OF ROCKY FLATS COLORADO	0532	WOODWARD CLYDE	DENVER	LAUREL PYE'S OFFICE BOOKSHELF

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ALL	11/1/77	PLUTONIUM DISTRIBUTION IN ROCKY FLATS SOIL	94-73	RRP	T130J	END CABINET #17
ALL	01/01/78	MONITORING OF RADIOACTIVE EFFLUENTS FROM NUCLEAR FACILITIES. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON THE MONITORING OF RADIOACTIVE AIRBORNE AND LIQUID RELEASES FROM NUCLEAR FACILITIES 5-9	0512	RFP	T130B	KEITH MOTYL'S OFFICE
ALL	01/09/78	SIZE CHARACTERISTICS OF PLUTONIUM PARTICLES IN ROCKY FLATS SOIL	1323	RFP	T130C	EMF LIBRARY / FOLDER 575 / ICN
ALL	01/01/79	ELEMENT CONCENTRATIONS TOXIC TO PLANTS, ANIMALS, & MAN	0508	RFP	T 130 B	KATHERINE TAYLOR'S BOOKSHELF
ALL	7/1/79	THE ROCKY FLATS LAND MANAGEMENT PLAN	1270	RFP	T130B	KEVIN LEWIS' OFFICE
ALL	01/01/80	MAP OF MIXED PRAIRIE GRASSLAND VEGETATION, ROCKY FLATS, COLORADO	0533	WOODWARD CLYDE	DENVER	LAUREL PYE'S OFFICE BOOKSHELF
ALL	01/03/80	CONTAMINATION OF MUNICIPAL WATER SUPPLIES IN THE DENVER METROPOLITAN AREA BY THE ROCKY FLATS PLUTONIUM PLANT.	1401	WCC	10TH FLOOR	GREG WALDMAN'S OFFICE
ALL	8-1-80	POCKET GOPHERS AND REDISTRIBUTION OF PLUTONIUM IN SOIL	0821	WCC	10TH FLOOR	LAUREL PYES'S OFFICE
ALL	12-1-80	SOIL DECONTAMINATION CRITERIA REPORT, NOVEMBER 1980	0801	RFP	T130B	LARRY WOOD'S OFFICE
ALL	01/01/81	THE TRANSPORT OF PLUTONIUM IN TERRESTRIAL ECOSYSTEMS. HEALTH PHYSICS, V.40, pp. 63-69	1322	RFP	T130B	IGGY LITAOR'S OFFICE #36
ALL	01/01/81	GEOLOGIC STRUCTURE, HYDROLOGY, AND WATER QUALITY OF THE LARAMIE - FOX HILLS AQUIFER IN THE DENVER BASIN, COLORADO. U.S.G.S. ATLAS HA-650, 1:500,000 (3 MAPS)	1381	U.S.G.S.	LIBRARY	(200) HY
ALL	04/01/81	ANNUAL ENVIRONMENTAL MONITORING REPORT, JANUARY-DECEMBER 1980	0411	RFP	T130B	BOOKCASE 52
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ALL	11/01/81	COMPARATIVE AIR FLOW PATTERNS AT ROCKY FLATS AND DENVER AIRPORT, JULY 1, 1980 - JUNE 30, 1981	1327	RFP	EMF / T130C	FOLDER 584 / ICN 0007442
ALL	11/01/81	WASTE OPERATIONS	1227	RFP	T130C	EMF FILE # 246 DOCUMENT #
ALL	01/01/82	THE FEASIBILITY OF EPIDEMIOLOGIC STUDIES OF CANCER IN RESIDENTS NEAR THE ROCKY FLATS PLANT, HEALTH PHYSICS V.42,NO.1,PP.65-68	1320	RFP	T130B	IGGY LITAOR'S OFFICE, #36
ALL	01/01/82	IMPORTANCE OF PLUTONIUM CONTAMINATION ON VEGETATION SURFACES AT ROCKY FLATS, COLORADO	0621	RFP	T130B	KATHERINE TAYLOR'S LIBRARY
ALL	1/7/82	PLUTONIUM AND AMERICIUM CONTRIBUTIONS TO TOTAL RADIOACTIVITY OF AIR NEAR ROCKY FLATS	1570	RFP	EMF / T130C	AR - RP- 00007
ALL	04/01/82	ANNUAL ENVIRONMENTAL MONITORING REPORT, JANUARY-DECEMBER 1981	0410	RFP	T130B	BOOKCASE 52
ALL	04/20/82	ANNUAL AIRBORNE EFFLUENT SUMMARY 1981 ES-376-82-235	0546	RFP	T 334 D	CHEM RISK 91CR046 ITEM 23 FILE
ALL	8-2-82	COMPARATIVE SCRUB SOLUTION TESTS FOR DECONTAMINATION OF TRANSURANIC RADIONUCLIDES FROM SOILS	0803	RFP	T130B	LARRY WOOD'S OFFICE
ALL	8-13-82	SEPARATION OF TRANSURANIC RADIONUCLIDES FROM SOIL BY VIBRATORY GRINDING	0800	RFP	T130B	LARRY WOOD'S OFFICE
ALL	09/01/82	AN AERIAL RADIOLOGICAL SURVEY OF THE UNITED STATES DEPARTMENT OF ENERGY'S ROCKY FLATS PLANT	1326	RFP	EMF / T130C	FOLDER 595 / ICN 0007568
ALL	09/20/82	BERYLLIUM LEVELS IN SURFICIAL SOILS NEAR THE ROCKY FLATS PLANT	0052	RFP	T334D	CHEM RISK 91CR015, ITEM 33,
ALL	01/01/83	SOIL SURVEY OF GOLDEN AREA, COLORADO. PARTS OF DENVER, DOUGLAS, JEFFERSON, AND PARK COUNTIES	1379	WCC	LIBRARY	DOC A57.38:C6/G56/980

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ALL	01/01/83	RADIONUCLIDE TRANSPORT PROCESSES IN TERRESTRIAL ECOSYSTEMS	1461	WOODWARD-CLYDE	DENVER	GREG WALDMAN'S OFFICE
ALL	02/01/83	LONG-RANGE ROCKY FLATS UTILIZATION STUDY, ALO-1983	0506	RFP	T 130 B	LIBRARY - KATHERINE TAYLOR
ALL	02/08/83	ANNUAL AIRBORNE PARTICULATE EFFLUENTS SUMMARY 1982 ES-417-83-244	0547	RFP	T 334 D	CHEM RISK 91CR046 ITEM 22 FILE
ALL	04/01/83	ANNUAL ENVIRONMENTAL MONITORING REPORT, U.S. DEPT. OF ENERGY ROCKY FLATS PLANT, JANUARY THROUGH DECEMBER 1982	0409	RFP	T130B	BOOKCASE 52
ALL	04/22/83	RADIOECOLOGICAL VEGETATION ANALYSIS, IN ENVIRONMENTAL SCIENCES BRANCH SEMIANNUAL PROGRESS REPORT FOR 1981 JULY THROUGH DECEMBER.	1386	WCC	10TH FLOOR	GREG WALDMAN'S OFFICE
ALL	06/01/83	CASE-CONTROL STUDY OF BRAIN TUMORS AMONG WHITE MALES EMPLOYED AT THE ROCKY FLATS PLANT. LA - 9804 - MS	0633	FRCC	RFP READING ROOM	E 83 - 003
ALL	11/01/83	HAZARDOUS WASTE IMPLEMENTATION PROGRAM	1128	RFP	T130C	EMF FILE FOLDER #994, #0010849
ALL	12/01/83	FINAL REPORT ON THE DEPT. OF ENERGY'S LONG-RANGE ROCKY FLATS UTILIZATION STUDY FOR FEDERAL EMERGENCY MANAGEMENT AGENCY CONTRACT NO. EMW-G-0002 WORK UNIT 6441D	0500	RFP	T 130 B	KATHERINE TAYLOR'S LIBRARY
ALL	01/01/84	TRANSURANIUM ELEMENTS AROUND THE ROCKY FLATS PLANT	1139	RFP	T130B	LARRY WOODS' OFFICE
ALL	01/01/84	AFS - AIRHEAD FILTER SYSTEM	2505	RFP	BLDG 123	
ALL	01/01/1984	LIS - LABORATORY INFORMATION SYSTEM	2504	RFP	BLDG 123	
ALL	04/01/84	ANNUAL ENVIRONMENTAL MONITORING REPORT, U.S. DEPT. OF ENERGY, ROCKY FLATS PLANT, JANUARY THROUGH DECEMBER 1983	0408	RFP	T130B	BOOKCASE 52

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ALL	05/01/84	ROCKY FLATS PLANT DAM SAFETY INSPECTION REPORTS	0554	RFP	T 130 B	KATHY TAYLOR'S LIBRARY
ALL	05/03/84	ENVIRONMENTAL DEVELOPMENTS AND ACCOMPLISHMENTS	1220	RFP	T334D	FBI FILE
ALL	06/25/84	BERYLLIUM LEVELS IN SURFICIAL SOILS NEAR ROCKY FLATS PLANT, IN HS&E ENVIRONMENTAL SCIENCES SEMI-ANNUAL PROGRESS REPORT FOR 1982 JANUARY THROUGH JULY	1388	WCC	10TH FLOOR	GREG WALDMAN'S OFFICE
ALL	11/26/84	AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM PERMIT NO. CO-0001333	0901	FRCC	RFP READING ROOM	E89 - 016
ALL	12/01/84	NONRADIOACTIVE GROUNDWATER DATA SUMMARY	1218	RFP	T 334 C	LEGAL / FBI FILE
ALL	01/01/85	ROCKY FLATS RISK ASSESSMENT GUIDE	1112	RFP	EMF	FILE #963, DOCUMENT #0010591
ALL	01/01/85	VOLATILE ORGANIC COMPOUNDS IN ROCKY FLATS PLANT GROUNDWATER	1154	RFP	T130C	EMF LIBRARY / FOLDER 1013 / ICN
ALL	1/1/85	DEPARTMENT OF ENERGY ROCKY FLATS PLANT 1984 SEMI-ANNUAL NON RADIOLOGICAL AIR MONITORING REPORT	1512	RFP	T130C	EMF FILE RP 0003
ALL	02/01/85	AIRFLOW PATTERNS NEAR THE ROCKY FLATS PLANT	1318	RFP	T130 B	IGGY LITAOR'S OFFICE #36
ALL	03/01/85	ANNUAL ENVIRONMENTAL MONITORING REPORT, JANUARY-DECEMBER 1984	0407	RFP	T130B	BOOKCASE 52
ALL	06/03/85	VOLATILE ORGANIC COMPOUNDS IN ROCKY FLATS WATER OVERVIEW	1153	RFP	T130C	EMF LIBRARY / FOLDER 1017 / ICN
ALL	07/01/85	VOLATILE ORGANIC COMPOUNDS IN ROCKY FLATS PLANT GROUNDWATER	0423	RFP	T334D	CHEM RISK FILE FOLDER A224
ALL	07/01/85	RADIOLOGICAL EMERGENCY RESPONSE PLAN, ROCKY FLATS PLANT	1106	FRCC	RFP READING ROOM	E85 - 012

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ALL	09/01/85	GROUNDWATER CONTAMINATION SOURCES	0061	RFP	T 334 D	CHEM RISK FILE FOLDER A-143
ALL	12/01/85	HYDROGEOLOGICAL CHARACTERIZATION OF THE ROCKY FLATS PLANT. PROJECT #1520	0077	RFP	T334D	ITEM #16 CHEM RISK FILES FILE
ALL	01/01/1986	RFEDS - ROCKY FLATS ENVIRONMENTAL DATA SYSTEM	2501	RFP	T130B	
ALL	01/01/1986	HPDB - HEALTH PHYSICS DATABASE	2503	RFP	BLDG 881	
ALL	02/12/86	GROUNDWATER INVESTIGATIONS	1262	RFP	T334C	FBI FILE / DOCUMENT #1201431
ALL	03/01/86	SHALLOW SOIL GAS INVESTIGATION OF ROCKY FLATS PLANT, GOLDEN, CO.	1170	RFP	T 334 C	FBI FILE
ALL	3/1/86	AIRBORNE EFFLUENT SUMMARY ROCKY FLATS PLANT CALENDAR YEAR 1985	1511	RFP	T130C	EMF FILE AR-RP-0002
ALL	04/01/86	ANNUAL ENVIRONMENTAL MONITORING REPORT, JANUARY-DECEMBER 1985	0406	RFP	T130B	BOOKCASE 52
ALL	04/01/86	COMPREHENSIVE ENVIRONMENTAL ASSESSMENT AND RESPONSE PROGRAM. PHASE I INSTALLATION ASSESSMENT, ROCKY FLATS PLANT (CEARP PHASE I)	1119	FRCC	RFP READING ROOM	E86 001
ALL	06/01/86	ROCKWELL INTERNATIONAL LONG- RANGE WASTE MANAGEMENT PLAN FOR RFP VOL 1 AND II	0540	RFP	T 130 B	BOOKSHELF #2 NORTH HALL
ALL	06/29/86	ROCKY FLATS LIBRARY LISTING - UPDATE JUNE 29, 1986	1311	RFP	EMF / T130 C	FOLDER 1056 / ICN 0011316
ALL	07/21/86	GEOLOGICAL AND HYDROLOGICAL DATA SUMMARY	1245	RFP	T130C	EMF LIBRARY/FOLDER
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ALL	7/28/86	RESOURCE CONSERVATION AND RECOVERY ACT PART B - OPERATING PERMIT APPLICATION FOR U.S. D.O.E. - ROCKY FLATS PLANT. HAZARDOUS & RADIOACTIVE MIXED WASTES C07890010526	0067	RFP	T130C	KIRK TIEKNOR
ALL	08/01/86	RFP INTERNAL ENVIRONMENTAL AUDIT CHECKLIST	1215	RFP	T130C	EMF FILE #910 DOCUMENT 0010080
ALL	12/19/86	ROCKY FLATS PLANT RADIOECOLOGY AND AIRBORNE PATHWAY SUMMARY REPORT	0549	WOODWARD-CLYDE	DENVER	LAUREL PYE'S OFFICE BOOKSHELF
ALL	01/01/1987	ENVIRONMENTAL RADIOACTIVITY FROM NATURAL, INDUSTRIAL, AND MILITARY SOURCES. THIRD EDITION.	1578	WOODWARD CLYDE	DENVER	LIBRARY / TD 196.R3 .E57
ALL	01/01/87	LETTER TO THE EDITOR RE: " CANCER INCIDENCE PATTERNS IN THE DENVER METROPOLITAN AREA IN RELATION TO THE ROCKY FLATS PLANT"	1403	WCC	10TH FLOOR	GREG WALDMAN'S OFFICE
ALL	03/01/87	ROCKY FLATS PLANT FLUIDIZED BED INCINERATOR RADIOACTIVE EMISSIONS AND HEALTH RISKS	1225	RFP	T334C	FBI FILE
ALL	04/01/87	ANNUAL ENVIRONMENTAL MONITORING REPORT, JANUARY-DECEMBER 1986	0405	RFP	T130B	BOOKCASE 52
ALL	04/07/87	REPORT OF THE REVIEW OF THE RCRA WASTE CONTROL PROGRAM AT THE ROCKY FLATS PLANT	1261	RFP	T334C	FBI FILE / DOCUMENT #1300054
ALL	05/01/87	RESUSPENSION PARAMETERS FOR TRAC DISPERSION MODEL, IN SMITH, L.C., ED, HS&E APPLICATION TECHNOLOGY SEMIANNUAL PROGRESS REPORT JULY THROUGH DECEMBER 1985.	1390	WCC	10TH FLOOR	GREG WALDMAN'S OFFICE
ALL	05/27/87	THE REMOVAL OF PLUTONIUM CONTAMINANTS FROM ROCKY FLATS PLANT SOILS	0610	FRCC	RFP READING ROOM	E87-007
ALL	08/01/87	IMPLEMENTATION PLAN FOR ENVIRONMENTAL SURVEY FINDINGS	1256	RFP	T130C	EMF FILE FOLDER #867 DOCUMENT
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ALL	12/01/87	GROUNDWATER MODELING OF IMPACTS OF PROPOSED SPRAY IRRIGATION	1419	RFP	T130C	EMF LIBRARY / WT-RP-00026
ALL	01/01/88	COLORADO LATILONG STUDY	1528	WCC	DENVER	ERTSD LIBRARY
ALL	02/01/88	ROCKY FLATS SAMPLING AND ANALYSIS DATA DOCUMENT DRAFT VOL. 1 - 3	1168	RFP	T 130 C	EMF FILE 920
ALL	02/01/88	TRAVEL TIME IN GROUNDWATER AT ROCKY FLATS PLANT	0060	RFP	T334D	CHEM RISK FILE FOLDER A-143
ALL	04/01/88	ANNUAL ENVIRONMENTAL MONITORING REPORT, JANUARY-DECEMBER 1987	0404	RFP	T130B	BOOKCASE 52
ALL	07/01/88	SUMMARY OF MAJOR PROBLEMS AT THE ROCKY FLATS PLANT	1226	RFP	T334C	FBI FILE
ALL	07/25/88	COLORADO DEPARTMENT OF HEALTH HAZARDOUS MATERIALS AND WASTE MANAGEMENTS DIVISION - HAZARDOUS WASTE INSPECTION REPORT	1276	RFP	T334C	FBI FILE #1301822
ALL	07/29/88	COMMUNITY RIGHT - TO - KNOW TOXIC CHEMICAL RELEASE REPORTING FOR 1988 - DOCUMENTATION REQUEST	1314	RFP	EMF / T130C	FOLDER 1072 / ICN 0011555
ALL	09/01/88	IMPLEMENTATION PLAN FOR ENVIRONMENTAL SURVEY FINDINGS REVISION 2.0	1121	RFP	T130C	EMF FILE 972 ICN #10704
ALL	9-1-88	RESULTS OF A TRACER STUDY FOR THE VALIDATION OF THE TRAC (TERRAIN-RESPONSIVE ATMOSPHERIC CODE) MODEL - VOLS. 1 & 2	0726	FRCC	RFP READING ROOM	TR-50V-88-1
ALL	09/01/88	U.S. DOE ENVIRONMENT, SAFETY AND HEALTH - OFFICE OF ENVIRONMENTAL AUDIT	0614	FRCC	RFP READING ROOM	RFPRR
ALL	09/02/88	WATER MANAGEMENT ALTERNATIVES FOR THE ROCKY FLATS PLANT	1257	RFP	T334C	FBI FILE DOCUMENT #1203148
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ALL	01/01/89	THE ROCKY FLATS DICTIONARY, A REFERENCE GUIDE TO TERMS & PHRASES USED AT RFP. FIRST EDITION	0507	RFP	T130B	SHELF 4 - KATHERINE TAYLOR'S
ALL	01/01/89	ANALYSES OF COMBINED MORTALITY DATA ON WORKERS AT THE HAUFORD SITE, OAK RIDGE NATIONAL LABORATORY, AND ROCKY FLATS NUCLEAR WEAPONS PLANT	1399	WCC	10TH FLOOR	GREG WALDMAN'S OFFICE
ALL	02/01/89	LAND USE INVENTORY, NORTHEAST, JEFFERSON COUNTY, COLORADO, JEFFERSON COUNTY / NORTH PLAINS AREA, LAND USE INVENTORY MAP	1364	GOLDEN	JEFF. CO. PLANNING	18301 W. 10TH. AVE., SUITE 220
ALL	03/01/89	ECOLOGIC ASSESSMENT OF HAZARDOUS WASTE SITES EPA 600/3-89/013	1378	U.S.E.P.A. REGION VIII	LIBRARY	DOWNTOWN DENVER
ALL	03/27/89	LETTERS FROM CITY OF BROOMFIELD TO ACTING ASSISTANT SECRETARY FOR DEFENSE PROGRAMS AND ENVIRONMENT, SAFETY AND HEALTH DEPARTMENTS OF ENERGY IN WASHINGTON, D.C.	1325	RFP	T334C	FBI FILE #302266
ALL	04/01/89	CATALOGUE OF MONITORING ACTIVITIES AT ROCKY FLATS	0078	R F P	T 334 D	CHEM RISK FILES FILE FOLDER A
ALL	04/28/89	ASSESSMENT OF HAZARDOUS INFLUENTS TO STP	1267	RFP	T334C	FBI FILE / DOCUMENT #1002495
ALL	05/01/89	ROCKY FLATS PLANT SITE ENVIRONMENTAL REPORT FOR 1988	0445	RFP	T130B	KATHERINE TAYLOR'S LIBRARY
ALL	06/01/89	HEAVY METAL EXPOSURE SPECIFICALLY CHROMIUM AND NICKEL, ANTHONY MONTOYA	0421	RFP	T334D	CHEM RISK FILE FOLDER A226,
ALL	06/01/89	RFP METEOROLOGICAL MONITORING PLAN AND QA/QC MANUAL	0539	RFP	T130 B	BOOKSHELF # 2 NORTH HALLWAY
ALL	06/07/89	SWMU'S CURRENT STATUS	1522	RFP	T334C	FBI FILE. DOCUMENT # 701593
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ALL	08/01/89	ACTION DESCRIPTION MEMORANDUM FOR ATRAZINE REMOVAL FROM DRAINAGE PONDS	1278	RFP	T334C	FBI FILE 53706
ALL	08/01/89	ASSESSMENT OF ENVIRONMENTAL CONDITIONS AT THE ROCKY FLATS PLANT	0458	RFP	T334D	CHEM RISK FILE FOLDER A-225
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ALL	09/01/89	GROUNDWATER ASSESSMENT PLAN	0703	RFP	T130B	SHELF 5
ALL	09/01/89	ENVIRONMENTAL MONITORING FOR LOW LEVEL WASTE DISPOSAL SITES. 2 VOLUMES	1117	FRCC	RFP READING ROOM	E89 - 009
ALL	10-1-89	PROGRAM PLAN FOR THE DEVELOPMENT EVALUATION AND APPLICATION OF THE TERRAIN RESPONSIVE ATMOSPHERIC CODE (TRAC)	0714	RFP	T130B	SHELF
ALL	10/01/89	TRANSURANIC (TRU) MIXED WASTE SUPERCOMPACTOR AND REPACKAGING FACILITY (SARF) TRU WASTE SHREDDER (TWS) VOL. 1 - II PART A-C	0649	FRCC	RFP READING ROOM	E89-025
ALL	11/01/89	ROCKY FLATS ENVIRONMENTAL PROTECTION IMPLEMENTATION PLAN	1105	FRCC	RFP READING ROOM	E89 - 056
ALL	12/01/89	ROCKY FLATS PLANT ENVIRONMENTAL RESTORATION/WASTE MANAGEMENT FIVE-YEAR PLAN ACTIVITY DATA SHEETS	0542	RFP	T 130 B	KATHERYN TAYLORS LIBRARY
ALL	01/01/90	ROCKY FLATS PLANT SITE ENVIRONMENTAL REPORT, JANUARY THROUGH DECEMBER 1989	0402	RFP	T130B	BOOKCASE 52 NEAR FRAN
ALL	01/01/90	WEMS - WASTE AND ENVIRONMENTAL MANAGEMENT SYSTEM	2507	RFP	BLDG 881	INFORMATION RESOURCES VAX
ALL	01/12/90	WETLANDS ASSESSMENT FOR U.S. D.O.E. - ROCKY FLATS PLANT	0531	WOODWARD CLYDE	DENVER	LAUREL PYE'S OFFICE BOOKSHELF

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ALL	02/01/90	RADIATION CONTROL DIVISION ROCKY FLATS SURFACE SOIL SURVEY 1970-1989	0521	RFP	T130B	IN FINAL PAST REMEDY REPORT IN
ALL	02/01/90	ROCKY FLATS PLANT RESIDUE COMPLIANCE EVALUATION REPORT AND INTERIM COMPLIANCE PLAN	0020	FRCC	RFP READING ROOM	E90-070
ALL	02/26/90	ROCKY FLATS PLANT FISCAL YEAR 1990 SITE SPECIFIC PLAN	0009	FRCC	RFP READING ROOM	E90-004
ALL	03/01/90	1989 ANNUAL RCRA GROUNDWATER MONITORING REPORT FOR REGULATED UNITS AT ROCKY FLATS PLANT	0707	FRCC	RFPPRR	E90-007
ALL	03/01/90	PHASE I RESIDUE CHARACTERIZATION PLAN	0019	FRCC	RFP READING ROOM	E90-071
ALL	03/01/90	VOLATILE ORGANIC EMISSION REPORT FOR THE U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT	0545	RFP	T 334 D	CHEM RISK 91CR047 ITEM 5 FILE
ALL	03/30/90	RESOURCE CONSERVATION AND RECOVERY ACT PART B - OPERATING PERMIT APPLICATION REVISION NO.3 (C07890010526) VOL. 1-3	0667	FRCC	RFP READING ROOM	E 90-008
ALL	04/01/90	SPECIAL REPORT 1989 SURFACE SOIL SURVEY RESULTS	1160	RFP	T130B	LARRY WOODS OFFICE, FILE
ALL	04/05/90	ROCKY FLATS PLANT ENVIRONMENTAL RESTORATION/WASTE MANAGEMENT FIVE-YEAR PLAN: ACTIVITY DATA SHEETS (FINAL)	0602	FRCC	RFP READING ROOM	E90-023
ALL	04/30/90	WETLANDS ASSESSMENT ROCKY FLATS SITE	1110	RFP	T130B	LARRY WOODS' OFFICE
ALL	05/10/90	ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT FIVE-YEAR PLAN FY 1992 - 1996; VOL 10; ACTIVITY DATA SHEETS, ROCKY FLATS OFFICE	0601	FRCC	RFP READING ROOM	E90-019
ALL	05/16/90	ANALYSIS OF OFFSITE EMERGENCY PLANNING ZONES FOR THE ROCKY FLATS PLANT - OVERVIEW	0660	FRCC	RFP READING ROOM	"RFP - ADD - 0001" (RO-75)

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ALL	06/01/90	EIS WRITTEN SCOPING COMMENTS VOL. 1 - 4	0668	FRCC	RFP READING ROOM	E90-040
ALL	6-1-90	ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT FIVE YEAR PLAN FISCAL YEARS 1992-1996. EXECUTIVE SUMMARY	0741	FRCC	RFP READING ROOM	E90-016
ALL	6-1-90	ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT FIVE YEAR PLAN FISCAL YEARS 1992-1996	0742	FRCC	RFP READING ROOM	E90-017
ALL	06/01/90	TASK 2 ADDENDUM VERTICAL SEISMIC PROFILE OF WELL 56-89BR AT THE RFP CONTRACT ASC 32245 PM	0541	RFP	T 130 B	BOOKSHELF #2 NORTH HALL
ALL	06/01/90	TRANSURANIUM ELEMENTS VOLUME 1, ELEMENTS OF RADIATION PROTECTION. U.S.E.P.A. AIR AND RADIATION (ANR-459), EPA 520/1-90-015. JUNE 1990.	1315	RFP	T130B	IGGY LITAOR'S OFFICE #36
ALL	06/01/90	TRANSURANIUM ELEMENTS VOLUME 2, TECHNICAL BASIS FOR REMEDIAL ACTIONS	1316	RFP	T130B	IGGY LITAOR'S OFFICE #36
ALL	6/1/90	RESPONSE TO PUBLIC COMMENTS ON FY 1991 - 1995 ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT FIVE - YEAR PLAN (8/89) AND DRAFT APPLIED RESEARCH, DEVELOPMENT, DEMONSTRATION, TESTING, AND EVALUATION	0752	FRCC	RFP READING ROOM	E90-018
ALL	07/01/90	CORRECTIVE ACTION PLAN IN RESPONSE TO THE AUGUST 1989 ASSESSMENT OF ENVIRONMENTAL CONDITIONS AT THE ROCKY FLATS PLANT	0648	FRCC	RFP READING ROOM	E90-026
ALL	07/01/90	FEDERAL FACILITIES COMPLIANCE AGREEMENT SEWAGE TREATMENT PLAN - COMPLIANCE PLAN	1144	RFP	EMF / T130B	FOLDER 999
ALL	07/01/90	REVISED PART A APPLICATION - HAZARDOUS + LOW LEVEL MIXED WASTE UNITS	0006	FRCC	RFP READING ROOM	E90-024
ALL	08/01/90	1989 POPULATION, ECONOMIC AND LAND USE DATABASE FOR ROCKY FLATS PLANT	0501	RFP	T130B	BOOKCASE OUTSIDE CUBICLE #101
ALL	08/21/90	RADIONUCLIDE DATA ONSITE AND OFFSITE	1576	WOODWARD CLYDE	DENVER	GREG WALDMAN'S OFFICE
ALL	08/28/90	DESIGN RECURRENCE INTERVALS STUDY ROCKY FLATS PLANT SITE. TASK 9 AS A PART OF ZERO-OFFSITE WATER-DISCHARGE STUDY. FINAL	1344	EG&G	BOULDER	RUSS APPLEHANS' OFFICE

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ALL	09/01/90	ATMOSPHERIC CONCENTRATIONS OF CHLORINATED SOLVENTS AROUND A NUCLEAR PROCESSING PLANT IN COLORADO	0647	FRCC	RFP READING ROOM	E90-061
ALL	09/01/90	WASTE STREAM AND RESIDUE IDENTIFICATION AND CHARACTERIZATION OVERVIEW DOCUMENT	0018	FRCC	RFP READING ROOM	E90-084
ALL	09/26/90	IMPLEMENTATION OF DOCUMENTATION REQUIREMENTS FOR NEPA ROCKY FLATS PLANT	1286	RFP BOULDER OFFICE	4888 PEARL	CARLATTA MUHEINS' OFFICE
ALL	10/01/90	FINAL REPORT OF THE GOVERNOR'S ROCKY FLATS SCIENTIFIC PANEL ON MONITORING SYSTEMS	0432	RFP	T334D	CHEM RISK 91CR036 ITEM 3 FILE
ALL	10/01/90	COLORADO MAMMAL DISTRIBUTION LATILONG STUDY	1529	WOODWARD CLYDE	DENVER	ERTSD LIBRARY
ALL	12/01/90	ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT (EM) PROGRAM: AN INTRODUCTION	0605	FRCC	RFP READING ROOM	E90-074
ALL	12/01/90	SPECIAL TASK FORCE REPORT ON THE ROCKY FLATS PLANT-FINAL-SAFETY ANALYSIS REPORT	0030	FRCC	RFP READING ROOM	E90-063
ALL	12/18/90	INTERIM REPORT NON-POINT SOURCE ASSESSMENT AND STORM-SEWER INFILTRATION STUDY, ROCKY FLATS PLANT SITE. TASKS 2 AND 3 OF THE ZERO-OFFSITE WATER DISCHARGE STUDY. - FINAL INTERIM	1340	EG&G	BOULDER	RUSS APPLEHANS' OFFICE
ALL	12/21/90	BACKGROUND GEOCHEMICAL CHARACTERIZATION REPORT ROCKY FLATS PLANT FOR 1989 FINAL	0081	RFP	T130B	RALPH LINDBERG'S OFFICE
ALL	01/01/91	FIVE-YEAR PLAN: FISCAL YEARS 1993-1997: FINAL ACTIVITY DATA SHEETS: 15 VOLUMES (V.15=ROCKY FLATS)	0028	FRCC	RFP READING ROOM	E91-068 VOL. 15
ALL	01/01/91	ROCKY FLATS PLANT AIR QUALITY MANAGEMENT PLAN	0650	FRCC	RFP READING ROOM	E91-041
ALL	01/01/91	RFP METEOROLOGICAL SITE LOG 10 METER TOWER	0046	RFP	T130B	BOOKSHELF IN NORTH -
ALL	01/01/91	RFP METEOROLOGICAL SITE LOG 61 METER TOWER 1991	0656	RFP	T130B	BOOKSHELF NNE PART OF TRAILER

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ALL	01/01/91	ROCKY FLATS PLANT FISCAL YEAR 1991 SITE-SPECIFIC PLAN	0010	FRCC	FRF-PRR	E91-004
ALL	01/01/91	ROCKY FLATS PLANT SITE ENVIRONMENTAL REPORT	1100	RFP		GISLINDE
ALL	1-1-91	SAMPLING OF DETENTION PONDS IN SUPPORT OF THE ENVIRONMENTAL RESTORATION PROGRAM AT ROCKY FLATS	0819	RFP	T130B	NICK DEMOS' OFFICE
ALL	01/01/91	TASK 1 REPORT (RI), IDENTIFICATION OF CHEMICALS AND RADIONUCLIDES USED AT ROCKY FLATS	0084	FRCC	RFP READING ROOM	E91-018
ALL	01/01/91	ROCKY FLATS PLANT COMMUNITY RELATIONS PLAN	0904	FRCC	RFP READING ROOM	E91-001
ALL	01/01/91	SITE DEVELOPMENT CONSTRUCTION PLAN	0908	FRCC	RFP READING ROOM	E91-075
ALL	01/01/91	HEALTH STUDIES	1550	RFP (ATTACHED)	T130F	COMMUNITY RELATIONS
ALL	01/01/91	THE ROCKY FLATS PLANT ENVIRONMENTAL MONITORING PLAN	1288	RFP	DENVER WEST	DAVID COSTAIN'S OFFICE
ALL	01/01/91	LIMS - LABORATORY INFORMATION MANAGEMENT SYSTEM	2506	RFP	BLDG 881	
ALL	01/08/91	SANITARY TREATMENT PLANT EVALUATION STUDY, ROCKY FLATS PLANT. TASK 10 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY. FINAL	1339	EG&G	BOULDER	RUSS APPLEHANS' OFFICE
ALL	01/08/91	STORM-RUNOFF QUANTITY FOR VARIOUS DESIGN EVENTS. TASK 6 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY. FINAL	1347	EG&G	BOULDER	RUSS APPLEHANS' OFFICE
ALL	01/10/91	ROCKY FLATS SURFACE WATER MANAGEMENT PLAN VOL I AND II. DRAFT FINAL	1591	RFP	T130J	CINDY PASCUA'S OFFICE
ALL	1/22/91	ROCKY FLATS INTERAGENCY AGREEMENT	94-202	BLDG 080	ADM RECORD	A-SW-000011

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ALL	01/23/91	U.S. DOE ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT. PUBLIC SCOPING MEETING. VOLUME # 20 OUT OF 23 VOLUMES.	1116	FRCC	RFP READING ROOM	E91 - 010
ALL	1/25/91	ROCKY FLATS PLANT FISCAL YEAR 1991 DRAFT SITE-SPECIFIC PLAN	94-27	BLDG 080	EM LIBRARY	101152
ALL	01/29/91	RADIOACTIVE MATERIALS ASSOCIATED WITH ROCKY FLATS PLANT	1241	RFP	T130C	EMF LIBRARY/FOLDER 1098/ICN
ALL	1/31/91	PROGRESS REPORT ON RADIOECOLOGICAL INVESTIGATIONS AT ROCKY FLATS	1135	RFP	T130B	LARRY WOODS' OFFICE
ALL	1/31/91	PROGRESS REPORT ON RADIOECOLOGICAL INVESTIGATIONS AT ROCKY FLATS	94-21	FRCC	RFP READING ROOM	E91-006
ALL	02/01/91	RESTORING THE ENVIRONMENT AND MANAGING WASTE THROUGH MINIMIZATION AND AVOIDANCE	0690	FRCC	RFP READING ROOM	E91-05
ALL	02/22/91	1989 SURFACE WATER AND SEDIMENT GEOCHEMICAL CHARACTERIZATION REPORT DRAFT	0553	RFP	T130B	CLEAN COPY IN KEITH MOTYL'S
ALL	03/01/91	TECHNOLOGY DEVELOPMENT TO CLEAN UP CONTAMINATED SOIL AND GROUNDWATER	0900	FRCC	RFP READING ROOM	E91 - 013
ALL	3/1/91	TASK 1 REPORT (R1): IDENTIFICATION OF CHEMICALS AND RADIONUCLIDES USED AT ROCKY FLATS	94-53	FRCC	RFP READING ROOM	E91-018
ALL	3/19-91	TEMPORARY WATER STORAGE CAPABILITIES STUDY. TASK 21 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY. FINAL	0734	RFP	T130B	LEE SOBCHAK'S OFFICE
ALL	03/25/91	ROCKY FLATS PLANT FY93-FY97 FIVE-YEAR PLAN	0600	FRCC	RFP READING ROOM	E90-019
ALL	3-26-91	RAW, DOMESTIC AND INDUSTRIAL WATER PIPELINE LEAK-DETECTION METHOD STUDY. TASK 20 OF THE ZERO - OFFSITE WATER - DISCHARGE STUDY. FINAL	0820	RFP	T130B	LEE SOBCHAK'S OFFICE
ALL	04/01/91	CONTAMINATION OF SURFACE SOIL IN COLORADO BY PLUTONIUM, 1970-1989: SUMMARY AND COMPARISON OF PLUTONIUM CONCENTRATIONS IN SOIL IN THE ROCKY FLATS VICINITY AND EASTERN COLORADO.	0015	FRCC	RFP READING ROOM	E91-024

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ALL	04/01/91	DOSE RECONSTRUCTION PROJECT PHASE I OF THE HEALTH STUDIES	0016	FRCC	RFP READING ROOM	E91-025
ALL	04/01/91	PRELIMINARY DESIGN REPORT: A FORMAL PRIORITY SYSTEM FOR ENVIRONMENTAL RESTORATION	0654	FRCC	RFP READING ROOM	E91-061
ALL	4/1/91	TASK 6 DRAFT PLAN (P6) ENVIRONMENTAL EXPOSURE PATHWAYS	1465	WOODWARD-CLYDE	DENVER	GREG WALDMAN'S OFFICE
ALL	04/22/91	FINAL TREATABILITY STUDIES PLAN	0535	WCC	DENVER	LAUREL PYE'S OFFICE
ALL	05/01/91	PHASE II GEOLOGIC CHARACTERIZATION DATA ACQUISITION (SURFACE GEOLOGIC MAPPING OF THE ROCKY FLATS PLANT AND VICINITY)	0555	RFP	T 130 B	BOOKSHELVES IN HALL WAY
ALL	5/5/91	VEGETATION/WILDLIFE BASELINE STUDIES LITERATURE REVIEW	94-77	RRP	T130J	END CABINET #17
ALL	05/07/91	SURFACE - WATER EVAPORATION STUDY ROCKY FLATS PLANT. TASK 15 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY. FINAL.	1341	EG&G	BOULDER	RUSS APPLEHANS' OFFICE
ALL	5/7/91	ROCKY FLATS PLANT SWQA PROJECT PLAN - REV. O QAPJP UPDATE	94-29	BLDG 080	ADM RECORD	A-SW-000222
ALL	5/9/91	CONTAMINATION OF SURFACE SOIL IN COLORADO BY PLUTONIUM, 1970-1989; SUMMARY AND COMPARISON OF PLUTONIUM CONCENTRATIONS IN SOIL IN THE ROCKY FLATS PLANT VICINITY AND EASTERN COLORADO	94-81	FRCC	RFP READING ROOM	E91-024
ALL	5-21-91	FEASIBILITY OF GROUNDWATER CUTOFF / DIVERSION STUDY. TASK 26 OF THE ZERO - OFFSITE WATER DISCHARGE STUDY. FINAL	0725	RFP	T130B	LEE SOBCHAK'S OFFICE
ALL	5-21-91	NON-TRIBUTARY GROUNDWATER STUDY. TASK 29 OF THE ZERO - OFFSITE WATER - DISCHARGE STUDY. FINAL	0736	RFP	T130B	LEE SOBCHAK'S OFFICE
ALL	5-21-91	REVERSE OSMOSIS & MECHANICAL EVAPORATION STUDY, ROCKY FLATS SITE, TASK 12 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY - FINAL	0730	RFP	T130B	LEE SOBCHAK'S OFFICE
ALL	5-21-91	SURFACE-WATER AND GROUND-WATER RIGHTS STUDY IN THE VICINITY OF ROCKY FLATS PLANT. TASK 14 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY. FINAL.	0733	RFP	T130B	LEE SOBCHAK'S OFFICE

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ALL	05/28/91	REVIEW OF THE PAPER BY ROBERT TERRY - MIL-004-91	0906	RFP	T130B	LARRY WOOD'S OFFICE
ALL	5/31/91	ROCKY FLATS PLANT GEOLOGICAL CHARACTERIZATION	94-63	RRP	BLDG T130J	FILE CABINET NO. 18
ALL	06/01/91	TASK 2 REPORT SELECTION OF THE CHEMICALS AND RADIONUCLIDES OF CONCERN	0008	FRCC	RFP READING ROOM	E91-050
ALL	06/01/91	PLANS FOR A PROGRAM TO RELOCATE THE OPERATIONS OF THE ROCKY FLATS PLANT AT GOLDEN, COLORADO	0902	FRCC	RFP READING ROOM	E91 - 057
ALL	06/01/91	ARVADA COMMUNITY RADIATION MONITORING PROGRAM (COMRAD)	1350	DENVER WEST BLDG.	SUITE 300	KIM HOWARD'S OFFICE
ALL	6/1/91	EFFLUENT INFORMATION SYSTEM AND ONSITE DISCHARGE INFORMATION SYSTEM	94-6	RFP BOULDER OFFICE	BILL OSBORNE	
ALL	6-4-91	WASTE GENERATION TREATMENT STUDY, ROCKY FLATS PLANT SITE. TASK 27 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY	0731	RFP	T130B	LEE SOBCHAK'S OFFICE
ALL	6/8/91	WASTE INFORMATION DATA REQUEST BY DOE HEADQUARTERS	94-75	RRP	T130J	END CABINET #17
ALL	6-11-91	ALTERNATIVES TO ZERO DISCHARGE, ROCKY FLATS PLANT SITE, TASK 17 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY	0732	RFP	T130B	LEE SOBCHAK'S OFFICE
ALL	6/13/91	GROUNDWATER PROTECTION AND MONITORING PROGRAM PLAN, DRAFT FINAL	94-64	FRCC	RFP READING ROOM	E91-033
ALL	6/21/91	WRITTEN SCOPING COMMENTS ON ROCKY FLATS PLANT SITE-WIDE ENVIRONMENTAL IMPACT STATEMENT: SCOPING PERIOD: MARCH 13 - MAY 17, 1991	94-43	FRCC	RFP READING ROOM	E91-028
ALL	6/24/91	PROGRESS REPORT ON RADIOECOLOGICAL INVESTIGATIONS AT ROCKY FLATS	94-22	FRCC	RFP READING ROOM	E91-035
ALL	6/28/91	CALENDAR YEAR 1990 RADIONUCLIDE AIR EMISSIONS ANNUAL REPORT FOR RFP	94-97	RRP	BILL OSBORNE'S OFFICE,	

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ALL	7/1/91	FINAL PLAN FOR PREVENTION OF CONTAMINANT DISPERSION, VERSION B	94-1	BLDG 080	ADM RECORD	A-SW-000064
ALL	7/1/91	PLAN FOR PREVENTION OF CONTANIMANT DISPERSION, FINAL	94-42	FRCC	RFP READING ROOM	E91-045
ALL	7/3/91	LOCAL AIR MONITORING TRIGGER LEVELS FOR PLUTONIUM IN SOILS	94-93	BLDG 080	ADM RECORD	A-SW-000118
ALL	7/12/91	CLASSIFICATIONS AND NUMERIC STANDARDS SOUTH PLATTE RIVER BASIN, LARAMIE RIVER BASIN, REPUBLICAN RIVER BASIN, SMOKY HILL RIVER BASIN	94-113	BLDG 080	ADM RECORD	OU04-000033
ALL	7/30/91	STATE RCRA PERMIT RESPONSE TO COMMENTS FOR STATE RCRA PERMIT	94-33	FRCC	RFP READING ROOM	E91-056
ALL	07/31/91	GEOLOGIC CHARACTERIZATION	0017	WOODWARD CLYDE	DENVER	KAREN PHILLIPS OFFICE
ALL	08/01/91	BASELINE WILDLIFE / VEGETATION STUDIES STATUS REPORT	1132	WOODWARD-CLYDE	DENVER	LAUREL PYE' OFFICE
ALL	08/01/91	(DOE) ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT FIVE-YEAR PLAN FISCAL YEARS 1993-1997. EXECUTIVE SUMMARY ONLY	0511	RFP	T 130 B	BOOKCASE IN FRONT OF AL
ALL	08/01/91	ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT: FIVE-YEAR PLAN, FISCAL YEARS 1993-1997	0083	FRCC	RFP READING ROOM	E91-052
ALL	08/01/91	CULTURAL RESOURCES CLASS III SURVEY OF THE DOE ROCKY FLATS PLANT - NORTHERN JEFFERSON COUNTY AND BOULDER COUNTY - "TECHNICAL APPENDICES A-C"	1521	DENVER WEST	EG&G	ANDY MCCLEANS OFFICE
ALL	8/26/91	FINAL TREATABILITY STUDIES PLAN	94-184	FRCC	RFP READING ROOM	E92-092
ALL	09/01/91	MONTHLY ENVIRONMENTAL MONITORING REPORT	0400	RFP	T130B	BOOKCASE 62 NEAR FRAN
ALL	9/1/91	NONNUCLEAR CONSOLIDATION PLAN	94-31	FRCC	RFP READING ROOM	E91-091

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ALL	9/1/91	CONTROL OF RADIONUCLIDE LEVELS IN WATER DISCHARGES FROM THE ROCKY FLATS PLANT; AS REQUIRED IN SECTION XII OF THE STATEMENT OF WORK TO THE INTERAGENCY AGREEMENT (JANUARY 22, 1991)	94-35	FRCC	RFP READING ROOM	E91-053
ALL	9/8/91	WIND AND TORNADO EFFECTS ON STRUCTURES, SYSTEMS, AND COMPONENTS TOPIC EVALUATION PLAN	94-82	FRCC	RFP READING ROOM	O91-085
ALL	09/10/91	ROCKY FLATS PLANT FISCAL YEAR 1992 SITE-SPECIFIC PLAN	0029	FRCC	RFP READING ROOM	E91-055
ALL	9-12-91	REMOVAL OF ACTINIDES FROM ROCKY FLATS SOIL. FINAL	0805	RFP	T130B	LARRY WOODS' OFFICE
ALL	9-30-91	NON-POINT SOURCE ASSESSMENT AND STORM - SEWER INFILTRATION / INFLOW AND EXFILTRATION STUDY, ROCKY FLATS PLANT SITE TASKS 2 AND 3 OF THE ZERO - OFFSITE WATER - DISCHARGE STUDY. FINAL.	0740	RFP	T130B	LEE SOBCHAK'S OFFICE
ALL	9-30-91	SANITARY SEWER INFILTRATION / INFLOW AND EX-FILTRATION STUDY. TASK 01 OF THE ZERO - OFFSITE WATER - DISCHARGE STUDY. FINAL	0738	RFP	T130B	LEE SOBCHAK'S OFFICE
ALL	10/1/91	DRAINAGE AND FLOOD CONTROL MASTER PLAN, DRAFT	94-74	RRP	T130J	END CABINET #17
ALL	10/29/91	RESUSPENSION OF SOIL PARTICLES FROM ROCKY FLATS CONTAINING PLUTONIUM PARTICLES. FINAL	1610	RFP / ERTSD TEAM	TRAILER	OUTSIDE T130B
ALL	11/1/91	INFORMATION SHEETS: ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT (EM PEIS)	94-39	FRCC	RFP READING ROOM	E91-095
ALL	11/1/91	ENVIRONMENTAL MONITORING PLAN	94-91	RRP	T130J	END LIBRARY
ALL	11/8/91	SELECTION OF EXPOSURE SCENARIOS, COMPUTER MODELS, AND DATA COLLECTION REQUIREMENTS FOR HUMAN HEALTH RISK ASSESSMENT, REVISION 2	94-104	RFP	T130J	END LIBRARY
ALL	11/9/91	ROCKY FLATS PLANT ENVIRONMENTAL PROTECTION IMPLEMENTATION PLAN	94-89	RRP	T130J	END LIBRARY
ALL	11/12/91	CATALOG OF MONITORING ACTIVITIES (REV. #10)	0502	RFP	T 130 B	(1) BOOKCASE 52 OR (2) ED MAST'S

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ALL	11/13/91	APPLICATION OF CHEMICAL-SPECIFIC ARARS VERSUS TBCS FOR FEDERAL AND COLORADO WQCC STANDARDS	94-23	BLDG 080	ADM RECORD	000003060
ALL	11/27/91	FINAL GROUNDWATER PROTECTION AND MONITORING PROGRAM PLAN	0513	RFP	T130B	GREG ANDERSON'S OFFICE
ALL	12/04/91	ROCKY FLATS PLANT COMMUNITY RELATIONS PLAN. FINAL. ENVIRONMENTAL RESTORATION PROGRAM	1138	RFP	NEAR T130B	WCC MOBILE OFFICE
ALL	12/4/91	ROCKY FLATS PLANT COMMUNITY RELATIONS PLAN; ENVIRONMENTAL RESTORATION PROGRAM	94-79	BLDG 080	ADM RECORD	000002565
ALL	12/10/91	VOLATILE ORGANIC COMPOUND EMISSION REPORT, RESPONSE TO CDH AQ REGULATION NO. 7	94-101	RRP	ROBIN RAMSEY'S OFFICE,	
ALL	12/17/91	INTERAGENCY AGREEMENT (IAG) DELIVERABLE DOCUMENTS TO BE FORWARDED TO THE NATURAL RESOURCE TRUSTEES	0503	RFP	T130B	ERIC DILLE'S OFFICE
ALL	12/20/91	AIR SURVEILLANCE NETWORK SITING STUDY ROCKY FLATS PLANT SITE	1346	DENVER WEST BLDG.	SUITE 300	DAVE MAXWELL'S OFFICE
ALL	12/20/91	AIR SURVEILLANCE NETWORK SITING STUDY	94-98	RRP	DAVE MAXWELL'S OFFICE,	
ALL	12/24/91	AIR QUALITY MANAGEMENT PLAN ROCKY FLATS PLANT	1573	DENVER WEST BLDG	SUITE 300	KIM HOWARD'S OFFICE
ALL	01/01/92	DRAFT HISTORICAL RELEASE REPORT FOR THE ROCKY FLATS PLANT V.I - TEXT V. II - APPENDICES	0466	NEPA SECTION	DENVER WEST	ALSO AT WCC TRAILER
ALL	01/01/92	EMD OPERATING PROCEDURES MANUAL NO. 5-21000-OPS	0556	RFP	T130B	ED MAST'S OFFICE
ALL	01/01/92	RHRS - RADIOLOGICAL HEALTH RECORDS SYSTEM	2502	RFP	BLDG 881	
ALL	01/01/92	EVALUATION OF VOLATILE ORGANIC COMPOUNDS - DISPERSION MODELING OF VOC EMISSION SOURCES	1484	EG&G DENVER WEST	DENVER	GISLINDE ENGLEMAN

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ALL	1/1/92	TOXICOLOGICAL REVIEW AND DOSE RECONSTRUCTION PROJECT, R6A DRAFT INTERIM REPORT, ENVIRONMENTAL EXPOSURE PATHWAYS	1464	WOODWARD-CLYDE	DENVER	GREG WALDMAN'S OFFICE
ALL	1/1/92	EVALUATION OF VOLATILE ORGANIC COMPOUNDS, (VOCS) DISPERSION MODELING OF VOC EMISSION SOURCES, FINAL	94-103	RRP	ROBIN RAMSEY'S OFFICE,	
ALL	1/9/92	SUMMARY REPORT FOR COMPLIANCE WITH CONTINUOUS RELEASE REPORTING REQUIREMENTS UNDER EPA 40 CFR PARTS 302 AND 355	94-112	RRP	ROBIN RAMSEY'S OFFICE,	
ALL	1/15/92	SUMMARY MASTER PLAN	94-51	FRCC	RFP READING ROOM	E91-083
ALL	2/1/92	CERTIFICATE OF DESIGNATION APPLICATON FOR NEW SANITARY LANDFILL	94-78	FRCC	RFP READING ROOM	E92-009
ALL	2/1/92	PHASE II GEOLOGIC CHARACTERIZATION DATA ACQUISITION, TASK 2 SHALLOW, HIGH-RESOLUTION SEISMIC REFLECTION PROGRAM INDIANA STREET AND WEST SPRAY FIELD, FINAL REPORT	94-216	RFP	BLDG 080	ENVIRONMENTAL RESTORATION
ALL	02/13/92	PRELIMINARY DRAFT SITE - WIDE EVALUATION OF TRANSPORTATION RISKS FOR THE ROCKY FLATS PLANT VOL I	1451	EG&G DENVER WEST	DENVER	GISLINDE ENGLEMANN
ALL	2/14/92	PLAN FOR PREVENTION OF CONTAMINANT DISPERSION, FINAL	94-19	FRCC	RFP READING ROOM	E92-016
ALL	2/21/92	WASTE STREAM & RESIDUE IDENTIFICATION & CHARACTERIZATION (WSRIC)	2508	DENVER WEST		
ALL	2/22/92	PLAINS SHARP-TAILED GROUSE RECOVERY PLAN	1463	WOODWARD-CLYDE	DENVER	GREG WALDMAN'S OFFICE
ALL	2/28/92	SUMMARY REPORT FOR COMPLIANCE WITH CONTINUOUS RELEASE REPORTING REQUIREMENTS UNDER EPA 40 CFR PARTS 302 AND 355	94-111	RRP	ROBIN RAMSEY'S OFFICE,	
ALL	3/1/92	ANNUAL REPORT FOR TREATABILITY STUDIES AT ROCKY FLATS PLANT FISCAL YEAR 1991	1447	WOODWARD CLYDE	DENVER	GREG WALDMANN'S OFFICE
ALL	3/1/92	FINAL REPORT PHASE II GEOLOGIC CHARACTERIZATION DATA ACQUISITION	94-20	BLDG 080	ADM RECORD	000002610

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ALL	3/1/92	1991 ANNUAL RCRA GROUNDWATER MONITORING REPORT FOR REGULATED UNITS AT ROCKY FLATS PLANT	94-72	FRCC	RFP READING ROOM	E92-035
ALL	3/1/92	FINAL COMMENTS/RESOLUTION SUMMARY OF EPA COMMENTS ON FINAL TREATABILITY STUDIES PLAN - ROCKY FLATS PLANT	94-85	FRCC	RFP READING ROOM	E92-019
ALL	3/1/92	PHASE II GEOLOGIC CHARACTERIZATION DATA AQUISITION: SURFACE GEOLOGIC MAPPING OF THE ROCKY FLATS PLANT AND VICINITY, JEFFERSON AND BOULDER COUNTIES, COLORADO	94-86	FRCC	RFP READING ROOM	E92-027
ALL	5/4/92	RAW DATA UNDERLYING THE ANALYSIS AND RECOMMENDATIONS IN THE NONNUCLEAR CONSOLIDATION PLAN	94-40	FRONT RANG E	RFP READING ROOM	E92-032
ALL	6/1/92	EFFLUENT INFORMATION SYSTEM AND ONSITE DISCHARGE INFORMATION SYSTEM	94-5	RFP BOULDER OFFICE	BILL OSBORNE	
ALL	6/1/92	DRAFT INTEGRATION OF NEPA, CERCLA & RCRA FOR ACTIVITIES UNDER THE INTERAGENCY AGREEMENT AT ROCKY FLATS PLANT	94-105	RFP	T130J	END LIBRARY
ALL	6/1/92	FINAL HISTORICAL RELEASE REPORT FOR THE ROCKY FLATS PLANT	94-186	FRCC	RFP READING ROOM	E92-074
ALL	6/3/92	ANNUAL AIR EMISSION REPORT FOR 1991	94-96	RRP	BILL OSBORNE'S OFFICE,	
ALL	6/8/92	ALTERNATIVE USE EVALUATION, DRAFT REVISION 1	94-107	RFP	T130J	END RECORDS MGMT FILE #095
ALL	6/30/92	U.S. DEPARTMENT OF ENERGY RADIONUCLIDE AIR EMISSIONS ANNUAL REPORT (UNDER SUBPART H OF 40CFR PART 61) CALENDAR YEAR 1991	94-15	FRCC	RFP READING ROOM	E92-081
ALL	6/30/92	RCRA PERMIT MODIFICATION REQUEST #8: MIXED RESIDUES (VOLI, VOL II, BOOK I, BOOK II)	94-18	FRCC	RFP READING ROOM	E92-037
ALL	9/1/92	BASELINE BIOLOGICAL CHARACTERIZATION OF THE TERRESTRIAL AND AQUATIC HABITATS AT THE ROCKY FLATS PLANT, FINAL REPORT	94-218	RFP	T130J	ECOLOGY AND NEPA DIVISION
ALL	9/4/92	AEI VENT INVENTORY	94-201	RFP	T130J	ECOLOGY AND NEPA FILES,

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ALL	9/30/92	BACKGROUND GEOCHEMICAL CHARACTERIZATION	94-225	BLDG 080	ADM RECORD	SW-000555
ALL	10/1/92	MISSION TRANSITION PROGRAM MANAGEMENT PLAN, DRAFT	94-16	FRCC	RFP READING ROOM	E92-051
ALL	10/1/92	EVALUATION OF VOLATILE ORGANIC COMPOUNDS, VOC SOURCE EVALUATION FOR CONTROL TECHNOLOGIES ROCKY FLATS PLANT	94-102	RRP	ROBIN RAMSEY'S OFFICE,	
ALL	10/12/92	ECOLOGY AND NEPA DIVISION/ENVIRONMENTAL MANAGEMENT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT DATA CALL	94-200	RFP	T130J	END FILES CABINET NO. 18
ALL	10/28/92	RCRA PERMIT MODIFICATION REQUEST: COLORADO PERMIT NO. 91-09-30-01	94-32	FRCC	RFP READING ROOM	E91-069
ALL	11/1/92	ENVIRONMENTAL MONITORING PLAN	94-92	RRP	T130J	END LIBRARY
ALL	11/9/92	ROCKY FLATS PLANT ENVIRONMENTAL PROTECTION IMPLEMENTATION PLAN	94-88	RRP	T130J	END LIBRARY.
ALL	11/13/92	ANNUAL MIXED RESIDUE REDUCTION REPORT	94-14	FRCC	RFP READING ROOM	E92-083
ALL	11/30/92	POSTING AND CONTROL OF CONTAMINATED AREA	94-114	BLDG 080	ADM RECORD	OU01-000456
ALL	12/1/92	WELL ABANDONMENT AND REPLACEMENT PROGRAM WORK PLAN FISCAL YEAR 1993	94-116	BLDG 080	ADM RECORD	WE 000596
ALL	12/18/92	ROCKY FLATS PLANT FINAL ENVIRONMENTAL MONITORING PLAN 1992	94-84	FRCC	RFP READING ROOM	E93-005
ALL	1/1/93	ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT FIVE-YEAR PLAN: FISCAL YEARS 1994-1998	94-80	FRCC	RFP READING ROOM	E93-003
ALL	1/20/93	EXISTING WASTE AT ROCKY FLATS PLANT	94-76	RRP	T130J	END CABINET #17

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ALL	2/1/93	ANNUAL REPORT FOR TREATABILITY STUDIES PROGRAM FISCAL YEAR 1992	94-87	BLDG 080	ADM RECORD	SW-000569
ALL	2/5/93	SOILS INVENTORY FOR CONTAMINATED MEDIA WITHIN EACH OU	94-212	RFP	T130J	END FILES CABINET NO. 18
ALL	3/1/93	1992 ANNUAL RCRA GROUNDWATER MONITORING REPORT FOR REGULATED UNITS AT THE ROCKY FLATS PLANT	94-83	BLDG 080	ADM RECORD	000015545
ALL	3/1/93	AIR DISPERSION MODELING OF VOC EMISSION SOURCES AT THE ROCKY FLATS PLANT	94-100	RRP	ROBIN RAMSEY'S OFFICE,	
ALL	3/3/93	RISK ASSESSMENT SEMINAR SESSION I: FUNDAMENTALS OF RADIOACTIVITY SESSION II:DATA COLLECTIN/EVALUATION, EXPOSURE ASSESSMENT AND TOXICITY ASSESSMENT; RADIONUCLIDE RISK MANAGEMENT AND RISK CHARACTERIZATION	94-13	FRCC	RFP READING ROOM	E03-011
ALL	3/11/93	MISSION TRANSITION PROGRAM MANAGEMENT PLAN	94-108	RFP BOULDER OFFICE	H. GLOW	
ALL	4/1/93	PHASE II GEOLOGIC CHARACTERIZATION DATA AQUISITIION, TASK 2 DEEP SEISMIC REVISED FINAL REPORT	94-185	BLDG 080	ADM RECORD	SW-000592
ALL	5/19/93	1993 SURFACE WATER DIVISION DAM INSPECTION REPORT	94-106	RFP	T130J	END LIBRARY
ALL	6/1/93	EFFLUENT INFORMATION SYSTEM AND ONSITE DISCHARGE INFORMATION SYSTEM	94-4	RFP BOULDER OFFICE	BILL OSBORNE	
ALL	6/1/93	ROCKY FLATS PLANT SITE ENVIRONMENTAL REPORT, JANUARY THROUGH DECEMBER 1992	94-110	RFP	T 130 J	END LIBRARY
ALL	6/1/93	NONNUCLEAR CONSOLIDATION ENVIRONMENTAL ASSESSMENT	94-189	RFP	T130J	ECOLOGY AND NEPA LIBRARY
ALL	6/11/93	PREDECISIONAL DRAFT, EXECUTIVE SUMMARY FOR THE ROCKY FLATS PLANT, FY93 SYSTEMS ENGINEERING ANALYSIS FACILITY/LAND USE COMPONENT	94-251	RFP	T130J	ECOLOGY AND NEPA FILES
ALL	6/17/93	ANNUAL AIR EMISSION REPORT FOR 1992	94-95	RRP	BILL OSBORNE'S OFFICE,	

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ALL	7/1/93	ROCKY FLATS PLANT TRANSITION STATUS REPORT	94-109	RFP	T 130 J	END LIBRARY
ALL	9/23/93	ROCKY FLATS PLANT LAND USE MANUAL	94-252	RFP	T130J	ECOLOGY AND NEPA FILES
SW	9/24/93	REPORT OF FINDINGS, 2ND YEAR SURVEY FOR THE PREBLE'S JUMPING MOUSE, ROCKY FLATS BUFFER ZONE, JEFFERSON CO., COLO	94-192	RFP	T130J	ECOLOGY AND NEPA DIVISION
SW	9/24/93	REPORT OF FINDINGS, UTE LADIES'-TRESSES AND COLORADO BUTTERFLY WEED SURVEYS, ROCKY FLATS BUFFER ZONE, JEFFERSON CO., COLORADO	94-193	RFP	T130J	ECOLOGY AND NEPA DIVISION
ALL	9/30/93	RFP FISCAL YEAR 1993 INTERIM INTEGRATED ROADMAP, REVISION 2.0 (3 VOLUMES)	94-235	RFP	BLDG T130J	END LIBRARY
ALL	10/6/93	LAND USE MANUAL	94-222	BLDG 080	ADM RECORD	3-21500-6D-END.01
ALL	10/15/93	GROUNDWATER PROTECTION AND MONITORING PROGRAM PLAN	94-217			
ALL	11/1/93	ROCKY FLATS ENVIRONMENTAL RESTORATION	94-244	BLDG 080		
ALL	12/16/93	GROUNDWATER GEOCHEMISTRY OF ROCKY FLATS PLANT	94-215			
ALL	12/20/93	ENVIRONMENTAL RESTORATION PROGRAM MONTHLY REPORT FOR NOVEMBER 1993	94-115	BLDG 080	ADM RECORD	
N/A		ROCKY FLATS PLANT EMD OPERATING PROCEDURES MANUAL	94-24	BLDG 080	ADM RECORD	000003046
N/A	01/01/01	PROBABILISTIC RISK ASSESSMENT OF HYDROGEN GENERATION IN DRUMS, CONTAINING PLUTUNIUM - CONATININATED MATERIALS	0543	RFP	T 130 B	SHELF #2 NORTH HALL
N/A	01/01/01	SAMPLING AND ANALYSIS OF SOILS FOR PLUTONIUM	0454	RFP	T334D	CHEM RISK FILE FOLDER A-222

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N/A	01/01/50	GEOLOGY AND ORE DEPOSITS OF THE FRONT RANGE, COLORADO	1383	U.S.G.S.	LIBRARY	(200) B
N/A	4/24/51	PROPOSED AEC SITES AT ROCKY FLATS, BOULDER AND JEFFERSON COUNTIES, CO. - STRUCTURE CONTOUR MAP OF COAL IN LARAMIE FORMATION	1357	RFP	T130C	EMF FOLDER 514 ICN # 6945
N/A	9/1/52	CAPROCK MINE, CAPROCK FUEL COMPANY, SECTION 16, TWP. 2, SO. RANGE 70 WEST	1356	RFP	T130C	E M F FOLDER 514 ICN # 6945
N/A	02/25/72	CHRONOLOGY OF ROCKY FLATS PLANT	1146	RFP	EMF / T130C	FOLDER 11047; ICN 001196
N/A	05/01/73	INTERCOMPARISON OF DIRECT RADIOMETRIC....COUNTING METHODS....AIR FILTERS	0528	RFP	T334D	CHEM RISK A236
N/A	05/07/73	TERRESTRIAL ECOLOGICAL STUDIES AT ROCKY FLATS	1355	RFP	T130C	EMF / FOLDER 514 / ICN #6937
N/A	6-1-75	CESIUM KINETICS IN A MONTANE LAKE ECOSYSTEM, HEALTH PHYSICS, VOL. 28, 1975, PP. 699-706	0812	WCC	10TH FLOOR	LAUREL PYE'S OFFICE
N/A	1-1-76	A REVIEW OF THE ECOLOGICAL PARAMETERS OF RADIONUCLIDE TURNOVER IN VERTEBRATE FOOD CHAINS, IN RADIOECOLOGY AND ENERGY RESOURCES, PROCEEDINGS OF THE 4TH. NATIONAL SYMPOSIUM ON RADIOECOLOGY, 1975,	0813	WCC	10TH FLOOR	LAUREL PYE'S OFFICE
N/A	01/01/76	AMERICIUM - ITS BEHAVIOR IN SOIL AND PLANT SYSTEMS EPA-600/3-76-005	1377	U.S.E.P.A. REGION VIII	LIBRARY	DOWNTOWN DENVER
N/A	09/16/76	COMMENTS ON THE JOHNSON, TIDBALL AND SEVENSON PAPER WHICH APPEARED IN THE AUGUST 1976 ISSUE OF SCIENCE MAGAZINE ES 376-76-190	1354	RFP	T130C	EMF / FOLDER 514 / ICN #6926
N/A	10/22/76	COMMENTS ON THE PAPER "PLUTONIUM HAZARD IN RESPIRABLE DUST ON THE SURFACE OF SOIL BY C. J. JOHNSON, R.R. TIDBALL AND R.C. SEVERSON (AUGUST 6, 1976 ISSUE OF SCIENCE)	1109	RFP	T130C	FOLDER 514 / ICN # 6924
N/A	11/01/76	PROFESSIONAL CONTRIBUTIONS OF COLORADO SCHOOL OF MINES - "STUDIES IN COLORADO FIELD GEOLOGY"	1236	USGS DENVER	LIBRARY	CALL # S-271-C78 PC
N/A	04/01/77	TRANSACTIONS OF MEETING ON ROCKY FLATS BUFFER ZONE ECOLOGICAL AND ENVIRONMENT RESEARCH MEETING	0524	RFP	T130B	LIBRARY - KATHERINE TAYLOR

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N/A	06/01/77	TRANSURANICS IN NATURAL ENVIRONMENTS	1387	DENVER WEST	TOM GREENGARD'S	ON LOAN FROM RFP LIBRARY OH
N/A	06/22/77	MINERAL EXTRACTION POLICY PLAN	1367	GOLDEN CO	PLANNING DEPT.	18301 W. 10TH. AVE., SUITE 220
N/A	12/1/77	THE ROCKY FLATS LAND MANAGEMENT PLAN	1235	RFP	T130C	EMF FOLDER 264 / DOCUMENT 3616
N/A	03/01/78	DRAFT IMPACT STATEMENT - RESPONSE TO COMMENTS	1152	RFP	T130B	EMP LIBRARY / FOLDER 1004
N/A	04/20/78	CORRELATION BETWEEN ROCKY FLATS PLUTONIUM POLLUTION AND INCREASES IN RESPIRATORY CANCER MORTALITIES IN THE DENVER AREA	1324	RFP	T130C	EMF LIBRARY / FOLDER 516 / ICN
N/A	11/17/78	SIZE FRACTIONATION METHODS: MEASURING PLUTONIUM IN RESPIRABLE DUST SCIENCE VOL. 202, 17 NOV 1978	1108	RFP	T130C	EMF / FOLDER 514 / ICN #6912
N/A	1-1-80	SYNTHESIS OF THE RESEARCH LITERATURE IN HANSON, W.C., ED., TRANSURANIC ELEMENTS IN THE ENVIRONMENT, PP. 1-44	0815	WCC	10TH FLOOR	LAUREL PYE'S OFFICE
N/A	01/01/80	ENERGY RESOURCES OF THE DENVER AND CHEYENNE BASINS, COLORADO --RESOURCE CHARACTERISTICS, DEVELOPMENT POTENTIAL, ENVIRONMENTAL PROBLEMS	1373	USGS LIBRARY		
N/A	04/01/80	AIR CONTAMINANT EMISSIONS NOTICE	0527	RFP	T334D	CHEM RISK, FILEFOLDER A236,
N/A	06/01/80	TECTONIC INFLUENCE ON DELTAIC SHORELINE FACIES, FOX HILLS SANDSTONE, WEST-CENTRAL DENVER BASIN	0525	RFP	T130B	SHELF 2, NORTH HALLWAY
N/A	07/01/80	PLUTONIUM IN A GRASSLAND ECOSYSTEM AT ROCKY FLATS	0620	RFP	T130B	KATHERINE TAYLOR'S LIBRARY
N/A	08/01/80	GREAT WESTERN RESERVOIR SPILLWAY SEDIMENT SAMPLING PROGRAM	0041	RFP	T 130 B	MICHAEL GUILLAUME'S OFFICE
N/A	09/24/80	MOBILE AMBIENT AIR MONITOR	1127	RFP	T130C	EMF FILE FOLDER #961

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N/A	01/01/81	EARTHQUAKE POTENTIAL IN COLORADO	1246	RFP	T130 C	EMF LIBRARY/ICN#0008688
N/A	01/01/81	PAST ACCIDENTAL RELEASES OF RADIOACTIVITY FROM THE ROCKY FLATS PLANT	0057	RFP	T 334 D	CHEMRISK FILE FOLDER A-152 ITEM
N/A	01/01/81	CANCER INCIDENCE IN AN AREA CONTAMINATED WITH RADIONUCLIDES NEAR A NUCLEAR INSTALLATION	1284	RFP	T130C	EMF FILE #128
N/A	7-10-81	HEALTH, SAFETY AND ENVIRONMENT DEPT., ENVIRONMENTAL SCIENCES BRANCH, PROGRESS REPORT FOR JANUARY-JUNE 1980	0817	FRCC	RFP READING ROOM	RO - 75 (3197)
N/A	09/29/81	THE RELATION OF THE ROCKY FLATS PLANT AND OTHER FACTORS TO 1969-1971 CANCER INCIDENCE IN THE DENVER AREA	1283	RFP	T130	EMF FILE #128
N/A	10/11/81	AN UPDATE OF EPIDEMIOLOGIC STUDIES OF PLUTONIUM WORKERS.	1279	RFP	T334C	FBI FILE 80272
N/A	01/01/82	OIL AND GAS FIELDS OF COLORADO, STATISTICAL DATA THROUGH 1981	1590	U.S.G.S. .	LIBRARY	(271) C 3 IS NO.18
N/A	3/1/82	CLIMATOLOGY OF COLORADO TORNADOES	1234	RFP	T130C	EMF FILE FOLDER # 270.
N/A	03/01/82	ROCKY FLATS WIND SUMMARIES FOR NOVEMBER, 1981 THROUGH MARCH, 1982 AND ROCKY FLATS SNOW COVER ANALYSIS	1233	RFP	T130C	EMF FILE FOLDER # 270.
N/A	07/01/82	DEFENSE TRANSURANIC WASTE PROGRAM STRATEGY DOCUMENT, DOE-TRU-8202	0691	FRCC	RFP READING ROOM	RO-75 (3378)
N/A	11/01/82	PLUTONIUM BURDENS IN PEOPLE LIVING AROUND THE ROCKY FLATS PLANT	0452	RFP	T334D	CHEM RISK FILE FOLDER A-196
N/A	11/29/82	PLUTONIUM BEHAVIOR IN THE SOIL / WATER ENVIRONMENT. PART II. SELECTED CHEMICAL AND PHYSICAL CHARACTERISTICS OF AQUEOUS PLUTONIUM & THE EFFECTS ON THE SORPTION OF PLUTONIUM BY SOILS	0665	FRCC	RFP READING ROOM	RO-75 (2480)
N/A	11/29/82	PLUTONIUM BEHAVIOR IN THE SOIL / WATER ENVIRONMENT. PART I: SORPTION OF PLUTONIUM BY SOILS, RFP-2480	0666	FRCC	RFP READING ROOM	RO-75 (2480)

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N/A	01/01/83	DETAILED COMMENTS ON THE BATTELLE REPORT COVERING ROCKY FLATS PLANT	1172	RFP	T334C	FBI FILE #600157
N/A	01/01/83	GREAT WESTERN RESERVOIR SEDIMENT SAMPLING STUDY - ENVIRONMENTAL ANALYSIS AND CONTROL.	1258	RFP	T334C	FBI FILE/ DOCUMENT #301765
N/A	01/01/83	JEFFERSON COUNTY SOLID WASTE MANAGEMENT PLAN - DRAFT - "THE CONCERN THAT IS CONFRONTING US"	1129	WOODWARD-CLYDE	DENVER	JEFF DAWSON'S OFFICE
N/A	01/01/83	PLUTONIUM LEVELS IN BOTTOM SEDIMENTS OF GREAT WESTERN RESERVOIR	1523	RFP	T334C	FBI FILE. DOCUMENT # 802084
N/A	01/20/83	ACTION DESCRIPTION MEMORANDUM FOR BUILDING 771 COMPLEX - UTILITIES UPGRADING	1151	RFP	T130C	EMF LIBRARY / FOLDER 1001
N/A	03/01/83	PLUTONIUM BURDENS IN PEOPLE LIVING AROUND THE ROCKY FLATS PLANT.	1395	RFP	T130C	EMF / FILE #1090 DOCUMENT #
N/A	05/12/83	ACTION PLAN - REMOVAL OF CONTAMINATED SOIL FROM AN AREA ADJACENT TO THE EAST SECURITY FENCE - ROCKY FLATS PLANT -	1259	RFP	T334C	FBI FILE / DOCUMENT #1201352
N/A	06/01/83	ANNUAL REPORT OF RADIATION EXPOSURE TO ROCKWELL EMPLOYEES AT THE ROCKY FLATS PLANT - 1982. DOE CONTRACT NO. DE-ACO4-76DDO-355	0661	FRCC	RFP READING ROOM	RFP-3602
N/A	07/01/83	SMALL WIND SYSTEMS FIELD EVALUATION, VOL 1 - EXECUTIVE SUMMARY & PROGRAM DESCRIPTION	0662	FRCC	RFP READING ROOM	RO-75 (356 1/2)
N/A	10/01/83	RISK ASSESSMENT FOR OUTSIDE STORAGE OF RFP WASTES	1260	RFP	T334C	FBI FILE / DOCUMENT #1201401
N/A	11/01/83	ACTION DESCRIPTION MEMORANDUM FOR PLANT LAUNDRY FACILITY	1113	RFP	EMF	FILE #963 DOCUMENT #0010602
N/A	03/01/84	GREAT WESTERN RESERVOIR STUDY	1150	RFP	T130C	EMF LIBRARY / FOLDER 997
N/A	08/01/84	ROCKY FLATS SOLAR EVAPORATION PONDS	1111	RFP	EMF	FILE FOLDER #964, DOCUMENT

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N/A	08/08/84	ACTIONS TO IMPROVE ENVIRONMENTAL POSTURE AT ROCKY FLATS	0055	RFP	T 334 D	CHEM RISK 91CR016, ITEM 5,
N/A	9/4/84	ACTION PLAN - REMOVAL OF CONTAMINATED SOIL FROM AN AREA ADJACENT TO THE EAST SECURITY FENCE, ROCKY FLATS PLANT	1571	RFP	EMF / T130C	SL - RP - 00013
N/A	09/17/84	PROPOSED REVISION OF DOE ORDER 5480.1A. RADIATION STANDARDS FOR PROTECTION OF THE PUBLIC	1158	RFP	T130C	EMF LIBRARY / FOLDER 1087 / ICN
N/A	11/01/84	ACCIDENTAL BYPASS OF SPRAY IRRIGATION WATERS VIA MCKAY DITCH	0460	RFP	T334D	CHEM RISK FILE FOLDER A-226
N/A	12/01/84	TRITIUM ANALYSIS IN WATER FOR 1984	1148	RFP	T130C	EMF LIBRARY / FOLDER 990
N/A	01/01/85	EFFECTS OF DISSOLVED ORGANIC CARBON ON THE ADSORPTION PROPERTIES OF PLUTONIUM IN NATURAL WATERS	1376	WCC (COPY	5TH FLOOR	LIBRARY SEARCH
N/A	01/01/85	STORM WATER RUNOFF DISCHARGES	1384	RFP	T334C	FBI FILE # 81211
N/A	01/01/85	CARCINOGENICITY OF PLUTONIUM, CURIUM AND OTHER TRANSURANICS IN MAN AT VERY SMALL DOSES	1402	WCC	10TH FLOOR	GREG WALDMAN'S OFFICE
N/A	02/01/85	AIR FLOW PATTERNS NEAR THE ROCKY FLATS PLANT	1156	RFP	T130C	EMF LIBRARY / FOLDER 1061 / ICN
N/A	02/01/85	REMEDIAL ACTION PROGRAM ON LANDS ADJACENT TO THE ROCKY FLATS PLANT	1120	RFP	T130B	LARRY WOODS FILE
N/A	03/01/85	ENVIRONMENTAL PROTECTION APPRAISALS: A SUGGESTED GUIDE FOR U.S. DEPT OF ENERGY FIELD ORGANIZATIONS	1142	RFP	EMF / T130C	FOLDER 981
N/A	05/01/85	JEFFERSON COUNTY TELECOMMUNICATIONS LAND USE PLAN	1517	CITY OF GOLDEN /	JEFFERSON COUNTY	18301 W. 10TH. AVE. - SUITE # 220
N/A	06/01/85	ROCKY FLATS PLANT DAM SAFETY INSPECTION REPORTS JUNE 1985	1312	RFP	EMF / T130C	FOLDER 1073 / ICN 0011556

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N/A	07/25/85	COMMUNITY RELATIONS PLAN - ROCKY FLATS PLANT	1254	RFP	T130C	EMF FILE FOLDER #868 DOCUMENT
N/A	01/01/86	GEOTECHNICAL ENGINEERING INVESTIGATION REPORTS (PROJECT NOS. 41-63050, 41-73021, 41-73019, 41-73015, 41-73008)	0519	RFP	T130B	LIBRARY - KATHERINE TAYLOR
N/A	1/13/86	HEPA FILTER MONITORING PROGRAM INTERIM REPORT OCTOBER 1984	0708	FRCC	RFPPRR	RFP-3762
N/A	01/13/86	INVENTORY OF D.O.E. - RFP HAZARDOUS WASTE FACILITIES	1224	RFP	T334C	FBI FILE
N/A	03/01/86	JEFFERSON COUNTY GENERAL LAND USE PLAN	1516	CITY OF GOLDEN /	JEFFERSON COUNTY	18301 W. 10TH. AVENUE, SUITE #
N/A	04/15/86	BYPASS OF UNTREATED SEWAGE	1169	RFP	334C	FBI FILE
N/A	05/30/86	WASTE STREAM IDENTIFICATION SURVEY, AREAS 1,2,3,& 4, ROCKY FLATS PLANT (7 VOLUMES)	0635	FRCC	RFP READING ROOM	E86-006 (VOLS 1-7)
N/A	06/01/86	RADIATION & HEALTH EFFECTS, A REPORT ON THE TM 1-2 ACCIDENT AND RELATED HEALTH STUDIES	0634	FRCC	RFP READING ROOM	E86-013
N/A	08/18/86	ANALYTICAL RESULTS OF AGGREGATED LIQUID WASTE STREAM SAMPLES ROCKY FLATS PLANT AREA 1	0628	FRCC	RFP READING ROOM	E86-007
N/A	09/01/86	DRILLING INVESTIGATION AND CULVERT LOCATION	0518	RFP	T130B	LIBRARY - KATHERINE TAYLOR
N/A	09/01/86	NUCLEAR ENERGY: ENVIRONMENTAL ISSUES AT DOE'S NUCLEAR DEFENSE FACILITIES, REPORT TO THE RANKING MINORITY MEMBER, SUBCOMMITTEE ON ENERGY, NUCLEAR PROLIFERATION, AND GOVERNMENT PROCESSES, COMMITTEE	1143	RFP	EMF / T130B	FOLDER 981
N/A	09/05/86	ANALYTICAL RESULTS OF WASTE STREAM SAMPLES AREA 2,3,4 (VOLS I,II,II)	0630	FRCC	RFP READING ROOM	E 86 - 010
N/A	09/20/86	DUST TRANSPORT - WIND BLOWN AND MECHANICAL RESUSPENSION	0631	FRCC	RFP READING ROOM	RO-75 (3914)

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N/A	11/11/86	DRAFT PRELIMINARY ANALYTICAL RESULTS OF SPECIAL SAMPLES COLLECTED 26 SEPTEMBER TO 3 OCTOBER 1986	0629	FRCC	RFP READING ROOM	E86-011
N/A	12/19/86	OVERVIEW OF THE TERRAIN RESPONSIVE ATMOSPHERIC CODE (TRAC)	1363	RFP	T130 E	EAS LIBRARY
N/A	01/01/87	PUBLIC DISTRUST AND HAZARD MANAGEMENT SUCCESS AT THE ROCKY FLATS NUCLEAR WEAPONS PLANT	1141	RFP	EMF / T130C	FOLDER 981
N/A	01/01/87	JEFFERSON COUNTY TRANSPORTATION PLAN, 1987 MAJOR THOROUGHFARE PLAN READOPTION	1368	GOLDEN CO	HIGHWAYS & TRANS.	18301 W 10TH. AVE., SUITE 220
N/A	01/01/87	BEDROCK AQUIFERS IN THE DENVER BASIN, COLORADO - A QUANTITATIVE WATER RESOURCES APPRAISAL	1237	USGS (DENVER)	LIBRARY	200 qB
N/A	01/13/87	RADIATION ISSUES CONCERNING HIGHWAY W-470 ON PROPOSED CORRIDOR EAST OF THE ROCKY FLATS NUCLEAR WEAPONS PLANT	1149	RFP	T130C	EMF LIBRARY / FOLDER 947
N/A	04/06/87	WASTE STREAM IDENTIFICATION & CHARACTERIZATION. INORGANIC COMPOUNDS DATA REPORT - VOLUME A-1	0641	FRCC	RFP READING ROOM	E87-003 SERIES A
N/A	04/06/87	WASTE STREAM IDENTIFICATION & CHARACTERIZATION REPORT. VOLUMES D-1 AND D-2. PESTICIDES/PCBs COMPOUNDS DATA REPORT	0638	FRCC	RFP READING ROOM	E87-003 SERIES D
N/A	04/06/87	WASTE STREAM IDENTIFICATION & CHARACTERIZATION REPORT. RADIOCHEMICAL COMPOUNDS DATA REPORT VOLUMES E - 1 AND E - 2	0637	FRCC	RFP READING ROOM	87 - 003
N/A	04/06/87	WASTE STREAM IDENTIFICATION & CHARACTERIZATION SEMI - VOLATILE COMPOUNDS DATA REPORT - VOLUMES C-1 TO C-6	0639	FRCC	RFP READING ROOM	E87-003
N/A	04/06/87	WASTE STREAM IDENTIFICATION & CHARACTERIZATION. VOLATILE ORGANIC COMPOUNDS REPORT - VOLUMES B-1 TO B-4	0640	FRCC	RFP READING ROOM	E87-003 SERIES B
N/A	11/03/87	COMPARATIVE UPTAKE OF U AND TH BY NATIVE PLANTS AT A U PRODUCTION SITE	1164	WOODWARD-CLYDE	DENVER	LAUREL PYE'S OFFICE BOOKSHELF
N/A	01/01/88	ASSESSMENT OF ALTERNATIVES TO ROUTINE OPERATION OF THE FLUIDIZED BED INCINERATOR	1253	RFP	T130C	EMF FILE FOLDER #1118,

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N/A	01/01/88	"GROUNDWATER CHEMISTRY"	1250	RFP	T334C	FBI FILE #20304
N/A	01/01/88	PLUTONIUM HAZARDS AND THE PROPOSED ROCKY FLATS INCINERATOR	1155	RFP	T130C	EMF LIBRARY / FOLDER 1040 / ICN
N/A	01/01/88	HEALTH RISK OF RADON AND OTHER INTERNALLY DEPOSITED ALPHA-EMITTERS. BEIR IV.	1408	WCC	12TH FLOOR	JERRY ANDERSEN'S OFFICE
N/A	02/01/88	IMPLEMENTATION PLAN FOR ENVIRONMENTAL SURVEY FINDINGS REVISION 1.0	1351	RFP	T130C	EMF FOLDER 1022 / ICN #0010997
N/A	03/18/88	RADIATION PROTECTION AND THE GENERAL PUBLIC DRAFT	1140	RFP	EMF / T130C	FOLDER 982
N/A	5-1-88	CLOSURE PLAN - BUILDING 443 NO. 4 FUEL OIL TANK	0807	(F88-002) FRCC	RFP READING ROOM	E88-002
N/A	05/04/88	BERYLLIUM AT ROCKY FLATS PLANT	0053	RFP	T334D	CHEM RISK 91CR015, ITEM 30,
N/A	06/01/88	PREDECISIONAL DRAFT ENVIRONMENTAL ASSESSMENT FOR THE FLUIDIZED BED INCINERATOR TRIAL BURN AT THE ROCKY FLATS PLANT	1145	RFP	EMF / T130C	FOLDER 1000 / ICN 0010881
N/A	07/01/88	RESOURCE CONSERVATION AND RECOVERY ACT. PART B - OPERATING PERMIT APPLICATION FOR U.S.D.O.E. - ROCKY FLATS PLANT. TRANSURANIC (TRU) MIXED WASTES CO78900-10526	0068	RFP	T130C	KIRK TIEKNOR
N/A	7/11/88	RCRA PERMITTING AND ENFORCEMENT ISSUES FOR ROCKY FLATS - U.S.D.O.E. NUCLEAR WEAPONS MANUFACTURING FACILITY EPA - ID #CO7890010526	1362	RFP	T334C	FBI FILE, VOL. 83, # 72029
N/A	08/11/88	FINAL CHLORINATED SOLVENT STUDY REPORT - ROCKY FLATS PLANT BUILDING-707	0433	RFP	T334D	CHEM RISK 91CR040 PART 2 ITEM
N/A	09/01/88	UNDERGROUND STORAGE TANK TESTING RESULTS PHASE II REPORT	1133	RFP	T130C	EMF FILE FOLDER 1119-DOC#11974
N/A	09/08/88	JEFFERSON COUNTY/BOULDER COUNTY EMERGENCY RESPONSE PLAN FOR NON-RADIOACTIVE HAZARDOUS MATERIALS INCIDENTS AT ROCKY FLATS PLANT	0916	FRCC	RFP READING ROOM	E88 - 022

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N/A	09/09/88	LETTER-REVIEW OF OFFICE OF RADIATION PROGRAMS' LOW-LET RISK ESTIMATE FOR REGULATORY PURPOSES	0012	FRCC	RFP READING ROOM	E88-026
N/A	10/01/88	SUMMARY OF MAJOR PROBLEMS AT D.O.E.'S ROCKY FLATS PLANT	1334	RFP	T334C	FBI FILE #1100488
N/A	10/03/88	INTERIM STATUS CLOSURE PLAN - BENCH SCALE TREATMENT, UNIT #32	0616	FRCC	RFP READING ROOM	E88-009
N/A	10/12/88	GAO REPORT ON ROCKY FLATS ES & H ACTIVITIES	0428	RFP	T334D	CHEM RISK 91CR040 PART 3 ITEM
N/A	12/01/88	ENVIRONMENT, SAFETY & HEALTH NEEDS OF THE U.S. DEPT OF ENERGY VOLUME 1: ASSESSMENT OF NEEDS	0642	FRCC	RFP READING ROOM	E88-023
N/A	01/01/89	U.S. D.O.E. ROCKY FLATS PLANT MIXED WASTE (RADIOACTIVE MATERIAL) INCINERATOR (TRIAL BURN) PRELIMINARY PUBLIC HEALTH ASSESSMENT	1167	RFP	T130C	EMF FILE 858
N/A	01/01/89	TECHNICAL SAFETY APPRAISAL OF THE ROCKY FLATS PLANT	0914	FRCC	RFP READING ROOM	E89 - 022
N/A	01/01/89	QUALITY ASSURANCE PROGRAM PLAN - ENVIRONMENTAL RESTORATION PROGRAM, ROCKY FLATS PLANT - DRAFT	0915	FRCC	RFP READING ROOM	E89 - 001
N/A	03/01/89	AIR SAMPLES TAKEN AT NORTH & SOUTH SPRAY FIELDS	0461	RFP	T334D	CHEM RISK FILES FOLDER A-226
N/A	03/01/89	ROCKY FLATS IMPACT ON GREAT WESTERN RESERVOIR [FACT SHEET] A REVIEW	0424	RFP	T334D	CHEM RISK FILE FOLDER A224,
N/A	04/01/89	DRAFT SUPPLEMENT ENVIRONMENTAL IMPACT STATEMENT WASTE ISOLATION PILOT PLANT (VOLUME 1 & 2)	0701	FRCC	RFP READING ROOM	E89-006
N/A	04/01/89	MICROBIOLOGICAL EVALUATION OF STP OPERATION AT ROCKY FLATS PLANT	1264	RFP	T334C	FBI FILE / DOCUMENT #501474
N/A	04/01/89	PROPOSAL TO PUMP WATER FROM POND B-5 TO THE UPPER CHURCH DITCH RE: NPDES PERMIT C0-0001333	0459	RFP	T334D	CHEM RISK FILE FOLDER A-226

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N/A	04/25/89	SUMMARY OF DISCUSSION ON TOXICITY DETECTION AND CONTROL IN THE WASTE TREATMENT SYSTEM AT ROCKY FLATS	1223	RFP	T334C	FBI FILE
N/A	05/01/89	ECONOMIC IMPACTS OF ROCKY FLATS, ISSUE PAPER, JEFFERSON COUNTY, COLORADO, PLANNING DEPARTMENT	1365	GOLDEN CO	JEFF. CO. PLANNING DEPT.	18301 W. 10TH. AVE., SUITE 220
N/A	06/12/89	THE JEFFERSON COUNTY OPEN SPACE MASTER PLAN	1519	CITY OF GOLDEN / JEFF	JEFFERSON COUNTY OPEN	18301 W. 10TH. AVE., SUITE 100
N/A	07/03/89	BIOMONITORING RESULTS FROM ROCKWELL'S ROCKY FLATS PLANT	1280	RFP	T334C	FBI FILE 350975
N/A	7/24/89	INVESTIGATION OF THE SURFACE AND GROUNDWATER FLOW MECHANICS OF AN EVAPORATION SPRAY FIELD AT THE ROCKY FLATS NUCLEAR WEAPONS PLANT, JEFFERSON COUNTY, CO.	1411	RFP	T334C	FBI FILE # 121377
N/A	07/25/89	RADIOACTIVE MATERIALS ASSOCIATED WITH ROCKY FLATS PLANT, HEALTH PHYSICS REPORT	0014	FRCC	RFP READING ROOM	E89-049
N/A	07/25/89	SOLID WASTE AND RESIDUE MANAGEMENT SYSTEMS AT ROCKY FLATS PLANT	0625	FRCC	RFP READING ROOM	E89-038
N/A	08/01/89	ATRAZINE AND SIMAZINE MEASUREMENTS OF A-4, B-5, AND C-2 PONDS.	0062	RFP	T 334 D	CHEM RISK FILE FOLDER A-143
N/A	08/01/89	ECONOMIC IMPACT OF THE DEPARTMENT OF ENERGY ON THE COLORADO ECONOMY	0004	FRCC	RFP READING ROOM	E91-049
N/A	08/01/89	LIST OF HERBICIDES USED AT ROCKY FLATS PLANT	0655	FRCC	RFP READING ROOM	
N/A	08/01/89	ROCKY FLATS SEWER PLANT	0626	FRCC	RFP READING ROOM	E89-042
N/A	8/1/89	NORTHEAST JEFFERSON COUNTY COMMUNITY PROFILE REPORT	1515	CITY OF GOLDEN /	JEFFERSON COUNTY	18301 W. 10TH. AVE., SUITE # 220
N/A	08/13/89	ROCKY FLATS 1988-89 CHEMICAL INVENTORY	0013	FRCC	RFP READING ROOM	E89-021

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N/A	09/01/89	INTERIM STATUS CLOSURE PLAN SWMU 25 (STORAGE PAD 750) LOW-LEVEL MIXED WASTE C07890010526	0537	RFP	T 130 B	BOOKSHELF #2 IN NORTHERN
N/A	09/01/89	INTERIM STATUS CLOSURE PLAN SOLID WASTE MANAGEMENT UNIT 16	0623	FRCC	RFP READING ROOM	E89-011
N/A	09/01/89	INTERIM STATUS CLOSURE PLAN SOLID WASTE MANAGEMENT UNIT 26	0624	FRCC	RFP READING ROOM	E89-012
N/A	09/01/89	INTERIM STATUS CLOSURE PLAN SOLID WASTE MANAGEMENT UNIT 63	0627	FRCC	RFP READING ROOM	E89-013
N/A	09/01/89	D.O.E. LAND DISPOSAL RESTRICTION STRATEGY REPORT FOR RADIOACTIVE MIXED WASTE	0911	FRCC	RFP READING ROOM	E89-053
N/A	09/01/89	RISK ASSESSMENT ENVIRONMENTAL IMPACT STATEMENT. NESHAPS (NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS) FOR RADIONUCLIDES. VOLS 1,2,3 & APPENDIX	1406	WCC	11TH FLOOR	JIM BURCH'S OFFICE
N/A	10/1/89	PROTECTING THE RADIATION WORKER AT ROCKY FLATS. PARTICIPANTS WORKBOOK I AND II (2 VOLS.)	0728	FRCC	RFP READING ROOM	E89-045 VOL. 1 & 2
N/A	10/01/89	ROCKY FLATS USAGE OF METHYLENE CHLORIDE	0462	RFP	T334D	CHEM RISK FILE FOLDER A-226,
N/A	10/03/89	ROCKY FLATS USAGE OF TETRACHLOROETHYLENE	0426	RFP	T334D	CHEM RISK 91CR040 PART 3 ITEM
N/A	10/03/89	ROCKY FLATS USAGE OF TRICHLOROETHYLENE	0425	RFP	T334D	CHEM RISK 91CR040 PART 3 ITEM
N/A	11/01/89	APPLIED RESEARCH, DEVELOPMENT, DEMONSTRATION, TESTING, AND EVALUATION PLAN FOR ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT. DRAFT	0917	FRCC	RFP READING ROOM	E89 - 055
N/A	11/08/89	ENVIRONMENTAL ASSESSMENT ACTION PLAN JFM - 1 (17) AUDIT FINDINGS - LEGAL CONSIDERATIONS JFM - 1 (16)	1125	RFP	T334C	FBI FILE VOL.4, 903657
N/A	11/20/89	FY90 IMPACT ASSESSMENT * 89-RF-4015	1360	RFP	T334C	FBI FILE VOL 54 # 39345

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N/A	12/01/89	OCCUPATIONAL INJURY AND PROPERTY DAMAGE SUMMARY	0063	RFP	T334D	CHEM RISK FILE FOLDER A-208
N/A	12/01/89	PRELIMINARY REVIEW OF TRENDS IN TIGER TEAM ASSESSMENTS	1103	FRCC	LIBRARY	RFRR - E90 - 006
N/A	12-18-89	WASTE MINIMIZATION ASSESSMENT REPORT RFP	0727	FRCC	RFP READING ROOM	E89-047
N/A	12/31/89	EMERGENCY PLANNING AND COMMUNITY RIGHT TO KNOW	1361	RFP	T334C	FBI FILE VOL 61 # 703134
N/A	01/01/90	BASELINE REVIEW OF THE RFP COMPLIANCE WITH CATEGORY I DOE ORDERS	0657	FRCC	RFP READING ROOM	
N/A	1-1-90	DISTRIBUTION OF LONG-LIVED RADIONUCLIDES IN AN ABANDONED REACTOR COOLING RESERVOIR, ECOLOGICAL MONOGRAPHS, 60(4), 1990, PP. 471-496	0814	WCC	10TH FLOOR	LAUREL PYE'S OFFICE
N/A	01/01/90	ROCKY FLATS PLANT "RESIDUE CLASSIFICATION PLAN"	0021	FRCC	RFP READING ROOM	E90-069
N/A	01/01/90	START-UP STUDIES FOR THE NEW PLUTONIUM FACILITY AT ROCKY FLATS, BATCH PROCESSING OF PLUTONIUM NITRATE	0644	FRCC	RFP READING ROOM	RO-75 (3556)
N/A	01/01/90	HEALTH EFFECTS OF EXPOSURE TO LOW LEVELS OF IONIZING RADIATION. BEIR V.	1407	WCC	12TH FLOOR	MIKE SAM'S OFFICE
N/A	2-26-90	WIND SPEED ANALYSIS FOR SUPERCOMPACTOR STUDY	0746	RFP	T130B	SHELF 4 BY CUBICLE 25
N/A	3-22-90	ENVIRONMENTAL ASSESSMENT OF SUPERCOMPACTOR AND REPACKAGING FACILITY AND TRU WASTE SHREDDER	0747	RFP	T130B	KATHERINE TAYLOR'S
N/A	04/01/90	THE NORTH PLAINS COMMUNITY PLAN - PART 1 "GOALS AND POLICIES"	1514	CITY OF GOLDEN /	JEFFERSON COUNTY	18301 W. 10TH. AVENUE, SUITE 220
N/A	04/02/90	SPILL PREVENTION COUNTERMEASURE AND BEST MANAGEMENT PRACTICES (SPCC/BMP) PLAN	0412	RFP	T130B	BOOKCASE 52

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N/A	04/05/90	WINTER RAPTOR NESTING AT ROCKY FLATS PLANT AND SURROUNDING AREA, GOLDEN, COLORADO PROJECT 667, TASK 12.25	1165	WOODWARD-CLYDE	DENVER	LAUREL PYE'S OFFICE BOOKSHELF
N/A	05/01/90	COMPOSITIONAL SUMMARY OF MAJOR CONSTITUENTS IN ROCKY FLATS DUCT SAMPLES	0001	FRCC	RFP READING ROOM	E90-011
N/A	05/01/90	MEMO: REVIEW AND RECOMMENDED MODIFICATIONS TO THE RFP GENERIC BASELINE RISK ASSESSMENT PLAN - BA #68157EB	0523	RFP	T130B	LIBRARY- KATHERINE TAYLOR
N/A	06/05/90	RADIATION PROTECTION OF THE PUBLIC AND THE ENVIRONMENT	1404	WCC	11TH FLOOR	JIM BURCH'S OFFICE
N/A	06/11/90	WIND RESUSPENSION OF TRACE AMOUNTS OF PLUTONIUM PARTICLES FROM SOIL IN A SEMI-ARID CLIMATE	0671	FRCC	RFP READING ROOM	# 3633
N/A	06/18/90	U.S. DOE PLUTONIUM RECOVERY MODIFICATION PROJECT. ENVIRONMENTAL IMPACT STATEMENT. PUBLIC SCOPING MEETING	1115	FRCC	RFP READING ROOM	E90 - 020
N/A	06/29/90	ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION INFORMATION REPORTING REQUIREMENTS	1405	WCC	11TH FLOOR	JIM BURCH'S OFFICE
N/A	07/23/90	NATIONAL CANCER INSTITUTE STUDY ON "CANCER MORTALITY IN THE ENVIRONS OF NUCLEAR FACILITIES."	1394	WCC	10TH FLOOR	GREG WALDMAN'S OFFICE
N/A	07/30/90	VELOCITY PROFILES FROM BERYLLIUM EMISSION SOURCES AT THE ROCKY FLATS PLANT	0051	RFP	T334C	CHEM RISK 91CR015, ITEM 36,
N/A	08/01/90	CANCER IN POPULATION LIVING NEAR NUCLEAR FACILITIES VOL. 1-3 (E 90-042)	0007	FRCC	RFP READING ROOM	E90-042 PORTION
N/A	08/16/90	EVALUATION - PA 90-02 ROOT CAUSES EVALUATION PROCEDURES DEVELOPMENT PROBLEMS WITHIN RESUMPTION TEAM 4	0669	FRCC	RFP READING ROOM	E90-047
N/A	01/01/91	FORMS OF OCCURRENCE OF PLUTONIUM IN SOILS, JOURNAL OF RADIO-ANALYTICAL AND NUCLEAR CHEMISTRY, ARTICLES, V.147, NO.1, PP.153-157	1321	RFP	T130B	IGGY LITAOR'S OFFICE #36
N/A	01/01/91	SIZE DETERMINATIONS OF PLUTONIUM COLLOIDS USING AUTOCORRELATION PHOTON SPECTROSCOPY; RADIOCHIMICA ACTA 52/53, 127-131 (1991)	0907	RFP	T130B	LARRY WOODS' OFFICE

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N/A	01/01/91	TECHNICAL MEMORANDUM 1 ADDENDUM TO FINAL PHASE III RFI/RI WORK PLAN	1231	RFP BOULDER OFFICE	4888 PEARL	CARLATTA MUHEINS' OFFICE
N/A	1/1/91	CCS - CHEMICAL CONTROL SYSTEM	2509	RFP	BLDG 881	
N/A	1/1/91	DOSE RECONSTRUCTION PROJECT, ROCK FLATS (PHASE I OF THE HEALTH STUDIES) BRIEFING BOOK 4, DRAFT	94-52	FRCC	RFP READING ROOM	E91-003
N/A	1/1/91	A CLOSER LOOK AT ROCKY FLATS	94-71	FRCC	RFP READING ROOM	E92-008
N/A	02/01/91	CLOSURE PLAN FOR MIXED RESIDUE RECOVERY INCINERATOR BUILDING 771, ROOM 149	0037	FRCC	RFP READING ROOM	E91-009
N/A	02/01/91	OPPORTUNITIES TO WORK WITH DOE'S NEW TECHNOLOGY INTEGRATION PROGRAM IN ENVIRONMENTAL MANAGEMENT	0651	FRCC	RFP READING ROOM	
N/A	02/01/91	"TECHNOLOGY DEVELOPMENT FOR WASTE RETRIEVAL AND PROCESSING"	0606	FRCC	RFP READING ROOM	E91-014
N/A	02/01/91	THE ECONOMIC IMPACT OF ROCKY FLATS OPERATIONS ON COLORADO AND THE DENVER METROPOLITAN AREA	0003	FRCC	RFP READING ROOM	E91-049
N/A	02/01/91	ENVIRONMENTAL ASSESSMENT OF THE PROPOSED ADOPTION AND IMPLEMENTATION OF A UNITED STATES POLICY ON RECEIPT AND REPROCESSING OF SPENT REACTOR FUEL (OFFSITE FUELS POLICY)	0909	FRCC	RFP READING ROOM	E91-034
N/A	03/20/91	RISK OF CANCER MORTALITY IN POPULATIONS LIVING NEAR NUCLEAR FACILITIES.	1393	WCC	10TH FLOOR	GREG WALDMAN'S OFFICE
N/A	03/20/91	MORTALITY AMONG WORKERS AT OAK RIDGE NATIONAL LABORATORY. EVIDENCE OF RADIATION EFFECTS IN FOLLOW-UP THROUGH 1984.	1391	WCC	10TH FLOOR	GREG WALDMAN'S OFFICE
N/A	03/25/91	ROCKY FLATS PLANT PLUTONIUM OPERATIONS PHASED RESUMPTION QUALITY ASSURANCE PROGRAM DESCRIPTION	0910	FRCC	RFP READING ROOM	E91-019
N/A	03/28/91	ACHIEVING FASTER, BETTER, CHEAPER COMPLIANCE THROUGH INTEGRATED DEMONSTRATIONS AND INTEGRATED PROGRAMS	0912	FRCC	RFP READING ROOM	E91 - 012

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N/A	04/04/91	THREATENED AND ENDANGERED SPECIES EVALUATION ROCKY FLATS PLANT SITE	0437	RFP	T130B	KATHERINE TAYLOR'S LIBRARY
N/A	05/01/91	EG&G CORPORATE OPERATIONAL READINESS REVIEW OF THE RFP BUILDING 559 VOL I-VII	0653	FRCC	RFP READING ROOM	
N/A	05/01/91	ENVIRONMENTAL SURVEILLANCE REPORT	0447	RFP	T130B	KATHERINE TAYLOR'S OFFICE
N/A	5/1/91	PROCESS WASTE MINIMIZATION STUDY RFP TASK 19 OF THE ZERO-OFFSITE WATER DISCHARGE STUDY	0720	RFP	T130B	LEE SOBCHAK'S OFFICE
N/A	5/1/91	DOSE RECONSTRUCTION PROJECT, ROCKY FLATS (PHASE I OF THE HEALTH STUDIES) BRIEFING BOOK 5, DRAFT	94-70	FRCC	RFP READING ROOM	E91-025
N/A	6/1/91	DRAFT DRAIN STUDY RFP, TASK 18 OF THE ZERO OFFSITE WATER DISCHARGE STUDY	0717	RFP	T130B	LEE SOBCHAK'S OFFICE
N/A	6/1/91	FINAL DRAFT CONSOLIDATION AND ZERO-DISCHARGE PLAN RFP, TASK 30 OF THE ZERO-OFFSITE WATER DISCHARGE STUDY.	0718	RFP	T130B	LEE SOBCHAK'S OFFICE
N/A	06/01/91	PU UPTAKE BY SELECTED CROP AND NATIVE VEGETATION SPECIES GROWN IN ROCKY FLATS SOILS	1212	WCC	DTC	LAUREL PYE'S OFFICE
N/A	06/11/91	TREATED SEWAGE/PROCESS WASTEWATER STUDY, ROCKY FLATS PLANT SITE. TASKS 11 AND 13 OF THE ZERO-OFFSITE WATER DISCHARGE STUDY. REVISION 1.	1348	EG&G	BOULDER	RUSS APPLEHANS' OFFICE
N/A	06/25/91	REPORT ON DRAIN INVESTIGATIONS, ROCKY FLATS PLANT. TASK 18 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY. FINAL.	1343	EG&G	BOULDER	RUSS APPLEHANS' OFFICE
N/A	07/01/91	LAND DEVELOPMENT REGULATIONS	1518	CITY OF GOLDEN /	JEFF. CO. PLANNING	18301 W 10TH. AVE., SUITE # 220
N/A	07/01/91	DEVELOPMENT OF A SCREENING - LEVEL EMERGENCY PLANNING ZONE FOR NONRADIOACTIVE HAZARDOUS MATERIALS	1375	RFP	T130E	EAS, JOYCE HOOKER
N/A	07/01/91	CONSOLIDATION AND ZERO-DISCHARGE PLAN RFP TASK 30 OF THE ZERO-OFFSITE WATER DISCHARGE STUDY. PREDECISIONAL.	0753	EG&G	BOULDER	RUSS APPLEHANS' OFFICE

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N/A	08/01/91	EG&G ROCKY FLATS ACTION PLAN RELATIVE TO THE U.S. DEPT. OF ENERGY OPERATIONAL READINESS REVIEW ANALYTICAL CHEMISTRY LABORATORY BUILDING 559	1104	FRCC	LIBRARY	E91 - 065
N/A	8/19/91	PHASE II RFI/RI WORK PLAN ALUVIAL (2 VOLUMES)	94-50	BLDG 080	ADM RECORD	MANUAL NO. 21100-WP-OU02.1
N/A	9/1/91	DOSE RECONSTRUCTION PROJECT, ROCKY FLATS (PHASE I OF THE HEALTH STUDIES) BRIEFING BOOK 6, DRAFT	94-54	FRCC	RFP READING ROOM	E91-072
N/A	09/09/91	ROCKY FLATS PLANT BLDG. 559 ASSESSMENT	0035	FRCC	RFP READING ROOM	E91-066
N/A	9/24/91	ROCKY FLATS PLANT ROADMAP ASSESSMENT, ANALYSIS & ISSUE RESOLUTION	94-90	RRP	T130J	END LIBRARY
N/A	10/1/91	EG&G ROCKY FLATS ENVIRONMENTAL MANAGEMENT DEPARTMENT ASSESSMENT OF KNOW, SUSPECT, AND POTENTIAL ENVIRONMENTAL RELEASES OF POLYCHLORINATED BIPHENYLS (PBCS), PRELIMINARY ASSESSMENT/SITE	94-94	BLDG 080	ADM RECORD	A-SW-000305
N/A	10/28/91	TERRAIN - RESPONSIVE ATMOSPHERIC CODE (TRAC) - TRANSPORT AND DISPERSION: FEATURES AND SOFTWARE OVERVIEW.	1527	RFP	T130E	LIBRARY
N/A	10/30/91	A HISTORY OF THE ROCKY FLATS PLUTONIUM/ACTINIDE RECOVERY PLANT 1952 TO 1991(DRAFT)	0548	RFP	T 334 D	CHEMRISK 91CR041 ITEM 7 FILE
N/A	11/01/91	PUBLIC COMMENT RESPONSIVENESS SUMMARY ON PLAN FOR PREVENTION OF CONTAINMENT DISPERSION	1230	RFP BOULDER OFFICE	4888 PEARL	CARLATTA MUHEINS' OFFICE
N/A	11/13/91	HAZARDOUS AIR POLLUTANTS (HAPS) AND OZONE-DEPLETING SUBSTANCES REPORT	94-99	RRP	ROBIN RAMSEY'S OFFICE,	
N/A	11-22-91	SEDIMENT REPORT ON COAL CREEK IN VICINITY OF HEADGATES TO UPPER CHURCH & KINNEAR DITCHES	0818	RFP	T130B	AL BROWN'S OFFICE, 2nd. DRAWER
N/A	12-1-91	WEATHER REPORTS JAN-DEC 1991	0713	RFP	T130B	SHELF
N/A	12/1/91	ENVIRONMENTAL MANAGEMENT RADIOLOGICAL GUIDELINES: MANUAL NO. 3-21000-OPS-EMRG	94-25	BLDG 080	ADM RECORD	000002578

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N/A	12/17/91	ROCKY FLATS PLANT ENVIRONMENTAL DATA MANAGEMENT PLAN	1374	AT WCC		IN FILE 22897
N/A	01/01/92	ROCKY FLATS PLANT TEN - YEAR ENERGY MANAGEMENT PLAN	1537	RFP	BLDG 130	RM 128, DWIGHT STEIN
N/A	02/01/92	QUARTERLY ENERGY CONSERVATION PERFORMANCE REPORT DOE F 6200. 1 REFERENCE DATA	1538	RFP	BLDG 130	RM 128, DWIGHT STEIN
N/A	2/1/92	DOSE RECONSTRUCTION PROJECT, ROCKY FLATS (PHASE I OF THE HEALTH STUDIES) BRIEFING BOOK 7, FEBRUARY 1992	94-55	FRCC	RFP READING ROOM	E92-010
N/A	2/1/92	ROCKY FLATS HISTORY: ROCKY FLATS TOXICOLOGIC REVIEW AND DOSE RECONSTRUCTION TASK 3/4 REPORT, DRAFT	94-57	FRCC	RFP READING ROOM	E92-023
N/A	2/14/92	UTE LADIES' TRESSES FINAL RULE	94-45	BLDG 080	ADM RECORD	OU01-000358
N/A	2/28/92	BACKGROUND GEOCHEMICAL CHARACTERIZATION PLAN ROCKY FLATS PLANT	94-34	FRCC	RFP READING ROOM	E92-014
N/A	3/1/92	DOSE RECONSTRUCTION PROJECT, ROCKY FLATS (PHASE I OF THE HEALTH STUDIES) BRIEFING BOOK 8, MARCH 1992	94-56	FRCC	RFP READING ROOM	E92-022
N/A	3/03/92	RESULTS OF FIELD SURVEY FOR SPIRANTHES DILUVIALIS	94-9	BLDG 080	ADM RECORD	OU01-000333
N/A	3/16/92	MIXED RESIDUE TANK SYSTEMS COMPLIANCE PLAN	94-17	FRCC	RFP READING ROOM	E92-039
N/A	3/16/92	UTE LADIES' TRESSES PRELIMINARY HABITAT SURVEY AT THE ROCKY FLATS PLANT	94-161	BLDG 080	ADM RECORD	D-OU02-000301
N/A	4/16/92	HABITAT SURVEYS FOR DILUVIAM LADIES' TRESSES	94-7	BLDG 080	ADM RECORD	OU02-000306
N/A	4/16/92	HABITAT SURVEYS FOR DILUVIUM LADIES; TRESSES	94-162	BLDG 080	ADM RECORD	D-OU02-000306

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N/A	5/22/92	FINAL INTERIM ACTION BENCH SCALE TREATABILITY STUDY REPORT (VOLUMES I-VI)	94-37	BLDG 080	ADM RECORD	OU02-000368
N/A	9/18/92	LANDFILL EXPLOSIVE GAS CONCENTRATIONS BASELINE DATA COLLECTION	94-3	BLDG 080	ADM RECORD	A-OU07-000075
N/A	9/18/92	HEALTH STUDIES ON ROCKY FLATS: PHASES 1 & 2 - TASKS 3/4: COMMENTS AND RESPONSES	94-62	FRCC	RFP READING ROOM	E92-077
N/A	12/1/92	TRITIUM CONSOLIDATION COMPARISON STUDY: RISK ANALYSIS	94-41	FRCC	RFP READING ROOM	E92-067
N/A	12/1/92	HEALTH STUDIES ON ROCKY FLATS: PHASES 1 & 2, BRIEFING BOOK 10: DECEMBER 1992	94-58	FRCC	RFP READING ROOM	E92-059
N/A	3/1/93	HEALTH STUDIES ON ROCKY FLATS: PHASES 1 & 2, BRIEFING BOOK 11: MARCH 1993	94-59	FRCC	RFP READING ROOM	E93-006
N/A	4/2/93	COMPENDIUM OF IN-SITU RADIOLOGICAL METHODS AND APPLICATIONS AT ROCKY FLATS PLANT, DRAFT	94-26	BLDG 080	ADM RECORD	000013836
N/A	4/12/93	FINAL INTERIM REPORT OF FIELD ACTIVITIES: VADOSE ZONE MONITORING SANITARY TREATMENT PLANT SLUDGE DRYING BEDS BUILDINGS 910 AND 995 ROCKY FLATS PLANT SITE	94-125	FRCC	RRFP READING ROOM	E93-017
N/A	4/26/93	BEFORE THE HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION COLORADO DEPARTMENT OF HEALTH, STATE OF COLORADO: SETTLEMENT AGREEMENT AND COMPLIANCE ORDER ON CONSENT NO. 93-04-23-01: IN THE	94-12	FRCC	RFP READING ROOM	E93-013
N/A	4/27/93	STATUS OF DRUM REMEDIATION EFFORTS IN THE PU&D YARD	94-138	BLDG 080	ADM RECORD	OU10-000074
N/A	5/1/93	HEALTH STUDIES ON ROCKY FLATS: PHASES 1 & 2, BRIEFING BOOK 12: MAY 1993	94-60	FRCC	RFP READING ROOM	E93-015
N/A	5/1/93	HEALTH STUDIES ON ROCKY FLATS: DOSIMETRY WORKING GROUP, BRIEFING BOOK 2: MAY 5, 1993	94-61	FRCC	RFP READING ROOM	E93-016
N/A	11/12/93	WELL EVALUATION REPORT DRAFT FINAL	94-236			

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N/A	1/14/94	THREATENED AND ENDANGERED SPECIES AND MIGRATORY BIRD PROCEDURES	94-191	RFP	T130J	ECOLOGY AND NEPA DIVISION
N/A	1/31/94	PRELIMINARY REPORT ON THE BEHAVIORAL ECOLOGY AND HABITAT USE OF THE STANDLEY LAKE BALD EAGLE PAIR	94-182	BLDG T130B	ECOLOGY AND NEPA	END FILES
N/A	4/1/94	KINEMATICS AND STRUCTURAL MODELS OF FAULTING ADJACENT TO THE ROCKY FLATS PLANT, CENTRAL COLORADO	94-183	BLDG 080	CONNIE DODGE'S OFFICE	ROCKY FLATS PLANT
1	1/10/73	RESPONSE OF SHORTGRASS PLAINS VEGETATION TO GAMMA RADIATION - I. CHRONIC IRRADIATION	1460	WOODWARD-CLYDE	DENVER	GREG WALDMAN'S OFFICE
1	6/12/78	PLUTONIUM CONCENTRATIONS IN ARTHROPODS AT A NUCLEAR FACILITY	1459	WOODWARD-CLYDE	DENVER	GREG WALDMAN'S OFFICE
1	01/01/83	UPDATED INFORMATION ON BURIAL SITES AT ROCKY FLATS PLANT	0058	RFP	T 334 D	CHEM RISK FILE FOLDER A-149
1	01/28/83	ENVIRONMENTAL INVENTORY UPDATED INFORMATION ON BURIAL SITES AT ROCKY FLATS	1221	RFP	T334C	FBI FILE
1	07/01/85	ROCKY FLATS PLANT PAST DISPOSAL AREAS	1222	RFP	T334C	FBI FILE
1	06/02/86	ELECTROMAGNETIC SURVEY, ROCKY FLATS PLANT, GOLDEN, COLORADO	1352	RFP	T130C	EMF FOLDER 1033 / ICN #0011035
1	07/01/87	CHARACTERIZATION OF WASTE SOURCES 3.0	0463	RFP	T334D	CHEM RISK FILE FOLDER A-226
1	07/01/87	REMEDIAL INVESTIGATION REPORT FOR HIGH PRIORITY SITES (881 HILLSIDE AREA) VOL I-V	0434	RFP	T130B	NORTH HALL BOOKSHELF 2
1	03/01/88	REMEDIAL INVESTIGATION REPORT FOR HIGH PRIORITY SITES (881 HILLSIDE AREA)	0705	FRCC	RFP READING ROOM	E88-016
1	3/1/88	FEASIBILITY STUDY REPORT FOR HIGH PRIORITY SITES (881 HILLSIDE AREA) VOLUMES 1 & 2	0751	FRCC	RFP READING ROOM	E88-017

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1	05/02/88	REVEGETATION FOLLOWING ARTIFICIAL DISTURBANCE	1101	RFP	T130B	LARRY WOOD'S OFFICE FILE
1	06/20/88	881 HILLSIDE ENVIRONMENTAL ASSESSMENT	1291	RFP	T334C	FBI FILE # 81200
1	07/01/88	GROUNDWATER MONITORING EVALUATION	0702	RFP	T130B	SHELF 5
1	9/23/88	ENVIRONMENTAL ASSESSMENT REPORT FOR HIGH PRIORITY SITES	0750	FRCC	RFP READING ROOM	E88-005
1	12/22/88	POTENTIAL CONTAMINANT SOURCES FOR NPDES DISCHARGE POINTS (ATTACHMENT NO. 4)	1243	RFP	T130C	EMF LIBRARY/FOLDER
1	01/01/89	BACKGROUND HYDROGEOCHEMICAL CHARACTERIZATION AND MONITORING PLAN	0704	RFP	T130B	SHELF 5
1	10/01/89	PROPOSED INTERIM MEASURES / INTERIM REMEDIAL ACTION PLAN AND DECISION DOCUMENT 881 HILLSIDE AREA HIGH PRIORITY SITES DRAFT FINAL	0080	RFP	TRAILER T130B	OU2 LIBRARY - ASK KATHERINE
1	01/01/90	881 HILLSIDE GEOTECHNICAL INVESTIGATION - HEALTH & SAFETY DOCUMENTATION	0005	FRCC	RFP READING ROOM	
1	01/01/90	ENVIRONMENTAL ASSESSMENT FOR 881 HILLSIDE (HIGH PRIORITY SITES) INTERIM REMEDIAL ACTION	0530	WOODWARD CLYDE	DENVER	LAUREL PYE'S OFFICE BOOKSHELF
1	01/01/90	INTERIM MEASURES / INTERIM REMEDIAL ACTION PLAN AND DECISION DOCUMENT 881 HILLSIDE AREA OPERABLE UNIT NO. 1 FINAL VOL. 1	1251	RFP	T 334 C	FBI FILE #74488
1	06/01/90	881 HILLSIDE RESTORATION PHASE 1-A PROJECT MANAGEMENT PLAN, WORK PROCEDURES, QA PROJECT PLANS FOR CONSTRUCTION AND DRILLING VOL.1&2	0036	FRCC	RFP READING ROOM	E90-009
1	06/01/90	PHASE III RI/FS WORK PLAN ROCKY FLATS PLANT 881 HILLSIDE AREA (OPERABLE UNIT 1) DRAFT FINAL VOLUME 1-TEXT	0529	WOODWARD CLYDE	DENVER	LAUREL PYE'S OFFICE BOOKSHELF
1	10/01/90	FRENCH DRAIN GEOTECHNICAL INVESTIGATION (881 HILLSIDE AREA OU1)	0082	RFP - KATHERINE	T130B	SHELVES BY CUBICLE 40

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1	01/01/91	DATA QUALITY REVIEW OF RFP 881 GENERAL LABORATORY ENVIRONMENTAL ANALYSIS DATA FOR THE RFP ENVIRONMENTAL RESTORATION 881 HILLSIDE	0438	RFP	T130B	KATHY TAYLOR'S LIBRARY - WEST
1	01/01/91	RFP METEOROLOGICAL SITE LOG 881 HILLSIDE STATION	0048	RFP	T 130 B	BOOKSHELF #2 IN NORTH -
1	03/01/91	FINAL PHASE III RFI/RI WORK PLAN ROCKY FLATS PLANT - 881 HILLSIDE AREA (OPERABLE UNIT 1) VOLUME 1 - TEXT	0551	WOODWARD-CLYDE	DENVER	LAUREL PYE'S OFFICE BOOKSHELF
1	3/1/91	FINAL PHASE III RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION, WORK PLAN, REVISION 1, ROCKY FLATS PLANT, 881 HILLSIDE AREA (OPERABLE UNIT NO. 1)	94-177	BLDG 080	ADM RECORD	OU01-000146
1	5/9/91	ATTACHMENT 2 - DRAFT WETLANDS ASSESSMENT FOR CONSTRUCTION OF 881 HILLSIDE INTERIM REMEDIAL ACTION	94-223	BLDG 080	ADM RECORD	OU01-000186
1	5/9/91	ATTACHMENT 1 - DRAFT FEDERAL NOTICE FOR WETLAND INVOLVEMENT FOR 881 HILLSIDE REMEDIAL ACTION CONSTRUCTION IMPACTS ON SOUTH INTERCEPTOR DITCH WETLAND	94-224	BLDG 080	ADM RECORD	OU01-000185
1	5/9/91	SITE PLAN FOR FRENCH DRAIN AND RELATED ELEMENTS SHOWING AFFECTED LENGTHS OF SOUTH INTERCEPTOR DITCH	94-229	BLDG 080	ADM RECORD	OU01-000191
1	5/9/91	ATTACHMENT 3 - DRAFT LETTER TO U.S. ARMY CORPS OF ENGINEERS REQUESTING DETERMINATION ON 404 PERMIT	94-230	BLDG 080	ADM RECORD	OU01-187, 188, 189
1	5/21/91	NEPA DIVISION, PLANT REVIEW CATEGORICAL EXCLUSION WORKSHEET: IAG SITE CHARACTERIZATION ACTIVITIES	94-204	BLDG 080	ADM RECORD	OU01-000265
1	06/01/91	GROUNDWATER PROTECTION AND MONITORING PROGRAM PLAN FINAL DRAFT	0085	FRCC	RFP READING ROOM	E91-033
1	6/1/91	FINAL PHASE III RFI/RI ENVIRONMENTAL EVALUATION WORK PLAN, ROCKY FLATS PLANT, 881 HILLSIDE (OPERABLE UNIT NO. 1)	94-170	BLDG 080	ADM RECORD	OU01-000305
1	6/1/91	ADDENDUM TO FINAL PHASE II RFI/RI WORK PLAN, REVISION 1, ROCKY FLATS PLANT, 881 HILLSIDE AREA (OPERABLE UNIT NO. 1)	94-174	BLDG 080	ADMNISTRATIVE RECORD	OU01-000145
1	6/1/91	ADDENDUM TO FINAL PHASE III RFI/RI WORK PLAN, REVISION 1, ROCKY FLATS PLANT, 881 HILLSIDE AREA (OU1)	94-234	BLDG 080	ADM RECORD	OU01-000145

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1	6-18-91	CONFIRMATION OF RAINFALL - RUNOFF RELATIONSHIPS STUDY. TASK 5 OF THE ZERO - OFFSITE WATER - DISCHARGE STUDY. FINAL	0735	RFP	T130B	LEE SOBCHAK'S OFFICE
1	7/10/91	SECTION D DETERMINATION CATEGORICAL EXCLUSION (CX) DETERMINATION RFP/CX010-91: OU1 AND OU2 SURFICIAL SOIL SIMULATION AND SAMPLING AT THE 903 PAD AREA AT RFP	94-205	BLDG 080	ADM RECORD	OU01-000520
1	8/1/91	TECHNICAL MEMORANDUM 1 ADDENDUM TO FINAL PHASE III RFI/RI WORK PLAN, CHEMICAL ANALYSIS PLAN, ROCKY FLATS PLANT, 881 HILLSIDE AREA (OPERABLE UNIT NO. 1)	94-172	BLDG 080	ADM RECORD	OU01-000151
1	8/27/91	PROJECT MANAGEMENT MANUAL, OPERABLE UNIT NO. 1, 881 HILLSIDE AREA	94-2	BLDG 080	ADM RECORD	OU01-000503
1	10-1-91	ASSESSMENT OF KNOWN SUSPECT AND POTENTIAL ENVIRONMENTAL RELEASES OF PCBs, PRELIMINARY ASSESSMENT OF SITE / DESCRIPTION	0737	RFP	T130B	LEE SOBCHAK'S OFFICE
1	11/01/91	ENDANGERED SPECIES ACT COMPLIANCE "881" HILLSIDE FRENCH DRAIN (881 HFD) PROJECT	1130	WOODWARD-CLYDE	DENVER	LAUREL PYE'S OFFICE
1	11/1/91	FISH AND WILDLIFE COORDINATION ACT MIGRATORY BIRD TREATY ACT COMPLIANCE 881 HILLSIDE FRENCH DRAIN (881-HFD) PROJECT FINAL HABITAT SURVEY REPORT	1166	WOODWARD-CLYDE	DENVER	LAUREL PYE'S OFFICE BOOKSHELF
1	11/1/91	PROJECT MANUAL OPERABLE UNIT NO. 1, 881 HILLSIDE IRA, CONSTRUCTION PHASE IIB, WATER TREATMENT FACILITY COLLECTION AND DISCHARGE SYSTEM	94-10	BLDG 080	ADM RECORD	MICROFICHE
1	11/1/91	TECHNICAL MEMORANDUM 4-ADDENDUM TO FINAL PHASE III RFI/RI WORK PLAN TRACER TEST PLAN, 881 HILLSIDE AREA (OU1)	94-28	BLDG 080	ADM RECORD	OU01-000327
1	11/1/91	TECHNICAL MEMORANDUM 4, ADDENDUM TO FINAL PHASE III RFI/RI WORK PLAN TRACER TEST PLAN 881 HILLSIDE AREA (OPERABLE UNIT NO. 1)	94-173	BLDG 080	ADM RECORD	OU01-000327
1	11/1/91	TECHNICAL MEMORANDUM 3 ADDENDUM TO FINAL PHASE III RFI/RI WORK PLAN MULTI-WELL PUMPING TEST PLAN 881 HILLSIDE AREA (OPERABLE UNIT NO. 1)	94-175	BLDG 080	ADM RECORD	OU01-000326
1	12/01/91	PLAINS SHARP-TAILED GROUSE RECOVERY PLAN	1173	CDOW CENTRAL	DENVER	DAVE WEBERS OFFICE
1	12/17/91	NATIONWIDE 404 PERMIT FOR THE FRENCH DRAIN IN OU1	94-228	BLDG 080	ADM RECORD	OU0112768

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1	12/20/91	ENVIRONMENTAL RESTORATION PROGRAM MONTHLY REPORT FOR NOVEMBER, 1991	0069	RFP	T130B	CUBICLE #28 - TOM OTTENSMAN
1	1/1/92	SYSTEMS OPERATION AND OPTIMIZATION TEST REPORT, FINAL, INTERIM MEASURE/INTERIM REMEDIAL ACTION FOR THE 881 HILLSIDE OPERABLE UNIT 1	94-48	BLDG 080	ADM RECORD	OU01-000455
1	2/1/92	DRAFT FINAL TECHNICAL MEMORANDUM 5, ADDENDUM TO FINAL PHASE III RFI/RI WORK PLAN, SURFACE SOIL SAMPLING AND ANALYSIS PLAN, ROCKY FLATS PLANT 881 HILLSIDE AREA (OPERABLE UNIT NO. 1)	94-169	BLDG 080	ADM RECORD	OU01-000308
1	2/1/92	WORKPLAN FOR THE STARTUP AND O&M OF THE IM/IRA FOR THE 881 HILLSIDE OU 1	94-231	BLDG 080	ADM RECORD	MANUAL 21100 WP OU 01.5
1	2/26/92	CORRESPONDENCE REQUESTING CONSULTATION FOR OU1	94-46	BLDG 080	ADM RECORD	OU01-000358
1	4/1/92	FISH AND WILDLIFE COORDINATION ACT MIGRATORY BIRD TREATY ACT ENDANGERED SPECIES ACT COMPLIANCE, 881 HILLSIDE FRENCH DRAIN (881-HFD) PROJECT, DRAFT HABITAT MITIGATION PLAN	94-232	BLDG 080	ADM RECORD	OU01-000350
1	5/1/92	RESPONSE TO EPA COMMENTS: FRENCH DRAIN (OU1) HABITAT MITIGATION PLAN	94-233	BLDG 080	ADM RECORD	OU01-000410
1	6/1/92	PUBLIC HEALTH RISK ASSESSMENT 881 HILLSIDE AREA (OU1) TECHNICAL MEMORANDUM NO. 6 EXPOSURE SCENARIOS, REVISION 4.0	94-171	BLDG 080	ADM RECORD	OU01-000413
1	6/8/92	FINAL INTERIM MEASURE/INTERIM REMEDIAL ACTION FRENCH DRAIN PERFORMANCE MONITORING PLAN, ROCKY FLATS PLANT 881 HILLSIDE AREA (OPERABLE UNIT NO. 1)	94-176	B.DG 080	ADM RECORD	OU01-000364
1	7/1/92	DESCRIPTION OF MODELS FOR THE PUBLIC HEALTH EVALUATION OPERABLE UNIT ONE ROCKY FLATS PLANT, COLORADO, TECHNICAL MEMORANDUM NO. 7, REVISION 2.0	94-243			
1	9/1/92	PUBLIC HEALTH RISK ASSESSMENT, 881 HILLSIDE AREA (OU1) TECHNICAL MEMORANDUM NO. 9, TOXICITY CONSTANT	94-47	BUDG 080	ADM RECORD	OU01-000419
1	9/1/92	PUBLIC HEALTH EVALUATION, 881 HILLSIDE AREA (OU1), TECHNICAL MEMORANDUM NO. 8 CONTAMINANT IDENTIFICATION, DRAFT	94-226	BLDG 080	ADM RECORD	OU01-0000419
1	11/1/92	SYSTEMS OPERATION AND OPTIMIZATION TEST REPORT, INTERIM MEASURE/INTERIM REMEDIAL ACTION FOR THE 881 HILLSIDE OPERABLE UNIT 1, FINAL	94-242	RFP		

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1	11/6/92	SECTION D DETERMINATION CATEGORICAL EXCLUSION (CX) DETERMINATION - RFP/CX017-910- FIELD ACTIVITIES FOR GEOLOGIC AND ECOLOGIC CHARACTERIZATION AT RFP	94-211	BLDG 080	ADM RECORD	OU05-000105
1	10/23/94	ATTACHMENT 2, DRAFT TEXT FOR "STATEMENT OF FINDINGS" FOR CONDUCT OF IAG SITE CHARACTERIZATION ACTIVITIES IN FLOODPLAINS/WETLANDS	94-180	BLDG 080	ADM RECORD	OU01-000271
2	01/01/84	ACTIVITY, SIZE, & FLUX OF RESUSPENDED PARTICLES FROM ROCKY FLATS SOIL, IN PRECIPITATION SCAVENGING, DRY DEPOSITION, & RESUSPENSION	0663	FRCC	RFP READING ROOM	RO-75 (3461)
2	01/01/84	AN ANALYSIS OF RESUSPENSION SOURCE AREA IMPACTS AT ROCKY FLATS SURVEILLANCE AIR SAMPLES S-7 AND S-8	0672	FRCC	RFP READING ROOM	# 3647
2	11/29/84	HS&E APPLICATION TECHNOLOGY, BRANCH PROGRESS REPORT, JULY 1982 THROUGH JULY 1983 RFP-3689	1319	RFP	T130B	T130B/IGGY LITAOR'S OFFICE
2	07/02/87	903 ASPHALT PAD PROPOSED USE AS A HAZARDOUS / MIXED WASTE STORAGE AREA	1273	RFP	T334C	FBI FILE #800101
2	12/31/87	REMEDIAL INVESTIGATION REPORT FOR 903 PAD, MOUND, AND EAST TRENCHES REPORT	0504	RFP	T130B	SHELF 6 AT BOOKCASES - CHECK
2	3-31-88	GROUNDWATER MONITORING AT REGULATED UNITS, ROCKY FLATS PLANT, GOLDEN, COLORADO	0743	FRCC	RFP READING ROOM	E88-013
2	09/09/88	ENVIRONMENTAL SURVEY JULY 1988	1157	RFP	T130C	EMF LIBRARY / FOLDER 1086
2	09/16/88	903 PAD SOIL DECONTAMINATION	1171	RFP	T 334 C	FBI FILE
2	08/01/89	A LISTING OF ROCKY FLATS PROBLEM WASTES	0429	RFP	T334D	CHEM RISK 91CR040 PART 3 ITEM 8
2	11/01/89	PROPOSED INTERIM MEASURES / INTERIM REMEDIAL ACTION PLAN AND DECISION DOCUMENT 903 PAD, MOUND AND EAST TRENCHES AREAS.	1412	RFP	T334C	FBI FILE # 122370
2	12/01/89	RESUSPESION OF ROCKY FLATS SOIL PARTICLES CONTAINING PLUTONIUM PARTICLES - A REVIEW	0430	RFP	T334D	CHEM RISK 1014 RF ITEM 3 FILE

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2	04/01/90	RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION FEASIBILITY STUDY WORK PLAN (ALLUVIAL): PHASE II; 903 PAD, MOUND AND EAST TRENCHES AREAS (OU NO.2)	0086	FRCC	RFP READING ROOM	E90-022
2	09/01/90	RADIOECOLOGICAL INVESTIGATIONS AT ROCKY FLATS	0002	FRCC	RFP READING ROOM	E90-041
2	09/26/90	PROPOSED SURFACE WATER INTERIM MEASURES / INTERIM REMEDIAL ACTION PLAN AND DECISION DOCUMENT (OU 2)	0011	FRCC	RFP READING ROOM	E90-038
2	11-15-90	COLLECTION OF SOIL SAMPLES IN THE VICINITY OF OPERABLE UNIT 2 (903 PAD, MOUND, EAST TRENCHES)	0802	RFP	T130B	LARRY WOOD'S OFFICE
2	01/01/91	PHASE II RFI/RI WORK PLAN (BEDROCK) DRAFT FINAL 903 PAD, MOUND AND EAST TRENCHES AREAS OPERABLE UNIT NO.2 (0U2)	0072	RFP	T130B BOOKCASE 11	BETWEEN CUBICLES 39-40, ASK
2	01/02/91	TASK 3 SHALLOW, HIGH-RESOLUTION SEISMIC REFLECTION PROFILING IN OPERABLE UNIT 2 (903 PAD, EAST TRENCHES, & MOUND) AT THE ROCKY FLATS PLANT. (FINAL REPORT)	0026	FRCC	RFP READING ROOM	E91-030
2	1/11/91	PROPOSED SURFACE WATER INTERIM MEASURES/INTERIM REMEDIAL ACTION PLAN/ENVIRONMENTAL ASESSMENT AND DECISION DOCUMENT, SOUTH WALNUT CREEK BASIN OPERABLE UNIT NO. 2	94-140	BLDG 080	ADM RECORD	OU02-000254
2	2/1/91	TASK 3: SHALLOW, HIGH-RESOLUTION SEISMIC REFLECTION PROFILING IN OPERABLE UNIT 2 (903 PAD, EAST TRENCHES, AND MOUND) AT THE ROCKY FLATS PLANT	94-141	FRCC	RFP READING ROOM	E91-030
2	2/1/91	TASK 3 SHALLOW, HIGH-RESOLUTION SEISMIC REFLECTION PROFILING IN OPERABLE UNIT 2 (903 PAD, EAST TRENCHES, AND MOUND) AT THE ROCKY FLATS PLANT	94-158	BLDG 080	ADM RECORD	WHO
2	02/10/91	PROPOSED SURFACE WATER INTERIM MEASURES INTERIM REMEDIAL ACTION PLAN / ENVIRONMENTAL ASSESSMENT AND DECISION DOCUMENT WOMAN CREEK BASIN OU 2	1232	RFP BOULDER OFFICE	4888 PEARL ST.	CARLATTA MUHEINS' OFFICE
2	03/08/91	FINAL SURFACE WATER INTERIM MEASURES/INTERIM REMEDIAL ACTION PLAN/ENVIRONMENTAL ASSESSMENT & DECISION DOCUMENT SOUTH WALNUT CREEK BASIN OPERABLE UNIT NO. 2	0079	AT RFP	TRAILER T130B	OU2 CABINET-ASK KATHERINE
2	3/8/91	SURFACE WATER INTERIM MEASURES/INTERIM REMEDIAL ACTION PLAN/ENVIRONMENTAL ASSESSMENT AND DECISION DOCUMENT: SOUTH WALNUT CREEK BASIN: OPERABLE UNIT NO. 2, FINAL (2 VOLUMES)	94-44	FRCC	RFP READING ROOM	E91-008
2	05/01/91	IN SITU SURVEYS OF THE U.S.D.O.E.'S ROCKY FLATS PLANT EGG-10617-1129 UC-702.	1317	RFP	T130B	IGGY LITAOR'S OFFICE #36

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2	05/01/91	ON SITE SURVEYS OF THE UNITED STATES DEPARTMENT OF ENERGY	0515	RFP	T130B	LIBRARY - KATHERINE TAYLOR
2	06/01/91	PHASE II RFI/RI WORK PLAN (BEDROCK) RFP 903 PAD, MOUND AND EAST TRENCHES AREAS OU2	0552	RFP	RFP	ADMINISTRATIVE RECORD
2	06/01/91	RADIOECOLOGICAL INVESTIGATIONS AT ROCKY FLATS	0025	FRCC	RFP READING ROOM	E91 - 035
2	6-1-91	STUDY OF DOWNSTREAM EROSION POTENTIAL RFP TASK 25 OF THE ZERO-OFFSITE WATER DISCHARGE STUDY	0721	RFP	T130B	LEE SOBCHAK'S OFFICE
2	6/1/91	PHASE II RFI/RI WORK PLAN (BEDROCK) FINAL, 903 PAD, MOUND AND EAST TRENCHES AREAS (OU2)	94-142	BLDG 080	ADM RECORD	MANUAL NO. 21100-WP-OU02.2
2	7/16/91	QUALITY ASSURANCE ADDENDUM QAA 2.2 TO THE ROCKY FLATS PLANT SITE-WIDE QA PROJECT PLAN FOR CERCLA RI/RF AND RCRA RFI/CMS FOR OPERABLE UNIT NO 2 (BEDROCK) 903 PAD, MOUND, AND EAST TRENCH AREAS, PHASE II RFI/RI	94-143	BLDG 080	ADM RECORD	OU02-000073
2	7/16/91	QUALITY ASSURANCE ADDENDUM QAA 2.1 TO THE ROCKY FLATS PLANT SITE-WIDE QA PROJECT PLAN FOR CERCLA RI/RF AND RCRA RFI/CMS FOR OPERABLE UNIT NO 2 (BEDROCK) 903 PAD, MOUND, AND EAST TRENCH AREAS, PHASE II RFI/RI	94-144	BLDG 080	ADM RECORD	
2	7/16/91	QUALITY ASSURANCE ADDENDUM FOR OPERABLE UNIT NO. 2 (BEDROCK), 903 PAD, MOUND, AND EAST TRENCHES AREA PHASE II RFI/RI	94-240	BLDG 080	ADM RECORD	
2	08/19/91	SURFICIAL SOIL SAMPLING PLAN, ATTACHMENT 1.0 TO TECHNICAL MEMORANDUM 1. FINAL PHASE II RFI/RI WORK PLAN, 903 PAD, MOUND, AND EAST TRENCHES AREA (OU NO. 2)	0643	RFP	T130B	ERIC DILLE'S CUBICLE #79
2	08/19/91	TECHNICAL MEMORANDUM 1, FINAL PHASE II RFI/RI WORK PLAN (ALLUVIAL), 903 PAD, MOUND & EAST TRENCHES AREA, OPERABLE UNIT NO.2	0064	BLDG 080	ADM RECORD	OU02-000098
2	08/19/91	PHASE II RFI/RI WORK PLAN ALLUVIAL MANUAL NO 21100-WP-OU 02.1 VOLUMES I AND II	1228	BOULDER RFP OFFICE	4888 PEARL ST.	CARLATTA MUHEIN
2	08/23/91	PHASE I WORK PLAN SOUTH WALNUT CREEK MANUAL NO. 21100-WP-OU 2.3 FINAL	1229	RFP BOULDER OFFICE	4888 PEARL ST.	CARLOTTA MUHEIN'S OFFICE
2	8/23/91	PHASE I WORK PLAN, FIELD TREATABILITY STUDY GRANULAR ACTIVATED CARBON TREATMENT SYSTEM, SOUTH WALNUT CREEK BASIN SURFACE WATER INTERIM REMEDIAL ACTION, OU2	94-30	BLDG 080	ADM RECORD	MANUAL NO. 21100-WP-OU02.3

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2	8/30/91	PROJECT MANAGEMENT MANUAL OPERABLE UNIT NO. 2, SOUTH WALNUT CREEK	94-49	BLDG 080	ADM RECORD	MANUAL NO. 21100-PM OU02.3
2	8/30/91	QUALITY ASSURANCE ADDENDUM TO THE ROCKY FLATS SITE-WIDE QUALITY ASSURANCE PROJECT PLAN FOR OPERABLE UNIT NO. 2 SURFACE WATER TREATMENT FACILITY	94-241	BLDG 080	ADM RECORD	
2	9/1/91	TECHNICAL MEMORANDUM 2: ADDENDUM TO FINAL PHASE II RFI/RI WORK PLANS (ALLUVIAL AND BEDROCK), CHEMICAL ANALYSIS PLAN, REV. 2 (OU2)	94-66	BLDG 080	ADM RECORD	OU02-000076
2	10/02/91	DRAFT PROPOSED SURFACE WATER INTERIM MEASURES/INTERIM REMEDIAL ACTION PLAN/ENVIRONMENTAL ASSESSMENT AND DECISION DOCUMENT (OU2)	0505	BLDG 080	ADM RECORD	
2	10/29/91	ATTACHMENT 3, REVIEW OF BASELINE RISK ASSESSMENT AND EE SECTIONS OF: OCT 91 PRELIMINARY DRAFT PHASE I RFI/RI WORK PLAN FOR OU10; AND JUNE 1991, FINAL PHASE II WORK PLAN (BEDROCK), OU2	94-209	BLDG 080	ADM RECORD	OU10-000037
2	11/14/91	DRAFT PLUTONIUM IN SOILS TREATABILITY STUDIES WORK PLANS: TRUCLEAN PROCESS AND MAGNETIC SEPARATION, OU2, VOLS 1 & 2	94-145	BLDG 080	ADM RECORD	
2	12/1/91	TECHNICAL MEMORANDUM 2, ADDENDUM TO FINAL PHASE II RFI/RI WORK PLANS (ALLUVIAL AND BEDROCK) CHEMICAL ANALYSIS PLAN OU2, REV. 3	94-146	BLDG 080	ADM RECORD	OU02-000182
2	12/1/91	TECHNICAL MEMORANDUM 2 ADDENDUM TO FINAL PHASE II RFI/RI WORK PLANS (ALLUVIAL AND BEDROCK) CHEMICAL ANALYSIS PLAN, REVISION 3, ROCKY FLATS PLANT, 903 PAD, MOUND AND EAST TRENCHES AREA (OPERABLE UNIT NO. 2)	94-159	BLDG 080	ADM RECORD	OU02-000182
2	12-16-91	PROPOSED SUBSURFACE INTERIM MEASURES / INTERIM REMEDIAL ACTION PLAN / ENVIRONMENTAL ASSESSMENT AND DECISION DOCUMENT (OU2) PRELIMINARY DRAFT	0729	RFP	T130B	DENNIS PONTIUS' OFFICE
2	3/2/92	PROPOSED SUBSURFACE INTERIM MEASURES / INTERIM REMEDIAL ACTION PLAN / ENVIRONMENTAL ASSESSMENT AND DECISION DOCUMENT. OU2. VOL I AND II.	1240	RFP	T130B	KATHERINE TAYLOR'S OFFICE
2	3/20/92	PROPOSED SUBSURFACE INTERIM MEASURES/INTERIM REMEDIAL ACTION PLAN ENVIRONMENTAL ASSESSMENT AND DECISION DOCUMENT, OPERABLE UNIT NO. 2	94-11	FRCC	RFP READING ROOM	E92-015
2	5/1/92	FINAL SUMMARY AND ANALYSIS OF RESULTS, FIELD TREATABILITY STUDY GRANULAR ACTIVATED CARBON TREATMENT SYSTEM PHASE 1, OU2	94-36	BLDG 080	ADM RECORD	OU02-000338
2	5/1/92	FINAL SUMMARY AND ANALYSIS OF RESULTS, FIELD TREATABILITY STUDY GRANULAR ACTIVATED CARBON TREATMENT SYSTEM PHASE I,SOUTH WALNUT CREEK BASIN SURFACE WATER INTERIM MEASURE/INTERIM REMEDIAL ACTION,	94-147	FRCC	RFP READING ROOM	E92-036

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2	5/1/92	FINAL SUMMARY AND ANALYSIS OF RESULTS FIELD TREATABILITY STUDY GRANULAR ACTIVATED CARBON TREATMENT SYSTEM PHASE I, SOUTH WALNUT CREEK BASIN SURFACE WATER INTERIM MEASURE/INTERIM REMEDIAL ACTION,	94-165	BLDG 080	ADM RECORD	D-OU02-000338
2	5/22/92	FINAL INTERIM REMEDIAL ACTION BENCH SCALE TREATABILITY STUDY REPORT, VOLUME I, 903 PAD, MOUND, AND EAST TRENCHES AREAS (SOUTH WALNUT CREEK), OPERABLE UNIT NO. 2	94-164	BLDG 080	ADM RECORD	OU02-000368
2	6/12/92	FINAL TECHNICAL MEMORANDUM 3, PHASE II RFI/RI AQUIFER TEST WORK PLAN (ALLUVIAL), OU2	94-148	BLDG 080	ADM RECORD	OU07-000339
2	8/20/92	SUBSURFACE INTERIM MEASURES/INTERIM REMEDIAL ACTION PLAN/ENVIRONMENTAL ASSESSMENT AND DECISION DOCUMENT, OU2, VOLS 1 & 2, FINAL	94-65	BLDG 080	ADM RECORD	OU02-000399
2	8/20/92	SUBSURFACE INTERIM MEASURES/INTERIM REMEDIAL ACTION PLAN/ENVIRONMENTL ASSESSMENT AND DECISION DOCUMENT, OPERABLE UNIT NO. 2 VOLUME I,FINAL	94-160	BLDG 080	ADM RECORD	OU02-000399
2	8/20/92	SURSURFACE INTERIM MEASURES/INTERIM REMEDIAL ACTION PLAN/ENVIRONMENTAL ASSESSMENT AND DECISION DOCUMENT OPERABLE UNIT NO. 2, VOLUME I, FINAL	94-160	BLDG 080	ADM RECORD	
2	9/10/92	FINAL SUBSURFACE INTERIM MEASURES/INTERIM REMEDIAL ACTION PLAN AND DECISION DOCUMENT FOR THE 903 PAD, MOUND, AND EAST TRENCHES AREA (OPERABLE UNIT NO. 2), PUBLIC COMMENT, RESPONSIVENESS SUMMARY	94-150	FRCC	RFP READING ROOM	092-049
2	9/10/92	FINAL SUBSURFACE INTERIM MEASURES/INTERIM REMEDIAL ACTION PLAN/ ENVIRONMENTAL ASSESSMENT AND DECISION DOCUMENT, OPERABLE UNIT NO. 2	94-149	FRCC	RFP READING ROOM	E92-048
2	11/19/92	FINAL PHASE II RFI/RI AQUIFER TEST REPORT 903 PAD, MOUND AND EAST TRENCHES AREAS (OPERABLE UNIT NO. 2)	94-38	BLDG 080	ADM RECORD	OU02-000474
2	11/19/92	FINAL PHASE II RFI/RI AQUIFER TEST REPORT, VOLUME 1-TEST, ROCKY FLATS PLANT, 903 PAD, MOUND, AND EAST TRENCHES AREAS (OPERABLE UNIT NO.2)	94-167	BLDG 080	ADM RECORD	OU02-000474
2	12/4/92	DRAFT OBSERVATIONS ON THE OCCURRENCE OF PLUTONIUM AND AMERICIUM IN GROUND AND SURFACE WATER, OU2	94-151	BLDG 080	ADM RECORD	OU02-000473
2	12/4/92	OBSERVATIONS ON THE OCCURRENCE OF PLUTONIUM AND AMERICIUM IN GROUND AND SURFACE WATER, ROCKY FLATS PLANT, 903 PAD, MOUND, AND EAST TRENCHES AREAS, OPERABLE UNIT NO. 2, DRAFT	94-163	BLDG 080	ADM RECORD	OU02-000473
2	1/1/93	TECHNICAL MEMORANDUM NO. 5 HUMAN HEALTH RISK ASSESSMENT, 903 PAD, MOUND, AND EAST TRENCHES AREAS, OU2, EXPOSURE SCENARIO, DRAFT FINAL	94-152	BLDG 080	ADM RECORD	OU02-000543

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2	1/1/93	TECHNICAL MEMORANDUM NO. 6 HUMAN HEALTH RISK ASSESSMENT, 903 PAD, MOUND, AND EAST TRENCHES AREAS, OU2, MODEL DESCRIPTION, DRAFT FINAL	94-153	BLDG 080	ADM RECORD	OU02-000542
2	1/1/93	TECHNICAL MEMORANDUM NO. 5, HUMAN HEALTH RISK ASSESSMENT 903 PAD, MOUND, AND EAST TRENCHES AREA, OPERABLE UNIT NO. 2 EXPOSURE SCENARIOS, DRAFT FINAL, ROCKY FLATS PLANT	94-166	BLDG 080	ADM RECORD	OU02-000543
2	1/12/93	FINAL PILOT TEST PLAN SOIL VAPOR EXTRACTION TECHNOLOGY, SUBSURFACE INTERIM MEASURES/ INTERIM REMEDIAL ACTION, OU2	94-154	BLDG 080	ADM RECORD	DOCUMENT NO. 21000-WP-OU02.07
2	2/1/93	FINAL TECHNICAL MEMORANDUM NO. 7, ADDENDUM TO FINAL PHASE II RFI/RI WORK PLAN, SURFACE SOIL SAMPLING AND ANALYSIS PLAN, OU2	94-155	BLDG 080	ADM RECORD	OU02-OOO544
2	2/1/93	FINAL TECHNICAL MEMORANDUM NO. 7 ADDENDUM TO FINAL PHASE II RFI/RI WORK PLAN, SURFACE SOIL SAMPLING AND ANALYSIS PLAN, ROCKY FLATS PLANT 903 PAD, MOUND, AND EAST TRENCHES (OPERABLE UNIT NO. 2)	94-168	BLDG 080	ADM RECORD	OU02-000544
2	3/1/93	DRAFT FINAL TECHNICAL MEMORANDUM NO. 8, REVISED PHASE II RFI/RI WORK PLAN, (BEDROCK), OU2	94-156	BLDG 080	ADM RECORD	OU02-OOO571
2	3/1/93	DRAFT FINAL TECHNICAL MEMORANDUM NO. 8, REVISED PHASE II RFI/RI WORK PLAN (BEDROCK), ROCKY FLATS PLANT, 903 PAD, MOUND, AND EAST TRENCHES, (OPERABLE UNIT NO. 2)	94-157	BLDG 080	ADM RECORD	
2	4/30/93	FINAL REPORT RADIOECOLOGICALINVESTIGATIONS AT ROCKY FLATS	94-195	RFP	T130B	ECOLOGY AND NEPA DIVISION
2	12/1/93	PRELIMINARY DRAFT, PHASE II RFI/RI REPORT 903 PAD, MOUND AND EAST TRENCHES AREA OPERABLE UNIT NO. 2, VOLUME 1	94-179	PETE LAURIIN'S OFFICE	BLDG 080	
3	08/06/76	"PLUTONIUM HAZARD IN RESPIRABLE DUST ON THE SURFACE OF SOIL" SCIENCE AUGUST 6, 1976, VOL.193,PP.488-490	1114	RFP	T130C	EMF FOLDER 1101 ICN#0011806
3	12/01/77	RE: REQUEST FOR LOCAL AGENCY REVIEW OF REZONING APPLICATION B77-75 AND RE: P.E. ROBBINS 12785 W. 88TH AVE., ARVADA, CO	1122	RFP	T130C	EMF FOLDER 1101 ICN#0011806
3	9/1/78	DISPERSION OF PLUTONIUM FROM CONTAMINATED POND SEDIMENTS, ENVIRONMENTAL SCIENCE AND TECHNOLOGY, V. 12, PP. 1085-1087	0810	RFP	T130B	AL BROWN'S OFFICE
3	03/16/79	PLUTONIUM CONCENTRATIONS IN SOIL ON LANDS ADJACENT TO THE ROCKY FLATS PLANT	1247	RFP	T130C	EMF LIBRARY / FOLDER 465 / ICN

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3	01/21/81	PLUTONIUM IN SOIL ADJACENT TO THE ROCKY FLATS PLANT, IN ENVIRONMENTAL STUDIES GROUP PROGRESS REPORT FOR 1979.	1389	WCC	10TH FLOOR	GREG WALDMAN'S OFFICE
3	02/21/81	HISTORY & EVALUATION OF REGIONAL RADIONUCLIDE WATER MONITORING & ANALYSIS AT THE ROCKY FLATS INSTALLATION, RFP-3019	0664	FRCC	RFP READING ROOM	RO-75 (3019)
3	04/01/81	RADIONUCLIDE CONCENTRATIONS IN RESERVOIRS, STREAMS AND DOMESTIC WATERS NEAR THE ROCKY FLATS INSTALLATION	0040	RFP	T130B	MICHAEL GUILLAUME'S OFFICE
3	06/01/83	GENERAL SEDIMENT SAMPLING PROGRAM, PROPOSED OFF-SITE SAMPLING ACTIVITIES	1575	WOODWARD CLYDE	DENVER	GREG WALDMAN'S OFFICE
3	10/07/83	SOIL SAMPLE COLLECTION AND ANALYSIS FOR PLUTONIUM GREAT WESTERN RESERVOIR CITY OF BROOMFIELD	1332	RFP	EMF / T130C	FOLDER 355 / 00004978
3	01/01/84	GREAT WESTERN RESERVOIR SEDIMENT SAMPLING STUDY ENVIRONMENTAL ANALYSIS AND CONTROL	1271	RFP	T334C	FBI FILE #600684
3	01/01/1984	GREAT WESTERN RESERVOIR STUDY (PRESENTATION)	1409	WOODWARD CLYDE	DENVER	GREG WALDMAN'S OFFICE
3	05/04/84	SUBJECT: RESULTS FROM GREAT WESTERN RESERVOIR SURFICIAL SEDIMENT SAMPLES AND SOIL SAMPLES	1147	RFP	T130C	EMF LIBRARY / FOLDER 948
3	09/01/84	STANDLEY LAKE SEDIMENT SAMPLE COLLECTION SUMMARY	0043	RFP	T 130 B	MICHAEL GUILLAUME'S OFFICE
3	01/01/85	DISCLOSURE TO THE CITY OF BROOMFIELD	0448	RFP	T130B	FINAL PAST REMEDY REPORT OU3
3	1/2/85	ANALYSIS OF GREAT WESTERN RESERVOIR PLUTONIUM CONCENTRATION DATA	1540	EG&G	DENVER WEST	GISLINDE ENGLEMANN'S OFFICE
3	02/14/85	GREAT WESTERN RESERVOIR SEDIMENT CORES	0042	RFP	T 130 C	EMF LIBRARY
3	04/10/85	SOIL SAMPLE COLLECTION AND ANALYSIS FOR PLUTONIUM ON LANDS ADJACENT TO GREAT WESTERN RESERVOIR FOR THE CITY OF BROOMFIELD	1268	RFP	T334C	FBI FILE / DOCUMENT #1303054

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3	2/13/86	ANALYSIS OF STANDLEY LAKE SEDIMENT STUDY DATA	1457	EG&G	DENVER WEST	GISLINDE ENGLEMANN'S OFFICE
3	02/19/87	RISK ASSESSMENT STUDY - GREAT WESTERN RESERVOIR EXPANSION	1216	RFP	T 334 C	LEGAL / FBI FILE
3	01/01/88	PRELIMINARY REPORT - ALGAL IMPLICATED PROBLEMS AT ROCKY FLATS	1274	RFP	T334C	FBI FILE #1001771
3	01/01/88	STANDLEY LAKE NORTH PLAINS: P1, GENERAL LAND USE PLAN RECOMMENDATIONS	1366	GOLDEN CO	JEFF. CO. PLANNING DEPT.	18301 W. 10TH. AVE., SUITE 220
3	06/01/88	REMEDIAL INVESTIGATION AND FEASIBILITY STUDY PLANS FOR LOW PRIORITY SITES. (DRAFT) VOLUME I SITE DESCRIPTIONS, GROUPINGS AND PRIORITIZATION	1371	RFP	T334C	FBI FILE #1202451
3	01/01/89	ALGAL IMPLICATED PROBLEMS AT ROCKY FLATS, (PRELIMINARY REPORT)	1370	RFP	T334C	FBI FILE #1001771
3	01/01/1989	210 Pb - DETERMINED LIMNOCHRONOLOGY OF SELECT COLORADO FRONT RANGE RESERVOIRS	1577	RFP	T130B	HOLLY WOLAVER'S OFFICE
3	4/1/89	ROCKY FLATS PHYTOPLANKTON STUDIES	1239	RFP	T130B	HOLLY WOLAVER'S OFFICE
3	04/10/89	ROCKY FLATS IMPACT ON GREAT WESTERN RESERVOIR	0456	RFP	T334D	CHEM RISK FILE FOLDER A224
3	10/01/89	REVIEW REPORT OF THE GREAT WESTERN RESERVOIR PRE-FEASIBILITY STUDY PRE-DECISIONAL DRAFT	0903	FRCC	RFP READING ROOM	E89-018
3	01/01/90	ENVIRONMENTAL SURVEILLANCE REPORT ON THE U. S. D. O. E. ROCKY FLATS PLANT, JAN. 1990	1126	RFP	T130C	EMF / FOLDER 554 / ICN #7273
3	01/01/90	STANDLEY LAKE FISH TOXICS MONITORING REPORT	0652	FRCC	RFP READING ROOM	E90-072
3	1/1/90	COMPARATIVE BIOLOGICAL AND PHYSICAL ANALYSIS OF ROCKY FLATS WASTEWATER DISCHARGE PONDS FROM MAY - JULY 1990	1456	RFP	T130B	HOLLY WOLAVER'S OFFICE

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3	1/1/90	BIOLOGICAL AND PHYSICAL ANALYSES OF ROCKY FLATS WASTEWATER DISCHARGE PONDS, JULY 1989 - JANUARY 1990	1454	RFP	T130B	HOLLY WOLAVER'S OFFICE
3	5-7-90	239, 240 Pu, 137Cs AND 210 Pb DISTRIBUTIONS IN COLORADO FRONT RANGE LAKE SEDIMENTS	0816	RFP	T130B	AL BROWN'S OFFICE, 2nd. DRAWER
3	05/09/90	SOILS AND SEDIMENTS (PUBLIC PRESENTATION)	1574	WOODWARD CLYDE	DENVER	GREG WALDMAN'S OFFICE
3	6/1/90	DRAFT PHASE I RFI/RI WORK PLAN SOLAR EVAPORATION PONDS (OPERABLE UNIT NO. 3)	1337	RFP	T334C	FBI FILE # 122356
3	6/11/90	EMISSIONS WORKSHOP, HISTORICAL RELEASES TABLE: TOTAL YEARLY WATERBORNE RELEASE OF RADIOACTIVE ELEMENTS FROM ROCKY FLATS	1159	RFP	T130B	LARRY WOODS' OFFICE, FILE
3	12/18/90	WATER-YIELD AND WATER-QUALITY STUDY OF OTHER SOURCES TRIBUTARY TO STANDLEY LAKE AND GREAT WESTERN RESERVOIR, ROCKY FLATS PLANT. TASK 16 OF THE ZERO OFF-SITE WATER-DISCHARGE STUDY. FINAL	1342	EG&G	BOULDER	RUSS APPLEHANS' OFFICE
3	01/01/91	OPERABLE UNIT 3: OFF-SITE RELEASES/SOILS (FACT SHEET)	1551	RFP (ATTACHED)	T130F	COMMUNITY RELATIONS
3	01/01/91	DOSE RECONSTRUCTION PROJECT	1462	WOODWARD-CLYDE	DENVER	GREG WALDMAN'S OFFICE
3	03/01/91	COMPLIANCE AGREEMENT, U.S. ENVIRONMENTAL PROTECTION AGENCY IN THE MATTER OF NPDES PERMIT CO-0001333, DEPT. OF ENERGY, ROCKY FLATS PLANT, GOLDEN CO, PROCEEDINGS UNDER EXECUTIVE ORDER	0464	RFP	T130B	BOOKCASE 52
3	04/01/91	FINAL HISTORICAL INFORMATION SUMMARY AND PRELIMINARY HEALTH RISK ASSESSMENT OPERABLE UNIT NO.3 - SITES 200-202	0044	RFP	T130B	MICHAEL GUILLAUME'S OFFICE
3	4/1/91	HISTORICAL INFORMATION SUMMARY AND PRELIMINARY HEALTH RISK ASSESSMENT, OPERABLE UNIT NO. 3 - SITES 200-202, FINAL	94-67	BLDG 080	ADM RECORD	OU03-000044
3	05/01/91	PAST REMEDY REPORT: OPERABLE UNIT NO.3-IHSS 199 FINAL	0034	FRCC	RFP READING ROOM	E91-042

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3	5/1/91	STUDY OF WATER RESOURCE MANAGEMENT RFP TASK 23 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY	0719	RFP	T130B	LEE SOBCHAK'S OFFICE
3	6/1/91	AUGMENTATION PLAN FOR RFP TASK 28 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY	0722	RFP	T130B	LEE SOBCHAK'S OFFICE
3	06/01/91	FINAL HISTORICAL INFORMATION SUMMARY & PRELIMINARY HEALTH RISK ASSESSMENT OPERABLE UNIT NO.3-IHSS 200-202	0032	FRCC	RFP-RR	E91-048
3	08/01/91	ENVIRONMENTAL ASSESSMENT HERBICIDE WEED CONTROL IN OU.3 ROCKY FLATS PLANT, GOLDEN, CO.	1214	WCC	DTC	SCOTT MERNITZ'S OFFICE
3	08/01/91	DRAFT ENVIRONMENTAL ASSESSMENT, HERBICIDE WEED CONTROL IN OU3, ROCKY FLATS PLANT, GOLDEN COLORADO	1589	WCC	10TH. FLOOR	LAUREL PYE'S OFFICE
3	09/01/91	CONTROL OF RADIONUCLIDE LEVELS IN WATER DISCHARGES FROM THE RFP FINAL	0510	RFP	T130B	SHELF 3 NORTH HALL
3	9/01/91	MONTHLY ENVIRONMENTAL MONITORING REPORT OCTOBER 1991 ER-4180110-205	0401	RFP	T130B	BOOKCASE 52 NEAR FRAN
3	11/01/91	PLAN FOR PREVENTION OF CONTAMINANT DISPERSION . FINAL	1137	RFP	T130B	DENNIS SMITH'S OFFICE
3	12/06/91	RFI/RI WORK PLAN FOR OU3 (FINAL WORK PLAN) ROCKY FLATS PLANT	1369	RFP	T130B	MICHAEL GUILLAUME'S OFFICE
3	01/20/92	ENVIRONMENTAL ASSESSMENT - STANDLEY LAKE DIVERSION PROJECT. DRAFT	1526	FRCC	RFP READING ROOM	E92-006
3	2/4/92	ATTACHMENT 1-DRAFT FLOODPLAIN ASSESSMENT FOR 1992 SITE CHARACTERIZATION FIELD WORK	94-220	BLDG 080	ADM RECORD	
3	2/28/92	RFI/RI WORK PLAN FOR OU 3, ROCKY FLATS PLANT	94-178	BLDG 080	ADM RECORD	OU03-000074
3	1/31/94	PRELIMINARY REPORT ON THE BEHAVIORIAL ECOLOGY AND HABITAT USE OF THE STANDLEY LAKE BALD EAGLE PAIR, OCTOBER 16 THROUGH DECEMBER 31, 1993	94-190	RFP	T130J	ECOLOGY AND NEPA LIBRARY

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4	2/1/81	DESIGN CRITERIA FOR PORTABLE IRRIGATION - VOL. 2	1358	R F P	T130C	E M F FOLDER 258 ICN # 3481
4	04/15/82	AN HISTORICAL EVALUATION OF RADIOLOGICAL AND CHEMICAL PROPERTIES OF WATER FROM HYDROLOGIC TEST WELLS AT ROCKY FLATS. EA-376-81-231	1331	RFP	EMF / T130C	FOLDER 379 / 0005260
4	09/26/86	APPENDIX A-7 OF "EXPOSURE INFORMATION REPORT" ENTITLED "SOLAR EVAPORATION PONDS, PRESENT LANDFILL, WEST SPRAY FIELD"	1266	RFP	T334C	FBI FILE DOCUMENT # 1001675
4	11/28/86	RESOURCE CONSERVATION AND RECOVERY ACT. POST-CLOSURE CARE PERMIT APPLICATION FOR U.S.D.O.E. - ROCKY FLATS PLANT. HAZARDOUS & RADIOACTIVE MIXED WASTES C07890010526	0465	RFP	T130C	KIRK TIEKNOR HAS SET
4	03/01/87	CLOSURE PLAN SOLAR EVAPORATION PONDS C07890010526	0538	RFP	T 130 B	BOOKSHELF #2 IN NORTH HALL
4	07/01/88	SOLAR EVAPORATION PONDS CLOSURE PLAN	0065	RFP	T130B	LIBRARY SHELVES - CHECK WITH
4	10/05/88	RCRA POST-CLOSURE CARE PERMIT APPLICATION FOR U.S.D.O.E.-ROCKY FLATS PLANT HAZARDOUS & RADIOACTIVE MIXED WASTES C07890010526	1136	RFP	T130B	KATHERINE TAYLOR'S LIBRARY
4	06/16/89	DRAFT ACTION DESCRIPTION MEMORANDUM FOR SOLAR EVAPORATION PONDS CLOSURE	1385	RFP	T334C	FBI FILE # 121305
4	9-29-89	RCRA CLOSURE PLAN TANKS T-40, T-66, T-67, T-68 HAZARDOUS WASTE MANAGEMENT UNIT 55	0749	RFP	T130B	SHELF 2, TOP SHELF, KATHERINE
4	01/01/90	CHRONOLOGY OF EVENTS LEADING UP TO THE PONDCRETE PROBLEM AND STORY ON PONDCRETE PROBLEM	1335	RFP	T334C	FBI FILES #81814 AND #81789
4	6/8/90	SOLAR EVAPORATION POND RADIOCHEMICAL IMPACTS ON THE NORTH WALNUT CREEK DRAINAGE AND NECESSARY CORRECTIVE ACTIONS	1414	RFP	T334C	FBI FILE # 141110
4	1/1/91	SOLAR PONDS INTERCEPTOR TRENCH SYSTEM GROUNDWATER MANAGEMENT STUDY RFP TASK 7 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY	0724	RFP	T130B	LEE SOBCHAK'S OFFICE
4	03/01/91	1990 ANNUAL RCRA GROUNDWATER MONITORING REPORT FOR REGULATED UNITS AT ROCKY FLATS PLANT VOL. I AND II	0607	RFP	T130B	BOOKCASE 5 SEE KATHERINE

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4	03/01/91	ADDENDUM TO THE 1989 GROUNDWATER MONITORING REPORT; APPENDIX B - 1990 ANNUAL RCRA GROUNDWATER MONITORING REPORT FOR REGULATED UNITS AT RFP, VOL. II	0073	RFP	T130 B	BOOKCASE 5, ASK KATHERINE
4	06/01/91	ENVIRONMENTAL ASSESSMENT - DEWATERING AND RCRA PARTIAL CLOSURE ACTION ON SOLAR EVAPORATION PONDS, ROCKY FLATS PLANT, GOLDEN, CO.	0918	FRCC	RFP READING ROOM	E91 - 047
4	7-1-91	SAMPLING AND ANALYSIS OF SOLAR POND 207 WATER AND SLUDGE (VOLUMES I-VI)	0808	RFP	T130C	ERNIE LOMBARDI'S OFFICE
4	7/12/91	DRAFT PROPOSED IM/IRA DECISION DOCUMENT FOR THE SOLAR PONDS	94-239	BLDG 080	ADM RECORD	OU04-000028
4	09/01/91	PROPOSED INTERIM MEASURE/INTERIM REMEDIAL ACTION DECISION DOCUMENT FOR THE SOLAR EVAPORATION PONDS OPERABLE UNIT NO.4	0520	FRONT-RANGE	RFP READING ROOM	E91-051
4	11/01/91	DRAFT FINAL PHASE I RFI/RI WORK PLAN, ROCKY FLATS PLANT, SOLAR EVAPORATION PONDS (OPERABLE UNIT NO. 4)	0444	RFP	GOLDEN	BRUCE PETERMAN'S OFFICE
4	11/04/91	ROCKY FLATS PLANT ADMINISTRATIVE RECORD FILE INDEX SOLAR PONDS (OU 4) AND SITEWIDE INFO FILE	0659	FRCC	RFP READING ROOM	
4	11/20/91	ROCKY FLATS PLANT ADMINISTRATIVE FILE INDEX SITEWIDE INFORMATION FILE & SOLAR PONDS (OPERABLE UNIT 4)	0658	FRCC	RFP READING ROOM	
4	2/12/92	SOLAR POND CLEANOUT PROJECT MANAGEMENT PLAN, REV. 2	94-119	RFP	T130J	END LIBRARY
4	3/1/92	1991 ANNUAL RCRA GROUNDWATER MONITORING REPORT FOR REGULATED UNITS AT ROCKY FLATS PLANT VOLS 1 & 2	1539	RFP	T130B	CUBICLE 7, SIGURD R. JAUNARAJ'S
4	3/6/92	EVALUATION OF THE OCCURRENCE OF THE DILUVIAL LADIES' TRESSES, IN OU4	94-118	BLDG 080	ADM RECORD	
4	4/1/92	PROPOSED INTERIM MEASURE/INTERIM REMEDIAL ACTION DECISION DOCUMENT FOR THE SOLAR EVAPORATION PONDS OPERABLE UNIT NO. 4	94-120	RFP	T130J	END FILE CABINET #18
4	4/20/92	OPERABLE UNIT 4 IM/IRA BIOLOGICAL REGULATION COMPLIANCE	94-117	BLDG 080	ADM RECORD	OU04-000144

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4	6/22/92	IMPACTS ON SOUTH PLATTE RIVER CAUSED BY OU4 IM/IRA	94-121	080	ADM RECORD	OU04-000155
4	10/20/93	SOLAR POND PROJECTS (SPP) HIGHLIGHTS FOR THE WEEK OF OCTOBER 11-15, 1993 - SRK-229093	94-199	BLDG 080	ADM RECORD	10229320
4	2/1/94	OU4 SOLAR EVAPORATION POND INTERIM MEASURE/INTERIM REMEDIAL ACTION ENVIRONMENTAL ASSESSMENT DECISION DOCUMENT (REVISION: ROUNDTABLE REVIEW DRAFT, PARTS I AND III)	94-69			
5	01/01/80	PLUTONIUM IN ROCKY FLATS FRESH WATER SYSTEMS "IN TRANSURANIC" ELEMENTS IN THE ENVIRONMENT	0514	RFP	T130B	LIBRARY - KATHERINE TAYLOR
5	5/12/83	RAINFALL CAPACITY OF ROCKY FLATS POND SYSTEMS	1269	RFP	T130C	EMF FILE FOLDER #270 /
5	06/01/88	ROCKY FLATS PLANT DAM SAFETY INSPECTION REPORTS (DRAFT)	1102	RFP	T130C	EMF FILE FOLDER NO. 987 ICN
5	12/09/88	CONTAMINANT SOURCES FOR NPDES POINTS	1275	RFP	T334C	FBI FILE #1001922
5	03/29/89	REPORT OF CHROMIC ACID LEAK FROM BUILDING 444 ACID WASTE TANK SYSTEM ROCKY FLATS PLANT, GOLDEN, COLORADO	1272	RFP	T334C	FBI FILE #700151
5	08/01/89	PESTICIDES IN ROCKY FLATS RETENTION PONDS - BACKGROUND / CURRENT STATUS	0056	RFP	T334D	CHEM RISK, FILE FOLDER A-143,
5	09/26/89	SPECIAL REPORT ON ROCKY FLATS HOLDING POND SAMPLING	0550	RFP	T 334 D	CHEM RISK 91CR040 PART 3 ITEM
5	01/01/90	SURFACE WATER MONITORING PLAN (DRAFT)	1242	RFP	T130C	EMF LIBRARY/FOLDER
5	01/26/90	BIOMONITORING RESULTS FROM EG&G'S ROCKY FLATS PLANT	1281	RFP	T334C	FBI FILE 351039
5	09/18/90	WATER-YIELD AND WATER-QUALITY STUDY OF WALNUT CREEK AND WOMAN CREEK WATERSHEDS, ROCKY FLATS PLANT SITE. TASK 4 AS A PART OF ZERO-OFFSITE WATER-DISCHARGE STUDY. REVISION 0.	1345	EG&G	BOULDER	RUSS APPLEHANS' OFFICE

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5	01/15/91	BYPASS UPSTREAM FLOWS AROUND ROCKY FLATS PLANT STUDY. TASK 24 OF THE ZERO-OFFSITE WATER-DISCHARGE STUDY. FINAL	1349	EG&G	BOULDER	RUSS APPLEHANS' OFFICE
5	2/1/91	PHASE I RFI/RI WORK PLAN, WOMAN CREEK PRIORITY DRAINAGE OPERABLE UNIT NO.5 VOLUME I & II	94-68	BLDG 080	ADM RECORD	MANUAL 21100-WP-OU05.1
5	08/01/91	FINAL PHASE I RFI/RI WORK PLAN-WOMAN CREEK PRIORITY DRAINAGE (OPERABLE UNIT NO. 5)	0024	WOODWARD CLYDE	FLOOR 11	KAREN PHILLIPS' OFFICE
5	08/15/91	EVALUATION OF SURFACE WATER QUALITY FOR ROCKY FLATS PLANT TERMINAL PONDS A-4, B-5, C-2.	1292	WCC	DTC	WITH OTHER EIS DOCUMENTS
5	10/01/91	ENDANGERED SPECIES ACT COMPLIANCE PROPOSED SOUTH INTERCEPTOR DITCH (SID) MAINTENANCE PROJECT FINAL BIOLOGY SURVEY REPORT	1211	WCC	DTC	LAUREL PYE'S OFFICE
5	10/01/91	FISH AND WILDLIFE COORDINATION ACT - MIGRATORY BIRD TREATY ACT- "PROPOSED SOUTH INTERCEPTOR DITCH (SID) PROJECT"	1131	WOODWARD-CLYDE	DENVER	LAUREL PYE'S OFFICE
5	8/1/92	FINAL PHASE I RFI/RI WORK PLAN WOMAN CREEK PRIORITY DRAINAGE (OU5), VOLUME I & II	94-122	080	ADM RECORD	OU05-000021
5	5/27/93	MODIFICATION TO WORK IN THE IAG	94-237	RFP	T130J	INCOMING CORRESPNDENCE - 9433
6	12/22/88	DETAILED REPORT ON NPDES VIOLATIONS, INVESTIGATIONS AND ACTIONS TAKEN / ATTACHMENT 2 / NPDES DISCHARGE PERMIT RENEWAL	1124	RFP	T130C	EMF FOLDER 894 ICN#9890
6	03/29/89	REPORTS OF CHROMIC ACID LEAK FROM BUILDING 444 ACID RINSE WASTE TANK SYSTEM	0427	RFP	T334D	CHEM RISK 91CR040 PART 3 ITEM
6	08/01/89	REPORT OF THE CHROMIC ACID INCIDENT INVESTIGATION AT ROCKY FLATS, FEBRUARY 22, 1989	0419	RFP	T334D	CHEM RISK FILE FOLDER A109
6	3/1/91	QUALITY ASSURANCE ADDENDUM QAA 6.1 TO THE ROCKY FLATS SITEWIDE QA PROJECT PLAN FOR CERCLA RI/FS AND RCRA RFI/CMS ACTIVITIES FOR OPERABLE UNIT NO. 6	94-123	080	ADM RECORD	OU06-000007
6	09/01/91	FINAL PHASE I RFI/RI WORK PLAN WALNUT CREEK PRIORITY DRAINAGE (OPERABLE UNIT 6)	0023	WOODWARD CLYDE	FLOOR 11	KAREN PHILLIPS' OFFICE

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6	10/01/91	TECHNOLOGY DEVELOPMENT, BIOLOGICAL CONDITIONS OF RFP SURFACE WATER PONDS A-3 AND A-4 FEBRUARY THOUGH AUGUST.	1525	RFP	T130B	SUSAN FORD'S OFFICE
6	6/1/92	PHASE I RFI/RI WORK PLAN FOR OPERABLE UNIT 6, WALNUT CREEK PRIORITY DRAINAGE, VOLUME I - TEXT	94-250			
6	11/10/92	UPDATE TO RFI/RI WORK PLAN FOR OU6, WALNUT CREEK PRIORITY DRAINAGE	94-124	080	ADM RECORD	OU06-000062
7	10/01/84	INVESTIGATION REPORT, BERYLLIUM DISEASE CASE AT ROCKY FLATS PLANT GOLDEN, COLORADO	0420	RFP	T334D	CHEM RISK FILE FOLDER A212 ITEM
7	11/23/87	RADIOACTIVE SOURCES IN ROCKY FLATS PLANT SANITARY LANDFILL	1263	RFP	T334C	FBI FILE / DOCUMENT #300453
7	06/30/88	CLOSURE PLAN - INACTIVE INTERIM STATUS FACILITIES "HAZARDOUS WASTE STORAGE AREA - SWMU #203"	0615	FRCC	RFP READING ROOM	E88-010
7	07/01/88	PRESENT LANDFILL CLOSURE PLAN - APP.6, VOL. 1 & 2 "PRESENT LANDFILL HYDROGEOLOGICAL CHARACTERIZATION REPORT"	0611	FRCC	RFP READING ROOM	E88-003
7	11/09/90	ENVIRONMENTAL ASSESSMENT OF NEW SANITARY LANDFILL ROCKY FLATS PLANT, GOLDEN, COLORADO (EG&G DRAFT REVIEW BOA CONTRACT BA 6444500PB)	1163	WOODWARD-CLYDE	DENVER	JEFF DAWSON'S OFFICE
7	1-1-91	PRESENT LANDFILL AREA GROUNDWATER / SURFACEWATER COLLECTION STUDY: RFP TASK 8 OF THE ZERO-OFFSITE WATER DISCHARGE	0723	RFP	T130B	LEE SOBCHAK'S OFFICE
7	3/1/91	GEOPHYSICAL APPLICATIONS FOR RCRA/CERCLA INVESTIGATIONS TASK 4, GROUND PENETRATING RADAR (LANDFILL) ROCKY FLATS PLANT, DRAFT REPORT	94-126	RFP	ADM RECORD	OU07-000024
7	5/8/91	GEOPHYSICAL APPLICATIONS FOR RCRA/CERCLA INVESTIGATIONS TASK 5, PLUME DELINEATION OF LANDFILL DRAINAGE AT THE ROCKY FLATS PLANT, DRAFT REPORT	94-127	RFP	ADM RECORD	OU07-000025
7	06/01/91	ENVIRONMENTAL ASSESSMENT NEW SANITARY LANDFILL ROCKY FLATS PLANT, GOLDEN, COLORADO (DRAFT)	1162	WOODWARD-CLYDE	DENVER	JEFF DAWSON'S OFFICE
7	08/01/91	PHASE I RFI/RI WORK PLAN, PRESENT LANDFILL IHSS 114 AND INACTIVE HAZARDOUS WASTE STORAGE AREA IHSS 203, OPERABLE UNIT NO. 7 (OU7)	0071	RFP	T130B BOOKCASE 4	TOP SHELF NEAR CUBICLE 36 - SEE

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7	12/1/91	PHASE I RFI/RI WORK PLAN FOR OPERABLE UNIT 7 PRESENT LANDFILL IHSS 114 AND INACTIVE HAZARDOUS WASTE STORAGE AREA IHSS 203, VOLUMEI - TEXT	94-249			
7	1/1/93	TECHNICAL MEMORANDUM NO. 3, DRAFT FINAL ADDENDUM TO FINAL PHASE I RFI/RI WORK PLAN, SURFACE SOIL AND ASBESTOS DISPOSAL AREA CHARACTERIZATION PLAN, ROCKY FLATS PLANT PRESENT LANDFILL (IHSS 114) AND INDIVIDUAL	94-128	RFP	ADM RECORD	OU07-000106
7	1/15/93	TECHNICAL MEMORANDUM NO. 1, HUMAN HEALTH RISK ASSESSMENT, PRESENT LANDFILL (IHSS 114), THE INACTIVE HAZARDOUS WASTE STORAGE AREA (IHSS 203), AND THE EAST LANDFILL POND AND ADJACENT SPRAY EVAPORATION AREAS	94-129	RFP	ADM RECORD	OU07-000102
7	2/11/93	TECHNICAL MEMORANDUM NO. 2, HUMAN HEALTH RISK ASSESSMENT, PRESENT LANDFILL (IHSS 114), THE INACTIVE HAZARDOUS WASTE STORAGE AREA (IHSS 203), AND THE EAST LANDFILL POND AND ADJACENT SPRAY EVAPORATION AREAS	94-130	RFP	ADM RECORD	OU07-000103
8	7-1-82	ANALYSIS OF MONTHLY STACK RELEASES, 1976-1982	0744	RFP	T334D	CHEMRISK FILE FOLDER A231,
8	07/01/84	ACTINIDE PROCESSING AT ROCKY FLATS	0526	RFP	T334D	CHEM RISK, FILE FOLDER A233,
8	07/18/88	CHLORINATED SOLVENT USAGE- BUILDING 707 PART I OF THE CHLORINATED SOLVENT STUDY	0431	RFP	T334D	CHEM RISK 91CR040 PART 2 ITEM
8	11/29/89	ROCKY FLATS PLANT - LOW LEVEL MIXED WASTE PLAN	0612	FRCC	RFP READING ROOM	E89-023
8	03/16/90	WASTE MINIMIZATION ASSESSMENT REPORT AMENDMENTS FINAL	0603	FRCC	RFP READING ROOM	E90-058
8	08/01/91	CULTURAL RESOURCES CLASS III SURVEY OF THE DEPARTMENT ROCKY FLATS PLANT, NORTHERN JEFFERSON AND BOULDER COUNTIES, COLORADO VERSION - 1.0	0670	WOODWARD-CLYDE	DENVER	RICH TOCHER'S OFFICE
8	5/1/92	DRAFT PHASE I RFI/RI WORK PLAN, ROCKY FLATS PLANT 700 AREA OPERABLE UNIT NO. 8 (SUPPLEMENTS: JUNE 22, 1992), VOLUME I - TEXT SECTIONS 1-11	94-245			
9	11/01/91	PHASE I RFI/RI WORK PLAN ORIGINAL PROCESS WASTE LINES O.U.9 VOL.1	0536	RFP	T130B	RANDY OGGS OFFICES
9	11/1/91	FINAL PHASE I RFI/RI WORK PLAN, ROCKY FLATS PLANT ORIGINAL PROCESS WASTE LINES (OPERABLE UNIT 9), VOL II APPENDICES	94-131	BLDG 080	ADM RECORD	OU09-000003

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9	11/20/91	FINAL PHASE I RFI/RI WORK PLAN, ROCKY FLATS PLANT ORIGINAL PROCESS WASTE LINES (OPERABLE UNIT 9), VOL I TEXT	94-131	BLDG 080	ADM RECORD	OU09-000002
9	2/1/92	FINAL PHASE I RFI/RI WORK PLAN, ROCKY FLATS PLANT, ORIGINAL PROCESS WASTE LINES (OPERABLE UNIT 9), VOLUME I - TEXT	94-248			
9	3/1/92	TECHNICAL MEMORANDUM, OPERABLE UNIT 9 PHASE I RFI/RI WORK PLAN, SECTION 9 ENVIRONMENTAL EVALUATION, REVISION, DRAFT	94-134	BLDG 080	ADM RECORD	OU08-000006
9	3/12/92	REVISIONS TO FINAL PHASE I RFI/RI WORK PLAN FOR THE ORIGINAL PROCESS WASTE LINES (OPERABLE UNIT NO. 9) EG&G PROJECT NO. BA68163PB, MODIFICATION NO. 3 TASK ORDER NO. 8	94-135	BLDG 080	ADM RECORD	OU09-000058
10	04/05/88	CLOSURE PLAN, CONTAINER STORAGE FACILITIES: PROPERTY UTILIZATION AND DISPOSAL CONTAINER STORAGE FACILITIES, SWINERTON AND WALBERG BUILDING 980 CONTAINER STORAGE FACILITY, SWINERTON AND WALBERG CONTRACTOR STORAGE YARD, BUILDING 885 DRUM STORAGE AREA, BUILDING 881 DRUM STORAGE AREA, BUILDING 865 DRUM STORAGE AREA, BUILDING 883 DRUM STORAGE AREA, BUILDING 334 CARGO CONTAINER AREA, BUILDING 444/453 DRUM STORAGE AREA	0692	FRCC	RFP READING ROOM	E88-001
10	10/01/88	CLOSURE PLAN INACTIVE INTERIM STATUS FACILITIES BUILDING 444 ACID DUMPSTERS SWMU #207	0646	FRCC	RFP READING ROOM	E 88 - 012
10	10/03/88	INTERIM STATUS - CLOSURE PLAN - BUILDING 460 ACID DUMPSTERS, BLD. 460 SOLVENT DUMPSTERS	0617	FRCC	RFP READING ROOM	E88-008
10	10/03/88	INTERIM STATUS CLOSURE PLAN MAIN HAZARDOUS WASTE STORAGE LOT LOCATION UNIT 1	0706	FRCC	RFP READING ROOM	E88-006
10	05/01/89	HISTORY OF OPERATIONS AT THE ROCKY FLATS 750 PONDCRETE STORAGE PAD	0422	RFP	T334D	CHEM RISK FILE FOLDER A224
10	05/01/89	HISTORY OF OPERATIONS AT THE ROCKY FLATS 904 PONDCRETE STORAGE PAD	0457	RFP	T334D	CHEM RISK FILE FOLDER A-224
10	10/30/91	REVIEW COMMENT SET REVIEW OF: DRAFT PHASE I RFI/RI WORK PLAN ROCKY FLATS PLANT OTHER OUTSIDE CLOSURES OPERABLE UNIT NO. 10 OCTOBER 1991	94-136	BLDG 080	ADM RECORD	OU10-000036
10	11/1/91	DRAFT FINAL PHASE I RFI/RI, RFP OTHER OUTSIDE CLOSURES OU 10 VOL. I-III	0715	RFP	T130B	ACROSS FROM LEE SOBCHAK'S
10	11/1/91	DRAFT FINAL PHASE I RFI/RI WORK PLAN, ROCKY FLATS PLANT OTHER OUTSIDE CLOSURES, (OPERABLE UNIT NO. 10) VOLS I, II, III	94-133	BLDG 080	ADM RECORD	OU10-000003, 4, 5

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10	10/14/92	FINAL PHASE I RFI/RI WORK PLAN OPERABLE UNIT 10, INDEX OF REPLACEMENT PAGES	94-137	BLDG 080	ADM RECORD	OU10-000042
11	05/16/88	RELOCATION OF MCKAY AND UPPER CHURCH DITCHES IN THE ROCKY FLATS WEST BUFFER ZONE	1277	RFP	T334C	FBI FILE
11	5-1-90	SHALLOW HIGH RESOLUTION SEISMIC REFLECTION SURVEYING GEOLOGIC CHARACTERIZATION OF THE ROCKY FLATS PLANT WEST SPRAY FIELD LINE (WORK PLAN)	0712	RFP	T130B	SHELF 5
11	5-1-90	WESTERN SPRAY FIELD GEOPHYSICAL APPLICATIONS HEALTH AND SAFETY PLAN	0711	RFP	T130B	SHELF 5
11	12-1-91	FINAL WORK PLAN PHASE I RFI/RI WORK PLAN O.U. 11. VOL I-II	0716	RFP	T130B	LEE SOBCHAK'S OFFICE
11	3/16/92	FINAL WORK PLAN PHASE I RFI/RI WORK PLAN FOR OU11	94-246			
12	05/30/86	WASTE STREAM IDENTIFICATION STUDY - AREA 1	1265	RFP	T334C	FBI FILE / DOCUMENT #30000
12	10/1/92	FINAL RFI/RI WORK PLAN, ROCKY FLATS PLANT, 400/800 AREA (OPERABLE UNIT NO. 12), VOLUME I - TEXT	94-247			
12	12/1/92	UPDATE TO FINAL RFI/RI WORK PLAN FOR OU12, VOLS I & II	94-139	BLDG 080	ADM RECORD	OU12-000046
13	10/9/92	FINAL PHASE I RFI/RI WORK PLAN, ROCKY FLATS PLANT, 100 AREA (OPERABLE UNIT NO. 13)	94-188	BLDG 080	ADM RECORD	OU13-000029
14	09/01/81	NEPTUNIUM PROCESSING AT THE ROCKY FLATS PLANT	0455	RFP	T334D	CHEM RISK FILE A-224 PART II ITEM
14	06/01/85	PLUTONIUM DISSOLUTION FROM ROCKY FLATS PLANT INCINERATOR ASH	0613	FRCC	RFP READING ROOM	E85-008
14	04/01/86	PLUTONIUM RELEASES TO THE ENVIRONMENT RESULTING FROM AN EFFLUENT SAAM ALARM	0059	RFP	T 334 D	CHEM RISK FILE FOLDER A-144

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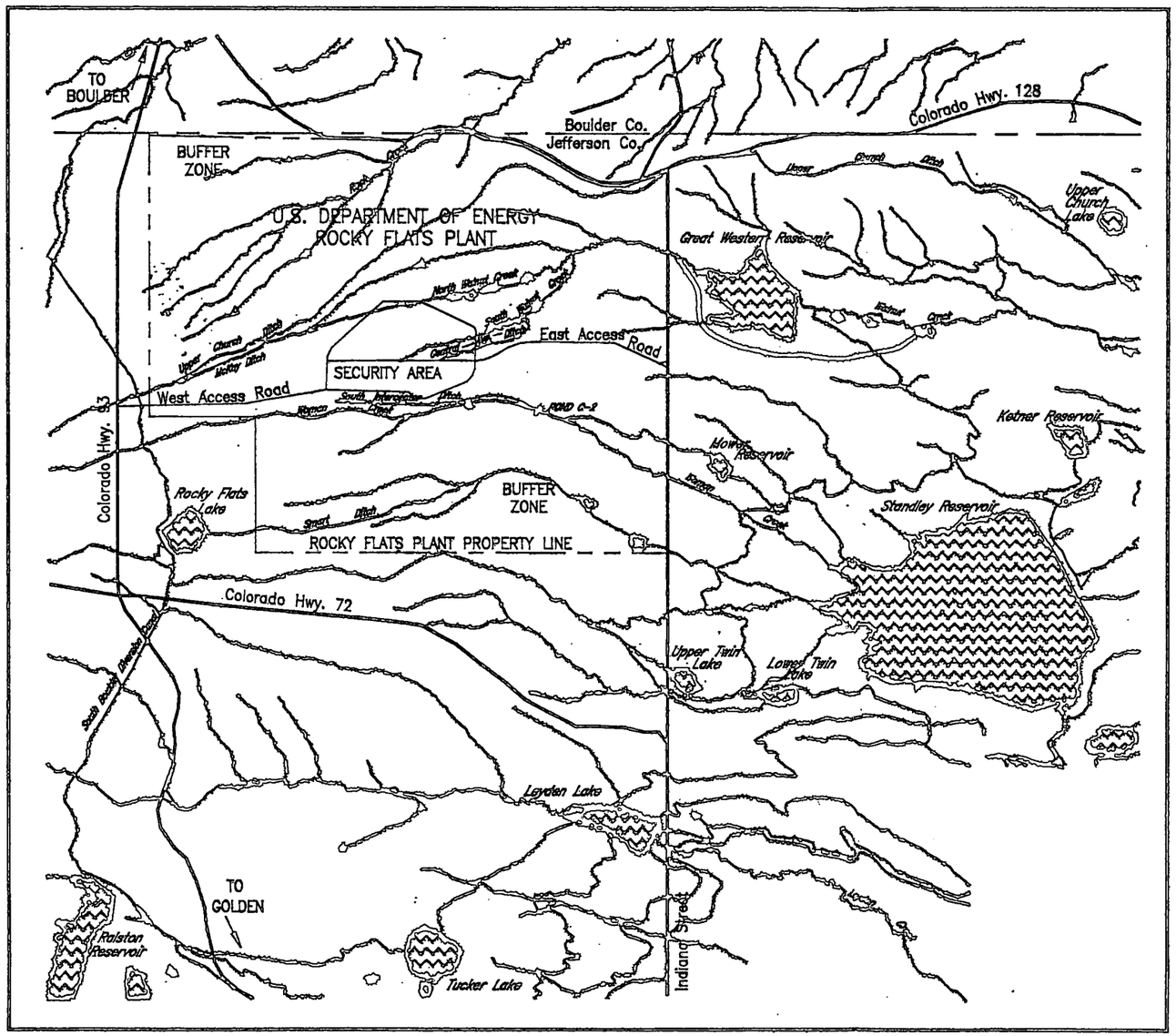
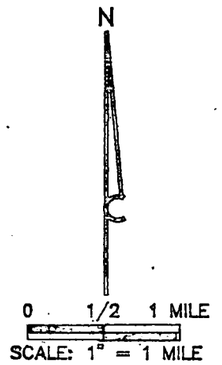
1,4	03/16/92	HABITAT SURVEY AT THE ROCKY FLATS PLANT FOR THE UTE LADIES' TRESSES AT THE OU1 FRENCH DRAIN, SOUTH INTERCEPTOR DITCH AND OU4 IM LOCATIONS	94-8	BLDG 080	ADM RECORD	OU02-000301
14	10/1/92	FINAL PHASE I RFI/RI WORK PLAN, ROCKY FLATS PLANT, RADIOACTIVE SITES (OPERABLE UNIT NO. 14), TEXT VOLUME I OF II	94-194	BLDG 080	ADM RECORD	MANUAL 21100-WP-OU14.1
15	10/01/88	CLOSURE PLAN INACTIVE INTERIM STATUS FACILITIES ORIGINAL URANIUM CHIP ROASTER SWMU #204	0645	FRCC	RFP READING ROOM	E88-011
15	1/15/93	FINAL PHASE I RFI/RI WORK PLAN, OU15, INSIDE BUILDING CLOSURES	94-187	BLDG 080	ADM RECORD	OU15-000052
16	10/1/92	FINAL NO FURTHER ACTION JUSTIFICATION DOCUMENT, ROCKY FLATS PLANT LOW-PRIORITY SITES (OPERABLE UNIT 16)	94-196	BLDG 080	ADM RECORD	
16	12/8/93	PROPOSED PLAN AND DRAFT MODIFICATION OF COLORADO HAZARDOUS WASTE PERMIT FOR ROCKY FLATS PLANT OPERABLE UNIT 16: LOW PRIORITY SITES	94-238	RFP	T130J	END FILES
4,7,9	5/8/93	FEDERAL REGISTER 1) FLOODPLAIN INVOLVEMENT NOTIFICATION FOR INSTALLATION OF WATER MONITORING DEVICES AT THE ROCKY FLATS PLANT (RFP) NEAR GOLDEN,	94-181	BLDG 080	ADM RECORD	OU03-000088
5,6,7	4/19/93	MEETING MINUTES ENVIRONMENTAL EVALUATIONS FOR OPERABLE UNITS 5, 6, AND 7 ROCKY FLATS PLANT, GOLDEN, COLORADO	94-213	BLDG 080	ADM RECORD	OU07-000117
1,2,5,6,SW	5/21/91	NATIONAL ENVIRONMENTAL POLICY ACT DOCUMENTATION ENVIRONMENTAL CHECKLIST -IAG SITE CHARACTERIZAITON ACTIVITIES OU1, OU2, OU5, OU6, AND SITEWIDE	94-203	BLDG 080	ADM RECORD	OU01-000264
1,2,5,6	9/17/91	ATTACHMENT 1 - TEXT FOR THE FEDERAL REGISTER NOTICE FOR WETLAND/FLOODPLAIN INVOLVEMENT FOR IAG SITE CHARACTERIZATION ACTIVITIES FOR OU1, OU2, OU5, AND OU6 AT DOE'S ROCKY FLATS PLANT NEAR	94-206	BLDG 080	ADM RECORD	OU01-000267
1,2,5,6	10/1/91	NATIONAL ENVIRONMENTAL POLICY ACT DOCUMENTATION ENVIRONMENTAL CHECKLIST -IAG SITE CHARACTERIZAITON ACTIVITIES IN FLOODPLAINS/WETLANDS FOR OU1, OU2, OU5, OU6, AND THE GEOLOGIC CHARACTERIZATION PROGRAM	94-207	BLDG 080	ADM RECORD	OU01-000275
1,2,5,6	10/23/91	TRANSMITTAL LETTER WITH ATTACHMENT 1: WETLAND/FLOODPLAIN ASSESSMENT FOR SITE CHARACTERIZAITON ACTIVITIES FOR OU1, OU2, OU5, OU6, AND THE GEOLOGIC CHARACTERIZATION PROGRAM	94-208	BLDG 080	ADM RECORD	OU01-000269
1,2,5,6	11/11/91	SECTION D DETERMINATION CATEGORICAL EXCLUSION (CX) DETERMINATION - RFP/CX000-91-IAG SITE CHARACTERIZAITON ACTIVITIES IN FLOODPLAINS/WETLANDS FOR OU1, OU2, OU5, OU6, AND THE GEOLOGIC	94-210	BLDG 080	ADM RECORD	OU01-000276

ERTSD BIBLIOGRAPHY

OUS	PUBLICATION DATE	TITLE	CONTROL NO.	PHYSICAL LOCATION	AVAILABLE AT	LOCATION
3,4,7,9	2/4/92	TRANSMITTAL OF REVISED DOCUMENTS FOR SITE CHARACTERIZATION WORK AT OUS 3, 4, 7, AND 9 - JEE-0070-92	94-198	BLDG 080	ADM RECORD	OU03-000064
3,4,7,9	2/4/92	REVISED DRAFT, "STATEMENT OF FINDINGS" FOR OUS 3, 4, 7, 9 SITE CHARACTERIZATION WORK IN FLOODPLAINS	94-219	BLDG 080	ADM RECORD	OU03-000067
3,4,7,9	2/4/92	REVISED DRAFT FEDERAL REGISTER FOR SITE CHARACTERIZATION FIELD WORK IN OPERABLE UNITS 3, 4, 7, AND 9 THAT WILL TAKE PLACE IN A FLOODPLAIN	94-221	BLDG 080	ADM RECORD	OU03-000066
3,4,7,9	2/12/92	NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) ENVIRONMENTAL CHECKLIST (EC) AND EC REVIEW FORM FOR SITE CHARACTERIZATION FIELD WORK FOR OUS 3, 4, 7, AND 9	94-197	BLDG 080	ADM RECORD	OU03-000069
8,10,13	5/11/93	SUBPART D CATEGORICAL EXCLUSION (CX) DETERMINATION RFO/CX16-93: SITE CHARACTERIZATION ACTIVITIES AT OUS 8, 10, 13	94-214	BLDG 080	ADM RECORD	OU08-000066 & 67





EXPLANATION

BROOMFIELD DIVERSION CANAL

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado

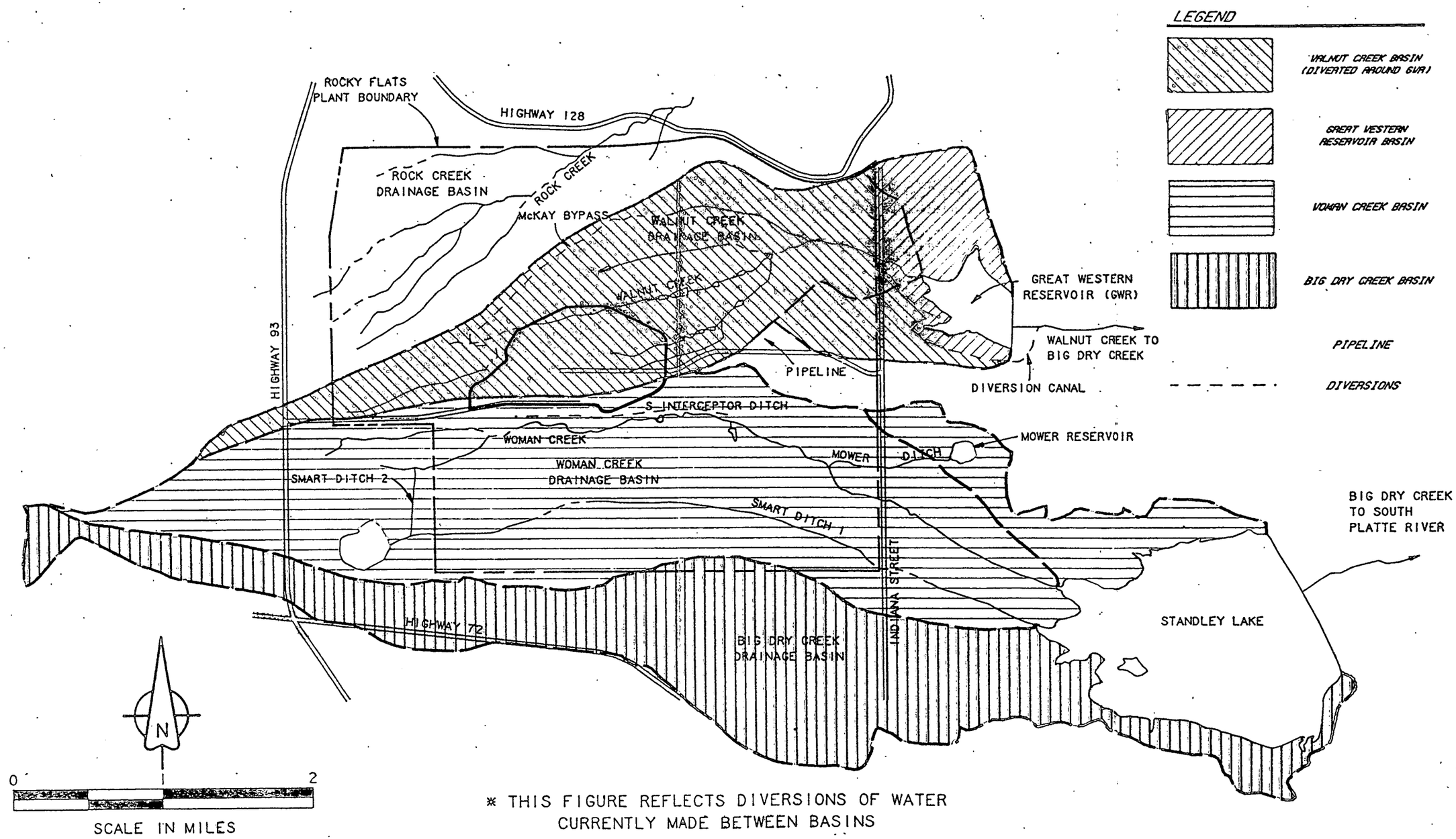
Figure 2.1-2
Source: DOE 1991r

ROCKY FLATS PLANT
BOUNDARIES AND BUFFER ZONE

REV. AUGUST 1991
APRIL 1991

SOURCE: EG&G 1991b

25060200

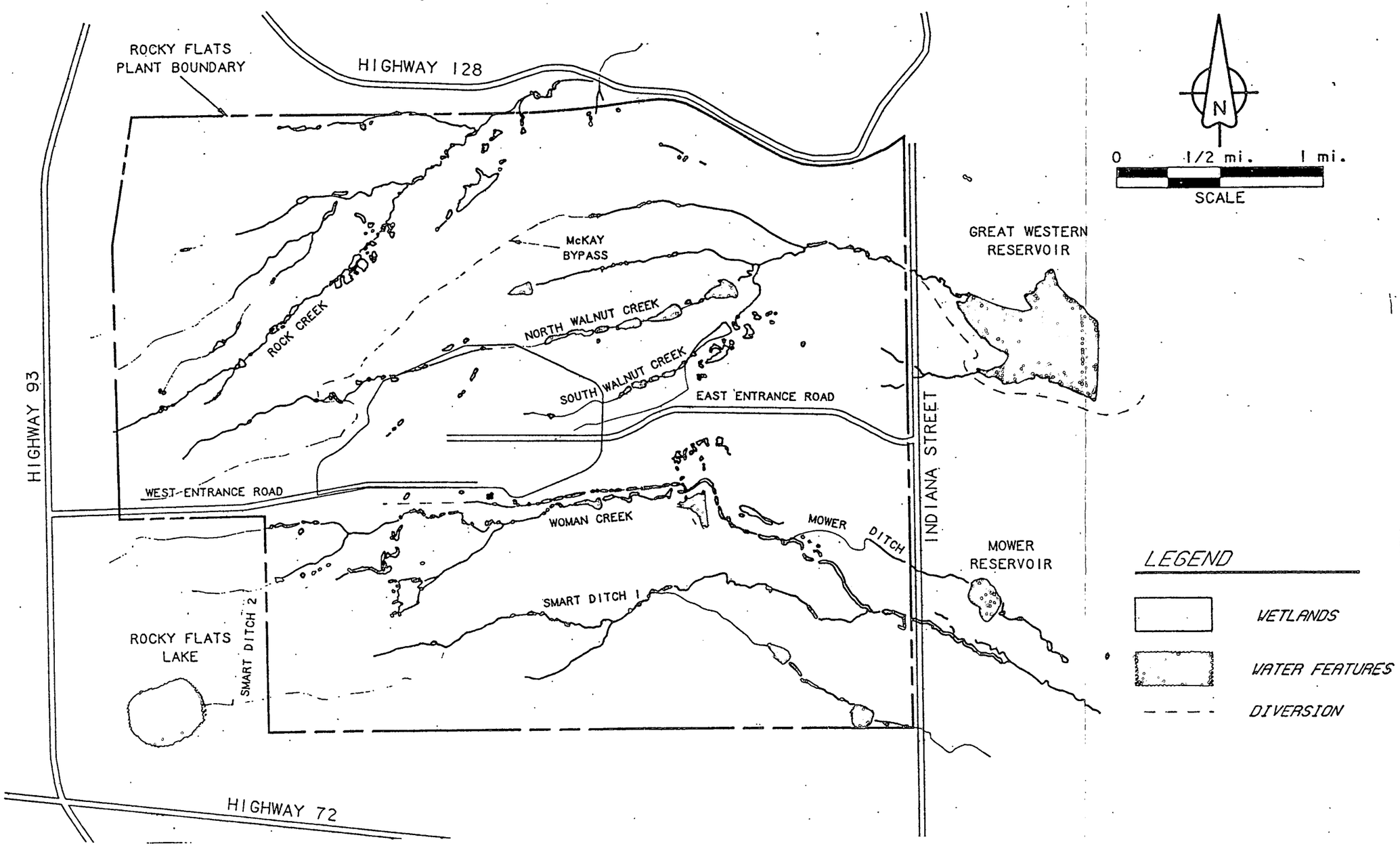


Source: DOE 1991bb

ROCKY FLATS DRAINAGE BASINS

Figure 3.5-2

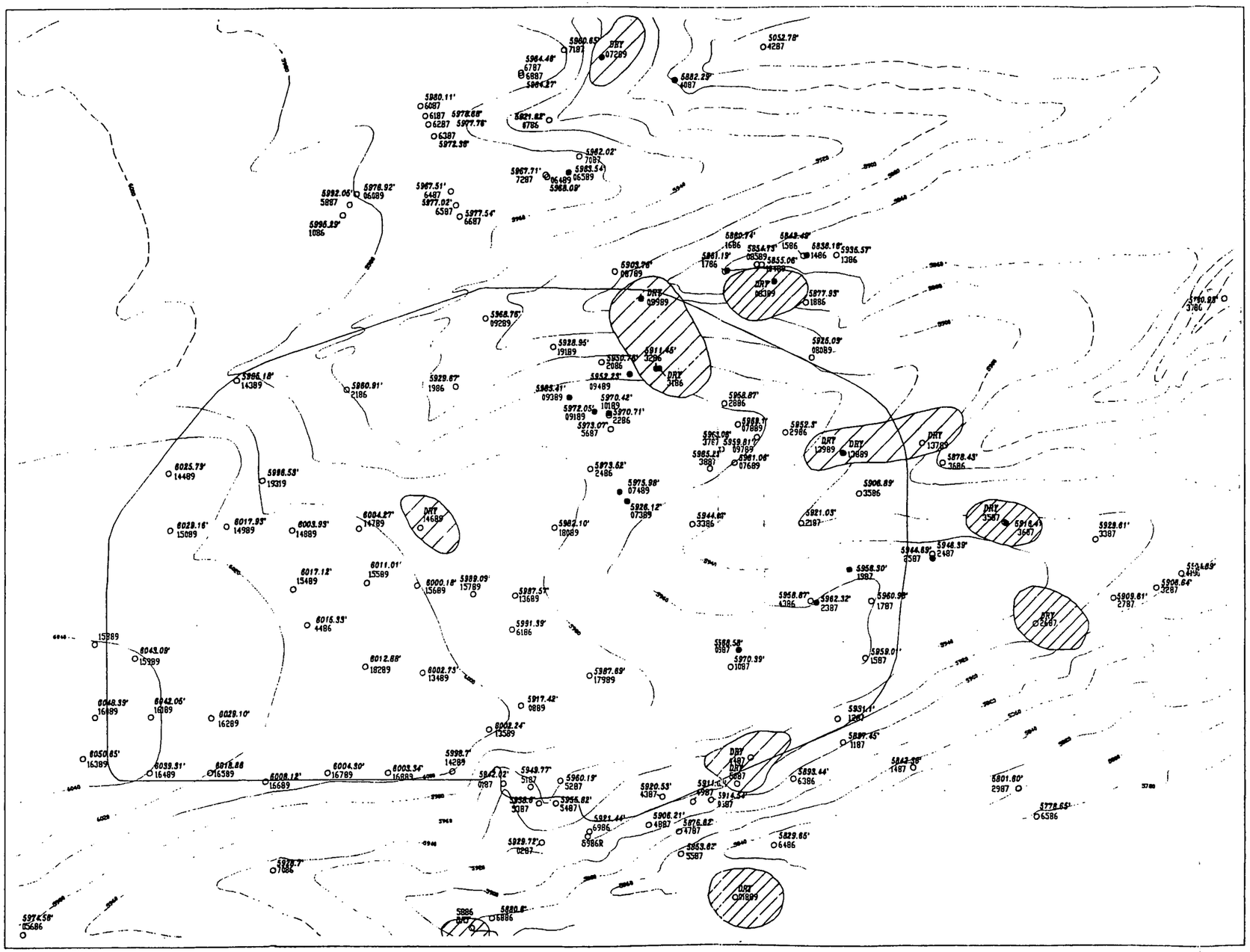
150271



Source: DOE 1991bb

ROCKY FLATS WETLANDS
Figure 3.5-3

150271



MAP LEGEND

Wells shown are only those open to uppermost hydrostratigraphic unit

5958.87' • Water level elevation above sea level

Anomalously dry area

Water level elevation contours

All water level data collected April, 1990.

-N-

0 400 800

SCALE: 1" = 800'
CONTOUR INTERVAL: 20'

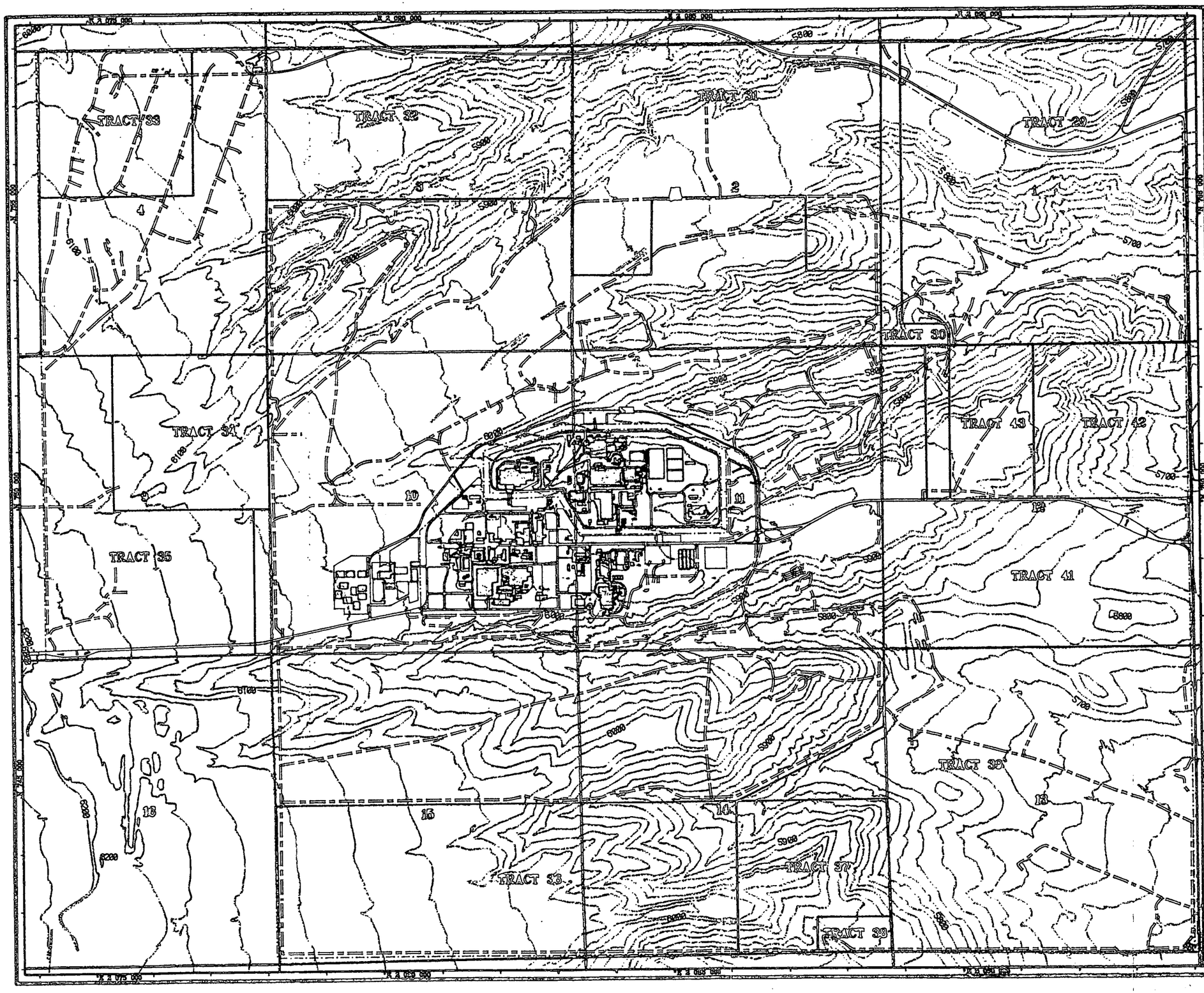
Source: EG&G 1991c
EG&G, 1991b

GROUNDWATER PROTECTION AND MONITORING PROGRAM PLAN

WATER LEVEL CONTOUR MAP
UPPERMOST HYDROSTRATIGRAPHIC UNIT

Figure 3.6-2

EG&G
Rocky Flats Plant, Golden, Colorado



U.S. Department of Energy

Rocky Flats Plant

Mineral Rights Boundaries in the Buffer Zone

- Mineral rights boundaries
- Public land survey system
- Paved roads
- Unimproved dirt roads
- Buildings or structures

500 0 feet 1000 5000

Mapscale = 1 : 20000

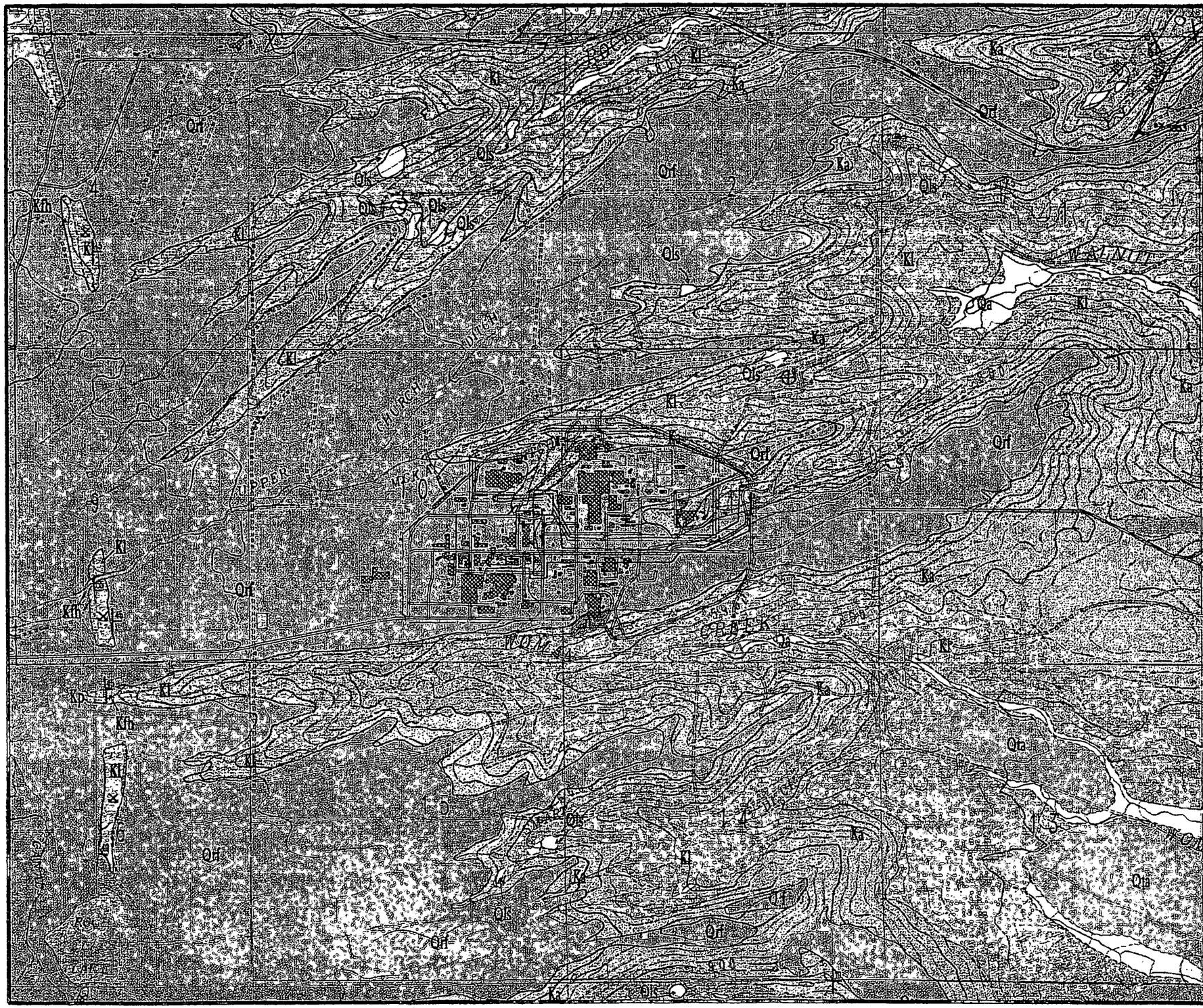
Figure 3.8-5
Source: DOE 19912d

Prepared by:

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

Date: 3-4-92



EXPLANATION

- Artificial Fill (RECENT)
- Valley Fill Alluvium (RECENT)
- Landslide Slump (RECENT)
- Undiff. Terrace Alluvium (PLEISTOCENE)
- Rocky Flats Alluvium (PLEISTOCENE)
- Arapahoe Formation (CRETACEOUS)
- Laramie Formation (CRETACEOUS)
- Fox Hills Sandstone (CRETACEOUS)
- Pierre Shale (CRETACEOUS)

Strike and dip of bedding planes in bedrock

inclined vertical overturned horizontal

Gravel, sand, or clay pit BM Benchmark

Area of bedrock exposure

Contact
dashed where approx. located;
dotted where concealed

From EG& G, 1992

SCALE 1" = 1700'

1700' 0 1700'

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado

Figure 3.8-3

SURFICIAL GEOLOGY
FOR THE
ROCKY FLATS PLANT

Source: EG&G 1992d