DRAFT FINAL
PHASE I RFI/RI WORK PLAN

ROCKY FLATS PLANT

OTHER OUTSIDE CLOSURES

(OPERABLE UNIT NO. 10)

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

ENVIRONMENTAL RESTORATION PROGRAM

NOVEMBER 1991

VOLUME I

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VOLUME I

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EXECUTIVE SUMMARY

This document presents the work plan for the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Remedial Investigation (RFI/RI) for Operable Unit 10 (OU10), Other Outside Closures at the Rocky Flats Plant (RFP). The objectives of the Phase I RFI/RI are to characterize source/soil contamination at IHSSs comprising OU10 and to provide input to the baseline risk assessment. The present work plan is prepared to be consistent with the Interagency Agreement (IAG) between the DOE, the EPA, and the State of Colorado and the appropriate guidance documents where applicable. This work plan includes a Field Sampling Plan (FSP), Baseline Risk Assessment Plan (BRAP), and Environmental Evaluation Work plan (EEW).

The following Individual Hazardous Substance Sites (IHSSs) are included in OU10:

- Radioactive Liquid Waste Storage Tanks (IHSS 124, 124.1, 124.2, 124.3)
- Oil Leak (IHSS 129)
- P.U.&D. Storage Yard - Waste Spills (IHSS 170)
- P.U.&D. Container Storage Facilities (IHSS 174)
- S&W Building 980 Container Storage Facility (IHSS 175)
- S&W Contractor Storage Yard (IHSS 176)
- Building 885 Drum Storage Area (IHSS 177)
- Building 334 Cargo Container Area (IHSS 181)
- Building 444/453 Drum Storage Area (IHSS 182)
- Building 460 Sump #3 Acid Side (IHSS 205)
- Inactive D-836 Hazardous Waste Tank (IHSS 206)

- Inactive Building 444 Acid Dumpsters (IHSS 207)
- Inactive 444/447 Waste Storage Area (IHSS 208)
- Unit 16, Building 980 Cargo Container (IHSS 210)
- Unit 15, 904 Pad Pondcrete Storage (IHSS 213)
- Unit 25, 750 Pad Pondcrete and Saltcrete Storage (IHSS 214).

The work plan provides an overview of RFP including historical background, environmental setting, geology, and hydrology. Initial evaluation of OU10 includes site locations and histories, descriptions of site physical characteristics, and summaries of previous investigations and contaminants detected. The work plan also includes conceptual models of each IHSS that describe potential sources of contamination and types of contaminants, release mechanisms, known and potential exposure pathways, and known or potential human and environmental receptors. The conceptual models assist in identifying sampling locations discussed in the FSP and preliminary identification of possible remedial alternatives.

The initial evaluation of surficial soils data collected at some of the IHSSs indicates that none of the data are validated and not usable for the baseline risk assessment. These data can only be used for planning of the field program.

The Phase I RFI/RI field program will be conducted in 4 steps: Step 1 consists of the installation of groundwater monitoring wells and collection of water level data; Step 2 consists of surficial soil sampling, soil gas screening, and radiation screening; Step 3 will be the drilling and sampling of soil borings located in hot spots identified in Step 2; and Step 4 consists of groundwater sampling downgradient of hot spots with the BAT sampler and the installation of tensiometers and lysimeters at 2 IHSSs.

Surficial soil sampling grids at the larger IHSSs were determined using a hot spot detection technique. Surficial soil samples at the smaller IHSSs were located at potential release points, at previous sampling sites and at IHSS perimeters.

Radiation surveys will be conducted at 11 sites and soil gas surveys will be conducted at 8 IHSSs. At total of 258 surficial soil samples will be collected. In addition, 67 asphalt/cement samples, 21 sediment samples, 20 surface water samples and 19 groundwater samples (excluding the BAT samples) will be collected. Fourteen new wells will be installed and water level measurements will be collected from an additional 47 wells.

The number of borings drilled for Step 3 cannot be determined until Step 2 has been completed. However, it was assumed that 58 borings would be drilled, 188 VOA samples would be collected, and 113 non-VOA samples collected. This assumption is used strictly for planning purposes and is based on drilling borings at 20 percent of the surficial sampling locations.

1.0 INTRODUCTION

This document presents the work plan for the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RFI/RI) for Operable Unit 10 (OU10), Other Outside Closures, at the Rocky Flats Plant (RFP) in Jefferson County, Colorado. This investigation is part of a comprehensive, phased program of site characterization, remedial investigations (RIs), feasibility studies (FSs), and remedial/corrective actions currently in progress at RFP. These investigations are pursuant to an Interagency Agreement (IAG) among the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the State of Colorado Department of Health (CDH) dated January 22, 1991 (DOE, 1991). The IAG program developed by DOE, EPA, and CDH addresses RCRA and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) issues. Although the IAG requires general compliance with both RCRA and CERCLA, RCRA regulations take precedence at OU10. In accordance with the IAG, the CERCLA terms "remedial investigation" and "feasibility study," as used in this document, are considered equivalent to the RCRA terms "RCRA Facility Investigation" (RFI) and "Corrective Measures Study" (CMS), respectively. Also in accordance with the IAG, the term "Individual Hazardous Substance Site" (IHSS) is equivalent to the term "Solid Waste Management Unit" (SWMU).

OU10 is one of 16 OUs units listed for investigation by the IAG. Table 1-1 is a list of the OUs. OU10 contains 16 IHSSs which are also listed in Table 1-1. Figure 1.0-1 shows the locations of the RFP IHSSs. IHSSs were defined from Appendix I, 3004(u) Waste Management Units, of the RCRA Part B Permit Application, Rev. No. 1, USDOE - Rocky Flats Plant, dated December 15, 1987 (Table 2 was revised by the facility (Rev. No. 2), and is dated April 13,

Table 1-1 Operable Units and Individual Hazardous Substance Sites Included in the IAG

OU Number	OU Name	Individual Hazardous Substance Sites
1	881 Hillside	102, 103, 104, 105.1, 105.2, 106, 107, 119.1, 119.2, 130, 145
2	903 Pad, Mound, and East Trenches	108, 109, 110, 111.1, 111.2, 111.3, 111.4, 111.5, 111.6, 111.7, 111.8, 112, 113, 140, 153, 154, 155, 183, 216.2, 216.3
3	Off-Site Releases	199, 200, 201, 202
4	Solar Ponds	101
5	Woman Creek	115, 133.1, 133.2, 133.2, 133.4, 133.5, 133.6, 142.10, 142.11, 209
6	Walnut Creek	141, 142.1, 142.2, 142.2, 142.3, 142.4, 142.5, 142.6, 142.7, 142.8, 142.9, 142.12, 143, 165, 166.1, 166.2, 166.3, 167.1, 167.2, 167.3, 216.1
7	Present Landfill	114, 203
8	700 Area	118.1, 118.2, 123.1, 123.2, 125, 126.1, 126.2, 127, 132, 135, 137, 138, 139.1, 139.2, 144, 146.1, 150.1, 150.2, 150.3, 150.4, 150.5, 150.6, 150.7, 150.8, 151, 159, 163.1, 163.2, 172, 173, 184, 188
9	Original Process Waste Lines	121
10	Other Outside Closures	124, 124.1, 124.2, 124.3, 129, 170, 174, 175, 176, 177, 181, 182, 205, 206, 207, 208, 210, 213, 214
11	West Spray Field	168
12	400/800 Area	116.1, 116.2, 120.2, 136.1, 136.2, 136.3, 147.1, 147.2, 157.2, 187, 189
13	100 Area	117.1, 117.2, 117.3, 122, 128, 134, 148, 152, 157.1, 158, 169, 171, 186, 190, 191
14	Radioactive Sites	131, 156.1, 156.2, 160, 161, 162, 164.1, 164.2, 164.3
15	Inside Building Closures	178, 179, 180, 204, 211, 212, 215, 217
16	Low-Priority Sites	185, 192, 193, 194, 195, 196, 197

1988); Appendix I, 3004(u) Waste Management Units, of the Transuranic Mixed Wastes RCRA Part B Permit Application, dated July 1, 1988; and the Comprehensive Environmental Assessment and Response Program, Phase I (DOE, 1991). The environmental impact from activities proposed under this plan will be very minor. Drilling and sampling is expected to release small amounts of fugitive dust and perhaps volatile organic compounds to the air. No impacts are expected on soil, groundwater, or surface water. Therefore, NEPA requirements for an environmental assessment or impact statement are not triggered.

As required by the IAG, this Phase I work plan addresses characterization of source materials and soils at OU10 IHSSs. A subsequent Phase II RFI/RI will investigate the nature and extent of surface water, groundwater sediment, biota, and air contamination and evaluate potential contaminant migration pathways.

This work plan was prepared in accordance with CERCLA, the National Oil and Hazardous Substance Pollution Contingency Plan (NCP), RCRA, National Environmental Policy Act (NEPA), and applicable Colorado state law. The presented work plan is prepared to be consistent with the IAG and the following guidance documents where applicable:

- EPA, Compendium of Superfund Field Operations Methods, September 1987
- EPA, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA: OSWER Directive 9355.3-01, October 1988
- EPA, RCRA Facility Investigation Guidance, Interim Final, May 1989
- EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, October 1986
- EPA, Guidance for Data Quality Objectives, 1987

- EPA, Interim Final Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual: OSWER Directive 9285.701A, July 1989

- EPA, Interim Final Risk Assessment Guidance for Superfund, Volume II: Environmental Evaluation Manual: EPA/540/1-89/001, March 1989

- EPA, Assessment of Errors in the Sampling of Soils; EPA/600/4-90/013, 1990

- EPA, Data Quality Objectives for Remedial Response Activities: Development Process. Office of Emergency and Remedial Response, EPA/540/G-87/003, 1987

- EPA, Data Quality Objectives for Remedial Response Activities, Example Scenario: RI/FS Activities at a Site with Contaminated Soil and Ground Water. Office of Emergency and Remedial Response, EPA/540/G-87/004, 1987

- EPA, Report on Minimum Criteria to Assure Data Quality. EPA/530-SW-90-021, 1989

- EPA, Guidance for Data Useability in Risk Assessment Interim Final. Office of Emergency and Remedial Response. EPA/540/G-90/008, 1990.

1.1 ENVIRONMENTAL RESTORATION PROGRAM

The Environmental Restoration (ER) Program, designed for investigation and cleanup of environmentally contaminated sites at DOE facilities, is being implemented in five phases. Phase 1 (Installation Assessment) includes preliminary assessments and site inspections to assess potential environmental concerns. Phase 2 (Remedial Investigations) includes planning and implementation of sampling programs to delineate the magnitude and extent of contamination at specific sites and evaluate potential contaminant migration pathways. Phase 3 (Feasibility Studies) includes evaluation of remedial alternatives and development of remedial action plans to mitigate environmental problems identified in Phase 2 as needing correction. Phase 4 (Remedial Design/Remedial Action) includes design and implementation of site-specific remedial actions selected on the basis of Phase 3 feasibility studies. Phase 5 (Compliance and Verification) includes monitoring and performance assessments of remedial actions as well as verification and documentation of the adequacy of remedial actions carried out under Phase 4. Phase 1 of the ER Program has been completed at RFP (DOE, 1986), and Phase 2 is currently in progress for OU10.

1.2 WORK PLAN OVERVIEW

This work plan presents an evaluation and summary of previous data and investigations, defines data quality objectives (DQOs) and data needs based on that evaluation, specifies Phase I RFI/RI tasks, and presents the Field Sampling Plan (FSP) for the Phase I RFI/RI. Also included in the work plan are a Baseline Risk Assessment Plan (BRAP), Community Relations Plan (CRP), Quality Assurance Addendum (QAA), and an Environmental Evaluation Work plan (EEW). The Health and Safety Plan for this work will be issued as a separate document. The RFP Site-Wide Quality Assurance Project Plan (QAPjP) provided guidance for the preparation of these plans.

Section 2.0 (Site Characterization) presents a conceptual model of each IHSS, based on a comprehensive review and detailed analysis of all available historical information, previous site investigations, site geology and hydrology, and available data on the nature and extent of contamination in soils, groundwater, surface water, and sediments. Section 3.0 presents potential sitewide Applicable or Relevant and Appropriate Requirements (ARARs), as required by the IAG, and a discussion of their application to the RFI/RI activities at OU10. Section 4.0 discusses the DQOs and work plan rationale for the Phase I RFI/RI. Section 5.0 specifies tasks to be performed for the Phase I RFI/RI. Section 6.0 presents the schedule for performance of Phase I RFI/RI activities.

The FSP, presented in Section 7.0, describes the sampling program necessary to determine the nature and extent of contamination, evaluate remedial alternatives, provide data for the baseline risk assessment, and provide data for the environmental evaluation. The FSP also describes sampling objectives, sampling locations and frequencies, sample designation, sampling equipment and procedures, and sample handling and analysis.

The BRAP, presented in Section 8.0, specifies the techniques and methodology necessary to identify and characterize the toxicity of all hazardous and radioactive substances present, contaminant fate and transport, the potential for human and environmental exposure, and the risk of potential threats to human health and the environment. The baseline risk assessments will provide the justification for performing Corrective/Remedial Actions.

Section 9.0 presents the general EE approach employed at RFP. It describes the way in which this approach will be applied at OU10 and presents a detailed FSP for work plan implementation. Due to the disturbed and developed nature of OU10, many of the specified EE activities will be reduced in scope. Details of the environmental evaluation are presented in Section 9.0.

1.3 REGIONAL AND PLANT SITE BACKGROUND INFORMATION

1.3.1 Facility Background and Plant Operations

RFP is a government-owned, contractor-operated facility that is part of the nationwide nuclear weapons production complex. The Plant was operated for the U.S. Atomic Energy Commission (AEC) from its 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 DOE in 1977. Dow Chemical U.S.A., an operating unit of the Dow Chemical Company, was the prime operating contractor of the facility from 1951 until June 30, 1975. Rockwell International was the prime operating contractor from July 1, 1975, until December 31, 1989. EG&G Rocky Flats, Inc., became the prime contractor on January 1, 1990.

The primary RFP mission is to produce components for nuclear weapons. Plutonium, uranium, beryllium, and stainless steel parts are fabricated at RFP and shipped off site for final assembly. Additional activities include chemical processing to recover plutonium from scrap material, metallurgical research and development, machining, assembly, nondestructive testing, coating remote engineering, chemistry, and physics. Waste handling operations at RFP include storage, transport, treatment, and packaging of waste materials generated on site. The waste forms that are handled include hazardous chemical waste, transuranic (TRU) waste, nonhazardous and nonradioactive waste, and combinations thereof. Current waste handling practices also involve on-site and off-site recycling of hazardous materials, on-site storage of hazardous and radioactive mixed wastes, and off-site disposal of solid radioactive materials at another DOE facility. However, both storage and disposal of hazardous and radioactive wastes occurred on site in the past. Preliminary assessments under the ER Program identified 16 past on-site storage and disposal locations as potential sources of environmental contamination within OU10.

1.3.2 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. The investigations performed prior to 1986, summarized by Rockwell International (1986a), include the following:

- Detailed description of the regional geology (Malde, 1955; Spencer, 1961; Scott, 1960, 1963, 1970, 1972, and 1975; Van Horn, 1972 and 1976; Dames and Moore, 1981; and Robson et al., 1981a and 1981b)

- Several drilling programs initiated in 1960 that resulted in construction of approximately 60 monitoring wells by 1982

- An investigation of surface water and groundwater flow systems by the U.S. Geological Survey (USGS) (Hurr, 1976)

- Environmental, ecological, and public health studies that culminated in an environmental impact statement (EIS) (DOE, 1980)

- A summary report on groundwater hydrology using data from 1960 to 1985 (Hydro-Search, Inc., 1985)

- A preliminary electromagnetic survey of the RFP perimeter (Hydro-Search, Inc., 1986)

- A soil gas survey of the RFP perimeter and buffer zone (Tracer Research, Inc., 1986)

- Routine environmental monitoring programs addressing air, surface water, groundwater, and soils (Rockwell International, 1975 to 1985, and 1986b).

In 1986, two major investigations were completed at RFP. The first was the ER Program Phase 1 Installation Assessment (DOE, 1986), which included analysis 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 SWMUs by Rockwell International (1987a). In accordance with the IAG, SWMUs are now designated as IHSSs. IHSSs were divided into three categories:

- Hazardous waste substance sites that will continue to operate and need a RCRA operating permit. These sites will need to have monitoring and maintenance programs developed which are based upon the evaluation of RFI/RI data.

- Hazardous waste substance sites that will be closed under RCRA interim status (OU10 IHSSs fall into this category). The RFI/RI for these sites will be designed to determine the impact of past activities. The data will be used to plan closure activities.

- Inactive waste substance sites that will be investigated and cleaned up under Section 3004(u) of RCRA or CERCLA. The RFI/RI for these sites will be designed to determine the impact of past activities. The data will be used to plan clean up activities which may be different from options considered for sites to be closed, due to difference in future use scenarios.

The second major investigation completed at RFP in 1986 involved a hydrogeologic and hydrochemical characterization of the entire site. Plans for this study were presented by Rockwell International (1986c and 1986d), and study results were reported by Rockwell International (1986e). Investigation results identified areas considered to be significant contributors to environmental contamination.

1.3.3 Physical Setting

1.3.3.1 Location

RFP is located in northern Jefferson County, Colorado, approximately 16 miles northwest of Denver (Figure 1.3-1). It encompasses approximately 6,550 acres of federally owned land in Sections 1 through 4 and 9 through 15 of T2S, R70W, 6th Principal Meridian. Major buildings are located within the RFP security area of approximately 400 acres. The security area is surrounded by a buffer zone of approximately 6,150 acres.

The approximately 140 on-site structures encompass approximately 256,400 square meters (2.76 million square feet [sq ft]) of floor space. Of this, major manufacturing, chemical processing, plutonium recovery, and waste treatment facilities occupy about 148,600 square meters (1.6 million sq ft). The remaining floor space is divided among laboratory, administrative,

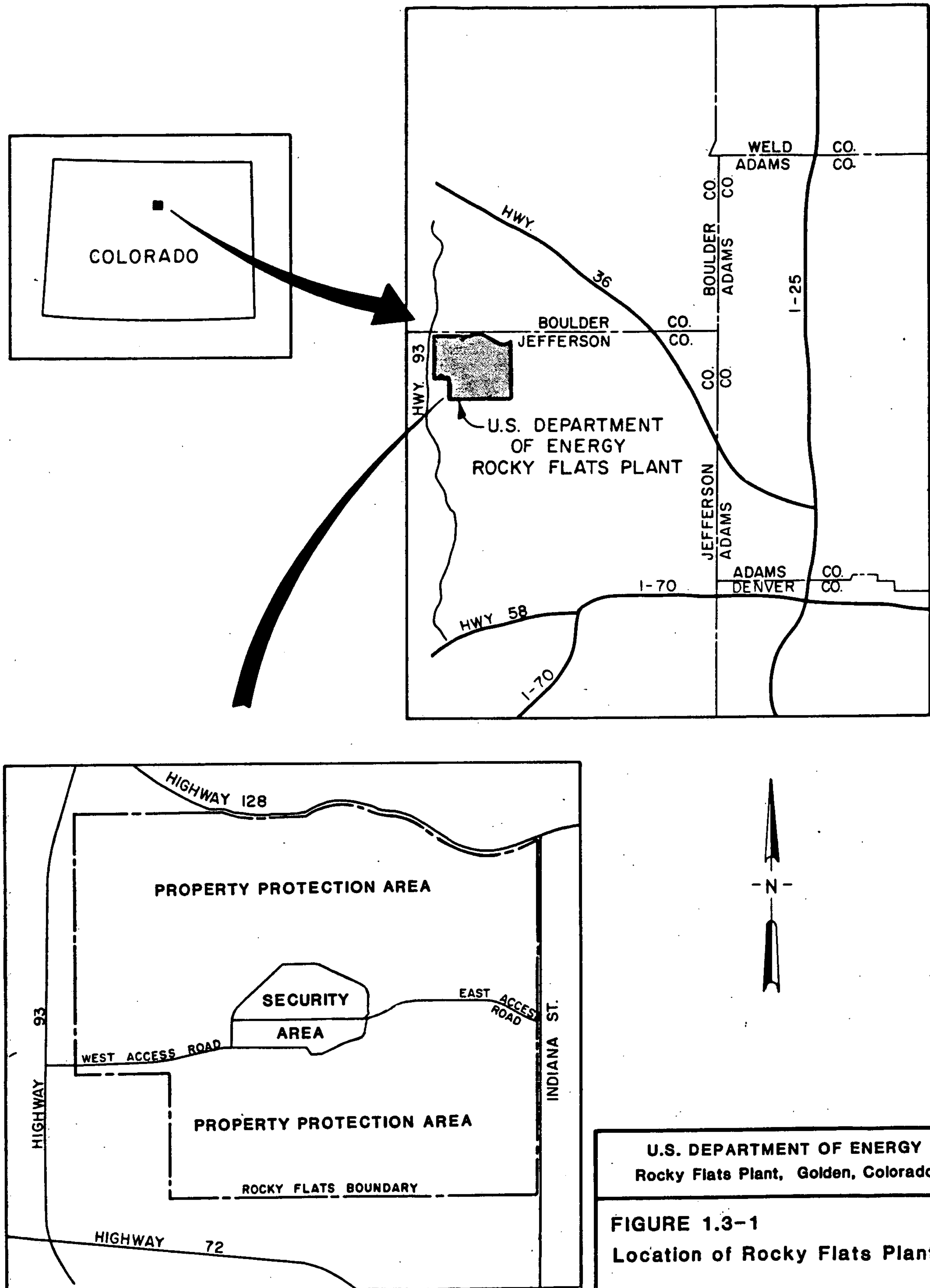

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FIGURE 1.3-1
Location of Rocky Flats Plant

utility, security, warehouse, storage, and construction contractor facilities (107,800 square meters [1.16 million sq ft]).

1.3.3.2 Topography

The natural environment in the vicinity of RFP and is influenced primarily by its proximity to the Front Range of the Rocky Mountains. Specifically, RFP is situated directly east of the north-south trending Rocky Mountains at an elevation of approximately 6,000 ft above mean sea level (msl), on a broad, eastward sloping plain of overlapping alluvial fans. The fans extend approximately 5 miles eastward from their origin in the abruptly rising Front Range, and terminate on low rolling hills at a break in slope. RFP is located approximately 25 miles east of the continental divide on a terrace between valleys cut by Walnut Creek and Woman Creek which are near the eastern edge of the fans.

1.3.3.3 Meteorology

RFP is located in a region of semiarid climate, characterized by warm summers and dry, cool winters, with some snow cover, as it is typical of much of the central Rocky Mountain Region. Clear skies, low average precipitation, and low relative humidity are also typical of this location. The elevation of RFP and the major topographical features in the area significantly influence the wind dispersion characteristics of the site. Winds, although variable, are predominantly northwesterly at RFP, with strongest winds occurring during the winter. The area occasionally experiences Chinook winds with gusts up to 100 miles per hour (DOE, 1980). Studies of air flow and dispersion characteristics indicate that winds coming down off the mountains turn and move north and northeast along the South Platte River valley, to the west and north of Brighton, Colorado.

Temperatures are moderate; extremely warm or cold weather is usually of short duration. On the average, daily summer temperatures range from 55 to 85 degrees Fahrenheit (F) and winter temperatures range from 20 to 45 degrees F. Temperature extremes recorded at the Plant have ranged from 102 degrees F on July 12, 1971 to -26 degrees F on January 12, 1963. The 24-year average maximum temperature for the period 1952 to 1976 was 76 degrees F, the average minimum was 22 degrees F, and the average annual mean was 50 degrees F. Average relative humidity was 46 percent (DOE, 1980).

Approximately 40 percent of the typical 15-inch annual precipitation falls during the spring season, predominantly as wet snow. Thunderstorms, occurring from June to August, account for an additional 30 percent of the annual precipitation. Drier autumn and winter seasons account for 19 and 11 percent of the annual precipitation, respectively. Snowfall, occurring from October through May, averages 85 inches per year. The maximum annual precipitation recorded over a 24-year period was 24.87 inches (63.17 centimeters) measured in 1969.

1.3.3.4 Surface Water Hydrology

Three intermittent streams drain RFP, flowing generally from west to east. These drainages are Rock Creek, Walnut Creek, and Woman Creek (Figure 1.3-2). Rock Creek drains the northwestern corner of RFP and flows northeast through the buffer zone to its off-site confluence with Coal Creek. North and South Walnut Creeks and an unnamed tributary drain the northern portion of RFP security area. These three forks of Walnut Creek join in the buffer zone and flow to Great Western Reservoir, which is approximately one mile east of the confluence. Woman Creek historically drained the southern RFP buffer zone flowing eastward to Standley Reservoir. A series of ponds designated Ponds A-1, A-2, A-3 and A-4 on Walnut Creek, Ponds B-1, B-2, B-3, B-4 and B-5 on South Walnut Creek and Ponds C-1 and C-2 on Woman Creek have been

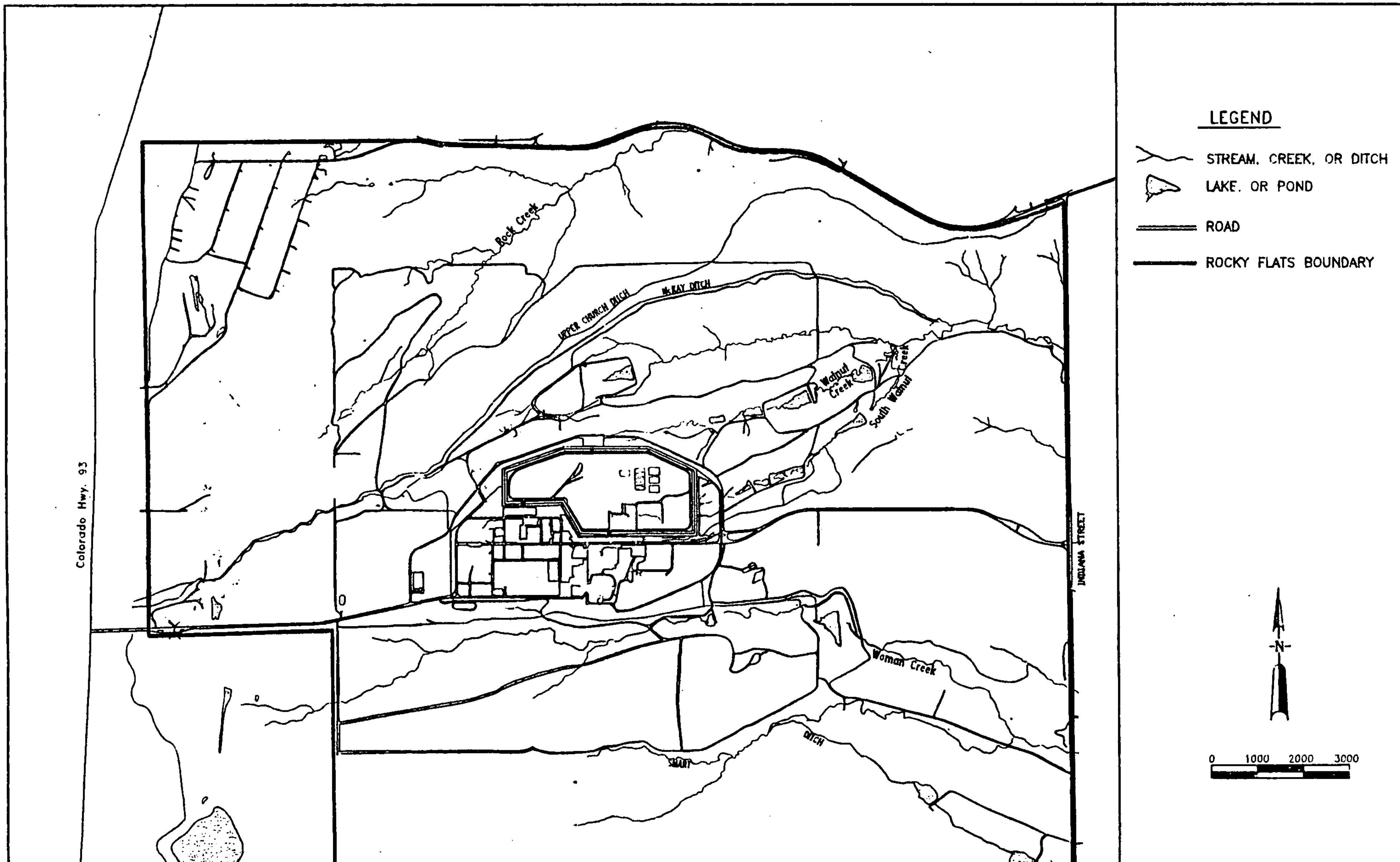

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FIGURE 1.3-2
Surface Water Drainage In Vicinity of Rocky Flats Plant

constructed to help control surface water flow and sediment transport. The South Interceptor Ditch lies between the RFP security area and Woman Creek and presently collects runoff from the southern RFP security area and diverts it to Pond C-2, where it is monitored in accordance with the RFP National Pollutant Discharge Elimination System (NPDES) permit prior to discharge to Woman Creek.

1.3.3.5 Ecology

The vegetation in the vicinity of RFP is representative of the plains grassland/lower montane ecotone. Grassland communities in this region are characterized by heavily grazed pastures with a mixture of herbs and relatively unpalatable grasses interspersed with isolated, undisturbed sites containing patches of big and little bluestem (*Andropogon gerardi* and *Andropogon scoparius*), needlegrass (*Stipa* sp.), blue grama (*Bouteloua gracilis*), and side-oats grama (*Bouteloua curtipendula*). Prickly pear cactus (*Opuntia* sp.) and yucca (*Yucca glauca*) are invaders where overgrazing has occurred; they are very common in the Property Protection Area (PPA), the approximately 6,150 acres surrounding the 400-acre RFP security area. Montane uplands contain ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii*), expressed in the foothills immediately adjacent to RFP as a savannah. Ravines contain wild plum (*Prunus americana*) and hawthorne (*Crataegus erythropoda*), with willows (*Salix* sp.), false indigo (*Amorpha fruticosa*) and cottonwood (*Populus* sp.) along drainages.

RFP includes species of flora representative of tall grass prairie, short grass plains, lower montane, and foothill ravine communities. The lands originally acquired for the site in 1951 have been generally undisturbed since that time. Most of the lands acquired in 1974 had been overgrazed. A plant inventory in 1973 reported 327 species of vascular plants, 25 lichens, 15 bryophytes, and one macroscopic green algae (Weber et al., 1974). The site's vegetation was mapped in 1974 (Clark, 1977). A few threatened or endangered species have been identified somewhere on RFP. None have been documented in OU10 IHSSs. Of the species identified, only the forktip three-awn (Aristida basiramea) is likely to occur as other than a transient at any of the OU10 IHSSs. A further discussion of threatened and endangered wildlife species is included in Section 9.0 Environmental Evaluation Work Plan. At that time, the area within the 1951 boundary, especially east and south of the Security Area, was primarily bluegrass (*Poa* sp.) and wheatgrass (*Agropyron* sp.) meadow, with marsh and stream-bank vegetation along the drainages. Higher elevations were more dry and barren, vegetated primarily by cheatgrass (*Bromus tectorum*) and musk thistle (*Carduus nutans*). West of the site and in the PPA, the coarse and rocky substrate was primarily vegetated with junegrass (*Koeleria pyramidata*), Klamath weed (St. Johnswort, *Hypericum perforatum*), and cheatgrass or musk thistle. Musk thistle was particularly abundant throughout the site in fallow and disturbed areas. The local presence of big bluestem and side-oats grama indicated recovery from overgrazing.

Current studies (December 1990 through August 1991) indicate that plant succession has progressed significantly since studies conducted in the 1970s. Most areas formerly mapped as annual weed communities now qualify as perennial grassland. Indicator species for perennial grassland such as western wheatgrass (*Agropyron smithii*) and Canada bluegrass (*Poa compressa*) have clearly increased in abundance and now dominate much of the site.

RFP wildlife habitats are similar to other foothills habitats because of the absence of barriers between the site and the surrounding foothill terrain. In such habitats, the most common large mammals are mule deer (*Odocoileus hemionus*). Medium-sized herbivorous mammals are represented primarily by white-tailed jack rabbits (*Lepus townsendii*), prairie dogs (*Cynomus ludovicianus*), (desert cottontails (*Sylvilagus audubonii*), and muskrats (*Ondatra zibethicus*).

Medium-sized carnivorous mammals are primarily coyotes (*Canis latrans*), red foxes (*Vulpes* vulpes), striped skunks (*Mephitis mephitis*), and long-tailed weasels (*Mustela frenata*), with occasional badgers (*Taxidea taxus*) and raccoons (*Procyon lotor*). Small mammals trapped in 1973 included deer mice (*Peromyscus maniculatus*), thirteen-lined ground squirrels (*Spermophilus tridecemlineatus*), northern pocket gophers (*Thomomys talpoides*), hispid pocket mice (*Perognathus hispidus*), silky pocket mice (*Perognathus flavus*), harvest mice (*Reithrodontomys* sp.), meadow voles (*Microtus pennsylvanicus*), and house mice (*Mus musculus*) (Winsor et al., 1975). Current studies (December 1990 to August 1991) have added several additional small mammal species, of which two are common: prairie voles (*Microtus ochrogaster*) and porcupines (*Erethizon dorsatum*).

Common small birds known to breed on RFP (based on current 1991 studies) are mourning doves (*Zenaidura macroura*), common nighthawks (*Chordeiles minor*), western kingbirds (*Tyrannus verticalis*), Say's phoebes (*Sayornis phoebe*), horned larks (*Eremophila alpestris*), barn swallows (*Hirundo rustica*), black-billed magpies (*Pica pica*), American robins (*Turdus migratorius*), European starlings (*Sturnus vulgaris*), yellow warblers (*Dendroica petechia*), blue grosbeaks (*Guiraca caerule*), green-tailed towhees (*Pipilo chlorurus*), rufous-sided towhees (*Pipilo erythrophthalmus*), vesper sparrows (*Pooecetes gramineus*), song sparrows (*Melospiza melodia*), western meadowlarks (*Sturnella neglecta*), red-winged blackbirds (*Agelaius phoeniceus*), Brewer's blackbirds (*Euphagus cyanocephalus*), brown-headed cowbirds (*Molothrus ater*), northern orioles (*Icterus galbula*), American goldfinches (*Carduelis tristis*), and house finches (*Carpodacus mexicanus*). Common birds-of-prey are turkey vultures (*Cathartes aura*), northern harriers (*Circus cyaneus*), red-tailed hawks (*Buteo jamaicensis*), Swainson's hawks (*Buteo swainsoni*), ferruginous hawks (*Buteo regalis*), rough-legged hawks (*Buteo lagopus*), American kestrels (*Falco sparverius*), and great horned owls (*Bubo virvinianus*). Mallards (*Anas platyrhynchos*) and, less commonly, Canada geese (*Branta canadensis*) and pintails (*Anas acuta*) breed on small ponds. Several species of diving ducks (*Aythya* sp.) are found in these ponds during migration. Great blue herons (*Ardea herodias*), and killdeer (*Charadrius vociferous*), spotted sandpipers (*Actitis macularia*), common snipe (*Calidris canulus*), and ring-billed gulls (*Larus delawarensis*) are also commonly found in the vicinity of the ponds.

Bullsnakes (*Pituophis melanoleucus*), prairie rattlesnakes (*Crotalus viridis*), and eastern yellow-bellied racers (*Coluber constrictor*) occur sitewide. Western painted turtles (*Chrysemys picta*) and western plains garter snakes (*Thamnophis radix*) appear in moist areas. Short-horned lizards (*Phrynosoma douglassi*) and red-sided garter snakes (*Thamnophis sirtalis*) occur, but are less common.

Aquatic life is not well developed in the streams, wastewater discharge system ponds, or other ponds. Aquatic and wetland vegetation, especially algae, is found in several of the wastewater and other ponds and reflects the nutrient supply. Black bass (probably largemouth bass, *Micropterus salmoides*), fathead minnows (*Pimephales promelas*), and bluegills (*Lepomis macrochirus*) were reported in one or more of the ponds (W-W Services, 1976). Data from 1976 indicates that crayfish and benthic macroinvertebrates, including the relatively sensitive sideswimmers (Amphipoda), mayflies (Ephemeroptera), caddisflies (Trichoptera), and facultative organisms, were found primarily in Pond B4 and in Woman Creek (W-W Services, 1976). Current studies (December 1990 to August 1991) in the PPA and OU1 and 2 have added golden shiner (*Notemigonus crysoleucas*), creek chub (*Semotilus atromaculatus*), stoneroller (*Campostoma anomalum*), white sucker (*Catostomus commersoni*), and green sunfish (*Lepomis cyanellus*) to the list and verified the presence of fathead minnows and largemouth bass. Current studies have also added six amphibians, three of which are common: tiger salamander

(*Ambystoma tigrinum*), boreal chorus frog (*Pseudacris triseriatus*), and northern leopard frog (*Rana pipiens*).

1.3.3.6 Surrounding Land Use and Population Density

RFP is located in a basically rural area. Approximately 50 percent of the area within 10 miles of RFP is in Jefferson County. The remainder is located in Boulder County (40 percent) and Adams County (10 percent). According to the 1973 Colorado Land Use Map, 75 percent of this land was unused or was used for agriculture. Since that time, portions of this land have been converted to housing, with several new housing subdivisions being constructed within a few miles of the buffer zone. One such subdivision is located south of the Jefferson County Airport and several are located southeast of RFP.

A demographic study using 1980 census data shows that approximately 1.8 million people lived within 50 miles of RFP. Approximately 9,500 people lived within 5 miles of RFP. The most populous sector was found to be to the southeast, between 10 and 50 miles from RFP and toward the center of the city of Denver. This sector had a 1980 population of about 555,000. Recent estimates of population growth registered by the Denver Regional Council of Governments (DRCOG) for the eight-county Denver metro region have shown a distinct decrease throughout the decade. Between 1980 and 1985, the population of the eight-county region increased by 197,890, a 2.4 percent annual growth rate. Between 1985 and 1989 a population gain of 71,575 was recorded, representing a 1.0 percent annual increase (the national average). The 1989 population showed an increase of 2,225 (or 0.1 percent) from the same date in 1988.

There are eight public schools within 6 miles of RFP. The nearest educational facility is Witt Elementary School, which is approximately 2.7 miles east of the RFP buffer zone. The closest hospital is Centennial Peaks Hospital located approximately 7 miles northeast. The closest park and recreation area is the Standley Reservoir area, which is approximately 5 miles southeast of RFP. Boating, picnicking, and limited overnight camping are permitted. Several other small parks exist in nearby communities (within 10 miles of RFP). The closest major park, Golden Gate Canyon State Park, located approximately 15 miles to the southwest, provides 8,400 acres used for camping and outdoor recreation. Other recreation areas, including Rocky Mountain National Park, are located in the mountains west and northwest of RFP; however, all are in excess of 15 miles away from the facility.

A portion of the land adjacent to RFP is zoned for industrial development. Industrial facilities within 5 miles of RFP include the 40-acre TOSCO (The Oilshale Company) laboratory, located 2 miles to the south; the Great Western Inorganics Plant, located 2 miles to the south; the Frontier Forest Products yard, located 2 miles to the south; the Idealite Lightweight Aggregate Plant, located 2.4 miles to the northwest; and the 990-acre Jefferson County Airport and Industrial Park, located 4.8 miles to the northeast.

Several ranches are located within 10 miles of RFP, primarily in Jefferson and Boulder Counties. Ranchers grow crops, raise beef and dairy cattle, and breed and train horses. According to the 1987 Colorado agricultural statistics, 20,758 acres of crops were planted in Jefferson County (total land area of approximately 475,000 acres) and 68,760 acres of crops were planted in Boulder County (total land area of 405,760 acres). Crops consisted of winter wheat, corn, barley, dry beans, sugar beets, hay, and oats. Livestock in the area consisted of 5,314 head of cattle, 113 hogs, and 346 sheep; Boulder County reported 19,578 head of cattle, 2,216 hogs, and 12,133 sheep.

1.3.3.7 Regional Geology and Hydrogeology

The water-bearing units at the RFP consist of alluvium, colluvium, valley fill alluvium, bedrock sandstone, and weathered and unweathered claystone of the Laramie and Fox Hills Sandstone and Arapahoe Formations (Figures 1.3-3 and 1.3-4). The alluvium, colluvium, and valley fill alluvium best fit the RCRA definition of the uppermost aquifer based on their proximity to the ground surface and higher hydraulic conductivities relative to the other units. Conversely, the unweathered claystone is interpreted to be an aquitard because of its low hydraulic conductivity (generally on the order of 1 x 10^{-7} and 10^{-8} cm/sec). This leaves for interpretation whether sandstone and weathered claystone, which are hydraulically interconnected with the alluvial system, should be a part of this interpretation of "uppermost aquifer." In some locations weathered claystone and sandstone have estimated hydraulic conductivities similar to the unweathered claystone and therefore are not considered a part of the "uppermost aquifer." However, because hydraulic conductivities for these units vary across the RFP, and in some instances these units subcrop beneath the IHSSs, they will be considered part of the "uppermost aquifer" where:

- weathered claystones and sandstones subcrop beneath an IHSS
- Saturated sandstones subcrop beneath saturated surficial material that has been contaminated by a regulated unit, regardless of the location with respect to the regulated unit.

Confined groundwater flow also occurs in bedrock sandstones.

Rocky Flats Alluvium

The Rocky Flats Alluvium is present beneath a large portion of RFP, and comprises broad planar deposits consisting of topsoil underlain by up to 100 ft of clay, silt, sand, and gravel. Groundwater is present under unconfined conditions in the relatively permeable Rocky Flats Alluvium. Groundwater generally flows from west to east in the direction of surface water

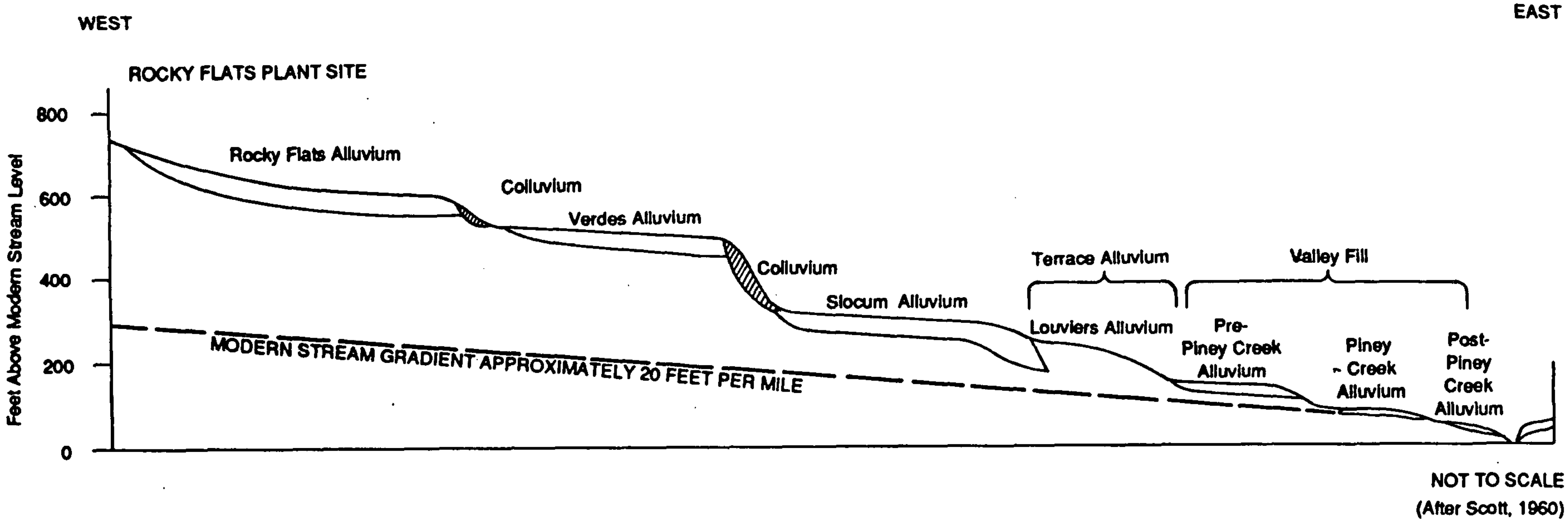

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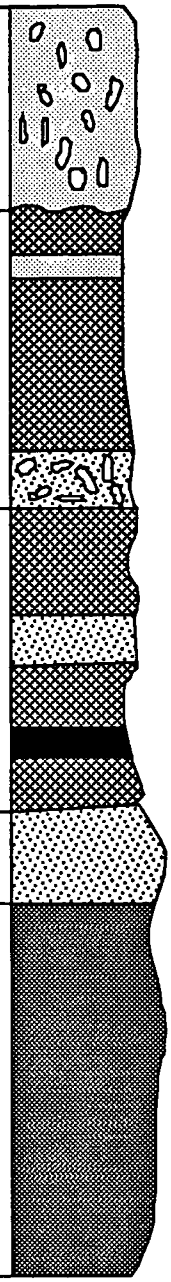
FIGURE 1.3-3
Erosional Surfaces and Alluvial Deposits East of the Front Range, Colorado

Quaternary	Alluvium	0-100'	Conglomerate in sandy clay matrix
Upper Cretaceous	Arapahoe Formation	0-150'	Tan sandy claystone and clayey sandstone; conglomeratic sandstone at base
	Laramie Formation	792'	Grey, fine-to-medium grained sandstone and silty clays; thin coal beds in lower part
	Fox Hills Sandstone	60'	Tan, fine-to-medium grained sandstone and sandy shale
	Pierre Shale	± 8000'	Dark grey, silty shale and few thin, silty sandstones



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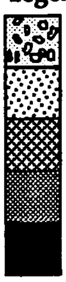

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Figure 1.3-4

GENERALIZED STRATIGRAPHIC SECTION, ROCKY FLATS AREA

After LeRoy and Weimer, 1971

November 1991

drainage. The range of hydraulic conductivity for Rocky Flats Alluvium is 1.6×10^{-5} to 1.3×10^{-3} centimeters/second (cm/s) (Rockwell International, 1989). Buried paleochannels in bedrock surfaces also control groundwater flow direction. The water table rises in response to recharge during spring, and falls throughout the remainder of the year. Precipitation, snowmelt, and water losses from ditches, streams, and ponds recharge the alluvium. Discharge from the alluvium occurs at minor seeps in the colluvium, which covers the contact between alluvium and underlying bedrock along the edges of valleys. The Rocky Flats Alluvium thins to the east and has been either removed by erosion, or deposited east of the RFP boundary, and does not serve as a groundwater supply source to wells located downgradient of RFP. Therefore, wells downgradient of the RFP do not directly sample water from the Rocky Flats Alluvium.

Other Alluvial Deposits

Various other alluvial deposits occur downslope from the Rocky Flats Alluvium in RFP drainages. Colluvium (slope wash) mantles the valley slopes between the Rocky Flats Alluvium and the valley bottoms. The range of hydraulic conductivity for the colluvium is 7.7×10^{-5} to 1.4×10^{-4} cm/s (EG&G, 1991). In addition, remnants of younger terrace deposits including the Verdos, Slocum, and Louviers Alluviums occur occasionally along the valley slopes. The hydraulic conductivity range for the Verdes, Slocum, and Louviers alluviums would be similar to the Rocky Flats alluvium because of their similar composition. Recent valley fill alluvium occurs in the active stream channels. The range of hydraulic conductivity for the valley fill is 3×10^{-4} to 3×10^{-3} cm/s (EG&G, 1991).

Unconfined groundwater flow occurs in these surficial units. Recharge is from precipitation, percolation from streams during periods of surface water runoff, and by seeps discharging from the Rocky Flats Alluvium. Discharge is by evapotranspiration and by seepage into other geologic formations and streams. The direction of groundwater flow is generally downslope through colluvial materials and then along the course of the stream in valley fill materials. During periods of high surface water flow, water is lost to bank storage in the valley fill alluvium and returns to the stream after the runoff subsides.

Arapahoe Formation

The Arapahoe Formation underlies RFP surficial materials. The Arapahoe Formation consists of claystone with thin lenticular sandstones. The total formation thickness varies up to 300 ft and is approximately 150 ft thick beneath the central portion of the plant. The permeable zones of the Arapahoe Formation are lenticular sandstones within the claystone. The lenticular sand bodies are composed of fine-grained sands and silts, and their hydraulic conductivity is low compared to the overlying Rocky Flats Alluvium. A seismic reflection survey is currently being implemented at RFP to further characterize bedrock geology.

The Arapahoe Formation is recharged by leakage from streams and overlying aquifer. The main recharge areas are found beneath the Rocky Flats Alluvium, although some recharge from the colluvium and valley fill alluvium probably occurs along the stream valleys. Recharge is greatest during the spring and early summer when rainfall and stream flow are at a maximum and water levels in the Rocky Flats Alluvium are high. Groundwater movement in the Arapahoe Formation is generally toward the east, although flow within individual sandstones is not fully characterized at this time. Regional groundwater flow in the Arapahoe Formation is east toward the South Platte River in the center of the Denver Basin. The hydraulic conductivity range for the Arapahoe Formation is 1.0×10^{-8} to 4.6×10^{-4} cm/s (Rockwell International, 1989).

Laramie Formation and Fox Hills Sandstone

The Laramie Formation underlies the Arapahoe Formation and is composed of two units: a thick upper claystone and a lower sandstone. The claystone is more than 500 ft thick and is of very low hydraulic conductivity. The USGS (Hurr, 1979) concludes that RFP operations will not affect any units below the upper claystone unit of the Laramie Formation.

The lower sandstone unit of the Laramie Formation and the underlying Fox Hills Sandstone comprise a regionally important aquifer in the Denver Basin known as the Laramie-Fox Hills Aquifer. These units subcrop west of RFP and can be seen in clay pits excavated through the Rocky Flats Alluvium. The steeply dipping beds of these units quickly flatten to the east. Recharge to the aquifer occurs along limited outcrop area along the Front Range that is exposed to surface water flow and leakage. The hydraulic conductivity range for the Laramie Formation is 1.0×10^{-8} to 5.5×10^{-7} cm/s (Rockwell International, 1989).

2.0 SITE CHARACTERIZATION

A total of 16 Individual Hazardous Substance Sites (IHSSs) have been grouped into OU10, Other Outside Closures, and their locations are illustrated on Plate 1.

Section 2.1 discusses each IHSS in detail outlining the location and history, previous investigations, physical characteristics, and nature and extent of contamination. Most of the information is derived from the IHSS Closure Plans. Section 2.2, the site conceptual model, will discuss sources of contamination, types of contamination, release mechanisms, contaminant migration pathways, and receptors.

The soil data used in this report are 1988 soil data analyzed by Weston Analytics (Appendix A-1). The data are not known to be validated (Schoendaller, 1990). The background level data used to analyze the 1988 soil data is taken from the Background Geochemical Characterization Report For 1989, Rocky Flats Plant, EG&G Rocky Flats, Inc. (EG&G, 1990b). The table from the Geochemical Characterization report used to obtain the background soil data is the background table for alluvial borehole samples.

Background soil data cannot be directly compared or correlated with soil data from each IHSS to determine whether each IHSS is definitively contaminated, but it can be used as a screening tool to guide development of the Field Sampling Plan (FSP). It is recognized that concentrations of metals and radionuclides in various soil horizons, soil types, and other valose zone strata may be variable, however, the presence of these analytes at concentrations above background should trigger further evaluation under this program. Review of data collected under this program will include an analysis of relevant background data from like soil horizons, soil types and other appropriate vadose zone strata to distinguish contaminated areas from noncontaminated areas.

The groundwater data are from the RFP database (Appendix A-2). These data are presented in cases where wells exist in the IHSS's immediate location and can provide relevant data.

Many of the following discussions refer to the thickness of alluvium beneath the IHSSs and the direction of gorundwater flow. Figure 2.0-1 is an isopach map of alluvial thickness and Figure 2.0-2 is a water table elevation map.

2.1 BACKGROUND AND PHYSICAL SETTING OF OU10

2.1.1 Radioactive Liquid Waste Storage Tanks (IHSSs 124.1, 124.2, and 124.3)

IHSS 124 is composed of three underground concrete tanks designated T-66, T-67, and T-68. Each of the tanks has been given an individual IHSS number in the IAG: T-66 is IHSS 124.2; T-67 is IHSS 124.3; and T-68 is IHSS 124.1. The following site description and discussion of site history are from the Closure Plan for this site (Rockwell International, 1989a).

IHSS 124.1 is a rectangular concrete tank located in-ground south of 124.2 and 124.3 with an actual capacity of 30,000 gallons and a nominal capacity of 28,000 gallons. IHSS 124.1 is 16 ft wide, 28 ft, 10 inches long, 10 ft, 3 inches deep, and the walls are 10 inches thick. IHSS 124.1 has two 2-ft-diameter manholes in its top.

IHSSs 124.2 and 124.3 are rectangular tanks with walls of concrete which are 10 inches thick. The two tanks share an inner wall and are capped by concrete. Both tanks are straddled by a dry chemical storage shed covering approximately two-thirds of the tank tops and using the tops as the shed floor. Inner dimensions of 124.2 and 124.3 are as follows: 20 ft long, 10 ft wide, and 10 ft, 2 inches deep. Each has an actual capacity of 14,000 gallons and a nominal capacity of 12,000 gallons, and may be accessed through individual 2-ft-diameter manhole openings at the tank tops. The tank floors are sloped to aid in draining.

2.1.1.1 Location and History

The following information is summarized from the closure plan for this IHSS (Rockwell International, 1989a).

IHSSs 124.1, 124.2, and 124.3 are located in or are directly adjacent to Building 774, which is in the north-central portion of the Rocky Flats Facility (Plate 1 and Figure 2.1-1). IHSSs 124.1, 124.2, and 124.3 are located to the east of Room 241, outside and adjacent to the building (Figure 2.1-2). The three tanks remained in operation until September 30, 1989.

The primary function of IHSSs 124.2 and 124.3 was to receive treated liquid decanted from the second-stage batch precipitation process in Building 774. IHSS 124.1 was used as a backup if IHSSs 124.2 and 124.3 were not available. Other uses for IHSS 124.1 included receipt, via tank truck, of aqueous waste from miscellaneous sources such as spills in Buildings 460, 483, and 484 and water overflows on the 904 Pad.

IHSS 124.1 was installed in 1959. According to available records, no coating was applied to this tank. Both IHSSs 124.2 and 124.3 were installed in 1953 and were cleaned, sandblasted, and coated with 8 tons of Amercoat No. 55 in 1956. The waste held in all the tanks was low in solids content and, therefore, not prone to compaction (Rockwell International, 1989a).

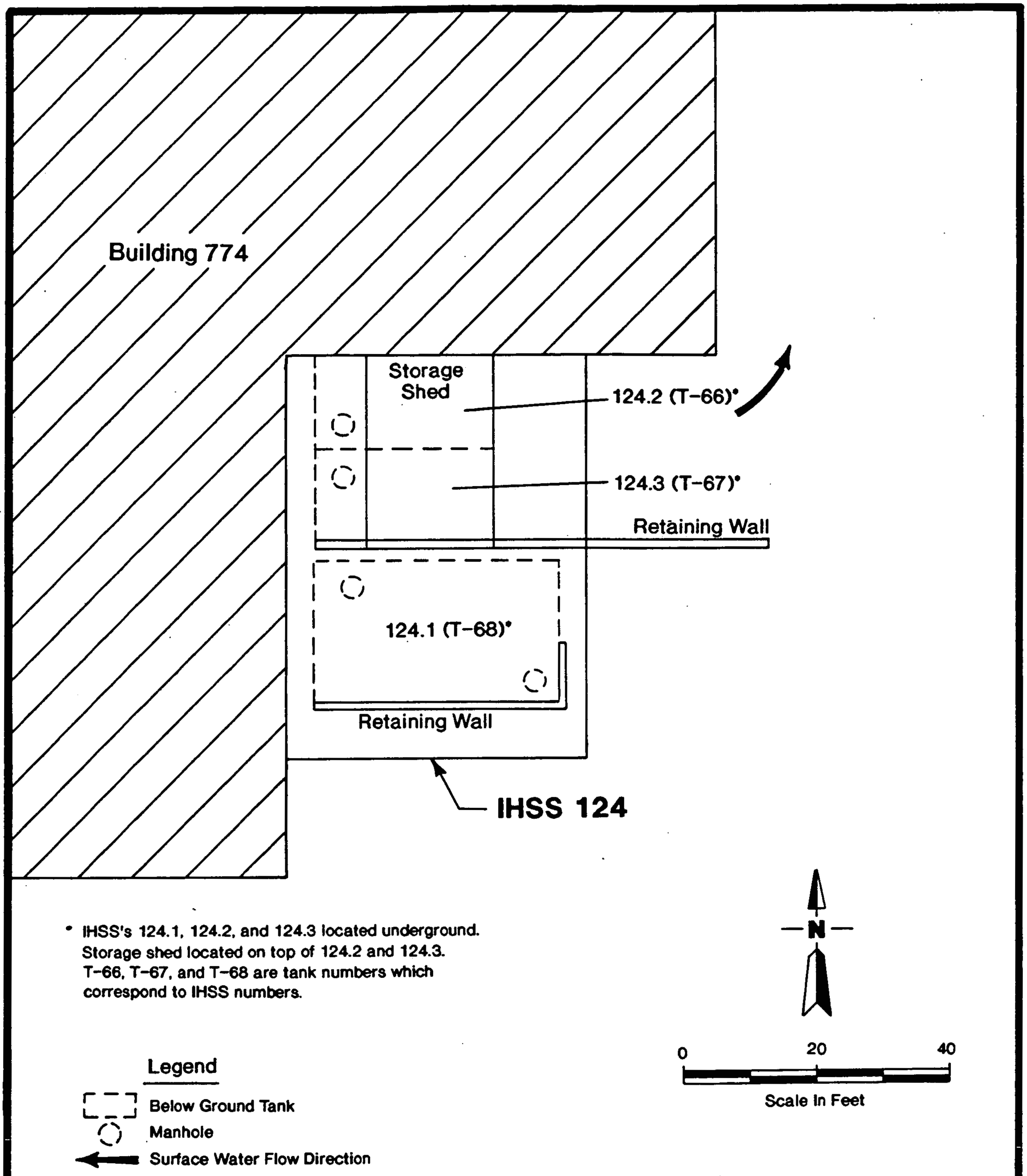

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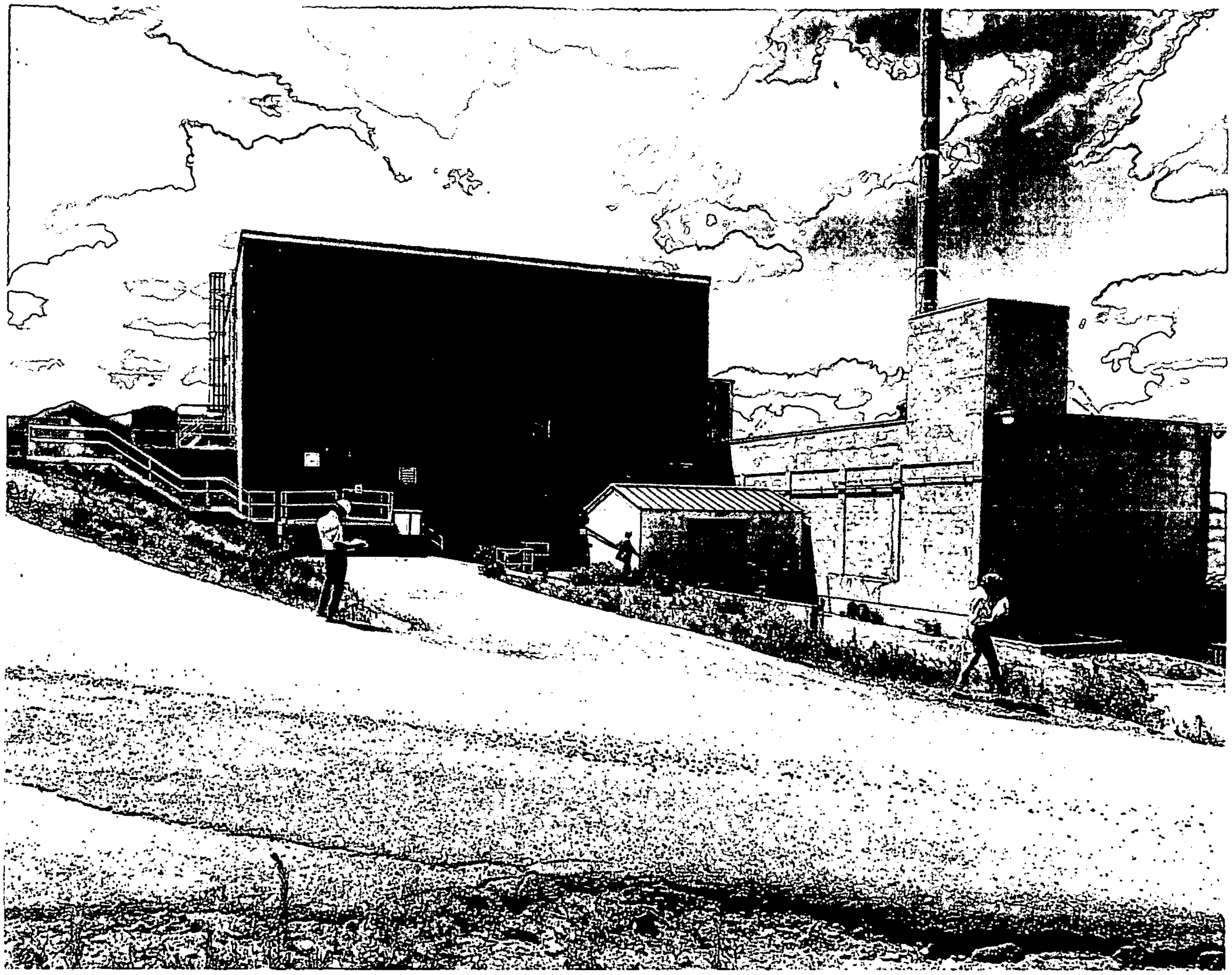
FIGURE 2.1-1
Radioactive Liquid Waste Storage Tanks (IHSS's 124.1, 124.2, 124.3) Location Map



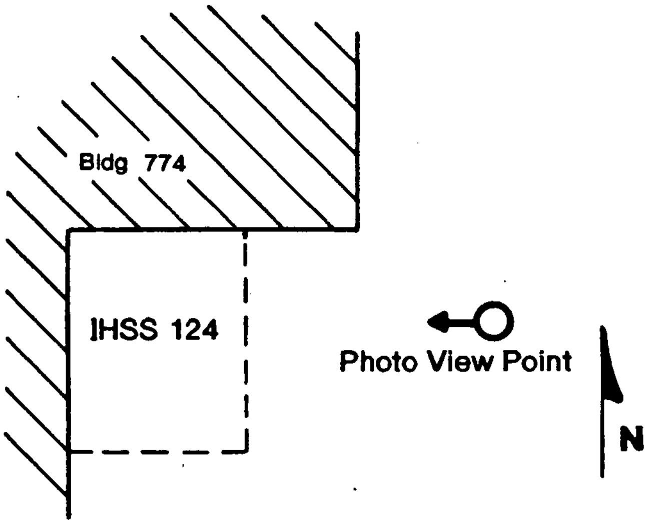


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FIGURE 2.1-2
Radioactive Liquid Waste Storage Tanks (IHSS 124.1, 124.2, 124.3) Site Photo

Each of the three tanks has two 4-inch-diameter fill lines and one 4-inch drain line. Within each tank the drain line has a 90-degree drop leg ending 6 inches off the tank floor. All piping enters or exits on the west wall of each tank. Because of the design of the drains in the 60-series tanks, approximately 1,000 gallons will remain in the bottom of each tank. The tank bottoms will be a mixture of aqueous wastes and solids which have precipitated from the tank contents. None of the tanks in the 60 series are reported to have been cleaned since coatings were applied. The waste held in the tanks is low in solids content and, therefore, not prone to compaction.

The sludges and effluents which may be in IHSSs 124.1, 124.2, and 124.3 have resulted from treatment of hazardous wastes with the following Hazardous Waste Numbers and characateristics:

- D001 — Ignitability
- D002 — Corrosivity
- D004 — EP - Toxicity (Arsenic)
- D005 — EP - Toxicity (Barium)
- D006 — EP - Toxicity (Cadmium)
- D007 — EP - Toxicity (Chromium)
- D008 — EP - Toxicity (Lead)
- D009 — EP - Toxicity (Mercury)
- D010 — EP - Toxicity (Selenium)
- D011 — EP - Toxcity (Silver).

The intermittent aqueous spillage received in IHSS 124.1 may exhibit, in addition to the above list, the following Hazardous Waste Numbers and characteristics:

- D003 — Reactivity

- F009 — Spent stripping solutions from electroplating containing cyanide and exhibiting characteristics of reactivity and toxicity.

Additional wastes that the Closure Plan identifies as potentially present at IHSSs 124.1, 124.2, and 124.3 are listed below:

- F001 — Spent halogenated solvents used in degreasing
- F002 — Spent halogenated solvents
- F003 — Spent nonhalogenated solvents.

2.1.1.2 Previous Investigations

IHSSs 124.1, 124.2, and 124.3 have not been previously investigated.

2.1.1.3 Physical Characteristics

The surficial materials existing at IHSSs 124.1, 124.2, and 124.3 consist of Rocky Flats Alluvium. The topography of the area gently slopes to the north, northeast (Plate 1). Approximately 10 ft of surficial materials overlie bedrock in the vicinity of IHSSs 124.1, 124.2, and 124.3. For a more detailed description of the geology, reference the bore log for Well 2086 found in Appendix B. Well 2086 is located approximately 120 ft to the northeast.

Groundwater is approximately 10 to 15 ft below the ground surface. The direction of flow in the unconfined flow system in the area of Building 774 is generally to the north into the Walnut Creek drainage. There is insufficient information to determine whether Wells 22-86 and 56-87, to the southeast of the tanks, or whether Well 19-86, to the west of Building 774, present the most relevant upgradient water quality data. Additional information is needed on the direction of flow of groundwater under Building 774 to accurately characterize the existing wells as being upgradient or downgradient of the tanks (RCRA Closure Plan, 1989a).

The following information on physical characteristics is summarized from the Closure Plan for this IHSS (Rockwell International, 1989a).

A french drain system has been installed north of IHSSs 124.1, 124.2, and 124.3 to intercept groundwater flowing towards North Walnut Creek. The system was installed in the hillside north of the Solar Evaporation Ponds and became operational in April 1981. This system of french drains north of the area strongly affects the surficial groundwater flow regime.

The depth of the drains range from approximately 1 to 27 ft below the ground surface, with a typical depth of 4 to 16 ft. The french drain system supplants a system of interceptor trenches (also shown in Figure 2.1-1) which was installed in the period from 1971 to 1974. The seepage intercepted by the french drain system flows by gravity into the interceptor trench pump house. The amount of water drained through this system has been estimated at 4 million gallons per year. This amount, however, includes the water collected in the foundation drains of Building 774, which is also piped into the interceptor trench pump house.

It can be hypothesized from the groundwater table elevation data for 1988 that shallow soils around IHSSs 124.1, 124.2, and 124.3 remain unsaturated throughout the year except for June. If this hypothesis is correct, then it appears that the existing french drain system is effectively collecting the shallow groundwater from the area of these tanks, except perhaps during periods of heavy precipitation. However, this interpretation is based on a limited number of wells, none of which are close to the tank location.

Evidence indicates that the existing french drain system is not completely effective in containing the contaminated groundwater flow from the area of the Solar Evaporation Ponds because contaminated groundwater has been detected at Wells 17-86 and 15-86 downgradient of the system. These wells are located toward the northeast of the pond area, away from the tanks. Evaluations are being conducted to develop criteria for final design of the groundwater collection and treatment system for the Solar Evaporation Ponds, which will address deficiencies of the existing system.

2.1.1.4 Nature and Extent of Contamination

There is no existing soil sampling data for IHSSs 124.1, 124.2, and 124.3 available at this time. The possible contaminants are plutonium, americium, and uranium.

Well 56-87 is upgradient of the Solar Evaporation Ponds and IHSSs 124.1, 124.2, and 124.3. Prior to installation of this well, soil samples were collected within the screened interval. The soil samples contained high concentrations of thallium, cadmium, antimony, and beryllium. It appears that constituents from the original Solar Pond or the original process waste line system may have impacted these soils (Rockwell International, 1989a).

Previous hydrogeologic investigations by Rockwell International and Weston have shown that groundwater in the surficial materials to the east of the tanks is contaminated. The Solar Evaporation Ponds are suspected as the sources for the contaminants which include nitrate, uranium, tritium, and trace metals. The groundwater in shallow bedrock also appears to have been impacted by the ponds. However, the extent of groundwater quality degradation in this zone is not adequately defined at this time. The report generated further states that the groundwater in deeper sandstone, which does not subcrop in the area, appears to have not been affected. None of the wells immediately adjacent to Building 774 are finished in the bedrock aquifer and, therefore, no information is presented here on water quality in this aquifer.

No upgradient or downgradient analytical groundwater data are available for this area, consequently further data are needed to assess the possibility of groundwater contamination from this site.

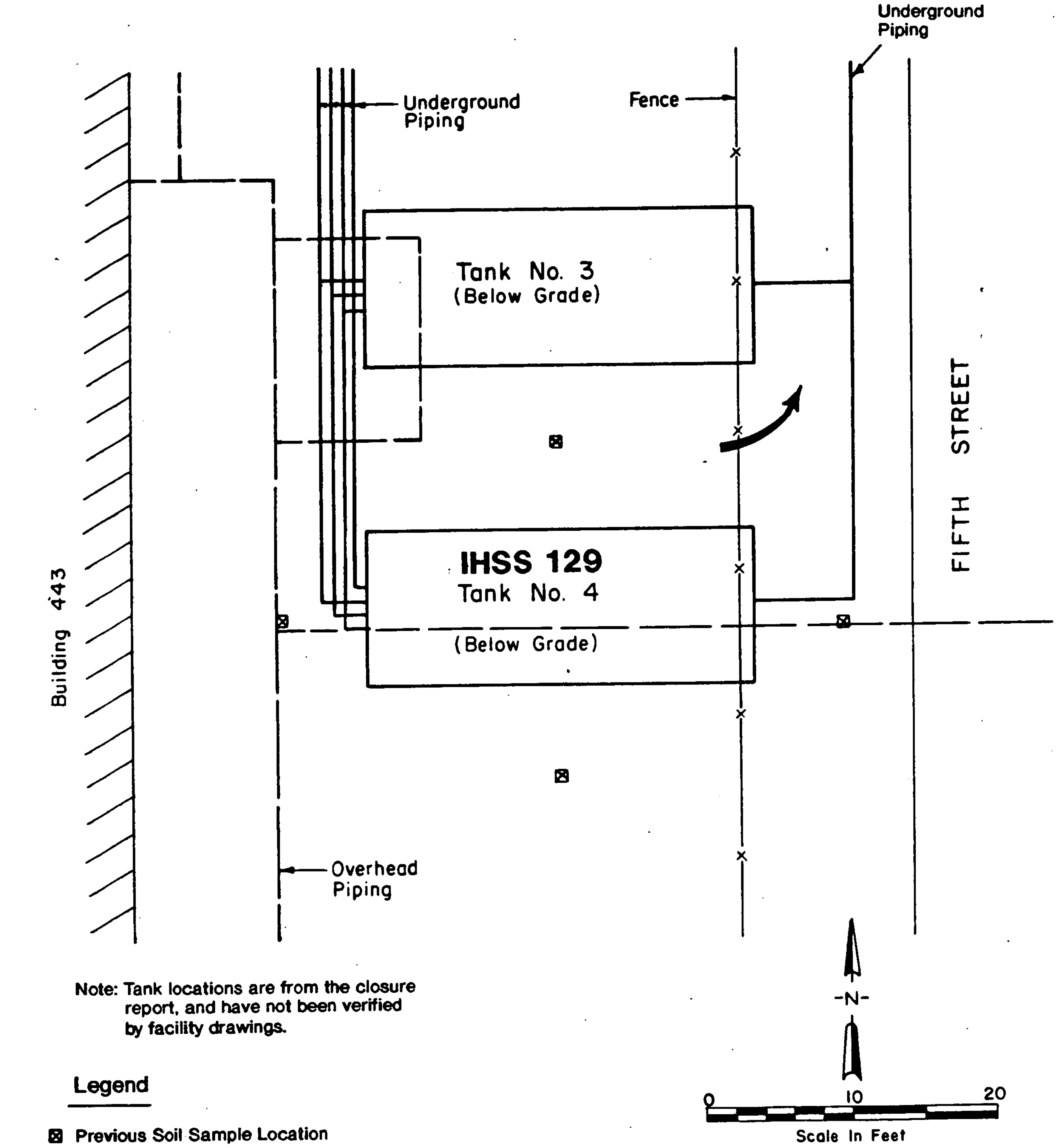
2.1.2 Oil Leak (IHSS 129)

The following discussion is summarized from the Closure Plan for the Building 443 No. 4 Fuel Oil Tank (Rockwell International et al., 1988a) and the RCRA Part B Permit Application for the Rocky Flats Plant Hazardous and Radioactive Mixed Wastes (Rockwell International, 1987).

2.1.2.1 Location and History

The Building 443 No. 4 Fuel Oil Tank (IHSS 129) is one of four fuel oil tanks located approximately 25 ft east of Building 443 (Figures 2.1-3 and 2.1-4). The fuel oil tanks are oriented longitudinally east to west in a north-south line. Tank No. 4 is the southernmost of these tanks. The top of this carbon steel tank is located approximately 4 ft below grade without secondary containment. It is 11 ft in diameter by 27 ft in length and has a total storage capacity of approximately 19,000 gallons.

Five pipelines are connected with tank No. 4 (Figure 2.1-3). Four steel supply and return lines connect each of the four tanks to Building 443. These four lines consist of a steam line to supply the heaters located inside each tank, a return condensation line from the heaters, a pump line to pump fuel oil to Building 443, and a return line for oil being circulated from the Building 443 boilers. An additional aboveground line connects two supply tanks south of Building 551 to the four tanks. The portion of this line that is connected to tank No. 4 is an underground steel pipe.



Note: Tank locations are from the closure report, and have not been verified by facility drawings.

Legend

⊠ Previous Soil Sample Location

← Surface Water Flow Direction

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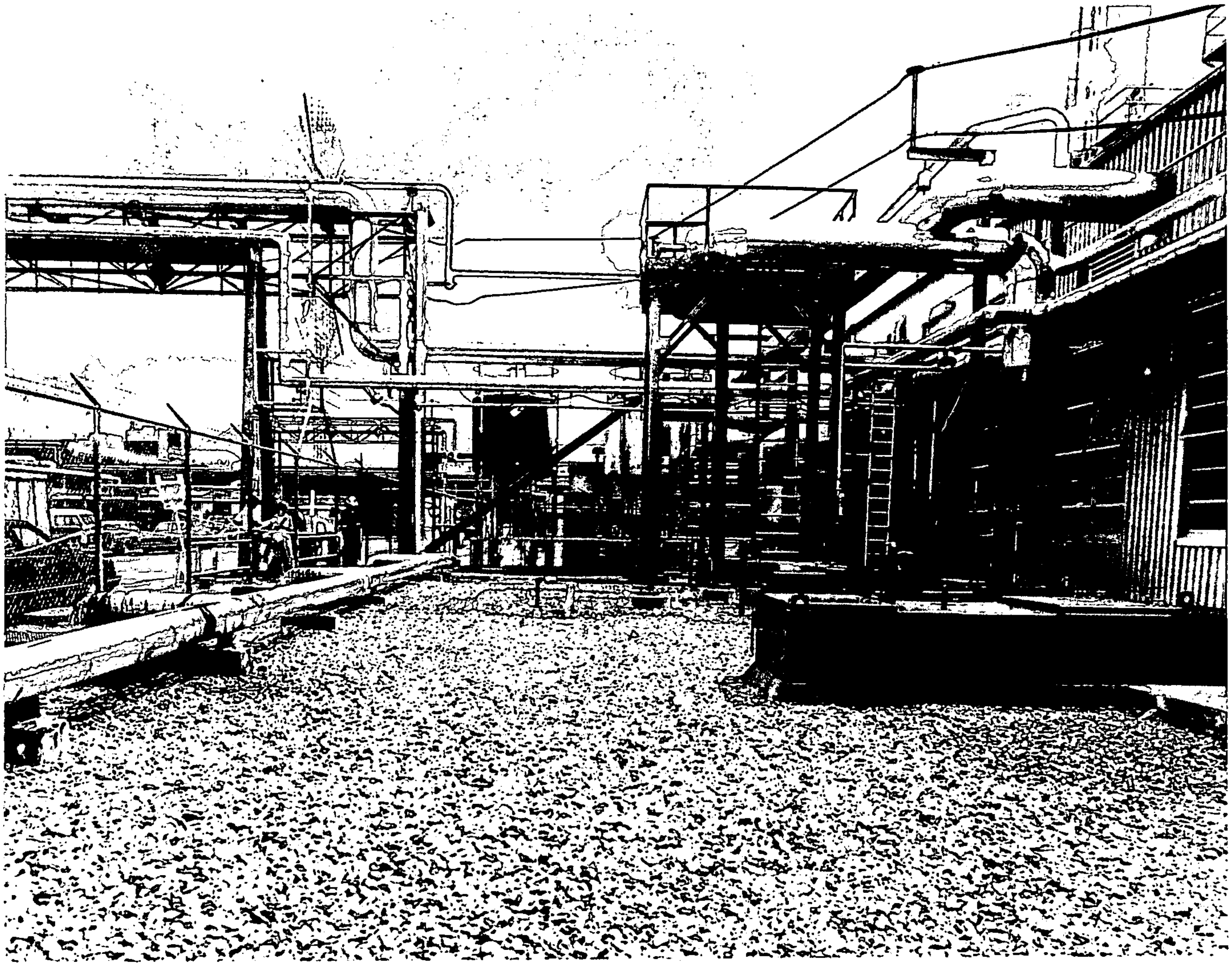
FIGURE 2.1-3
Oil Leak (IHSS 129)
Location Map



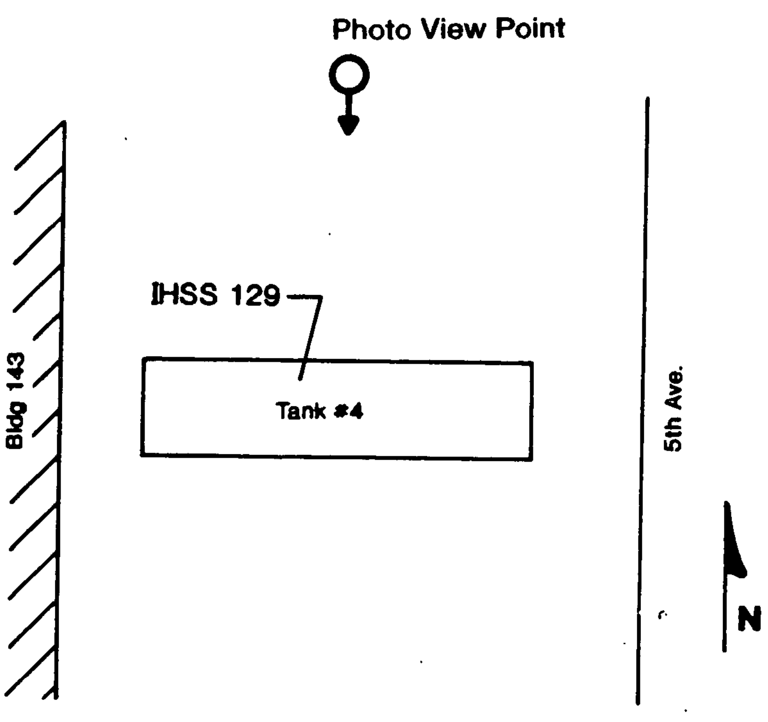


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FIGURE 2.1-4
Oil Leak (IHSS 129)
Site Photo

The four fuel oil tanks historically supplied #6 fuel oil to the Building 443 steam plant. Two of the tanks were installed in 1952, while tank No. 4 and another tank were installed in 1967. Although tank No. 4 was primarily used from 1967 to 1984 to store #6 fuel oil, during the 1970s it was used to store #2 diesel oil. From 1984 to 1986, tank No. 4 was used to store a waste mixture of water and compressor oil prior to disposal. The compressor waste was a mixture of approximately 9 parts water to 1 part oil and was stored at a rate up to approximately 30 gallons per day. Solvents used to clean equipment and for cleaning up fuel oil spills have also been added to tank No. 4 from 1967 to 1986. Reportedly, solvents were not added to any of the other tanks. The solvents were added by pouring them through a vertical pipe located at the east end of the tank No. 4. Approximately 55 gallons of solvent were used every 2 years in Building 443. This amount corresponds to the approximate quantity of solvents added to tank No. 4. Use of tank No. 4 was discontinued in 1986 when a 4-ft-deep fence post hole excavation located approximately 6 inches east of the eastern edge of tank No. 4 partially filled with a material appeared to be compressor oil. Subsequently, the contents of tank No. 4, approximately 12,900 gallons of material, were removed in 1986. Minor amounts of sludge may remain in tank No. 4 and associated lines.

There are no documented decreases in the level of material stored in tank No. 4 which would have indicated releases of material. Nevertheless, the source of the material in the fence post hole is believed to be spills associated with filling and possible leakage from tank No. 4. This theory is supported by documented increases in the level of material in tank No. 4 due to groundwater entering through a leak on the top of the tank. A summary of information pertaining to releases of fuel oil in the vicinity of the four #6 fuel oil tanks is presented below.

During 1967 and 1968, reported spills of #6 fuel oil were traced to overfilling the supply tanks because of inadequate instrumentation. The amount of fuel oil released is unknown.

In November 1977, approximately 600 gallons of #6 fuel oil were recovered from the sewage treatment plant. A cracked transfer pipe in an underground pipeline near tank No. 4 was determined to be the source of the oil. The oil had reportedly leaked out of the pipe, travelled through the pipe backfill and bedding materials, and seeped into a sump in Building 443 that was connected to the sewage treatment plant. The total amount of oil released is unknown. The pipe was repaired, and oil-contaminated soil encountered in the excavation was disposed of in the RFP sanitary landfill.

Following the observation of oil in the fence post hole east of tank No. 4, a trench approximately 3 ft wide, 4 ft deep, and 100 ft long was excavated east of the four Building 443 fuel oil tanks. The western edge of the trench was located approximately 3 to 4 ft east of the four fuel oil tanks. Dark fuel oil stains were observed in the southernmost 30 ft of the trench, immediately east of tank No. 4, and were believed to be related to previously mentioned spills and leakage events. No free product was present in the trench.

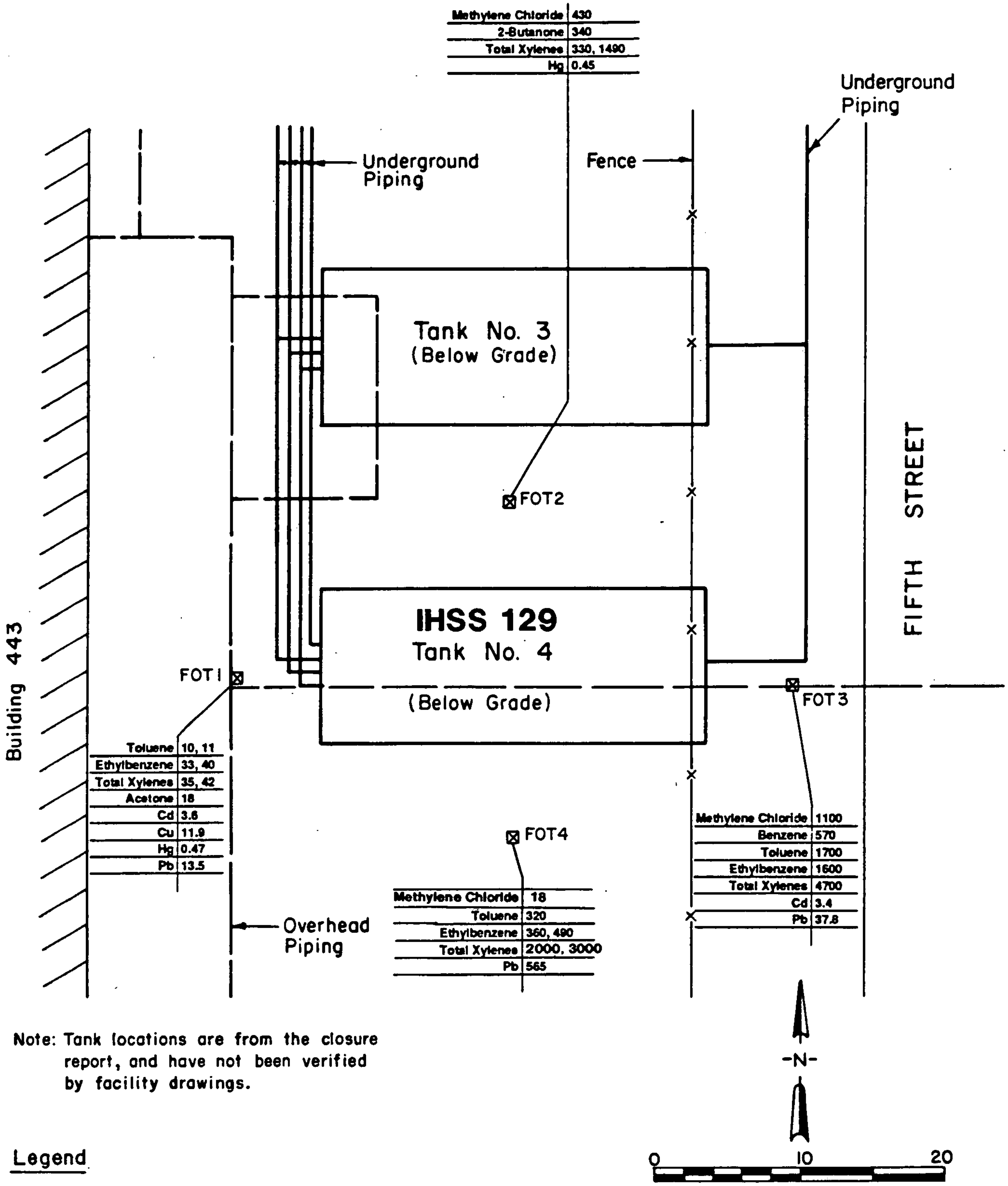
2.1.2.2 Previous Investigations

In 1986, samples were collected of the material stored in tank No. 4 and of the liquid that partially filled the excavated fence post hole east of tank No. 4. These samples were analyzed by both an on-site and an independent laboratory. The volatile organic compounds trichloroethylene, 1,1,1-trichloroethane, methylene chloride, and trichlorofluoromethane were detected in materials stored in tank No. 4. All of these compounds except trichloroethylene were also detected in the sample from the fence post hole. The Closure Plan for tank No. 4 (Rockwell

International et al., 1988a) indicates that the No. 4 Fuel Oil Tank was the potential source of volatile organics in the material collected from the fence post hole.

The Closure Plan for the No. 4 Fuel Oil Tank (Rockwell International, 1988a) presents results of groundwater analyses from five quarterly samplings of nearby alluvial Well 44-86 in 1986 and 1987. Well 44-86 is located approximately 150 ft northeast and cross-gradient of tank No. 4 and is not indicative of impacts to groundwater because of leakage or spills from tank No. 4. Trichloroethylene, 1,1,1-trichloroethane, and methylene chloride were the common analytes detected in tank No. 4 and the fence post hole, and were sampled for in Well 44-86. 1,1,1-Trichloroethane was found in two out of five sampling events; in one sampling event its concentration was less than one order of magnitude below the maximum contaminant level (mcl) of 0.20 milligram per liter (mg/l), and in the other sampling event the concentration was an estimated value below the analytical detection limit. Methylene chloride was detected in one out of two sampling events. The value for methylene chloride was actually an estimated value below the detection limit. Methylene chloride was also detected in a blank. Trichloroethylene was not detected in five out of five sampling events.

The Closure Plan for the Building 443 No. 4 Fuel Oil Tank (Rockwell International et al., 1988a) specifies an initial soil characterization program to determine the nature and extent of soil contamination. Subsequent to submittal of this Closure Plan, soil samples were obtained in 1988 from the four approximate locations shown in Figure 2.1-5 (Weston, 1988). These borings were proposed to extend 10 ft below the water table or to a maximum depth of 30 ft. The actual depth of these borings is presently unknown. It was also proposed that continuous samples would be screened visually in the field to identify areas of contamination and that a portable gas chromatograph would be used to determine the presence of trichloroethylene or 1,1,1-



Note: Tank locations are from the closure report, and have not been verified by facility drawings.

Legend

⊠ Previous Soil Sample Location

Cd Cadmium
Cu Copper
Pb Lead
Hg Mercury

UNITS
Organics are ug/kg for soils: ug/l for water
Inorganics are mg/kg for soils: mg/l for water
Radionuclides are pci/g for soils: pci/l for water

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FIGURE 2.1-5
Analytes Detected Above Background
Oil Leak (IHSS 129)

trichloroethane. Analysis of soil samples included Hazardous Substance List (HSL) volatile organic analysis (VOAs), HSL base neutral acid extractable organics (BNAs), and HSL metals. Section 2.1.2.4 presents the results.

2.1.2.3 Physical Characteristics

The land surface at IHSS 129 gently slopes to the northeast (Plate 1). Approximately 25 ft of alluvium and fill overlie the bedrock in the vicinity of IHSS 129. The geologic materials in the vicinity of IHSS 129 consist of Rocky Flats Alluvium, fill, and Arapahoe Formation deposits. Unconfined groundwater flows to the east and probably intercepts the south Walnut Creek drainage. Depth to groundwater is estimated to be approximately 10 ft.

2.1.2.4 Nature and Extent of Contamination

Analytical results for soil samples taken in the area (Weston, 1988) indicate the presence of organics above detection limit including 1,1,1-trichloroethane, methylene chloride, benzene, toluene, ethylbenzene, 2-butanone, and total xylenes. The organic 1,1,1-trichloroethane was also detected by a portable gas chromatograph during field sampling. Table 2-1 lists the organics detected, present below detection limits, and present in blanks. Metals detected above background include mercury, cadmium, copper, and lead. Table 2-1 also lists the metals above background. Radionuclides were not tested at this site. The sampling locations and concentrations of analytes detected above background are illustrated in Figure 2.1-5.

No upgradient or downgradient analytical groundwater data are available for this area.

2.1.3 <u>P.U.&D. Container Storage Yard - Waste Spills (IHSS 170)</u>

2.1.3.1 Location and History

Table 2-1 IHSS 129 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg)				
Methylene chloride		FOT1	2/2	4.0J, 14B
		FOT2	2/2	65J, 430
		FOT3	1/1	1100
		FOT4	2/2	573, 60J
Acetone		FOT1	1/1	18
		FOT4	1/1	370J
2-Butanone		FOT2	1/1	340
Benzene		FOT1	2/2	3.0J, 5.0J
		FOT3	1/1	570
		FOT4	2/2	78J, 180J
Toluene		FOT1	2/2	10, 11
		FOT2	2/2	71J, 180J
		FOT3	1/1	1700
		FOT4	2/2	170J, 320

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram

Table 2-1 IHSS 129 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) - Contd.				
Ethylbenzene		FOT1	2/2	33, 40
		FOT2	2/2	140J, 200J
		FOT3	1/1	1600
		FOT4	2/2	360, 490
Total Xylenes		FOT1	2/2	35, 42
		FOT2	2/2	330, 1500
		FOT3	1/1	4700
		FOT4	2/2	2000, 3000
2-Methylnaphthalene		FOT1	1/1	7800J
		FOT4	1/1	7800J
Pyrene		FOT1	1/1	7100J
Benzo(a)anthracene		FOT1	1/1	3600J
Chrysene		FOT1	1/1	8100J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram

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Table 2-1 IHSS 129 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals (mg/kg)				
Cadmium	3.20	FOT1	1/1	3.60
		FOT3	1/1	3.40
Copper	11.1	FOT1	1/1	11.9
Mercury	0.320	FOT1	1/1	0.470
		FOT2	1/1	0.450
Lead	12.2	FOT1	1/1	13.5
		FOT3	1/1	37.8
		FOT4	1/1	565

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram

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The P.U.&D. Storage Yard, approximately 260 ft by 1,000 ft in size is located southeast of the present landfill (Figures 2.1-6 and 2.1-7). The P.U.&D. Storage Yard began to be used in 1974 when operations were moved from the north end of the 551 Storage Yards. The P.U.&D. Storage Yard is presently active. 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, and drums of spent solvents (paint thinners) and waste oils (Rockwell International, 1988b).

Six tanks, containing approximately 1,800 gallons of liquid waste, have been generated from the cleanup of the RFP P.U.&D. Storage Yard. A 90-Day Accumulation Area has been established at the P.U.&D. Storage Yard for the storage of this material. EG&G Rocky Flats, Inc., is proposing to ship tanks numbered 1, 2, 4, 5, and 6 off site for disposal as nonradioactive waste.

Releases of battery acids have occurred in the past during removal of the batteries by recyclers. RFP personnel interviewed indicated that other releases have occurred from leaking dumpsters and drums of solvents and waste oils (Rockwell International, 1988b).

During a site visit in May 1990, EBASCO personnel observed that machined steel is currently stored near the middle of the P.U.&D. Storage Yard in a dumpster located several hundred feet from the reported location of the IHSS 174 Dumpster Storage Area (Rockwell International, 1988b). Stained soil was also observed in the vicinity of this area. Inspection of air photos revealed a patch of stained soil near the center of the Storage Yard in 1985, which coincides with the current dumpster location. The dumpsters in current use reportedly do not contain hazardous constituents (Rockwell International, 1988b).

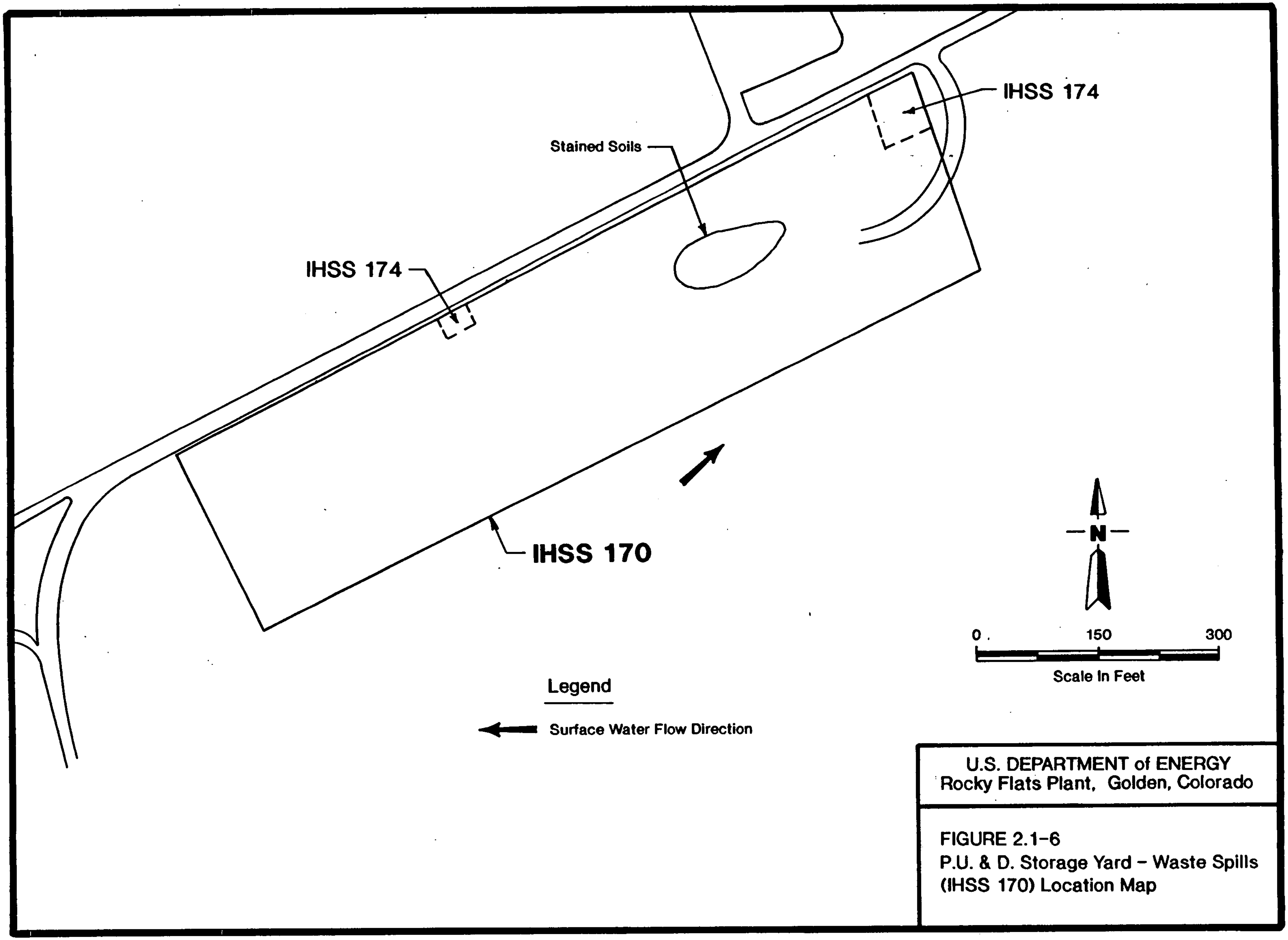

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FIGURE 2.1-6
P.U. & D. Storage Yard - Waste Spills
(IHSS 170) Location Map

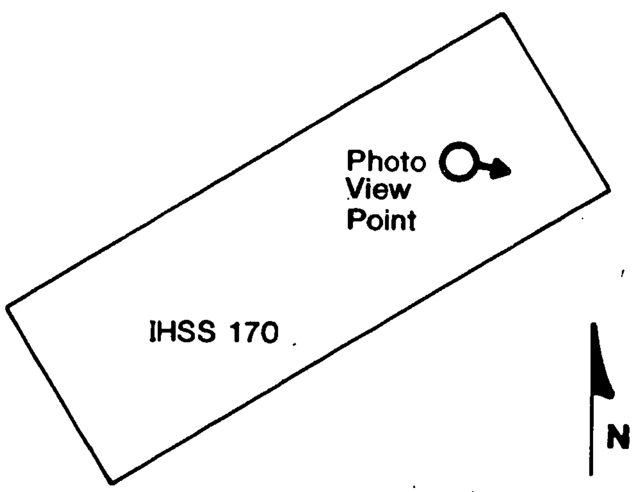

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FIGURE 2.1-7
P.U. & D. Storage Yard - Waste Spills (IHSS 170) Site Photo

2.1.3.2 Previous Investigations

It is unknown if any previous soil or water sampling investigations have been performed but six tanks have been sampled. Tanks of water at P.U.&D. Storage Yard samples of tanks 1, 3, 4, 5, and 6 had a 6 to 23 volume percent organics, although Waste Guidance (Jim Fitzsimmons) said the layers of organic were approximately 1/4 to 1 inch thick. Therefore, the samples probably had a higher percentage organic than the tank (EG&G, 1990a). The results from analytical report E90-2032, for tanks 1 through 6 are listed below. The units are in ppm.

Acetone	0.20-0.30	Aluminum	100-300
Methylethyl ketone	0.30	Calcium	4.0-250
Ethylene dichloride	2.2-5.0	Iron	4.0-300
Freon 113	8.0	Potassium	4.0-300
Ethyl acetate	1.8	Sodium	4.0-300
Trichloroacetate	9.0-270	Gross Alpha	1.0±12-230±0.20
Perchloroethylene	0.50	Gross Beta	2.0±29-220±0.20
Toluene	0.50		

2.1.3.3 Physical Characteristics

The topography gently slopes to the northeast and east (Plate 1). Approximately 35 to 55 ft of Rocky Flats Alluvium and fill overlie the Arapahoe Formation in the vicinity of the P.U.&D. Storage Yard. The groundwater flows to the northeast, and probably intercepts the Present Landfill's groundwater extraction system on the north tributary of Walnut Creek. The depth to groundwater is approximately 10 ft. The closest well, Well 1086, is located 550 ft to the northeast of IHSS 170 (Plate 1).

2.1.3.4 Nature and Extent of Contamination

No previous investigations were performed so the nature and extent of contamination is unknown.

Acetone, methylene chloride, and nitrate/nitrite were detected in the groundwater of downgradient Well 1086 (Table 2-2). Well 1086 is located 550 ft northeast of IHSS 170. Additional sampling is required to characterize the natural and extent of contamination.

2.1.4 P.U.&D. Container Storage Yard - Waste Spills (IHSS 174)

The following discussion is summarized from the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1988b).

2.1.4.1 Location and History

Two separate areas are located within the P.U.&D. Container Storage Yard, the Drum Storage Area and the Dumpster Storage Area (Figures 2.1-8 and 2.1-9). The Drum Storage Area of IHSS 174 is a square area located within the northeast corner of the P.U.&D. Storage Yard and has dimensions of approximately 60 by 60 ft. The P.U.&D. Storage Yard was recently identified as IHSS 170 and is discussed in Section 2.1.3. The Dumpster Storage Area of IHSS 174 was reportedly located along the northern fence line, approximately 300 ft east of the western fence line of the P.U.&D. Storage Yard.

Operations began in the Drum Storage Area sometime between 1974 and 1976 and ended in 1985. The Drum Storage Area was used for storage of 55-gallon steel drums that primarily contained waste oils from equipment and vehicle maintenance as well as waste paints and paint thinners from the RFP Paint Shop. These drums were placed directly on the ground surface without secondary containment. The drums and their contents were periodically sold for recycling until 1984, when the oil was determined to contain hazardous constituents. It has been estimated that a total of 460 drums were stored during the operation of the Drum Storage Area, although the maximum number of drums stored at any one time may have been considerably less

Table 2-2 IHSS 170 Downgradient Groundwater Sampling Summary (1990 Groundwater Monitoring Report).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (mg/l)				
Acetone		1086	2/6	11.0 - 42.0
Methylene chloride		1086	1/6	22.0
Inorganics (mg/l)				
Nitrate/Nitrite	3.43	1086	4/8	3.60 - 4.30

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
mg/l - milligram per liter

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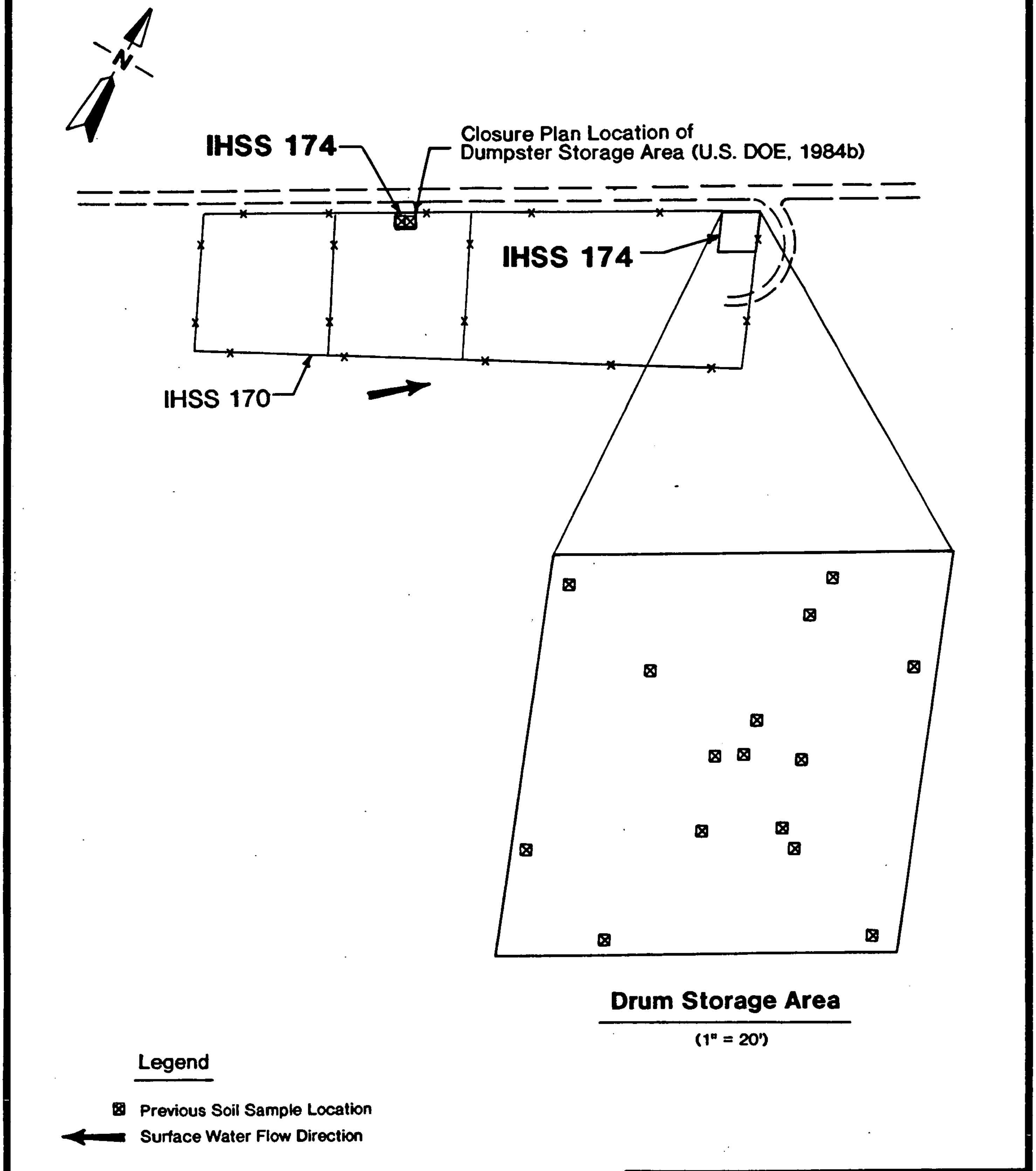

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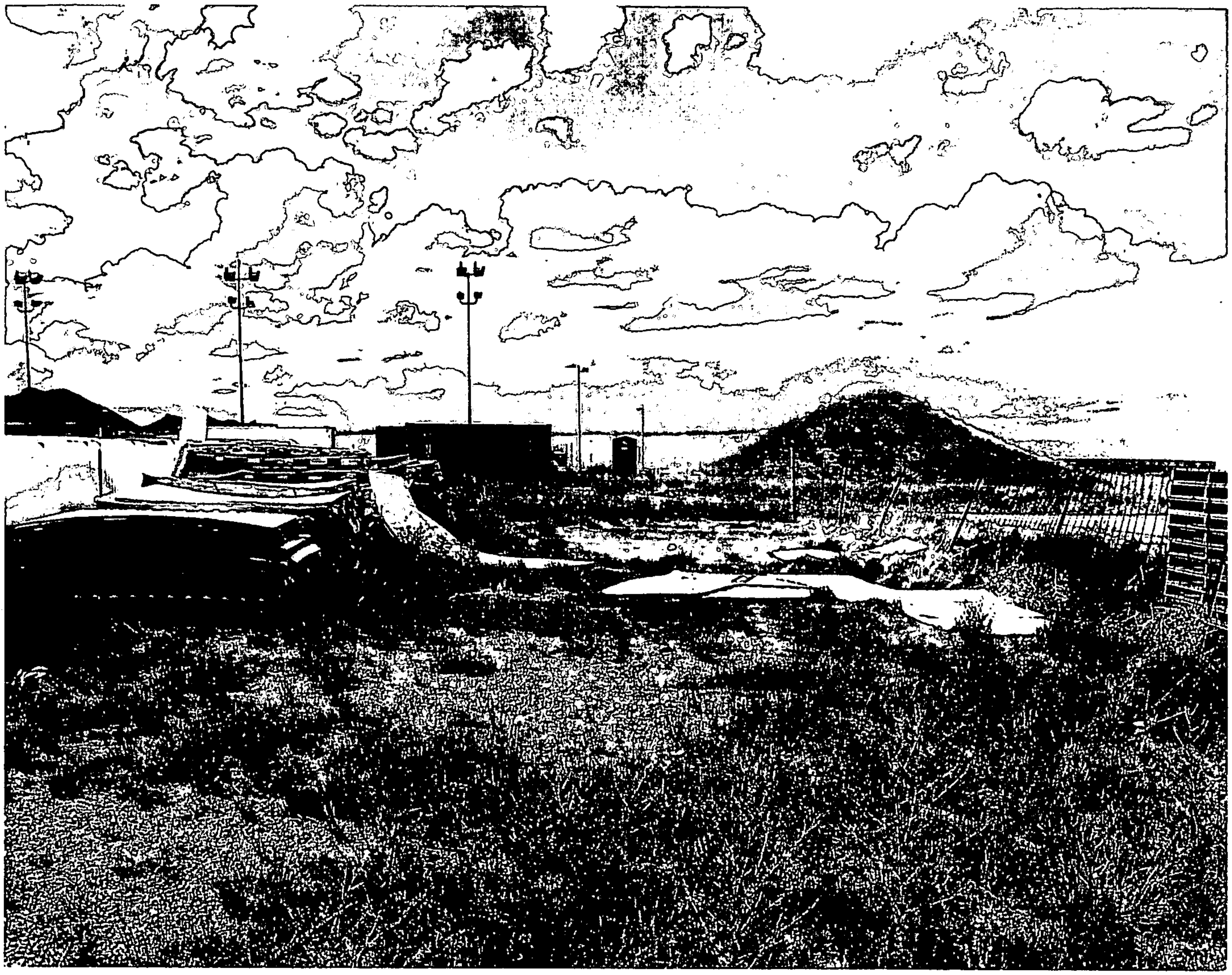
FIGURE 2.1-8
P.U. & D. Container Storage Facilities
(IHSS 174) Location Map



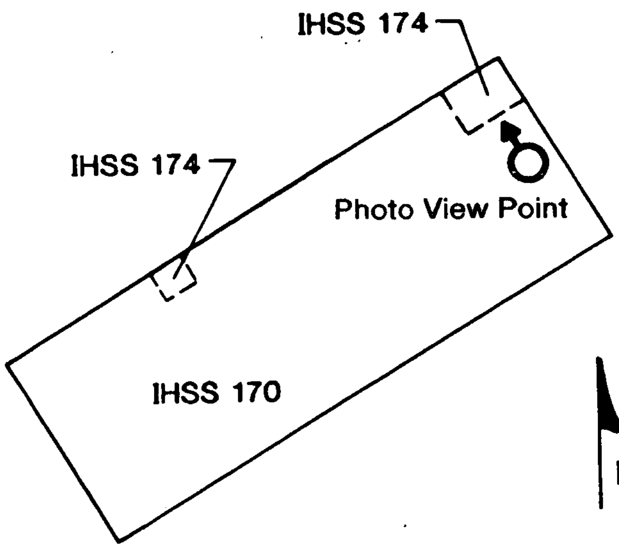


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FIGURE 2.1-9
P.U. & D. Container Storage Facilities
(IHSS 174) Site Photo

(Rockwell International, 1988b). Assuming a total drum storage of 460 drums, this corresponds to a total storage capacity of 25,300 gallons over the IHSS's operating life. Drums were generally stored for 1 to 2 years prior to removal and sale for recycling of their contents. In August 1985, the drums were removed from the area for disposal by the Oil and Solvent Company.

The Dumpster Storage Area of IHSS 174 was used from 1974 to 1985 for storage of stainless steel machining chips that were coated with lathe coolant. Two coolants were used. One was freon based and the other was composed of approximately 70 percent hydraulic oil and 30 percent carbon tetrachloride. Only one 12- by 16-ft dumpster with a total storage capacity of 860 cubic ft (ft^3) was used to contain the coated chips at any one time. The dumpster was located directly on the ground surface without secondary containment. Storage of these RCRA-regulated materials in the dumpster was discontinued in 1985, possibly due to elimination of solvents from the chip generating process.

2.1.4.2 Previous Investigations

In May 1985, samples were collected from 101 of the remaining 158 drums, composited into 12 samples, and analyzed. The oil fraction of the composited samples was analyzed quantitatively to determine which constituents composed the makeup of the oil. The remaining portions of the sample were analyzed by infrared spectroscopy. Components of the drummed waste were determined to include paraffinic base mineral oil, a volatile hydrocarbon solvent (e.g., mineral spirits such as aliphatic naphtha), carbon dioxide, methyl alcohol, silicone lubricant, freon, freon TF, water, and xylenes. Metals and other inorganics detected in the samples included aluminum, barium, beryllium, calcium, chromium, copper, iron, potassium, lithium, magnesium, molybdenum, sodium, nickel, lead, silicon, and zinc (Rockwell International, 1988b).

An initial soil characterization program to determine the nature and extent of soil contamination was specified for the Drum and Dumpster Storage Areas in the Closure Plan for the Container Storage Facilities (Rockwell International, 1988d). Subsequent to submittal of the Closure Plan, soil samples were obtained in 1988 from the approximate locations shown in Figure 2.1-9 (Weston, 1988). Only 50 percent of the proposed soil samples were collected while awaiting final approval of the Closure Plan. These soil samples were collected from 1-ft-deep excavations and were composited over the 1 ft interval except for VOA samples, which were grab samples from a depth of 1 ft. Analysis of soil samples included HSL VOAs, HSL BNAs, HSL metals, inorganics, and radionuclides and results are presented in Section 2.1.4.4.

Prior to soil sampling, visual and direct radiation surveys were also conducted at the Drum and Dumpster Storage Areas to identify areas of potential contamination. The radiation surveys consisted of gamma surveys with a Field Instrument for Detection of Low Energy Radiation (FIDLER). In addition to the random systematic grid sampling program established in the Closure Plan, areas of stained soil or above background radiation levels were included.

During the visual surveys, several areas of stained soil and stressed vegetation were observed in the Drum Storage Area. Staining was also observed in the northeast portion of this area where a dumpster of vanadium shavings was previously stored. Some shavings were still present on the ground surface. No areas were determined to exceed background gamma radiation levels during the FIDLER survey.

2.1.4.3 Physical Characteristics

The topography of IHSS 174 gently slopes to the northeast and east (Plate 1). Approximately 30 to 50 ft of Rocky Flats Alluvium and fill overlie the Arapahoe Formation in the vicinity of

IHSS 174, P.U.&D. Container Storage Facilities. The unconfined groundwater flows to the northeast and probably intercepts the groundwater extraction system of the Present Landfill on the north tributary of Walnut Creek. The depth to groundwater is approximately 10 ft below the ground surface. The closest well, Well 1086, is located 550 to 1,250 ft northeast of the IHSS 174 sites.

2.1.4.4 Nature and Extent of Contamination

The soil characterization program of the Dumpster Storage Area was conducted at the reported IHSS 174 located along the northern fence line, approximately 300 ft east of the western fence line of the P.U.&D. Storage Yard.

There have been no documented spills at the Drum or Dumpster Storage Areas. An initial soil characterization program to determine the nature and extent of soil contamination in the Drum and Dumpster Storage Areas was initiated in 1988. Analysis of soil samples taken from borings in the area indicate the presence of organics above detection limit including acetone, 4-chloro-3-methylphenol, tetrachloroethene, 1,1,1-trichloroethane, and bis (2-ethylhexyl) phthalate.

Metals and inorganics detected above background include arsenic, barium, beryllium, cadmium, iron, manganese, zinc, vanadium, copper, potassium, and nitrates. Radionuclides detected above background include gross alpha; americium 241; uranium 233, 234; plutonium 239, 240; and uranium 238. Table 2-3 summarizes the organics detected, and the metals, inorganic, and radionuclides detected above background. The concentrations and sampling locations of these analytes detected above background are illustrated in Figure 2.1-10.

Table 2-3 IHSS 174 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg)				
Methylene chloride		CS001	1/1	9.0B
		CS002	1/1	7.0B
		CS003	1/1	8.0B
		CS004	1/1	20B
		CS005	1/1	12B
		CS006	1/1	26B
		CS007	1/1	22B
		CS008	1/1	5.0JB
		CS009	1/1	7.0B
		CS010	1/1	7.0B
		CS011	1/1	40B
		CS012	1/1	32B
		CS013	1/1	36B
		CS013 dup	1/1	17B
		CS014	1/1	8.0B
		CS015	1/1	31B
		CS016	1/1	4.0JB

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-3 IHSS 174 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) contd.				
Methylene chloride - contd.		CS017	1/1	3.0JB
Acetone		CS001	1/1	5.0J
		CS009	1/1	7.0J
		CS011	1/1	4.0J
		CS012	1/1	4.0J
		CS013	1/1	10J
		CS017	1/1	12
1,1,1-Trichloroethane		CS005	1/1	160
Tetrachloroethene		CS002	1/1	2.0J
		CS004	1/1	94

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

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Table 2-3 IHSS 174 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) contd.				
Toluene		CS001	1/1	2.0J
		CS002	1/1	2.0J
		CS003	1/1	2.0J
		CS005	1/1	4.0J
		CS006	1/1	1.0J
		CS007	1/1	1.0J
		CS009	1/1	2.0J
		CS010	1/1	1.0J
		CS011	1/1	1.0J
		CS013	1/1	3.0J
		CS013 dup	1/1	5.0J
		CS014	1/1	2.0J
		CS015	1/1	1.0J
Phenanthrene		CS003	1/1	90J
		CS007	1/1	76J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) contd.				
Anthracene		CS004	1/1	180J
Fluoranthene		CS001	1/1	130J
		CS003	1/1	130J
		CS007	1/1	130J
		CS016	1/1	110J
Pyrene		CS001	1/1	97J
		CS003	1/1	110J
		CS007	1/1	86J
Benzo(a)anthracene		CS003	1/1	110J
Bis(2-ethylhexyl) Phthalate		CS002	1/1	1400J
		CS004	1/1	1700
		CS005	1/1	1700J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-3 IHSS 174 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (μg/kg) contd.				
Bis(2-ethylhexyl) Phthalate - contd.		CS006	1/1	1700J
		CS007	1/1	430
		CS008	1/1	430
		CS009	1/1	630
		CS010	1/1	420
		CS011	1/1	1100J
		CS012	1/1	410
		CS013	1/1	590
		CS014	1/1	530
		CS015	1/1	380
		CS016	1/1	96J
Chrysene		CS001	1/1	98J
		CS003	1/1	130J
Phenol		CS004	1/1	320J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
μg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) contd.				
Benzoic acid		CS004	1/1	400J
4-Chloro-3-methylphenol		CS004	1/1	740
		CS013	1/1	720
Ethylbenzene		CS013 dup	1/1	1.0J
N-Nitrosodiphenylamine		CS017	1/1	490J
Di-n-butyl Phthalate		CS016	1/1	590B
		CS017	1/1	810JB
Total Xylenes		CS001	1/1	2.0J
		CS003	1/1	2.0J
		CS005	1/1	3.0J
		CS009	1/1	1.0J
		CS010	1/1	2.0J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) contd.				
Total Xylenes - contd.		CS014	1/1	2.0J
Metals and Other Inorganics (mg/kg)				
Arsenic	4.29	CS010	1/1	4.40
		CS016	1/1	4.90
Barium	79.5	CS002	1/1	82.2
		CS005	1/1	80.6
		CS008	1/1	81.5
		CS009	1/1	93.1
		CS010	1/1	84.4
		CS015	1/1	87.4
		CS016	1/1	83.2
		CS017	1/1	101

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

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Table 2-3 IHSS 174 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
<u>Metals and Other Inorganics (mg/kg)</u> contd.				
Beryllium	4.70	CS005	1/1	14.3
		CS009	1/1	13.1
Cadmium	3.20	CS003	1/1	3.30
		CS007	1/1	3.50
		CS010	1/1	3.60
		CS012	1/1	27.2
Copper	11.1	CS011	1/1	12.7
		CS012	1/1	13.8
		CS013	1/1	11.5
		CS015	1/1	12.8
		CS016	1/1	11.6
		CS017	1/1	23.4
Iron	13800	CS015	1/1	14800
		CS017	1/1	20800

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/kg) contd.				
Manganese	235	CS005	1/1	241
Nitrate/Nitrite	3.43	CS017	1/1	4.60
Potassium	1560	CS003	1/1	1610
		CS005	1/1	1700
		CS007	1/1	1700
		CS008	1/1	1710
		CS009	1/1	1850
		CS010	1/1	1740
		CS012	1/1	1590
		CS013	1/1	1670
		CS014	1/1	1650
		CS015	1/1	1980
Vanadium	37.2	CS002	1/1	41.2
		CS005	1/1	2120

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
μg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-3 IHSS 174 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/kg) contd.				
Vanadium - contd.	37.2	CS009	1/1	2590
		CS013	1/1	140
Zinc	39.7	CS004	1/1	52.0
		CS005	1/1	43.1
		CS006	1/1	42.8
		CS011	1/1	71.1
Radionuclides (pCi/g)				
Uranium 233, 234	0.656	CS003	1/1	0.70 ± 0.10
		CS004	1/1	0.67 ± 0.13
		CS006	1/1	0.90 ± 0.12
		CS009	1/1	0.72 ± 0.11
		CS011	1/1	0.87 ± 0.11
		CS012	1/1	0.80 ± 0.11
		CS013	1/1	0.83 ± 0.12

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

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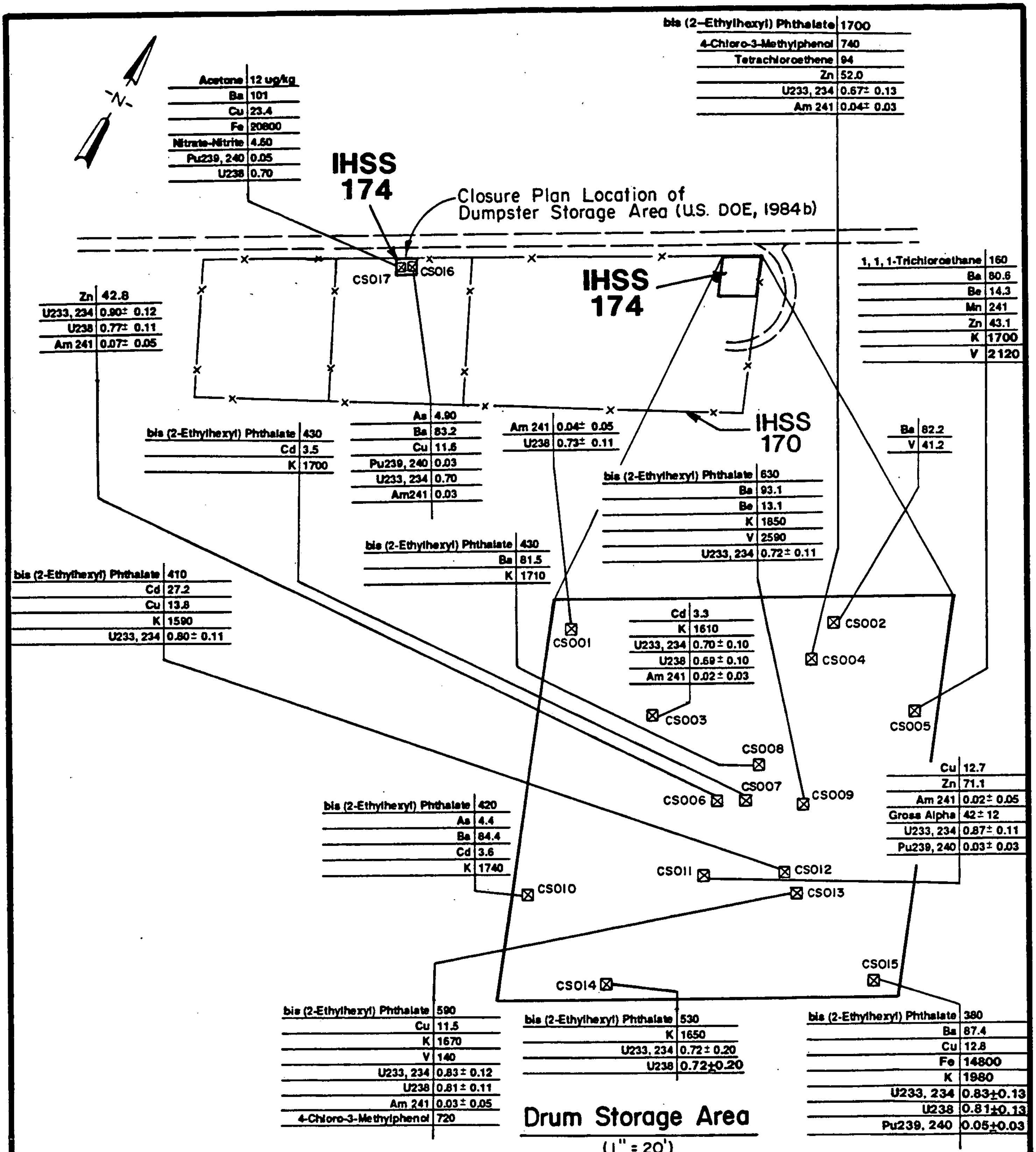
Table 2-3 IHSS 174 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Radionuclides (pCi/g) contd.				
Uranium 233, 234 - contd.	0.656	CS014	1/1	0.72 ± 0.20
		CS015	1/1	0.83 ± 0.13
		CS016	1/1	0.70
Uranium 238	0.683	CS001	1/1	0.73 ± 0.11
		CS003	1/1	0.69 ± 0.10
		CS006	1/1	0.77 ± 0.11
		CS013	1/1	0.81 ± 0.11
		CS014	1/1	0.72 ± 0.20
		CS015	1/1	0.81 ± 0.13
		CS017	1/1	0.70
Americium 241	0.014	CS001	1/1	0.04 ± 0.05
		CS003	1/1	0.02 ± 0.03
		CS004	1/1	0.04 ± 0.03
		CS006	1/1	0.07 ± 0.05
		CS011	1/1	0.02 ± 0.05
		CS013	1/1	0.03 ± 0.05

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Radionuclides (pCi/g) contd.				
Americium 241 - contd.	0.014	CS016	1/1	0.03
Gross Alpha	38.4	CS011	1/1	42 ± 12
Plutonium 239, 240	0.015	CS011	1/1	0.03 ± 0.03
		CS015	1/1	0.05 ± 0.03
		CS016	1/1	0.03
		CS017	1/1	0.05

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram



Legend

⊠ Previous Soil Sample Location

As Arsenic
Ba Barium
Be Beryllium
Cd Cadmium
Cu Copper
Fe Iron
Mn Manganese
K Potassium
V Vanadium
Zn Zinc

UNITS

Organics are ug/kg for soils: ug/l for water
Inorganics are mg/kg for soils: mg/l for water
Radionuclides are pci/g for soils: pci/l for water

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FIGURE 2.1-10
Analytes Detected Above Background
P.U. & D. Container Storage Facilities
(IHSS 174)

Analysis of groundwater samples taken from downgradient Well 1086 resulted in detections of acetone and methylene chloride (Plate 1). Inorganics detected above background include nitrate/nitrite. Table 2-4 lists the organics detected and the inorganics above background.

No upgradient well data are known to have been collected and Well 1086 is located approximately 500 ft from the east site and 1,250 ft form the west site of IHSS 174. Due to the distance of Well 1086 from the IHSS 174 locations, a groundwater plume may not be intercepted, so further data are needed to assess the possibility of groundwater contamination from IHSS 174 more accurately.

2.1.5 S&W Building 980 Container Storage Facility (IHSS 175)

The following discussion is summarized from the Closure Plan for the Container Storage Facilities (Rockwell International, 1988b).

2.1.5.1 Location and History

The S&W Building 980 Container Storage Facility is reportedly located in the eastern third of a storage yard located south of Building 980 (Figure 2.1-11). The site has dimensions of approximately 25 by 25 ft. The precise location of IHSS 175 could not be determined during a site visit in May 1990. The general area was reportedly regraded in spring 1988 (Rockwell International, 1988b).

IHSS 175 was used from approximately 1980 to 1986 for storage of 55-gallon steel drums containing wastes generated by the S&W contractor's maintenance and fabrication shops. These wastes typically came from vehicle maintenance and painting activities and contained paraffinic-based mineral oil, a mixture of paraffinic- and naphthenic-based mineral oil, xylenes, freon TF,

Table 2-4 IHSS 174 Downgradient Groundwater Sampling Summary (1990 Groundwater Monitoring Report).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (mg/l)				
Acetone		1086	2/6	11.0 - 42.0
Methylene chloride		1086	1/6	22.0
Inorganics (mg/l)				
Nitrate/Nitrite	3.43	1086	4/8	3.60 - 4.30

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
mg/l - milligram per liter

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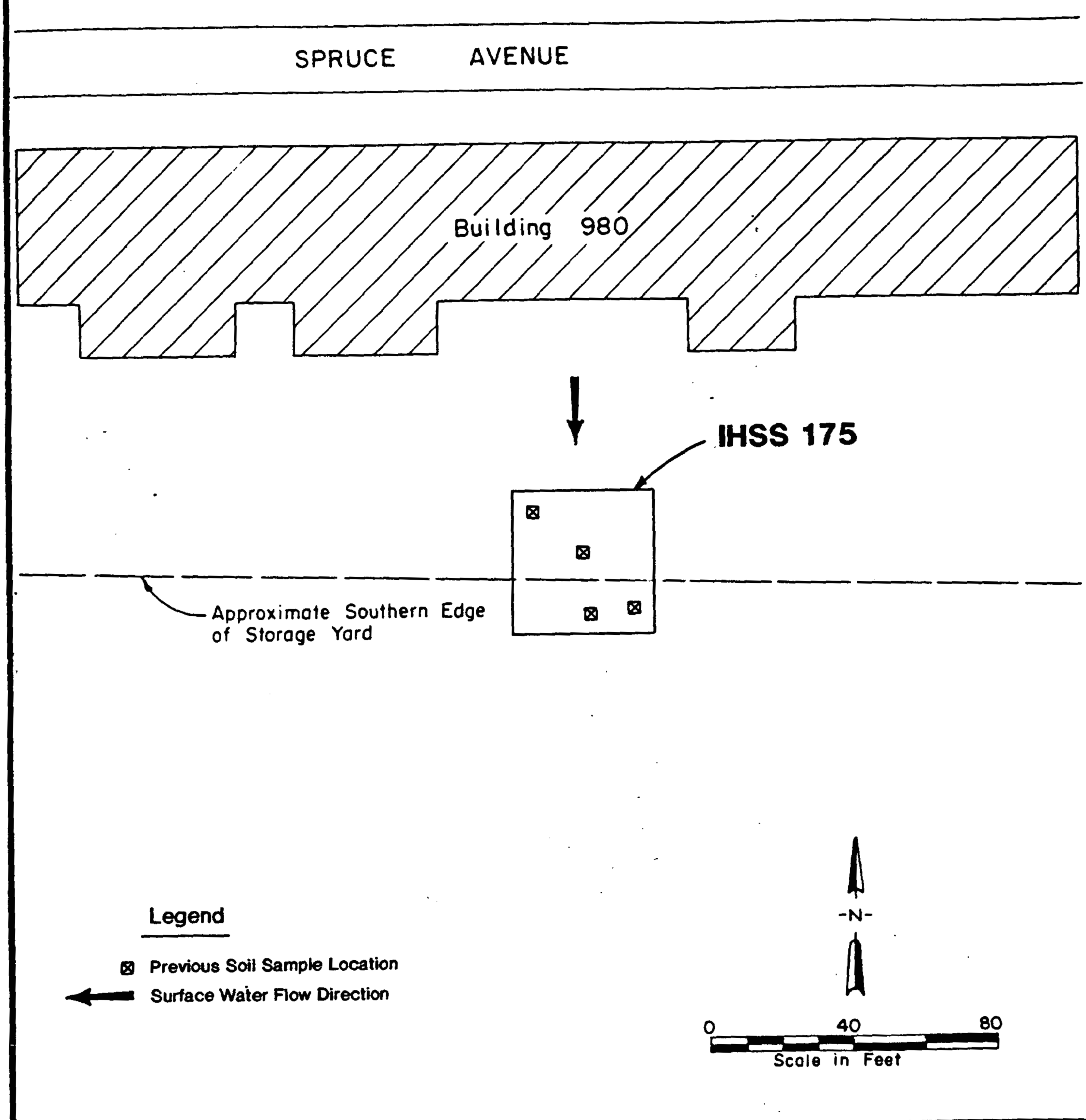

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FIGURE 2.1-11
S & W Building 980 Container Storage Facility (IHSS 175) Location Map

glycol ether/borate-based brake fluid, aluminum, barium, beryllium, calcium, sodium, lead, silicon, and zinc. A maximum of ten drums containing waste have been stored there at any one time. The drums were placed directly on the ground surface. A berm approximately 1 to 1.5 ft high was reportedly located on the west, south, and east sides of the overall storage yard. There have been no documented spills or leaks from this area; however, ground stains are visible. The area has been used from 1986 to the present as a 90-day accumulation area.

2.1.5.2 Previous Investigations

In May 1985, samples were collected from seven drums, composited into five samples and qualitatively analyzed. The oil layers of the composited samples were analyzed to determine their base materials and the remaining portions of the samples were analyzed by infrared spectroscopy. Components of the drummed waste were determined to include paraffinic-based mineral oil, a mixture of paraffinic- and naphthenic-based mineral oil, xylenes, freon TF, and glycol ether/borate-based brake fluid. Metals detected in the samples included aluminum, barium, beryllium, calcium, sodium, lead, silicon, and zinc.

An initial soil characterization program to determine the nature and extent of soil contamination was specified for the S&W Building 980 Container Storage Facility in the Closure Plan for the Container Storage Facilities (Rockwell International, 1988b). Subsequent to submittal of the Closure Plan, soil samples were obtained in 1988 from the approximate locations shown in Figure 2.1-11 (Weston, 1988). Only 40 percent of the proposed soil samples were collected while awaiting final approval of the Closure Plan. One soil sample was collected from an area of stained soil and three samples were collected based on the random systematic grid sampling program. These soils samples were collected from 1-ft-deep excavations and were composited over the 1-ft-deep interval except for VOA samples, which were grab samples from a depth of

1 ft. Analysis of soil samples included HSL VOAs, HSL BNAs, HSL metals, inorganics, and radionuclides. Section 2.1.5.4 presents the results are presented in Section 2.1.5.4.

Prior to soil sampling, a visual and a direct radiation survey were also conducted to identify areas of potential contamination. Several areas of ground staining were observed during the visual survey and it was noted that vegetation was sparse in the area. No areas were determined to exceed background levels of gamma radiation during the FIDLER survey.

2.1.5.3 Physical Characteristics

The topography of IHSS 175 gently slopes to the northeast and more steeply to the east (Plate 1). Less than 10 ft of Rocky Flats alluvium and fill overlie the Arapahoe Formation in the vicinity of IHSS 175. The alluvium consists of clays, silts, sands, and gravel, and the bedrock is composed on claystone. The unconfined groundwater flows to the east, following the slope of the weathered bedrock surface and probably intercepts the south Walnut Creek drainage.

The depth to groundwater is approximately 15 ft below the ground surface. The closest well, Well 3386, is located 300 ft southeast of IHSS 175.

For a more detailed description of the geology, reference the bore log for Well 3386 found in Appendix B.

2.1.5.4 Nature and Extent of Contamination

Analysis of soil samples taken from borings in the area indicate detections of organics that include methylene chloride and acetone. Metals and other inorganics detected above background include calcium, cadmium, copper, mercury, lead, magnesium, potassium, zinc, and nitrate/nitrites. Radionuclides detected above background include gross alpha; gross beta; uranium 233, 234; uranium 238; plutonium 239, 240; and americium 241. Table 2-5 summarizes organics detected and the metals, inorganics, and radionuclides above background. Figure 2.1-12 reports the sampling locations and the concentrations of analytes detected above background.

No upgradient or downgradient analytical groundwater data are known to have been collected.

2.1.6 S&W Contractor Storage Yard (IHSS 176)

The following discussion is summarized primarily from the Closure Plan for the Container Storage Facilities (Rockwell International, 1988b).

2.1.6.1 Location and History

The S&W Contractor Storage Yard (IHSS 176) is located approximately 50 ft east of the Solar Evaporation ponds in the vicinity of Building 964 (Figures 2.1-13 and 2.1-14). This yard has been used for storage of contractor materials for use in various projects at the RFP. IHSS 176 is approximately 290 by 390 ft in size according to the IAG (1989). The actual area of IHSS 176 used for storage appears to be considerably larger based on inspection of aerial photographs.

The S&W Contractor Storage Yard has been used for storage since 1970. This area was not intended to be used for the storage of hazardous waste. Drum storage began at this site in 1970 and continued until 1985. Containers were stored in numerous areas of the S&W Contractor Storage Yard throughout time. The total amount of waste stored at the S&W Contractor Storage Yard is unknown. In 1985, materials were identified in several areas of the S&W Contractor Storage Yard that qualified as hazardous waste. These containers had been placed directly on

Table 2-5 IHSS 175 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (μg/kg)				
Methylene chloride		CS018	1/1	8.0B
		CS019	1/1	6.0B
		CS020	1/1	28
		CS021	1/1	10
Acetone		CS020	1/1	23
		CS021	1/1	20
Bis(2-ethylhexyl) Phthalate		CS018	1/1	180JB
		CS019	1/1	190JB
		CS020	1/1	120JB
		CS021	1/1	370B

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
μg/kg - microgram per kilogram
mg/kg - millirgram per kilogram
pCi/g - picocurie per gram

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Table 2-5 IHSS 175 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/kg)				
Calcium	8430	CS018	1/1	11400
		CS019	1/1	8630
		CS020	1/1	11400
Cadmium	3.20	CS020	1/1	3.80
		CS021	1/1	3.60
Copper	11.1	CS018	1/1	14.2
		CS019	1/1	23.3
		CS020	1/1	19.0
		CS021	1/1	21.8
Mercury	0.320	CS018	1/1	0.980
		CS019	1/1	2.10
		CS021	1/1	2.30

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - millirgram per kilogram
pCi/g - picocurie per gram

Table 2-5 IHSS 175 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/kg) contd.				
Potassium	1560	CS019	1/1	1730
		CS020	1/1	1960
		CS021	1/1	1660
Magnesium	2480	CS020	1/1	2570
Lead	12.2	CS018	1/1	12.6
		CS019	1/1	26.1
		CS020	1/1	14.5
		CS021	1/1	28.5
Nitrate/Nitrite	3.43	CS020	1/1	7.50
		CS021	1/1	5.60
Zinc	39.7	CS019	1/1	58.0
		CS020	1/1	40.0
		CS021	1/1	80.2

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
μg/kg - microgram per kilogram
mg/kg - millirgram per kilogram
pCi/g - picocurie per gram

Table 2-5 IHSS 175 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Radionuclides (pCi/g)				
Gross Alpha	38.4	CS018	1/1	40
		CS019	1/1	58
		CS021	1/1	50
Gross Beta	36.8	CS018	1/1	41
		CS019	1/1	45
		CS020	1/1	39
		CS021	1/1	46
Uranium 233, 234	0.656	CS018	1/1	0.68
		CS019	1/1	0.79
		CS020	1/1	0.75
		CS021	1/1	0.70
Uranium 238	0.683	CS018	1/1	0.71
		CS019	1/1	0.87
		CS020	1/1	0.80
		CS021	1/1	0.77

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - millirgram per kilogram
pCi/g - picocurie per gram

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Table 2-5 IHSS 175 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Radionuclides (pCi/g) contd.				
Plutonium 239,240	0.0150	CS018	1/1	0.02
		CS019	1/1	0.04
		CS020	1/1	0.06
		CS021	1/1	0.42
Americum 241	0.014	CS020	1/1	0.06
		CS021	1/1	0.15

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
μg/kg - microgram per kilogram
mg/kg - millirgram per kilogram
pCi/g - picocurie per gram

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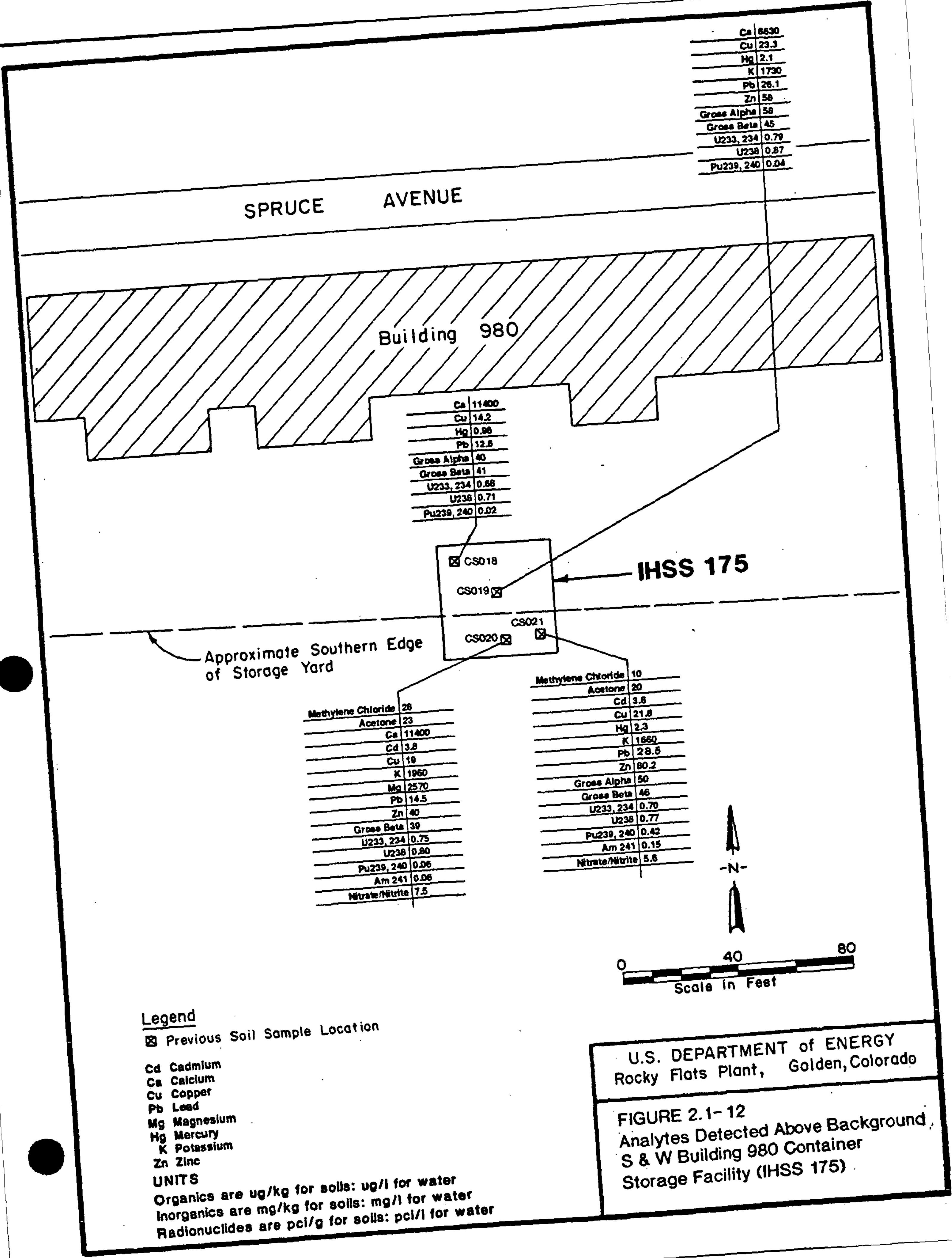

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FIGURE 2.1-12
Analytes Detected Above Background
S & W Building 980 Container
Storage Facility (IHSS 175)

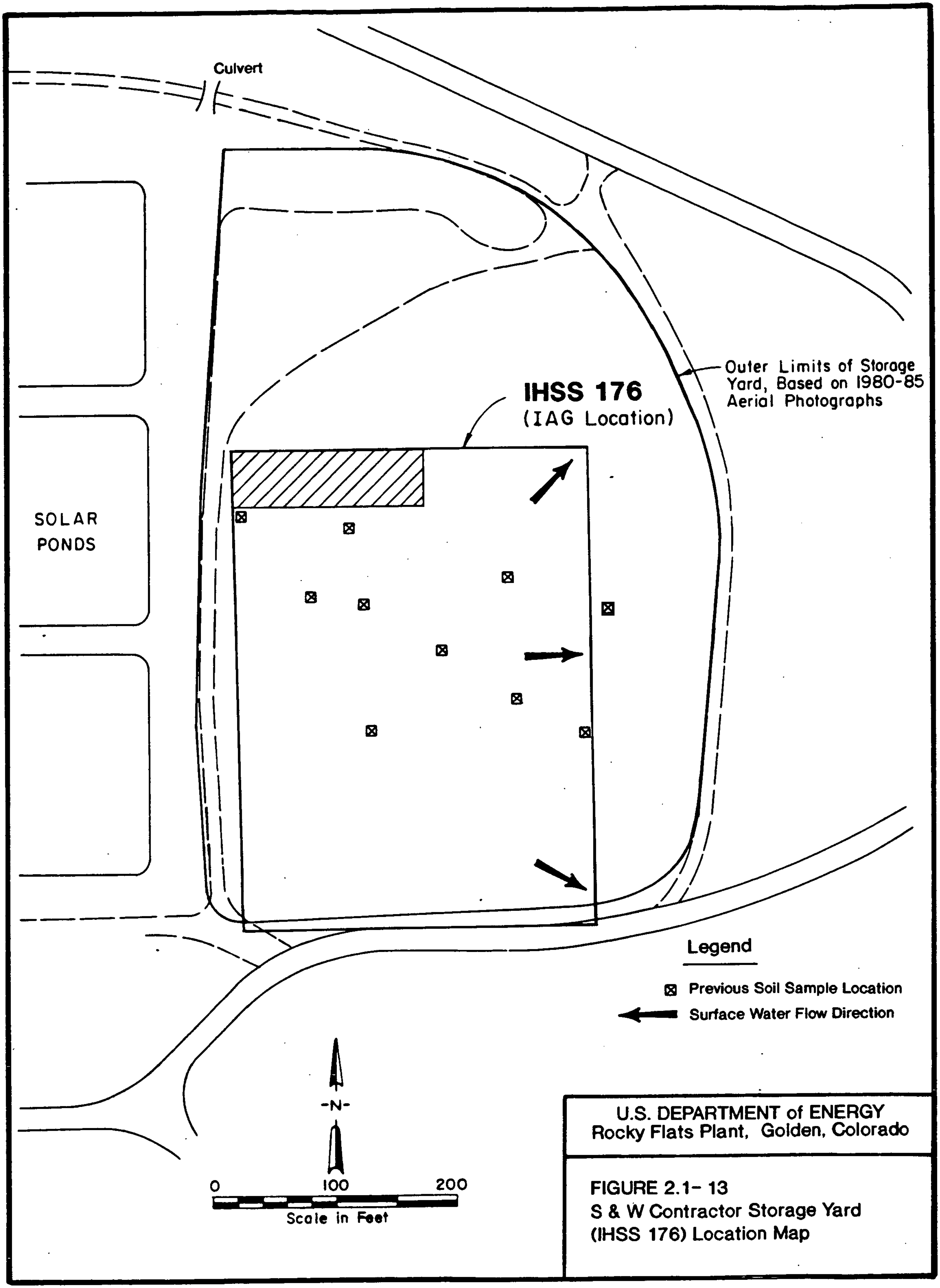
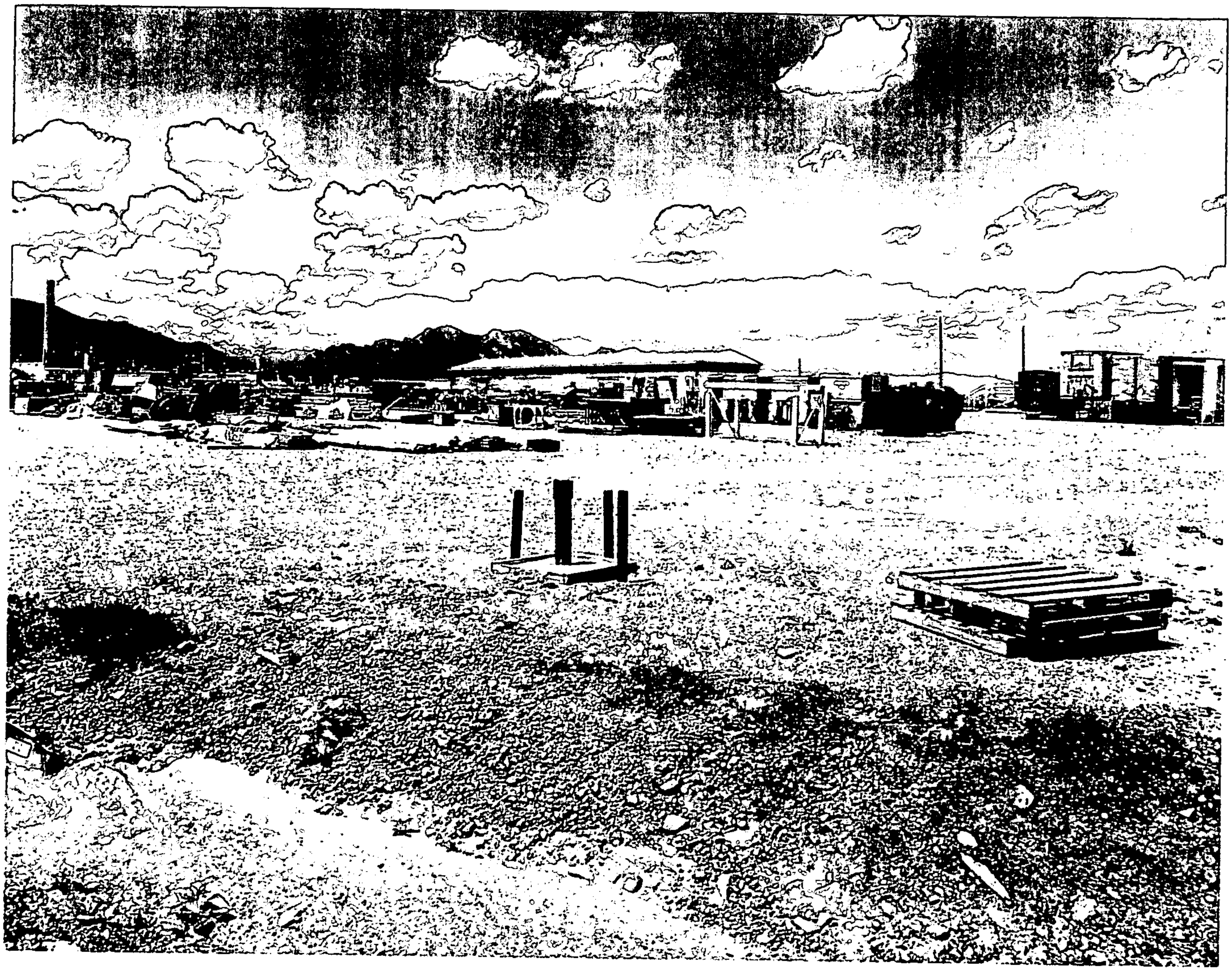


FIGURE 2.1- 13
S & W Contractor Storage Yard
(IHSS 176) Location Map



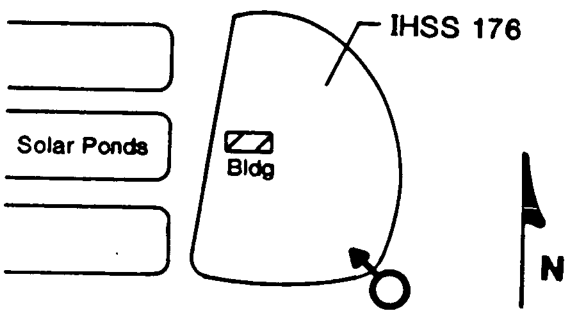


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FIGURE 2.1-14
S & W Contractor Storage Yard
(IHSS 176) Site Photo

the ground surface or on pallets. The contents of the containers were sampled in 1985 and qualitatively analyzed. Components of the drummed waste were determined to be primarily mineral spirits, water, waste oil, volatile organics, and metals. The containers were subsequently removed and disposed as hazardous waste. Most of the S&W Contractor Storage 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.

A site visit in May 1990 indicated that use of the S&W Contractor Storage Yard is diminishing. Air photos from 1967 to 1985 indicate that a larger area than the actual boundaries of IHSS 176 was used as a storage yard.

2.1.6.2 Previous Investigations

An initial soil characterization program to determine the nature and extent of soil contamination was specified for the S&W Contractor Storage Yard in the Closure Plan for the Container Storage Facilities (Rockwell International, 1988b). Subsequent to submittal of the Closure Plan, soil samples were obtained in 1988 from the approximate ten locations shown in Figure 2.1-13 (Weston, 1988). Only 35 percent of the proposed soil samples were collected while awaiting final approval of the Closure Plan. One sample location was based on ground staining, five sample locations were based on historical use of the area, and four sample locations were based on the presence of hazardous waste in 1985. The soil samples were collected from 1 ft deep excavations and were composited over the 1 ft deep interval except for VOA samples, which were grab samples from a depth of 1 ft. Analysis of soil samples included HSL VOAs, HSL BNAs, HSL metals, inorganics, and radionuclides. Prior to soil sampling, a visual and a direct radiation survey were also conducted to identify areas of potential contamination.

2.1.6.3 Physical Characteristics

The ground surface gently slopes to the northeast - east at IHSS 176 (Plate 1). Approximately 15 ft of alluvium and fill overlie the bedrock in the vicinity of IHSS 176. The alluvium observed in Well 2886 located 100 ft north of IHSS 176 consisted of a thin cobble layer resting atop claystone of the Arapahoe Formation which was overlain by approximately 8 ft of mixed gravel and clay (Appendix B). The groundwater flows to the northeast and the depth to groundwater is estimated to be approximately 5 ft below the ground surface.

2.1.6.4 Nature and Extent of Contamination

Analysis of soil samples taken from borings in the area indicate levels above the detection limit for methylene chloride, and acetone. Table 2-6 lists the organics detected and metals, inorganics, and radionuclides detected above background concentrations. Metals and other inorganics detected above background include aluminum, arsenic, calcium, cadmium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, vanadium, zinc, and nitrate/nitrite. Radionuclides detected above background include americium 241; plutonium 239, 240; uranium 238; and uranium 233, 234. Figure 2.1-15 illustrates the concentrations and sampling locations of the analytes detected above background.

Upgradient data from Well P207689 indicates detections above or equal to background levels for the metals and inorganics aluminum, beryllium, calcium, lead, magnesium, sodium, cyanide, and sulfate. Table 2-7 lists the metals and other inorganics above background and the background values. Radionuclides detected above background include americium 241; plutonium 239; tritium; and uranium 233, 234. Table 2-7 lists radionuclides detected above background and the background values.

Table 2-6 IHSS 176 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg)				
Methylene chloride		CS024	1/1	25B
		CS025	1/1	20B
		CS026	1/1	18B
		CS027	1/1	20B
		CS028	1/1	6B
		CS029	1/1	14
		CS030	1/1	20B
		CS031	1/1	5B
		CS038	1/1	14B
		CS033	1/1	8B
Acetone		CS024	1/1	14
		CS025	1/1	10J
		CS026	1/1	12
		CS027	1/1	11J
		CS029	1/1	26
		CS030	1/1	10J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) - contd.				
Acetone		CS032	1/1	12
		CS033	1/1	20
Chloroform		CS024	1/1	1.0J
		CS025	1/1	1.0J
		CS026	1/1	1.0J
		CS027	1/1	1.0J
		CS030	1/1	1.0J
		CS032	1/1	1.0J
Toluene		CS024	1/1	1.0J
		CS025	1/1	2.0J
		CS026	1/1	3.0J
		CS027	1/1	2.0J
		CS030	1/1	2.0J
		CS032	1/1	2.0J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-6 IHSS 176 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (μg/kg) - contd.				
Total Xylenes		CS025	1/1	2.0J
		CS026	1/1	3.0J
		CS027	1/1	2.0J
		CS032	1/1	1.0J
4-Nitrophenol		CS032	1/1	160J
Pentachlorophenol		CS032	1/1	110J
Phenanthrene		CS029	1/1	76J
		CS030	1/1	210J
		CS033	1/1	49J
Anthracene		CS032	1/1	41J
Di-n-butyl Phthalate		CS030	1/1	450JB

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
μg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-6 IHSS 176 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (μg/kg) - contd.				
Fluoranthene		CS025	1/1	350J
		CS028	1/1	46J
		CS029	1/1	120J
		CS030	1/1	290J
		CS032	1/1	58J
		CS033	1/1	82J
Pyrene		CS028	1/1	43J
		CS029	1/1	100J
		CS030	1/1	370J
		CS032	1/1	56J
		CS033	1/1	77J
Benzo(a)anthracene		CS029	1/1	53J
		CS033	1/1	37J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
μg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

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Table 2-6 IHSS 176 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) - contd.				
Bis(2-ethylhexy) Phthalate		CS028	1/1	130JB
		CS029	1/1	110JB
		CS031	1/1	130JB
		CS032	1/1	600B
		CS033	1/1	110JB
Chrysene		CS025	1/1	210J
		CS029	1/1	61J
		CS033	1/1	42J
Benzo(b)fluoranthene		CS029	1/1	51J
		CS033	1/1	28J
Benzo(k)fluoranthene		CS029	1/1	53J
		CS033	1/1	52J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-6 IHSS 176 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) - contd.				
Benzo(a)pyrene		CS029	1/1	57J
		CS033	1/1	40J
Metals and Other Inorganics (mg/kg)				
Aluminum	13400	CS030	1/1	13900
Arsenic	4.29	CS024	1/1	6.90
		CS026	1/1	8.80
		CS027	1/1	6.60
		CS030	1/1	19.4
		CS032	1/1	4.70
		CS033	1/1	5.30
Calcium	8430	CS024	1/1	13600

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

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Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/kg) - contd.				
Cadmium	3.20	CS024	1/1	5.40
		CS026	1/1	4.50
		CS027	1/1	4.70
		CS028	1/1	5.50
		CS029	1/1	4.20
		CS030	1/1	7.30
		CS031	1/1	4.10
		CS032	1/1	3.60
		CS033	1/1	8.80
Copper	11.1	CS024	1/1	13.1
		CS025	1/1	17.4
		CS026	1/1	12.2
		CS027	1/1	13.1
		CS028	1/1	18.9
		CS029	1/1	17.1
		CS030	1/1	21.4

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-6 IHSS 176 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/kg) - contd.				
Copper - contd.	11.1	CS031	1/1	16.2
		CS032	1/1	11.8
		CS033	1/1	18.0
Iron	13800	CS030	1/1	17500
Mercury	0.320	CS031	1/1	2.90
		CS033	1/1	2.30
Potassium	1560	CS024	1/1	2840
		CS025	1/1	1800
		CS026	1/1	2320
		CS027	1/1	2280
		CS028	1/1	1880
		CS029	1/1	1940
		CS030	1/1	2340
		CS031	1/1	1590

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-6 IHSS 176 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/kg) - contd.				
Potassium - contd.	1560	CS032	1/1	2770
		CS033	1/1	2120
Magnesium	2480	CS028	1/1	2550
Manganese	235	CS024	1/1	363
		CS025	1/1	235
		CS027	1/1	261
		CS030	1/1	261
		CS032	1/1	330
		CS033	1/1	265
Nickel	21.4	CS024	1/1	47.4
		CS025	1/1	70.3
		CS026	1/1	38.6
		CS027	1/1	48.5
		CS030	1/1	45.6

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-6 IHSS 176 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/kg) - contd.				
Nickel - contd.	21.4	CS032	1/1	37.9
Lead	12.2	CS024	1/1	73.8
		CS025	1/1	13.4
		CS026	1/1	17.7
		CS027	1/1	24.3
		CS028	1/1	17.1
		CS030	1/1	33.0
		CS032	1/1	15.9
		CS033	1/1	27.6
Vanadium	37.2	CS026	1/1	43.5
Zinc	39.7	CS024	1/1	92.6
		CS025	1/1	51.0
		CS027	1/1	41.5
		CS028	1/1	45.9

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/kg) - contd.				
Zinc - contd.	39.7	CS029	1/1	48.3
		CS030	1/1	58.1
		CS032	1/1	41.5
		CS033	1/1	43.6
Nitrate/Nitrite	3.43	CS024	1/1	25.0
		CS025	1/1	4.50
		CS026	1/1	4.90
		CS027	1/1	5.20
		CS028	1/1	6.00
		CS029	1/1	4.60
		CS030	1/1	15.0
		CS032	1/1	48.0
		CS033	1/1	20.0

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

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Table 2-6 IHSS 176 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Radionuclides (pCi/g)				
Uranium 233, 234	0.656	CS024	1/1	1.3 ± 0.3
		CS025	1/1	0.66 ± 0.16
		CS026	1/1	0.67 ± 0.14
		CS028	1/1	0.92 ± 0.18
		CS030	1/1	0.80 ± 0.15
		CS031	1/1	0.74 ± 0.16
		CS032	1/1	0.66 ± 0.17
		CS033	1/1	0.97 ± 0.22
Uranium 238	0.683	CS024	1/1	1.1 ± 0.3
		CS025	1/1	0.79 ± 0.16
		CS028	1/1	1.0 ± 0.2
		CS033	1/1	0.93 ± 0.21
Plutonium 239, 240	0.015	CS024	1/1	0.43 ± 0.17
		CS025	1/1	0.20 ± 0.15
		CS026	1/1	0.19 ± 0.15
		CS027	1/1	1.0 ± 0.2

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

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Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Radionuclides (pCi/g) - contd.				
Plutonium 239, 240 - contd.	0.015	CS028	1/1	0.34 ± 0.16
		CS029	1/1	0.32 ± 0.17
		CS030	1/1	0.70 ± 0.16
		CS033	1/1	0.44 ± 0.15
Americium 241	0.014	CS024	1/1	0.39 ± 0.11
		CS025	1/1	0.17 ± 0.07
		CS026	1/1	0.28 ± 0.08
		CS027	1/1	0.34 ± 0.08
		CS028	1/1	0.15 ± 0.08
		CS029	1/1	0.20 ± 0.07
		CS030	1/1	0.30 ± 0.08
		CS031	1/1	0.07 ± 0.06
		CS032	1/1	0.18 ± 0.07
		CS033	1/1	0.21 ± 0.08

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
μg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

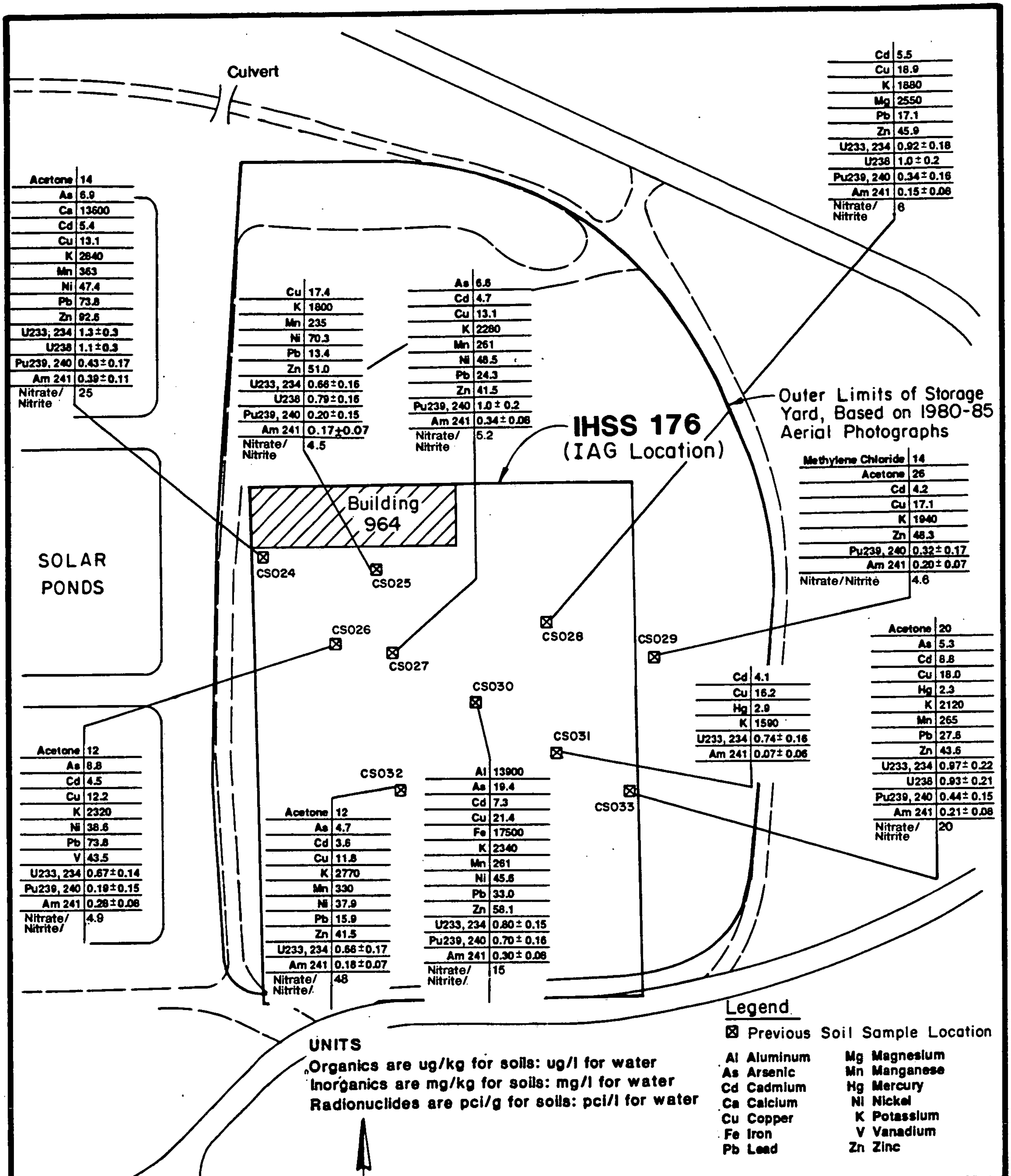

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FIGURE 2.1-15
Analytes Detected Above Background
S & W Contractor Storage Yard
(IHSS 176)

Table 2-7 IHSS 176 Upgradient Groundwater Sampling Summary (Rocky Flats Groundwater Database).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
<u>Metals and Other Inorganics (mg/l)</u>				
Aluminum	0.320	P207689	3/11	7.34 - 8.92
Beryllium	0.005	P207689	1/11	0.006
Calcium	62.6	P207689	5/11	89.1 - 131
Lead	0.040	P207689	1/11	0.040
Magnesium	16.1	P207689	7/11	66.3 - 142
Sodium	46.7	P207689	7/11	103 - 211
Cyanide	0.010	P207689	3/7	0.0100 - 0.025
Sulfate	67.1	P207689	5/6	93.0 - 290
<u>Radionuclides (pCi/l)</u>				
Americium 241	0.017	P207689	1/6	0.096
Plutonium 239	0.015	P207689	1/1	0.195
Tritium	359	P207689	4/5	360 - 700
Uranium 233, 234	0.100	P207689	5/5	9.32 - 12.0

mg/l - milligram per liter
pCi/l - picocurie per liter

Analysis of groundwater samples taken from Well 0460 within IHSS 176 indicates detections above or equal to background for the inorganics and metals calcium, cobalt, magnesium, mercury, potassium, sodium, zinc, carbonate, and sulfate. Table 2-8 lists the metals and other inorganics above background values. Radionuclides detected above background include americium 241, gross alpha, plutonium 239, strontium 90, tritium, and uranium 233, 234. Table 2-8 lists radionuclides detected above background and the background values.

Metals and other inorganics located in the groundwater beneath IHSS 176 that were not detected in upgradient samples are cobalt, mercury, potassium, zinc, and carbonate. Radionuclides located beneath IHSS 176 that were not detected in upgradient samples include gross alpha and strontium 90. This may indicate that IHSS 176 is the source of these contaminants mentioned above but more information is needed from the proposed soil borings and wells at this site.

2.1.7 Building 885 Drum Storage Area (IHSS 177)

The following discussion is summarized from the Closure Plan for the Container Storage Facilities (Rockwell International, 1988b).

2.1.7.1 Location and History

The Building 885 Drum Storage Area (IHSS 177) consists of the eastern and western sections of Building 885 (Figures 2.1-16 and 2.1-17). While the central section of Building 885 is completely enclosed, the eastern and western Drum Storage Areas are covered by a roof and are enclosed on two and three sides, respectively. The floors of the Drum Storage Areas are constructed of concrete. Each of the two Drum Storage Areas are approximately 10 by 20 ft in size.

Table 2-8 IHSS 176 Downgradient Groundwater Sampling Summary (Rocky Flats Groundwater Database).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/l)				
Calcium	62.6	0460	18/19	63.4 - 171[N,E]
Cobalt	0.050	0460	1/19	0.120[N]
Magnesium	16.1	0460	19/19	17.5 - 49.1[N,E]
Mercury	0.001	0460	1/19	0.001[N]
Potassium	11.3	0460	19/19	12.0 - 77.0[N,E]
Sodium	46.7	0460	19/19	50.6 - 152[N,E]
Zinc	0.141	0460	19/19	0.177 - 0.930[N,E]
Carbonate	5.00	0460	1/9	350
Sulfate	67.1	0460	10/19	68.0 - 6550
Radionuclides (pCi/l)				
Americium 241	0.017	0460	6/15	0.020 - 0.080[N]
Gross Alpha	55.1	0460	3/24	60 - 62[N]
Plutonium 239	0.015	0460	5/17	0.016 - 0.790[N]
Strontium 90	0.900	0460	3/8	1.20 - 6.40[N]
Tritium	359	0460	14/17	370 - 3000[N]
Uranium 233, 234	0.100	0460	17/17	0.240 - 28.1[N]

[N] - Data not validated
[E] - Value estimated because of interference
mg/l - milligram per liter
pCi/l - picocurie per liter

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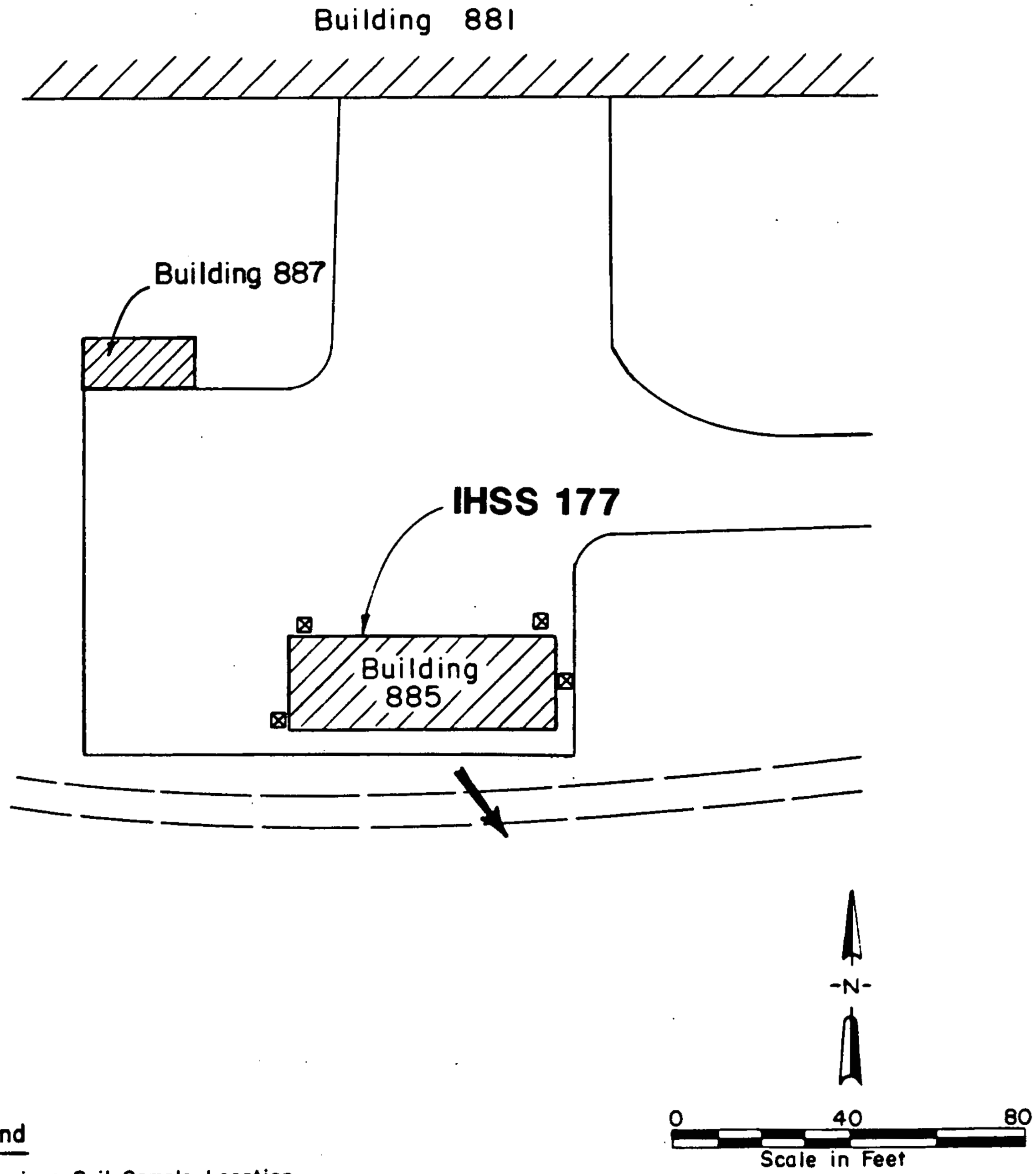

Legend

⊠ Previous Soil Sample Location

⟵ Surface Water Flow Direction

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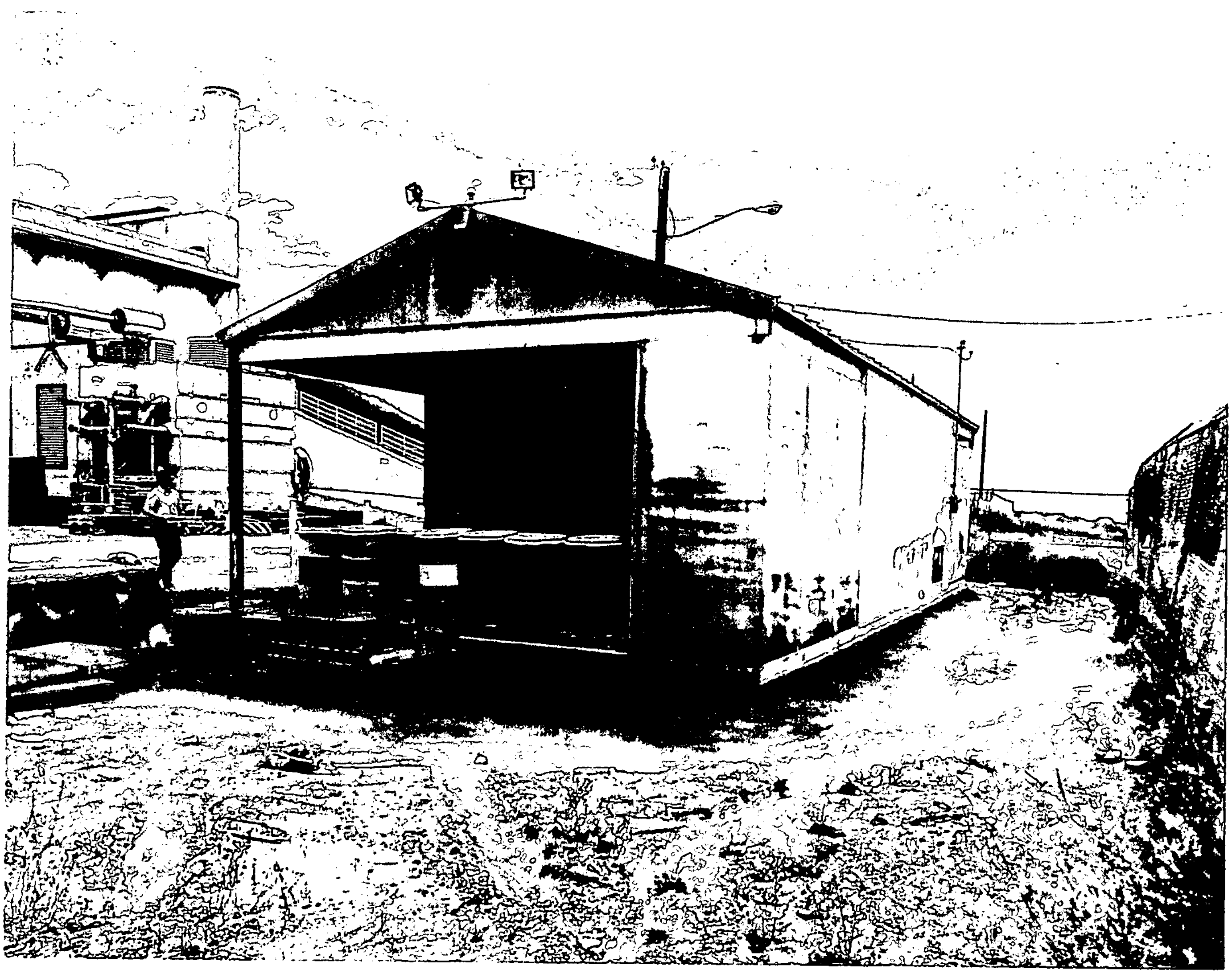
FIGURE 2.1-16
Building 885 Drum Storage Area
(IHSS 177) Location Map



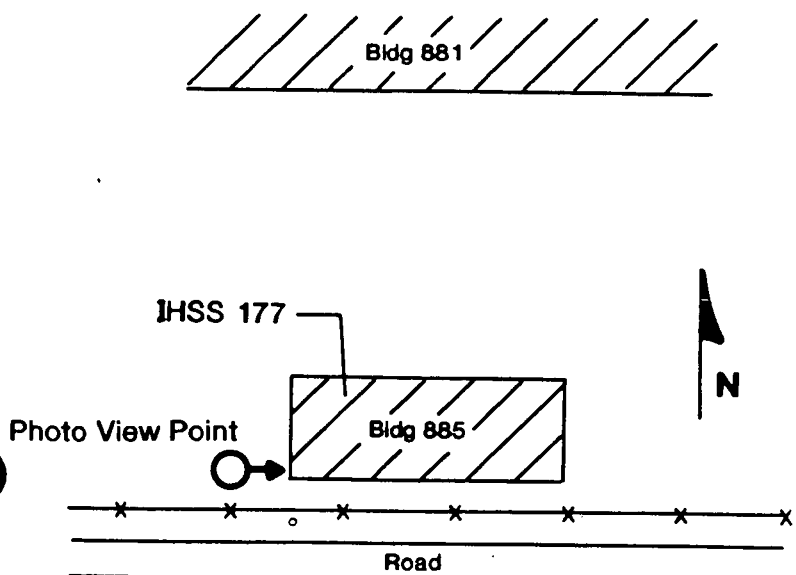


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FIGURE 2.1- 17
Building 885 Drum Storage Area
(IHSS 177) Site Photo

IHSS 177 has been used for drum storage since the mid-1950s. The Drum Storage Areas have been used from 1986 to the present as a 90-day accumulation area and as a satellite collection station. The west section of Building 885 was used for storage of unused and waste oils, while the east section stored unused and waste paint and paint solvents. Waste material also contained low-level radioactive wastes. A maximum of ten to twenty 55-gallon drums were stored on pallets on the concrete floors in each area. Only one drum in each section was used for waste storage; the remaining drums contained unused oils and solvents. The total container storage capacity was 110 gallons, assuming only one drum in each of the two areas contained waste material. There have been no documented spills or leaks in this area.

2.1.7.2 Previous Investigations

An initial soil characterization program to determine the nature and extent of soil contamination was specified for IHSS 177 in the Closure Plan for the Container Storage Facilities (Rockwell International, 1988b). Subsequent to submittal of the Closure Plan, four soil samples were collected from IHSS 177 and analyzed in 1988. The approximate sampling locations are shown in Figure 2.1-16 (Weston, 1988). These samples were collected from 1 ft deep test pits located below a 6-inch-thick asphalt layer. Samples were composited over the test pit depth except for VOA samples, which were grab samples from a depth of 1 ft. Analysis of soil samples included HSL VOAs, HSL BNAs, HSL metals, inorganics, and radionuclides. Prior to soil sampling, visual and direct radiation surveys were conducted to identify areas of potential contamination.

A recent visual survey of IHSS 177 indicated that the area was still in use for drum storage; however, no ground staining was observed. However, ground staining was noted during an earlier visual survey in 1986. No areas were determined to exceed background levels of gamma radiation during prvious FIDLER surveys.

2.1.7.3 Physical Characteristics

The area around IHSS 177 gently slopes to the south and east (Plate 1). Approximately 12 ft of alluvium overlie the bedrock in the vicinity of IHSS 177. The alluvium, as described in Well 5187, located approximately 20 ft from the northwest corner of IHSS 177, consist of sandy, gravelly clay. The groundwater flows to the south and the depth to groundwater is estimated to be approximately 10 ft below the ground surface.

2.1.7.4 Nature and Extent of Contamination

Analysis of soil samples taken from borings surrounding IHSS 177 indicate detections of organics which include acetone, 2-butanone, and trans-1, 2-dichloroethene. Metals and inorganics detected above or equal to background include aluminum, barium, calcium, cadmium, copper, lead, iron, magnesium, mercury, vanadium, zinc, and potassium. Radionuclides detected above background include gross alpha; gross beta; uranium 238; uranium 233, 234; plutonium 239, 240; and americium 241. Table 2-9 lists the organics detected; metals, inorganics, and radionuclides detected above background concentrations; and organics present below detection limits and present in blanks. Figure 2.1-18 illustrates the concentrations and sampling locations of the analytes detected above background.

Analysis of groundwater samples taken from upgradient Well 5287 indicates detections above background for the metals and other inorganics including aluminum, calcium, copper, magnesium, manganese, nickel, sodium, zinc, and sulfate. Table 2-10 lists metals and other inorganics above background and the background values. Radionuclides detected above background include americium 241; gross alpha; plutonium 239; uranium 233, 234; uranium 238; and tritium. Table 2-10 lists radionuclides detected above background and the background values.

Table 2-9 IHSS 177 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg)				
Acetone		CS034	1/1	71
		CS035	1/1	43
		CS036	1/1	15
		CS037	1/1	71
2-Butanone		CS037	1/1	15
Methylene chloride		CS034	1/1	39B
		CS035	1/1	38B
		CS036	1/1	35B
		CS037	1/1	14B
trans-1,2-Dichloroethene		CS034	1/1	8.0
		CS035	1/1	4.0J
Tetrachloroethene		CS034	1/1	4.0J
		CS035	1/1	3.0J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-9 IHSS 177 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) - contd.				
Toluene		CS034	1/1	2.0J
		CS035	1/1	1.0J
		CS036	1/1	2.0J
		CS037	1/1	1.0J
Chlorobenzene		CS035	1/1	2.0J
Ethylbenzene		CS035	1/1	2.0J
Total Xylenes		CS034	1/1	3.0J
		CS035	1/1	3.0J
		CS036	1/1	2.0J
		CS037	1/1	2.0J
Benzo(b)fluorathene		CS035	1/1	290J
		CS037	1/1	350J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-9 IHSS 177 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) - contd.				
Benzo(k)fluroanthene		CS035	1/1	400J
		CS037	1/1	320J
Benzo(a)pyrene		CS035	1/1	470J
		CS037	1/1	230J
Ideno(1,2,3-c,d)pyrene		CS035	1/1	270J
Benzo(g,h,i)perylene		CS035	1/1	340J
N-Nitrosodiphenylamine		CS037	1/1	880J
Phenanthrene		CS035	1/1	770J
		CS037	1/1	500J
Anthracene		CS035	1/1	250J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-9 IHSS 177 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) - contd.				
Di-n-butyl Phthalate		CS037	1/1	1300J
Fluoranthene		CS035	1/1	930J
		CS037	1/1	780J
Pyrene		CS034	1/1	240J
		CS035	1/1	1100J
		CS037	1/1	880J
Butylbenzyl phthalate		CS037	1/1	510J
Bis(2-ethylhexyl) Phthalate		CS034	1/1	2000JB
		CS035	1/1	1200JB
		CS036	1/1	2100B
		CS037	1/1	1400JB

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-9 IHSS 177 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) - contd.				
Chrysene		CS035	1/1	550J
		CS037	1/1	550J
Di-n-octyl Phthalate		CS037	1/1	290J
Metals (mg/kg)				
Aluminum	13400	CS034	1/1	14600
Barium	79.5	CS034	1/1	159
		CS035	1/1	147
		CS037	1/1	193
Cadmium	3.20	CS034	1/1	3.20
Calcium	3490	CS034	1/1	43700
		CS035	1/1	11700

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-9 IHSS 177 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals (mg/kg) - contd.				
Calcium - contd.	3490	CS036	1/1	9150
		CS037	1/1	92600
Copper	11.3	CS034	1/1	14.4
		CS035	1/1	19.2
		CS036	1/1	41.6
		CS037	1/1	13.2
Iron	13800	CS035	1/1	14700
		CS036	1/1	22300
		CS037	1/1	14900
Lead	7.88	CS034	1/1	37.4
		CS035	1/1	50.0
		CS036	1/1	43.9
		CS037	1/1	62.4

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

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Table 2-9 IHSS 177 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals (mg/kg) - contd.				
Magnesium	2480	CS034	1/1	3670
		CS036	1/1	6330
		CS037	1/1	4240
Mercury	0.204	CS034	1/1	0.590
		CS035	1/1	0.270
		CS036	1/1	0.220
		CS037	1/1	0.280
Potassium	1560	CS036	1/1	2810
Vanadium	29.8	CS036	1/1	31.3
		CS037	1/1	34.0
Zinc	27.7	CS034	1/1	42.0
		CS035	1/1	54.6
		CS036	1/1	68.4
		CS037	1/1	37.1

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Radionuclides (pCi/g)				
Gross Alpha	38.4	CS035	1/1	45 ± 12
		CS037	1/1	39 ± 15
Gross Beta	36.8	CS036	1/1	43 ± 7
		CS037	1/1	37 ± 7
Uranium 233,234	0.656	CS034	1/1	1.0 ± 0.2
		CS035	1/1	1.3 ± 0.5
		CS036	1/1	0.8 ± 0.2
		CS037	1/1	1.3 ± 0.3
Uranium 238	0.683	CS034	1/1	1.1 ± 0.3
		CS035	1/1	1.1 ± 0.2
		CS036	1/1	0.7 ± 0.19
		CS037	1/1	2.0 ± 0.5

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-9 IHSS 177 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Radionuclides (pCi/g) - contd.				
Plutonium 239,240	0.015	CS034	1/1	0.03 ± 0.06
		CS037	1/1	0.03 ± 0.12
Americum 241	0.014	CS035	1/1	0.02 ± 0.1
		CS036	1/1	0.02 ± 0.1

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
μg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

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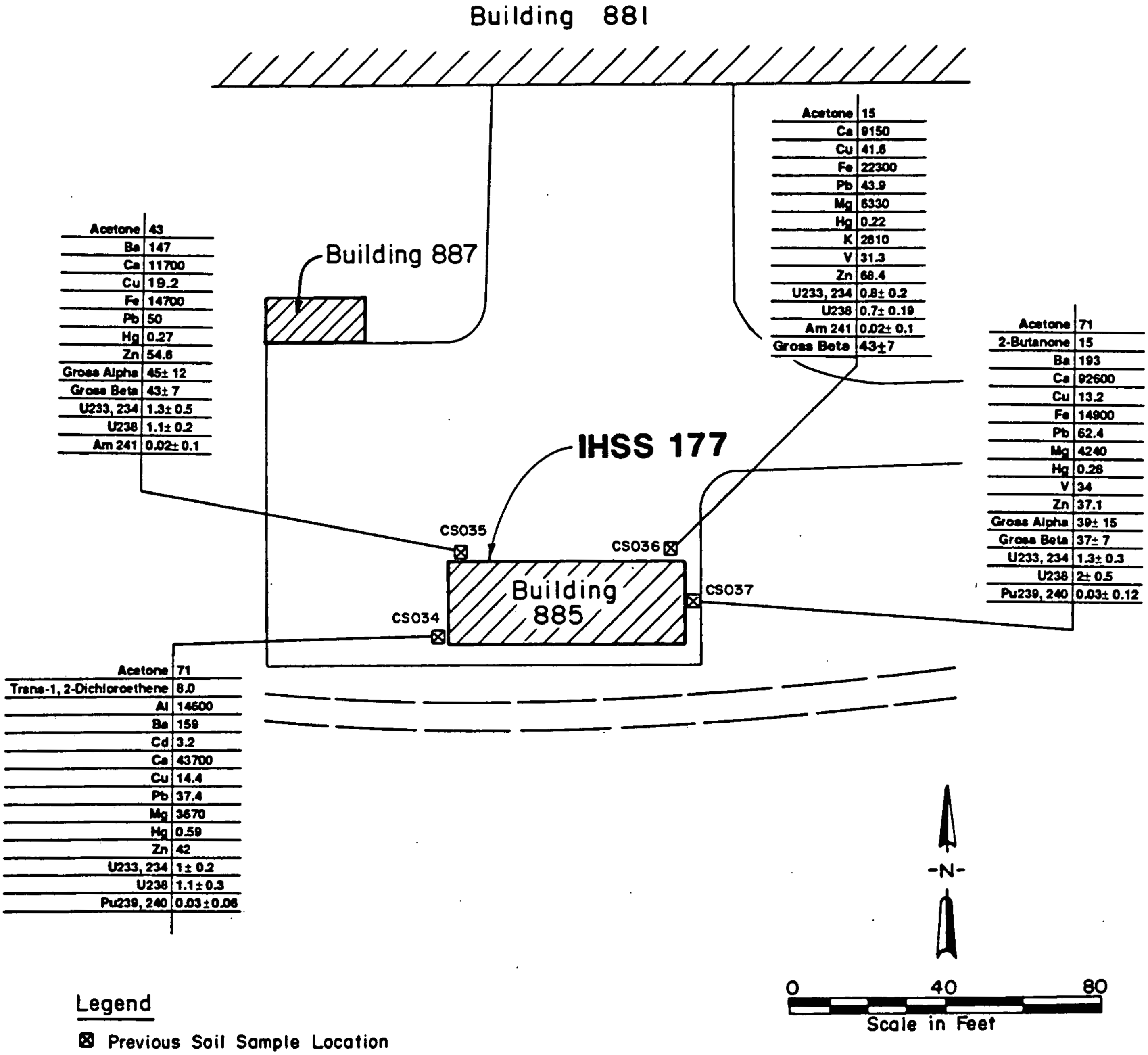

CS035:

Acetone	43
Ba	147
Ca	11700
Cu	19.2
Fe	14700
Pb	50
Hg	0.27
Zn	54.6
Gross Alpha	45± 12
Gross Beta	43± 7
U233, 234	1.3± 0.5
U238	1.1± 0.2
Am 241	0.02± 0.1

CS036:

Acetone	15
Ca	9150
Cu	41.6
Fe	22300
Pb	43.9
Mg	6330
Hg	0.22
K	2810
V	31.3
Zn	68.4
U233, 234	0.8± 0.2
U238	0.7± 0.19
Am 241	0.02± 0.1
Gross Beta	43±7

CS037:

Acetone	71
2-Butanone	15
Ba	193
Ca	92600
Cu	13.2
Fe	14900
Pb	62.4
Mg	4240
Hg	0.26
V	34
Zn	37.1
Gross Alpha	39± 15
Gross Beta	37± 7
U233, 234	1.3± 0.3
U238	2± 0.5
Pu239, 240	0.03± 0.12

CS034:

Acetone	71
Trans-1, 2-Dichloroethene	8.0
Al	14600
Ba	159
Cd	3.2
Ca	43700
Cu	14.4
Pb	37.4
Mg	3670
Hg	0.59
Zn	42
U233, 234	1± 0.2
U238	1.1±0.3
Pu239, 240	0.03±0.06

Al Aluminum
Ba Barium
Cd Cadmium
Ca Calcium
Cu Copper
Fe Iron
Pb Lead
Mg Magnesium
Hg Mercury
K Potassium
V Vanadium
Zn Zinc

UNITS

Organics are ug/kg for soils: ug/l for water
Inorganics are mg/kg for soils: mg/l for water
Radionuclides are pci/g for soils: pci/l for water

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FIGURE 2.1- 18
Analytes Detected Above Background
Building 885 Drum Storage Area
(IHSS 177)

Table 2-10 IHSS 177 Upgradient Groundwater Sampling Summary (Rocky Flats Groundwater Database).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/l)				
Aluminum	0.320	5287	1/16	0.388
Calcium	62.6	5287	16/16	85.7 - 125^{N}
Copper	0.0477	5287	2/16	0.048 - 0.059
Magnesium	16.1	5287	16/16	19.5 - 32.5^{N}
Manganese	0.213	5287	7/16	0.217 - 0.756^{N}
Nickel	0.043	5287	3/16	0.050 - 0.132^{N}
Sodium	46.7	5287	16/16	125 - 204^{N}
Zinc	0.141	5287	3/16	0.154 - 0.379
Sulfate	67.1	5287	15/16	180 - 587
Radionuclides (pCi/l)				
Americium 241	0.015	5287	2/9	0.020 - 0.040
Gross Alpha	55.1	5287	4/13	59 - 76^{N}
Plutonium 239	0.015	5287	1/9	0.020
Uranium 233, 234	0.100	5287	9/9	4.70 - 37.0^{N}
Uranium 238	25.6	5287	1/9	26.0
Tritium	359	5287	1/12	380

^{N} - Data not validated
mg/l - milligram per liter
pCi/l - picocurie per liter

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Downgradient data from Well 5387 indicates detections above background levels for the metals and other inorganics including calcium, copper, magnesium, nickel, sodium, zinc, and sulfate. Table 2-11 lists metals and other inorganics above background and the background values. The radionuclides detected above background includes uranium 233, 234. Table 2-11 lists the radionuclide detected above background and the background value.

2.1.8 Building 334 Cargo Container Area (IHSS 181)

The following discussion is summarized from the Closure Plan for the Container Storage Facilities (Rockwell International, 1988b).

2.1.8.1 Location and History

IHSS 181 is the site of a former cargo container area. The cargo container was 8 by 20 by 8 ft high steel and was used to store 55-gallon drums. The cargo container was located in the parking lot north of Building 334 (Figure 2.1-19). A maximum of eighteen 55-gallon drums could be stored in the cargo container; however, seven drums were the maximum stored there. The maximum storage capacity was, therefore, 385 gallons. The cargo container was located on an asphalt pad, and a collection pan was located in the bottom of the cargo container for secondary containment.

This area was used from the summer of 1984 to July 1986 for storage of drums containing waste machine oils, solvents, machine coolants and, possibly, low-level radioactive wastes. There is no documented or visual evidence of spills or leakage. The cargo container was moved to the Building 444/453 Drum Storage Area, IHSS 182 (Section 2.1.9).

Table 2-11 IHSS 177 Downgradient Groundwater Sampling Summary (Rocky Flats Groundwater Database).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/l)				
Calcium	62.6	5387	2/2	105 - 131
Copper	0.048	5387	2/2	0.106 - 0.122
Magnesium	16.1	5387	2/2	31.6 - 37.6
Nickel	0.043	5387	2/2	0.115 - 0.345
Sodium	46.7	5387	2/2	93.6 - 109
Zinc	0.141	5387	2/2	0.266 - 0.970
Sulfate	67.1	5387	2/2	210 - 240
Radionuclides (pCi/l)				
Uranium 233, 234	0.100	5387	1/1	10.2

mg/l - milligram per liter
pCi/l - picocurie per liter

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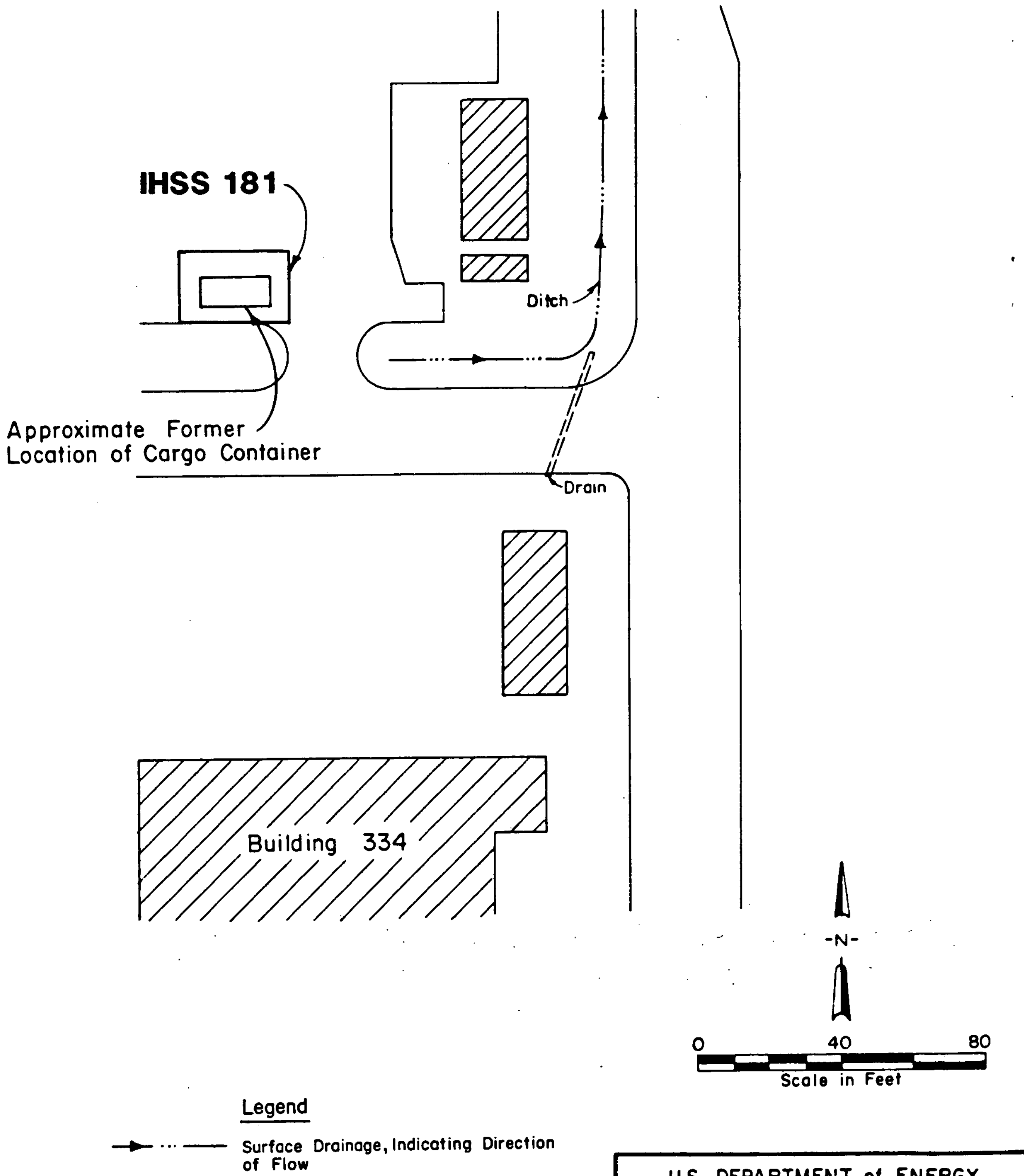

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FIGURE 2.1-19
Building 334 Cargo Container Area (IHSS 181) Location Map

2.1.8.2 Previous Investigations

No previous investigations of IHSS 181 have been conducted.

2.1.8.3 Physical Characteristics

The topography of IHSS 181 gently slopes to the east (Plate 1). The groundwater flows to the northeast and the depth to groundwater is approximately 10 ft below the ground surface. The closest well is located approximately 200 ft from the site; therefore, the data from well logs will not provide representative descriptions of geological materials at the IHSS. Approximately 20 ft of alluvium and fill overlie the bedrock in the vicinity of IHSS 181.

2.1.8.4 Nature and Extent of Contamination

No analytical data on soil or water are available, so the extent of contamination in this area is unknown.

No upgradient or downgradient analytical groundwater data are available for this area.

2.1.9 Building 444/453 Drum Storage Area (IHSS 182)

The following discussion is summarized from the Closure Plan for the Container Storage Facilities (Rockwell International, 1988b).

2.1.9.1 Location and History

IHSS 182 is located between Buildings 444 and 453 and covers an area of approximately 1,700 square ft (ft^2) (Figures 2.1-20, 2.1-21, and 2.1-22). In the mid-1970s, the area was covered with 4 inches of asphalt. There are no berms around the area.

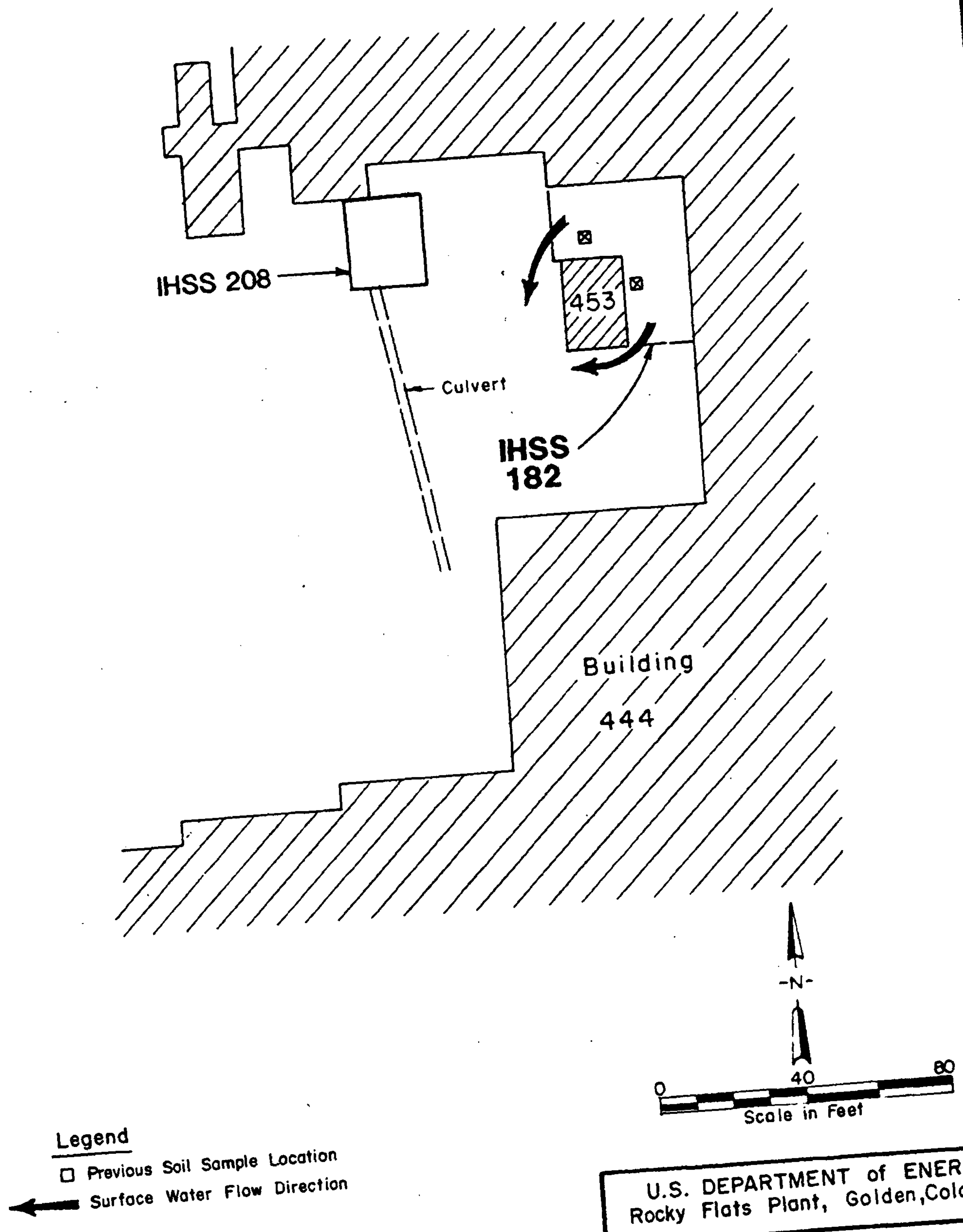

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FIGURE 2.1-20
Building 444/453 Drum Storage Area (IHSS 182) Location Map

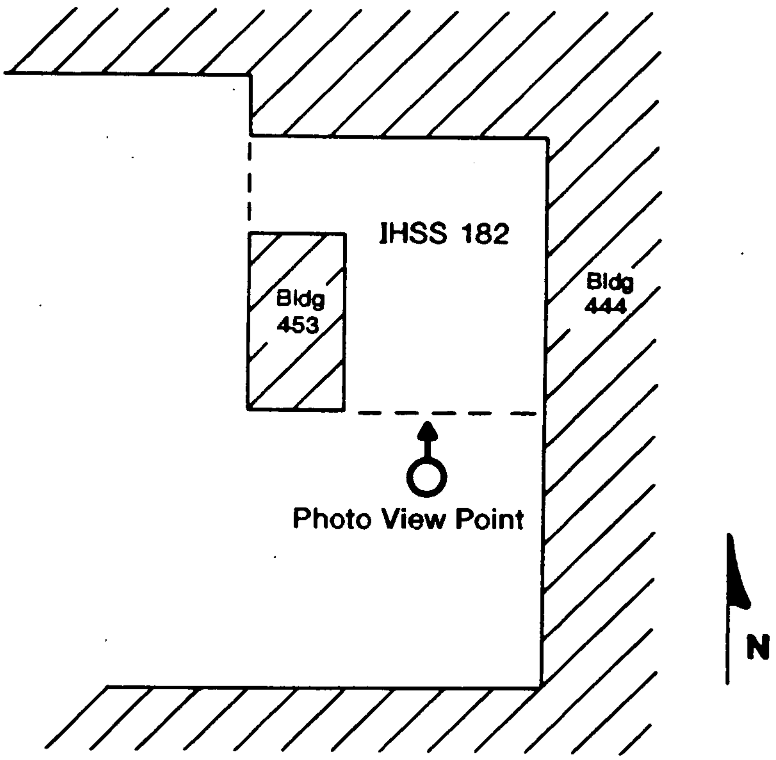

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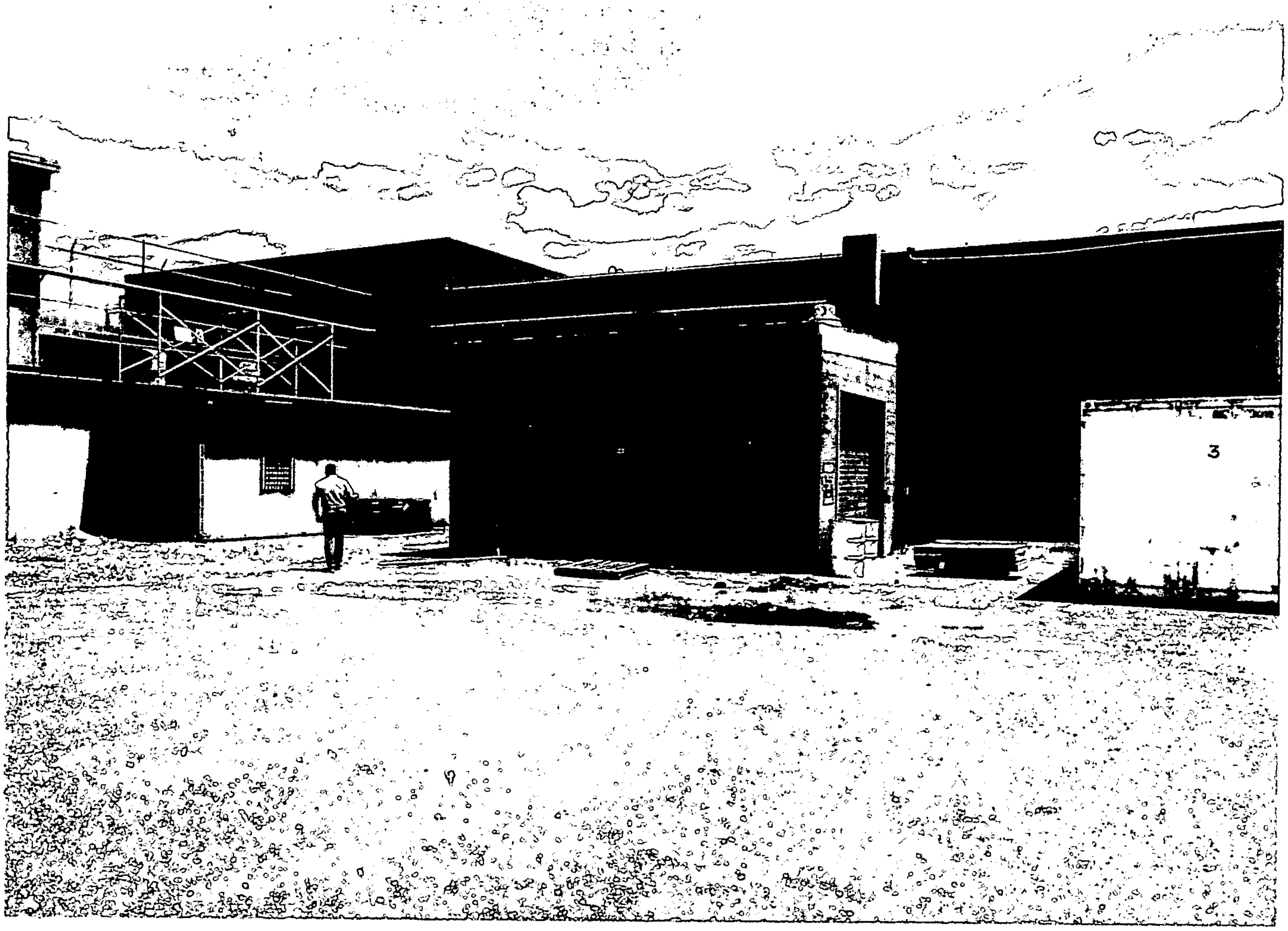
FIGURE 2.1-21
Building 444/453 Drum Storage Area (IHSS 182) Site Photo



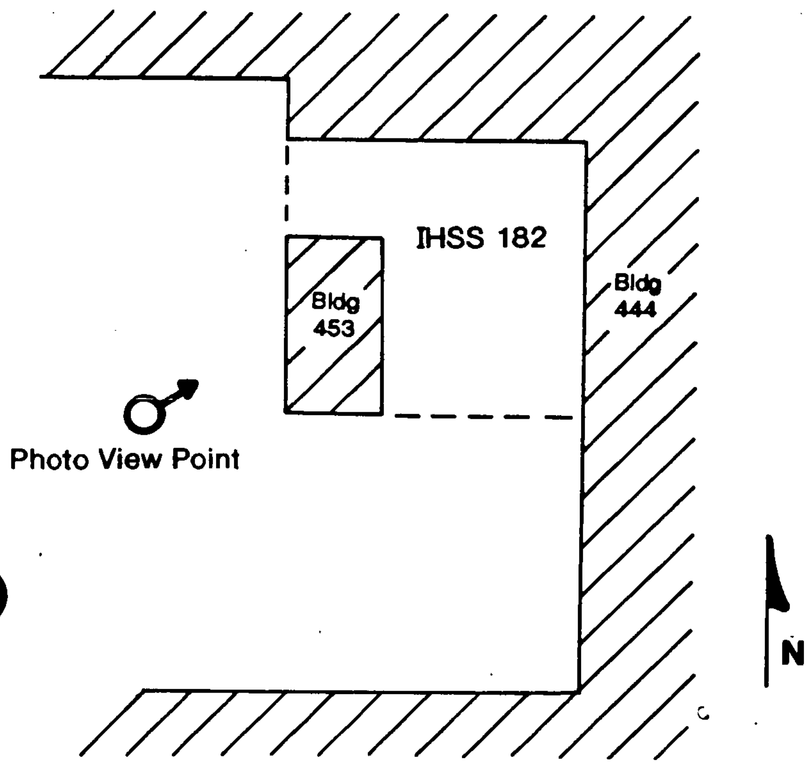


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FIGURE 2.1-22
Building 444/453 Drum Storage Area (IHSS 182) Site Photo

IHSS 182 was first used as a storage area. Buildings 444 and 453 were constructed in the late 1960s. Storage continued until the fall of 1986. Originally, 55-gallon drums were placed directly on the ground surface. In the mid-1970s, the top 4 inches of soil in a portion of the Drum Storage Area was removed because it was believed to be contaminated. It was replaced with 4 inches of asphalt. However, drums were still stored on the soil in the remaining portion of the Drum Storage Area. It is unknown where the contaminated soil was moved or stored.

The maximum number of drums ever stored at one time was approximately 200; however, some of these drums contained unused oil. The exact number of drums containing contaminated waste oils or solvents is unknown. Based on storage of two hundred 55-gallon drums, the total container storage capacity at any given time was 11,000 gallons. Waste hydraulic oils and chlorinated solvents were stored in the 55-gallon drums. Beryllium and low-level uranium contamination were sometimes present in the waste. IHSS 182 is roped off and is generally empty, although trash, such as wood, is sometimes temporarily placed in the roped off area.

The Building 334 Cargo Container was moved and relocated adjacent to IHSS 182 in fall 1986. This Cargo Container was moved out of IHSS 182 to the main hazardous waste storage area identified as Unit #1 in the RCRA Part B permit application (Rockwell International, 1988b).

During a site visit in May 1990, no drums of waste oil or solvents were observed in IHSS 182. Soil staining, apparently due to spillage of oils, was generally present throughout IHSS 182.

2.1.9.2 Previous Investigations

An initial soil characterization program to determine the nature and extent of soil contamination was specified for IHSS 182 in the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1988b). Subsequent to submittal of the Closure Plan, soil samples were obtained in 1988 from the approximate locations shown in Figure 2.1-20 (Weston, 1988). Only 67 percent of the proposed samples were collected while awaiting final approval of the Closure Plan. These samples were collected from 1-ft-deep excavations below the concrete sidewalk and were composited over the 1-ft-deep interval except for VOA samples, which were grab samples from a depth of 1 ft.

Prior to soil sampling, visual and direct radiation surveys were also conducted to identify areas of potential contamination. The samples were reportedly analyzed for HSL VOAs, BNAs, HSL metals, inorganics, and radionuclides. Section 2.1.9.4 presents the results of this sampling.

2.1.9.3 Physical Characteristics

The land surface at IHSS 182 is nearly flat. A small depression where surface water collects is located near the southwest corner of the site. The geologic materials in the vicinity of IHSS 182 consist of Rocky Flats Alluvium, fill, and Arapahoe Formation deposits.

The topography gently slopes to the east and south (Plate 1). Approximately 25 ft of alluvium and fill overlie the bedrock in the vicinity of IHSS 182. The groundwater flows to the east and the depth to groundwater is approximately 20 ft below the ground surface.

2.1.9.4 Nature and Extent of Contamination

Analysis of soil samples taken from borings in the area indicate detections of organics which include acetone, 1,1,1-trichloroethane, toluene, ethylbenzene, total xylenes, naphthalene, phenanthrene, fluoranthene, and pyrene. Table 2-12 lists the organics detected and metals and radionuclides detected above background. Metals detected above background include aluminum, cadmium, copper, iron, mercury, potassium, magnesium, manganese, nickel, vanadium, and zinc.

Table 2-12 IHSS 182 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg)				
Methylene chloride		CS022	1/1	8.0B
		CS023	1/1	7.0B
Acetone		CS022	1/1	19
		CS023	1/1	19
1,1-Dichloroethene		CS022	1/3	5.0J
1,1-Dichloroethane		CS022	1/3	4.0J
1,1,1-Trichloroethane		CS022	2/3	220, 980
Tetrachloroethene		CS022	1/3	1.0J
Toluene		CS022	1/2	7.0
Ethylbenzene		CS022	1/2	7.0

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-12 IHSS 182 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
<u>Volatile and Semivolatile Organics (μg/kg)</u> - contd.				
Total Xylenes		CS022	1/2	14
Naphthalene		CS022	1/1	44000
2-Methylnaphthalene		CS022	1/1	13000J
Acenaphthene		CS022	1/1	27000J
Dibenzofuran		CS022	1/1	14000J
Fluorene		CS022	1/1	23000J
Phenanthrene		CS022	1/1	95000
		CS023	1/1	380J
Anthracene		CS022	1/1	28000J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
μg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

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Table 2-12 IHSS 182 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (μg/kg) - contd.				
Fluoranthene		CS022	1/1	77000
		CS023	1/1	400J
Pyrene		CS022	1/1	62000
		CS023	1/1	320J
Benzo(a)anthracene		CS022	1/1	25000J
Bis(2-ethylhexyl) Phthalate		CS022	1/1	12000J
		CS023	1/1	630J
Benzo(b)fluoranthene		CS022	1/1	26000J
Benzo(k)fluoranthene		CS022	1/1	27000J
		CS023	1/1	180J

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
μg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Table 2-12 IHSS 182 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Volatile and Semivolatile Organics (µg/kg) - contd.				
Benzo(a)pyrene		CS022	1/1	34000J
		CS023	1/1	220J
Ideno(1,2,3-c,d)pyrene		CS022	1/1	28000J
Dibenz(a,h)anthracene		CS022	1/1	14000J
Benzo(g,h,i)perylene		CS022	1/1	32000J
Metals (mg/kg)				
Aluminum	13400	CS022	1/1	14100
Cadmium	3.20	CS022	1/1	5.40
		CS023	1/1	4.90

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

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Table 2-12 IHSS 182 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals (mg/kg) - contd.				
Copper	11.1	CS022	1/1	21.1
		CS023	1/1	31.9
Iron	13800	CS022	1/1	17600
		CS023	1/1	18400
Mercury	0.320	CS022	1/1	0.38
Potassium	1560	CS022	1/1	2330
		CS023	1/1	2820
Magnesium	2480	CS022	1/1	3970
		CS023	1/1	4400
Manganese	235	CS022	1/1	276
Nickel	21.4	CS022	1/1	22.3

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

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Table 2-12 IHSS 182 Soil Sampling Summary (10/88-1/89, Weston Analytics).

Analyte	Background Value[1]	Station Number	Frequency of Detection	Concentration Range
Metals (mg/kg) - contd.				
Vanadium	37.2	CS022	1/1	38.5
Zinc	39.7	CS022	1/1	72.8
		CS023	1/1	45.4
Radionuclides (pCi/g)				
Uranium 233, 234	0.656	CS022	1/1	1.3 ± 0.2
Uranium 238	0.683	CS022	1/1	5.9 ± 0.3

[1] - Any detection of volatile or semivolatile organics is considered to be above background levels
J - Present below detection limit
B - Present in blanks
Note: Data not validated
μg/kg - microgram per kilogram
mg/kg - milligram per kilogram
pCi/g - picocurie per gram

Radionuclides detected above background include uranium 233, 234, and uranium 238. Figure 2.1-23 illustrates the concentrations and sampling locations of the analytes detected above background.

No representative upgradient or downgradient analytical groundwater data are available for this area.

2.1.10 <u>Building 460 Sump #3 Acid Side (IHSS 205)</u>

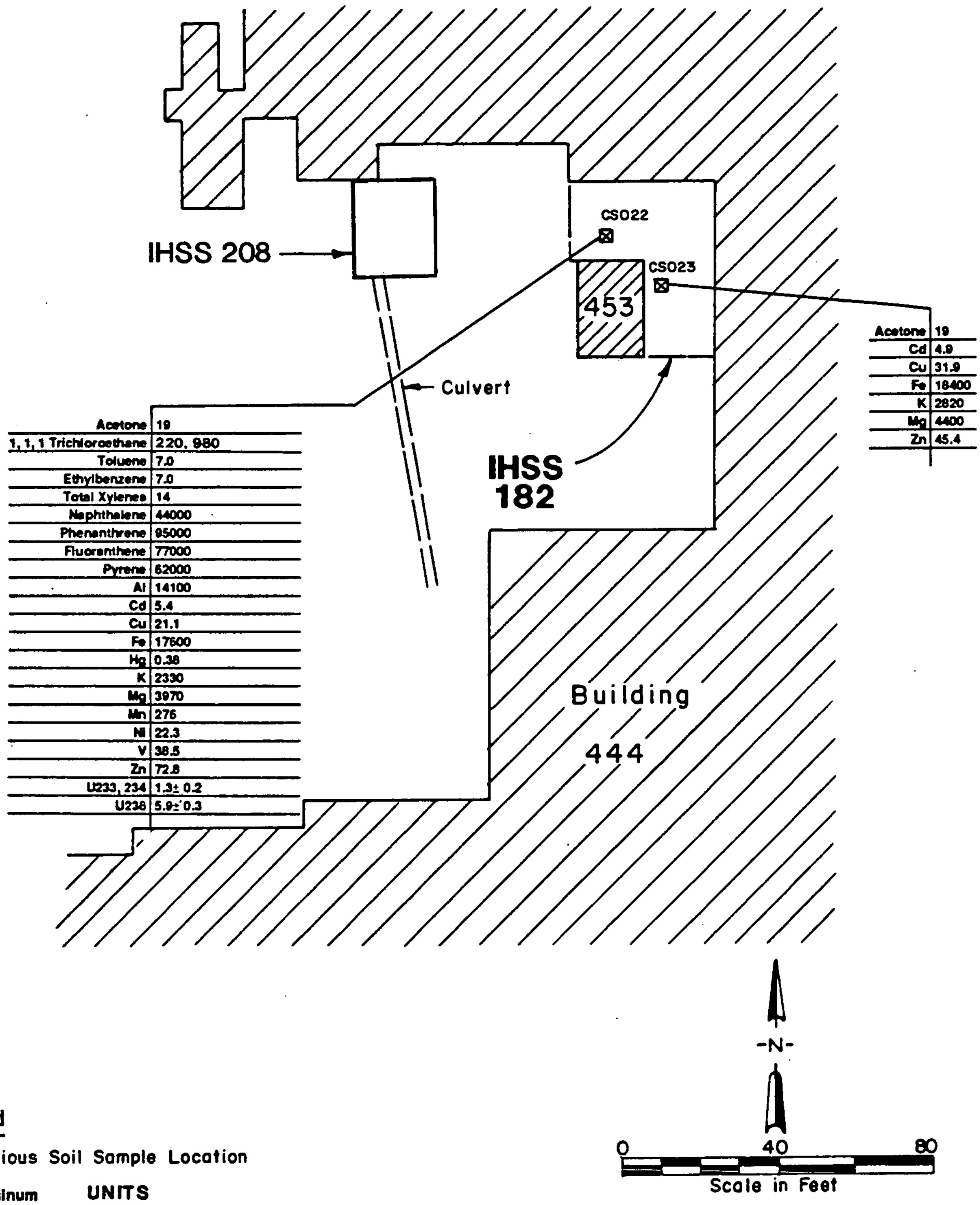
The following discussion is summarized from the Closure Plan for the Building 460 Acid and Solvent Dumpsters (Advanced Sciences, Inc., 1988).

2.1.10.1 Location and History

The dumpsters (portable cylindrical vessels) are located outside Building 460 along the southeast corner of the building (Figures 2.1-24 and 2.1-25). These 460 dumpsters had been operated as interim status units in the 1986/1987 time frame, and were identified in the November 1986 RCRA Part A and Part B permit applications. The acid dumpsters are still in use, but as a 90-day accumulation area rather than an interim status unit. These changes away from interim status were reflected in the Revised RCRA Part A and Part B Permits submitted to CDH and EPA on December 15, 1987. Interim status usage of the dumpsters ceased on March 24, 1988.

Lines run from the waste generators to a sump or holding tank (the acid sump is located in Room 156B), after which lines run from these holding tanks through the concrete wall to the dumpsters, where they are attached by quick connect couplings to the dumpsters.

The acid dumpsters are 3/16-inch thick, 394L stainless steel, 250-gallon cylinders, lined with Kynar polyvinyledine fluoride (as specified by SM-122, Section 6, ASME). Each dumpster



CS022:

Acetone	19
1, 1, 1 Trichloroethane	220, 980
Toluene	7.0
Ethylbenzene	7.0
Total Xylenes	14
Naphthalene	44000
Phenanthrene	95000
Fluoranthene	77000
Pyrene	62000
Al	14100
Cd	5.4
Cu	21.1
Fe	17600
Hg	0.38
K	2330
Mg	3970
Mn	276
Ni	22.3
V	38.5
Zn	72.8
U233, 234	1.3± 0.2
U238	5.9± 0.3

CS023:

Acetone	19
Cd	4.9
Cu	31.9
Fe	18400
K	2820
Mg	4400
Zn	45.4

Legend

⊠ Previous Soil Sample Location

Al Aluminum
Cd Cadmium
Cu Copper
Fe Iron
Mg Magnesium
Mn Manganese
Hg Mercury
Ni Nickel
K Potassium
V Vanadium
Zn Zinc

UNITS

Organics are ug/kg for soils: ug/l for water
Inorganics are mg/kg for soils: mg/l for water
Radionuclides are pci/g for soils: pci/l for water

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FIGURE 2.1-23
Analytes Detected Above Background
Building 444/453 Drum Storage Area
(IHSS 182)

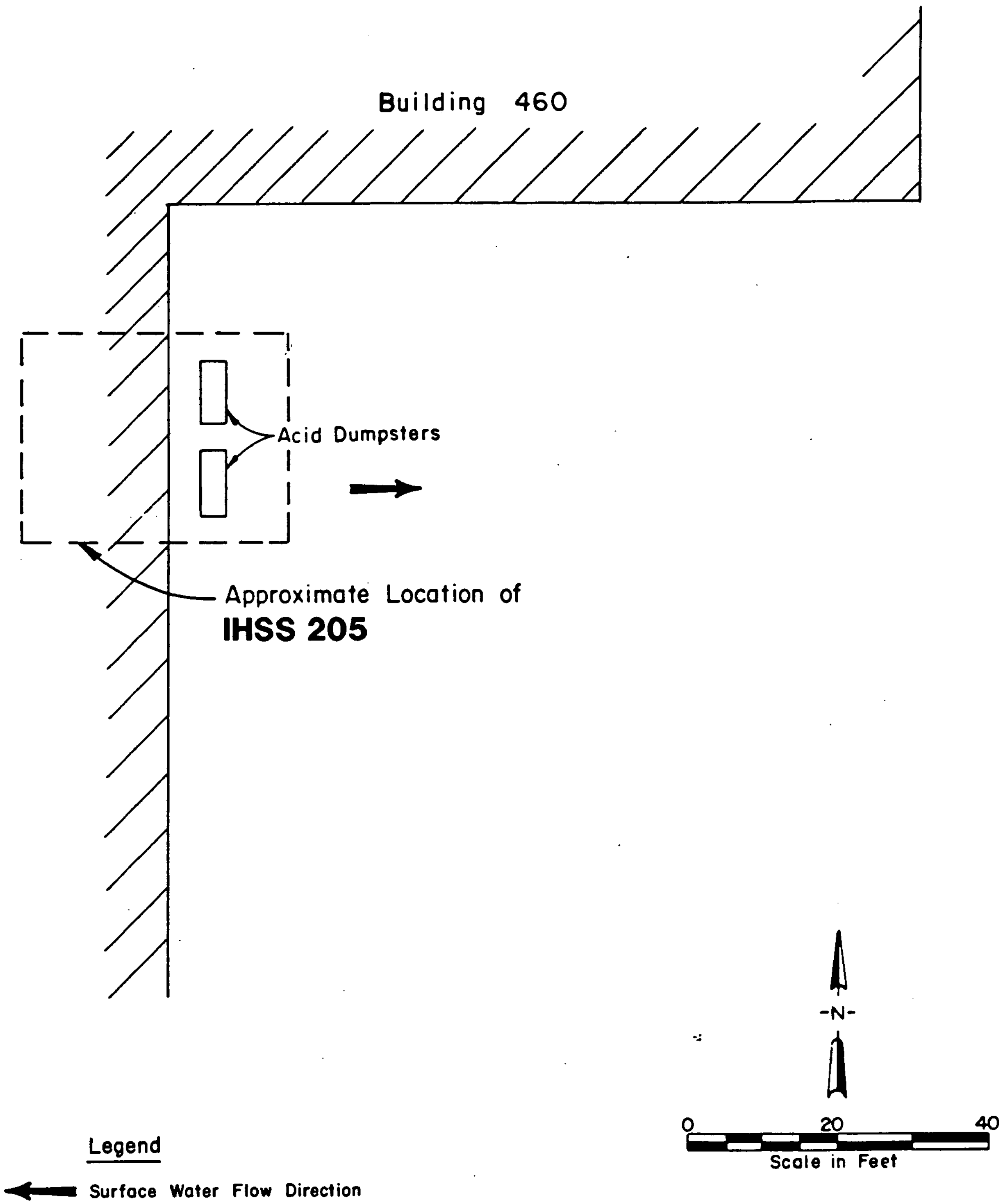

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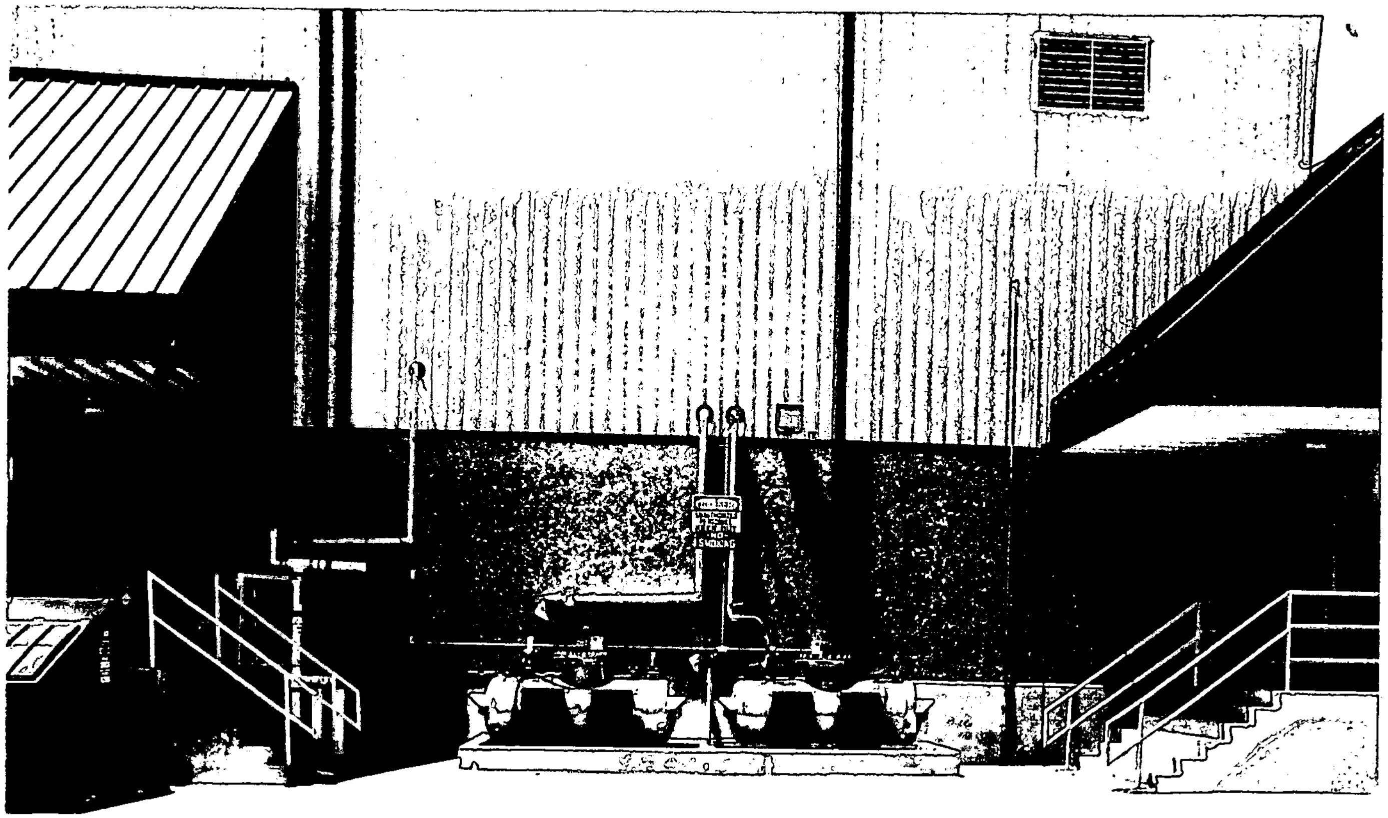
FIGURE 2.1-24
Building 460 Sump #3 Acid Side (IHSS 205) Location Map



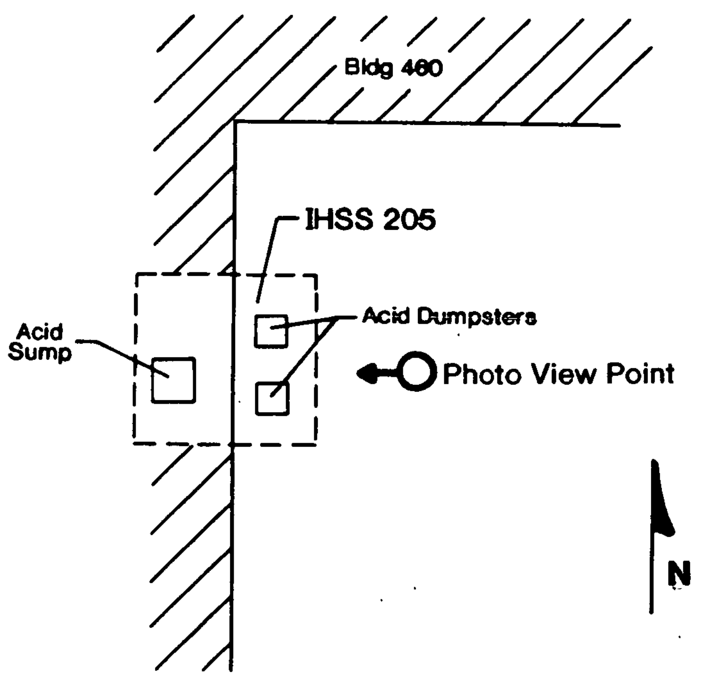


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FIGURE 2.1-25
Building 460 Sump #3 Acid Side (IHSS 205) Site Photo

contains an 18-inch-diameter manhole on the top and a 1-inch-diameter drain fitted with a ball-valve in the bottom. The paired dumpsters are used in a manner such that one dumpster of the pair can receive wastes while the other dumpster is being emptied.

The acid dumpsters have a storage capacity of 250 gallons each or a combined total of 500 gallons, however, they are used one at a time. Therefore, the capacity for storage is normally somewhat less than 250 gallons. An additional small amount of storage is available in an acid sump, a fiberglass tank located inside Building 460 (Room 156B) where acid wastes are transferred to the acid waste dumpsters through permanent piping.

A level sensor is mounted in a 2-1/2-inch-diameter, stainless steel pipe near the end of each dumpster. An up-to-the-minute log of the volume in the tank is maintained and visually checked with the sensor weekly to determine when dumpster changeover was necessary, generally when the liquid level reached about 1 ft from the top of the dumpster.

The dumpsters are contained within a concrete-bermed area, with a concrete divider separating each dumpster (Figure 2.1-25). Each bermed area measures 4 ft, 6-1/2 inches wide by 8 ft, 6 inches long, and 12 inches deep. Each bermed area has a 286-gallon capacity.

The containment areas cannot be drained into one another, e.g., each area represents a distinct basin separated by the dividing berm(s). Each basin, however, can be partially drained to the area outside of containment through a drain hole located 1-1/2 inches above the basin floor. It is unknown if these drain holes were ever opened, but they are currently plugged.

No cracks are present in the concrete containment pad under the acid dumpsters, and no spills from the dumpsters have ever escaped the secondary containment system. No stains from dumpster spillage are present. Stain from rainwater and snowmelt accumulation, however, is present.

The acid dumpsters are connected to an acid sump (a fiberglass tank in the wall of Building 460) with quick-disconnects to facilitate exchanging dumpsters. A pump transfers waste acids from the sump through a dedicated pipe system to the acid waste dumpster. The acid sump is connected to the Building 460 dedicated drainage system (exclusively acids).

When it is necessary to empty one of the dumpsters, it is either transported by the Trucking group directly to Building 374 or 774, or moved by forklift to an adjacent, bermed location for transfer to drums. Acid wastes are transferred from the dumpsters to steel drums with poly liners, using a 1/2 hp pump and 1-inch-diameter Tygon tubing. Filled acid drums are then stored in the Building 460 Drum Storage Area.

Waste materials handled by the Acid Dumpster were a mixture of approximately 80 percent water and 20 percent acid. The acids were primarily nitric acid and Nitradd, a combination of hydrofluoric acid and ammonium salts.

Building 460, the Consolidated Non-Nuclear Manufacturing Building, contains 25 major functions/operations:

Electric Discharge Machining	Copper Cleaning
Acid Cleaning - Automated line	Aqueous Cleaning
Acid Cleaning - Internal line	Inspection
Electro-Chemical Machining	R and D Lab
Final Step-Cleaning	Machinery
Nondestructive Testing	Assembly Machining
Hardware Machining	Assembly
R and D Shop	Maintenance Paint Shop (2)
Maintenance Machine Shop	Maintenance Pipe Shop

Crush Grinding Operation
Maintenance Sheet Metal Shop
Maintenance Carpenter Shop
Lube Oil Storage
Production Testing Cells
Metallography Lab

2.1.10.2 Previous Investigations

Previous soil sampling investigations have not been conducted at this site.

2.1.10.3 Physical Characteristics

The area around IHSS 205 is paved and flat lying. The geologic materials in the vicinity consist of Rocky Flats Alluvium, fill, and Arapahoe Formation deposits.

Approximately 25 ft of alluvium and fill overlie the bedrock in the vicinity of IHSS 205. The closest well is located approximately 500 ft from the site; therefore, detailed bore logs do not provide representative information on geologic materials in IHSS 205. The topography gently slopes to the east and south (Plate 1). The groundwater flows to the east and the depth to groundwater is approximately 20 ft below the ground surface.

2.1.10.4 Nature and Extent of Contamination

No samples were collected in this area for analysis, so the extent of contamination is unknown.

No upgradient or downgradient analytical groundwater data are available for this area.

2.1.11 <u>Inactive D-836 Hazardous Waste Tank (IHSS 206)</u>

The following discussion is summarized from the RCRA Part B Permit Application (Rockwell International, 1987).

2.1.11.1 Location and History

IHSS 206 was previously identified in the RCRA Part B permit application (Rockwell International, 1987) as Unit # 41.14, a portion of the Building 374 Waste Treatment Facility (Unit #42). Although the D-836 Hazardous Waste Tank was mobile, the area considered for the scope of this Work Plan is the area outside Building 374 where this tank was connected to the building (Figures 2.1-26 and 2.1-27). The tank is constructed of carbon steel and is 8 ft in diameter and 49.5 ft in length, with a total storage capacity of 19,000 gallons.

The Inactive D-836 Hazardous Waste Tank was constructed in 1962. Prior to 1975, it was probably used to store U.S. Air Force fuel at another location. From 1975 to 1987, the tank was used to store off-specification Building 374 product water (water too high in conductivity). Therefore, it probably has not released any contaminants of concern. No spills or leaks from the tank have occurred (Cypher, 1990). The tank was located over compacted soil outside of Building 374 and was not secondarily contained.

2.1.11.2 Previous Investigations

Previous soil sampling investigations have not been conducted at this site.

2.1.11.3 Physical Characteristics

The topography of IHSS 206 gently slopes to the north - northeast (Plate 1). The geologic materials in the vicinity consist of Rocky Flats Alluvium, fill, and Arapahoe Formation deposits.

Approximately 5 ft of alluvium and fill overlie the bedrock in the vicinity of IHSS 206. The closest well is located approximately 750 ft from the site; therefore, detailed bore logs will not be useful for detailed information on geologic materials at the IHSS. The groundwater flows to the northeast and the depth to groundwater is approximately 15 ft below the ground surface.

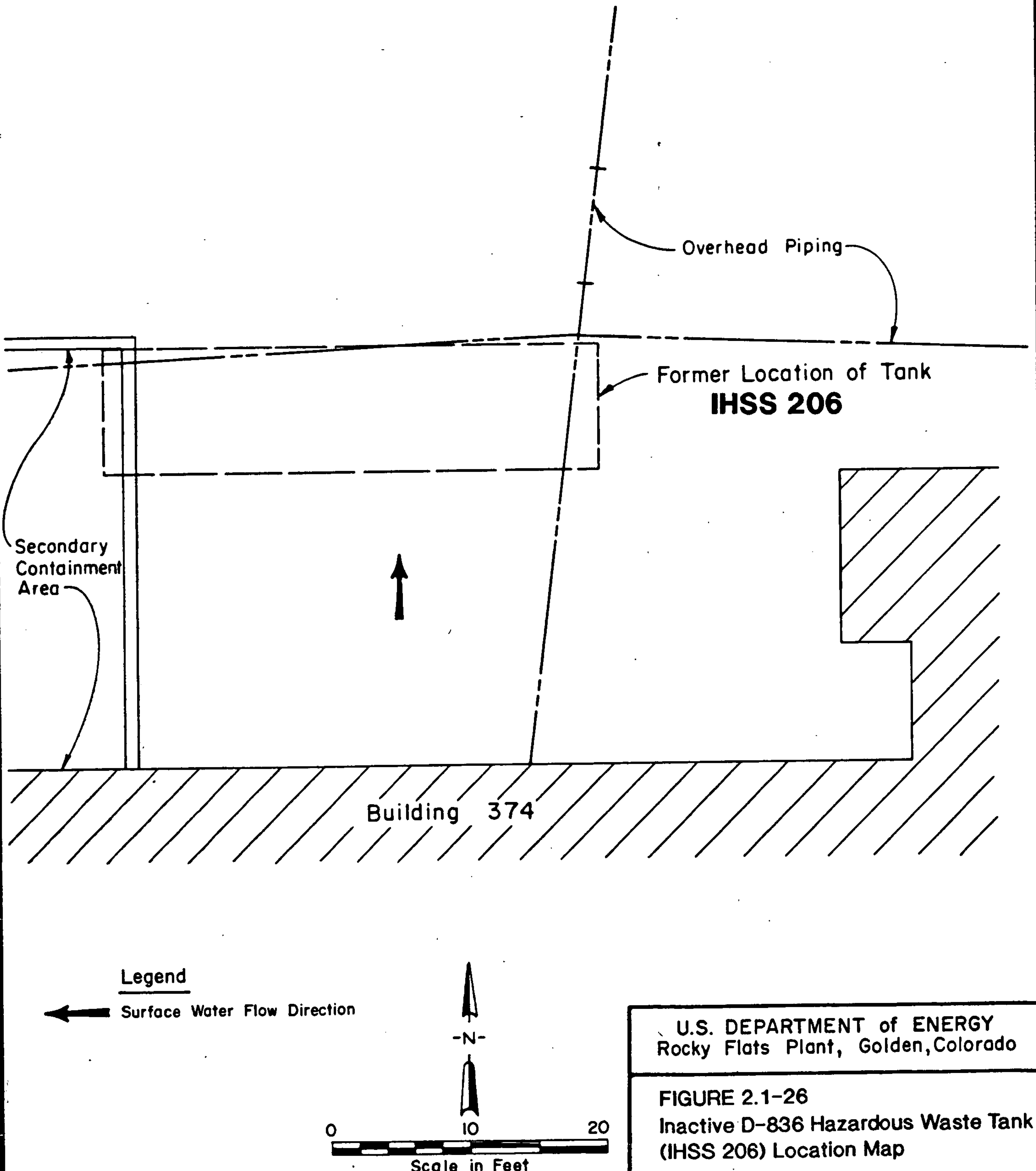

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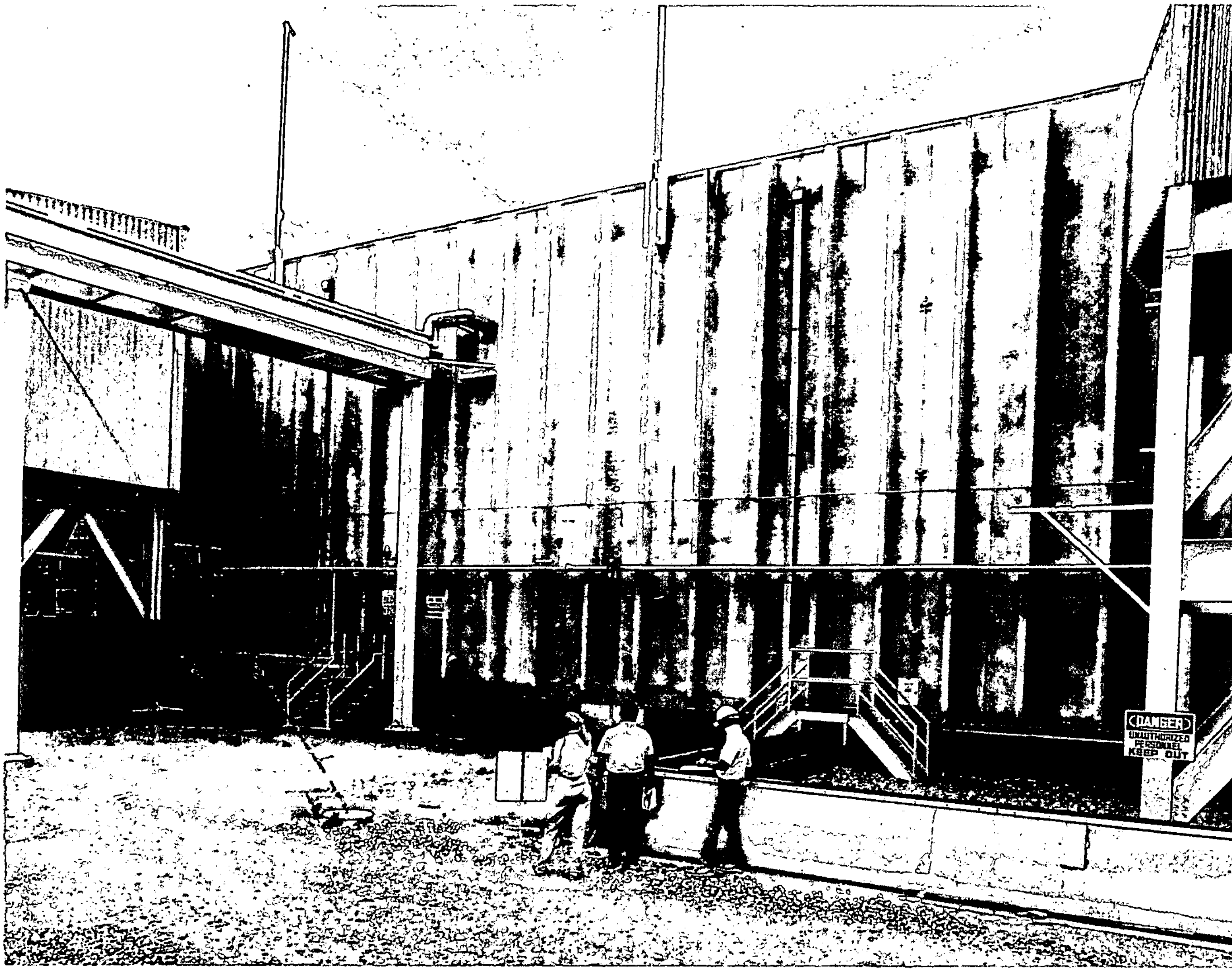
FIGURE 2.1-26
Inactive D-836 Hazardous Waste Tank (IHSS 206) Location Map



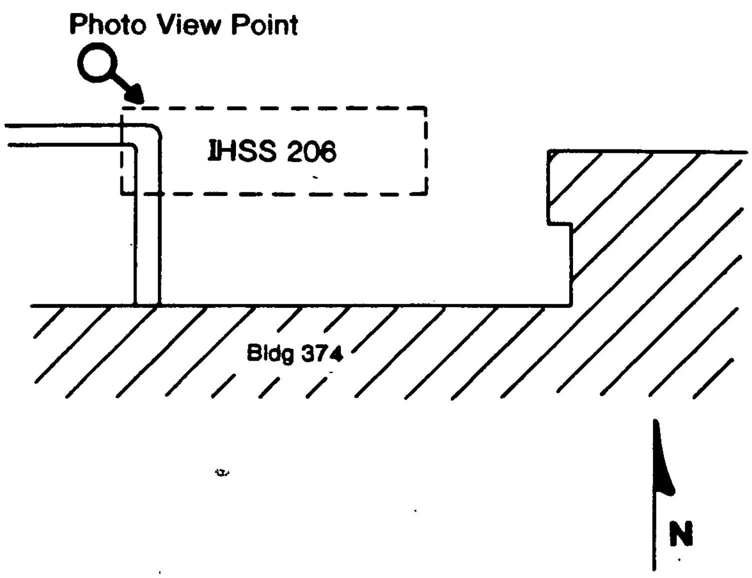


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FIGURE 2.1-27
Inactive D-836 Hazardous Waste Tank (IHSS 206) Site Photo

2.1.11.4 Nature and Extent of Contamination

No soil sampling investigations have been conducted at this site, so the nature and extent of contamination is not known.

No upgradient or downgradient analytical groundwater data are available for this area.

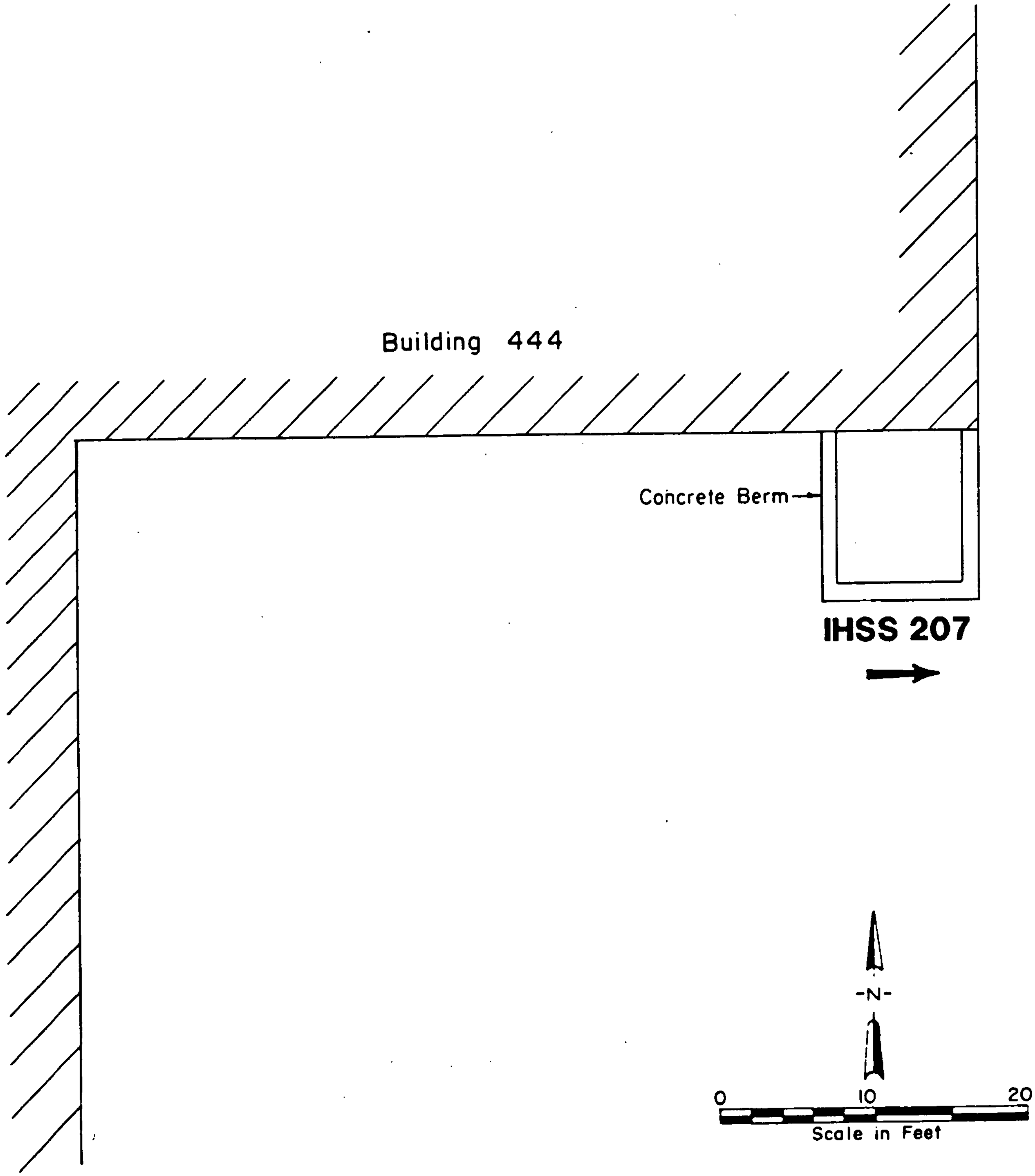
2.1.12 Inactive Building 444 Acid Dumpsters (IHSS 207)

The following discussion is summarized from the Closure Plan for Building 444 Acid Dumpsters (Rockwell International, 1988c).

2.1.12.1 Location and History

IHSS 207 is the site of former Building 444 Acid Dumpsters which were located outside and to the east of Building 444 (Figures 2.1-28 and 2.1-29). The acid dumpsters were located within a bermed area with inner dimensions measuring 9.5 ft by 9 ft by 1 ft. The bermed area had the capacity to contain 640 gallons. Although the bermed area had the capacity to store two 500-gallon dumpsters, only one dumpster was filled at a time.

The acid dumpsters were used to store acidic wastes from Building 444 and operated from 1980 through 1987. When one dumpster was full it was transported to Building 374 or 774 for treatment and the other dumpster was subsequently used for waste storage. The waste consisted of acidic waste from the chemical milling of beryllium and electropolishing solution from chemical milling. The raw milling acid consisted of a mixture of 75 percent phosphoric acid, 3 percent sulfuric acid, and chromium trioxide. The electropolishing solution consisted of phosphoric acid. The spent acid was drained into a sump and then into the acid dumpsters. There were no reports of spills from the acid dumpsters. The bermed area was inspected frequently. The acid dumpsters and associated piping were decontaminated and moved to another



Legend

Surface Water Flow Direction

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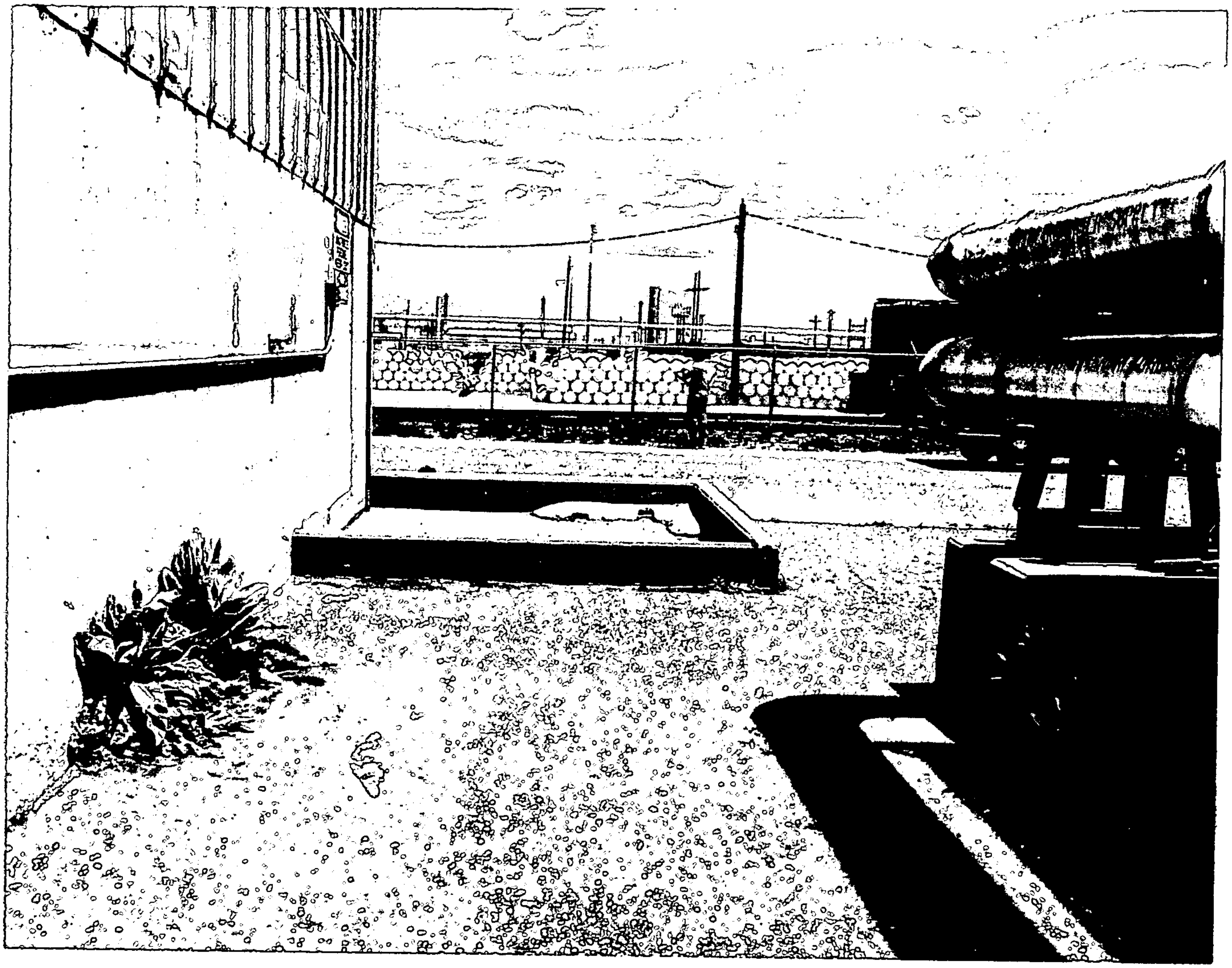
FIGURE 2.1-28
Inactive Building 444 Acid Dumpster (IHSS 207) Location Map



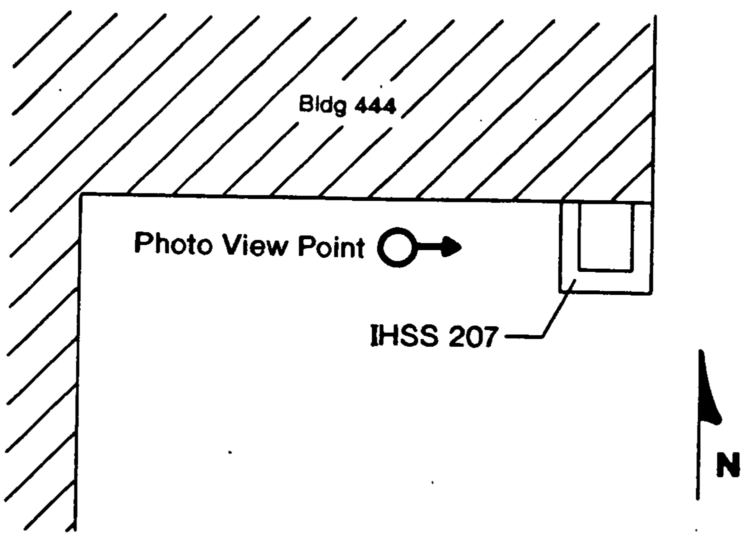


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FIGURE 2.1-29
Inactive Building 444 Acid Dumpster (IHSS 207) Site Photo

process area during 1987. During a site visit in May 1990, it was noted that although the bermed area was still intact, some concrete degradation had occurred.

Additional contaminants of concern found in the acid waste stream of Building 444 include the metals cadmium, chromium, lead, and silver and the radionuclides uranium 233, 234; uranium 238; americium 241; and tritium (Rockwell International, 1988c). These contaminants have no IHSS associated with actual storage. There is a possibility some of these waste acids could have been stored at IHSS 207.

2.1.12.2 Previous Investigations

No previous soil or water sampling investigations have been performed. The bermed area had been inspected on a frequent basis. No spills have been reported to date.

2.1.12.3 Physical Characteristics

The topography of IHSS 207 slopes to the east (Plate 1). The geologic materials in the vicinity consist of Rocky Flats Alluvium, fill, and Arapahoe Formation deposits.

Approximately 25 ft of alluvium and fill overlie the bedrock in the vicinity of IHSS 207. The closest well, in this case, is located approximately 200 ft south of the site. For a more detailed description of the geology, reference the bore log for Well P419689 found in Appendix B. The groundwater flows to the east and intercepts the Walnut Creek drainage. The depth of groundwater is approximately 25 ft below the ground surface.

2.1.12.4 Nature and Extent of Contamination

No analytical data are available, so extent of contamination is unknown.

No upgradient or downgradient analytical groundwater data are available for this area for this area.

2.1.13 Inactive 444/447 Waste Storage Area (IHSS 208)

The following discussion is summarized from the RCRA Part B permit application (Rockwell International et al., 1987).

2.1.13.1 Location and History

The Inactive 444/447 Waste Storage Area (IHSS 208) was previously identified in the RCRA Part B permit application (Rockwell International, 1987) as Unit #3, and was located in the same area as IHSS 182 (Figures 2.1-30 and 2.1-31). This storage area consisted of a 20- by 8-ft cargo container with a maximum waste volume of 990 gallons. Similar to IHSS 206, this storage area was also mobile and is currently used to store hazardous waste at Unit #1 (Hazardous Storage Area) (Rockwell International, 1987).

IHSS 208 was used from 1986 to 1987 at Unit #3, which was located at the same point as IHSS 182. This storage area was secondarily contained, and no leaks or spills were reported in this area. Typical stored wastes included a composite of nitric acid with silver, sodium fluoride, sodium fluoride solution, plating acids (hydrochloric acid, nitric acid, hydrofluoric acid) with concentrated chromium plating solution, concentrated cadmium cyanide solution, nickel sulfamate, and developer and fixer.

2.1.13.2 Previous Investigations

No previous soil sampling investigations have been performed at IHSS 208.

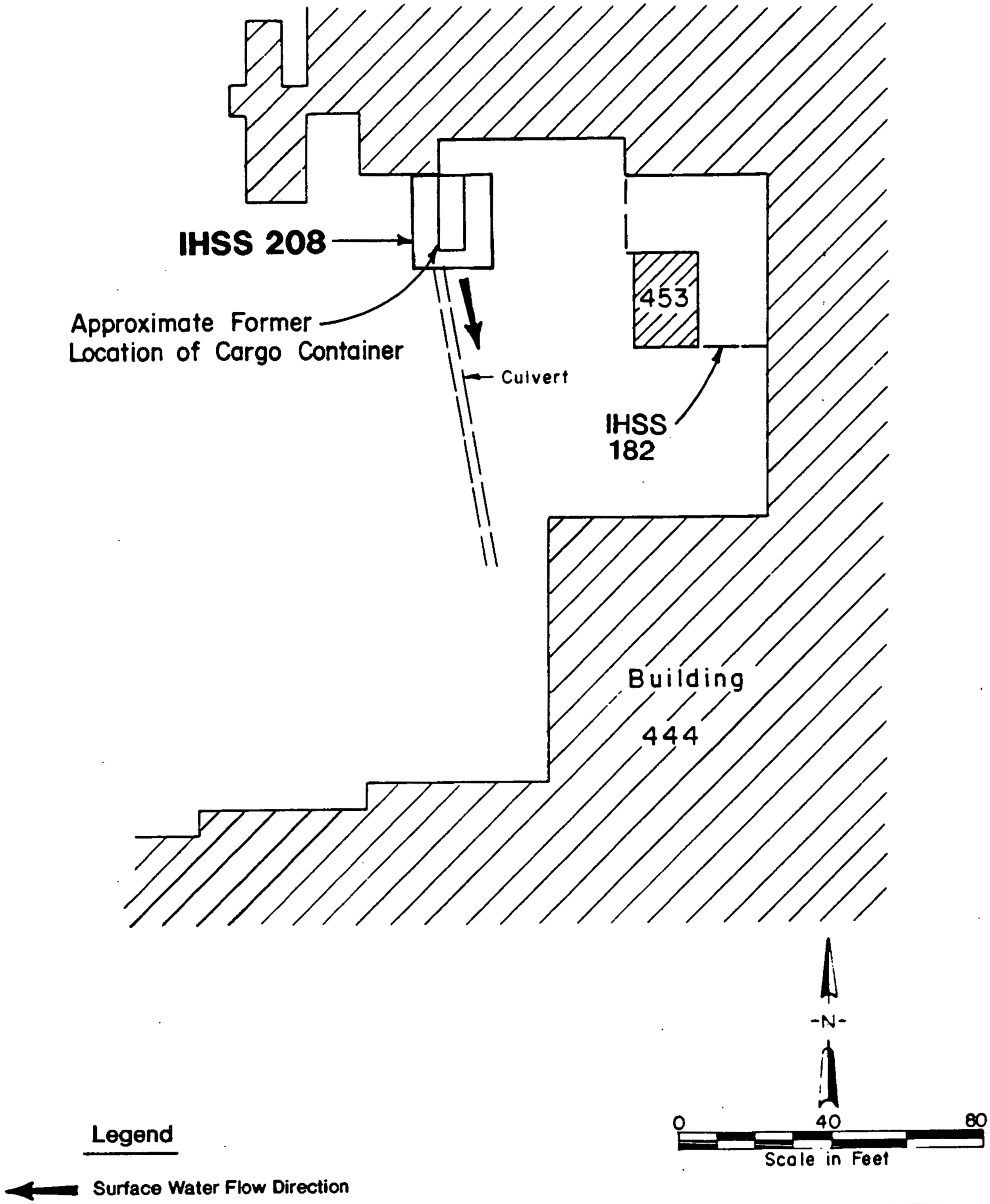

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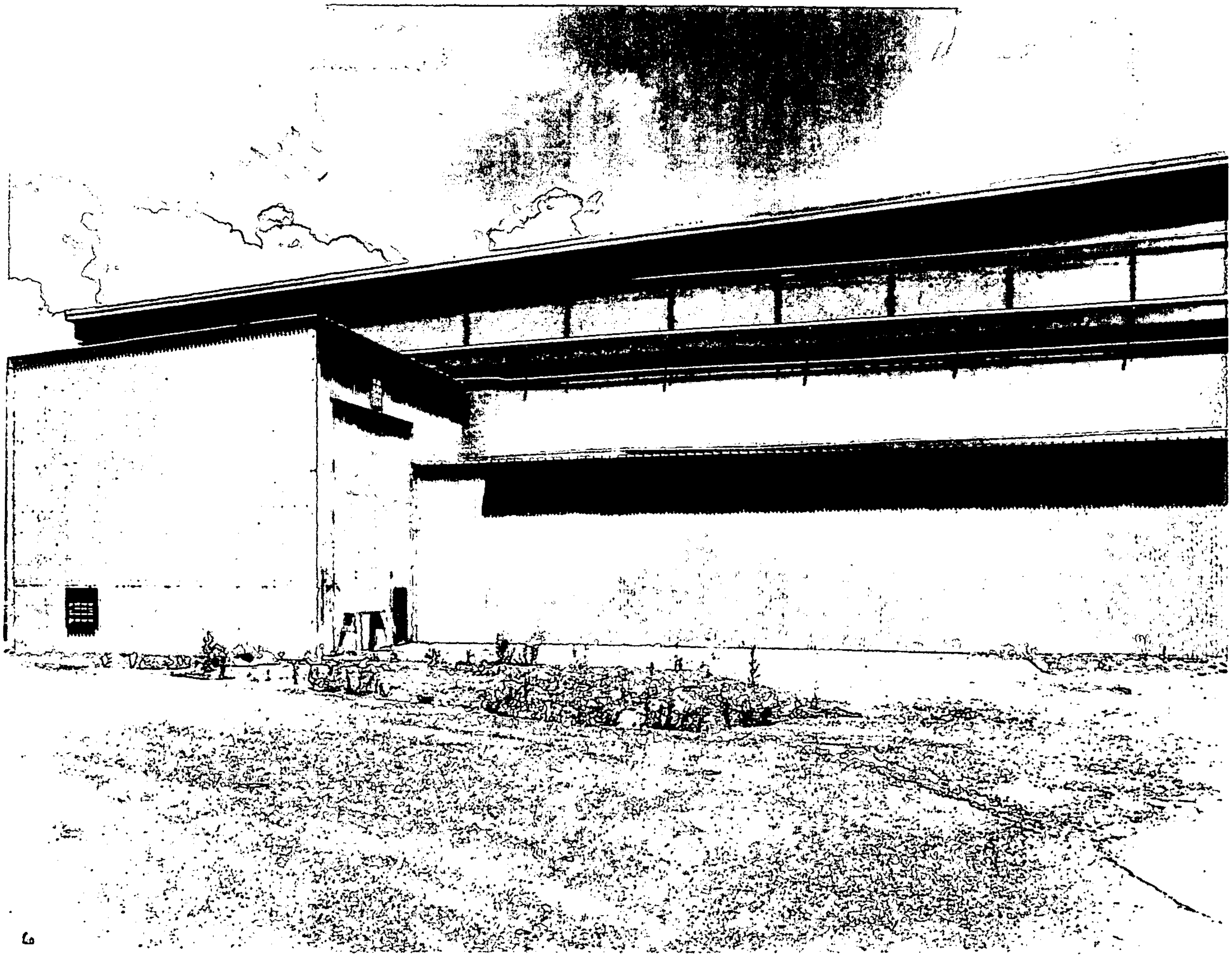
FIGURE 2.1-30
Inactive 444/447 Waste Storage
Area (IHSS 208) Location Map



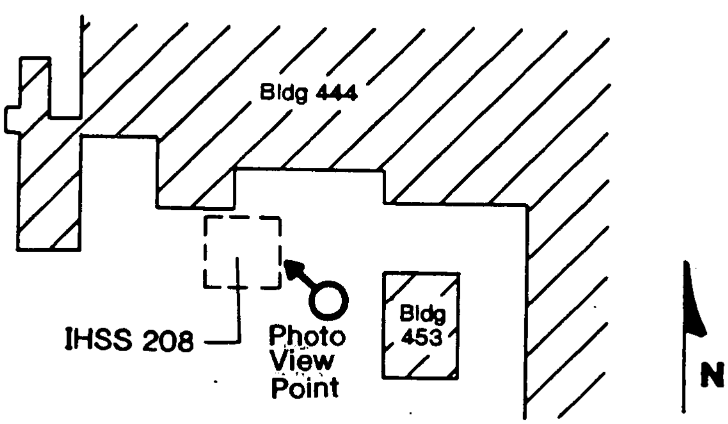


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FIGURE 2.1-31
Inactive 444/447 Waste Storage Area (IHSS 208) Site Photo

2.1.13.3 Physical Characteristics

The topography of IHSS 208 gently slopes to the east (Plate 1). The geologic materials in the vicinity consist of Rocky Flats Alluvium, fill, and Arapahoe Formation deposits.

Approximately 25 ft of alluvium and fill overlie the bedrock in the vicinity of IHSS 208. The closest well is located approximately 750 ft from the site; therefore detailed bore logs will not be useful for descriptions of geologic materials. The groundwater flows to the east and intercepts the south Walnut Creek drainage. The depth of groundwater is approximately 20 ft below the ground surface.

2.1.13.4 Nature and Extent of Contamination

No soil sampling investigations have been conducted at this site, so the nature and extent of contamination is not known.

No upgradient or downgradient analytical groundwater data are available for this area for this area.

2.1.14 Unit 16, Building 980 Cargo Container (IHSS 210)

2.1.14.1 Location and History

IHSS 210 is located south of Spruce Avenue and east of 10th Street (Figure 2.1-32). Unit 16, an area located southeast of Building 980, provided solid and liquid waste drum storage for automotive oils, stoddard solvent, paints and paint thinner, paper and rags contaminated with oils, grease, gasoline, diesel fuel, solvents, metal scraps, and fiberglass resins and catalysts. IHSS 210 includes a steel cargo container and a roped area of ground adjacent and to the east of the container. The Cargo Container is approximately 20 ft long, 8 ft wide, and 8 ft high. The dimensions of the roped area are approximately 10 ft wide and 20 ft long.

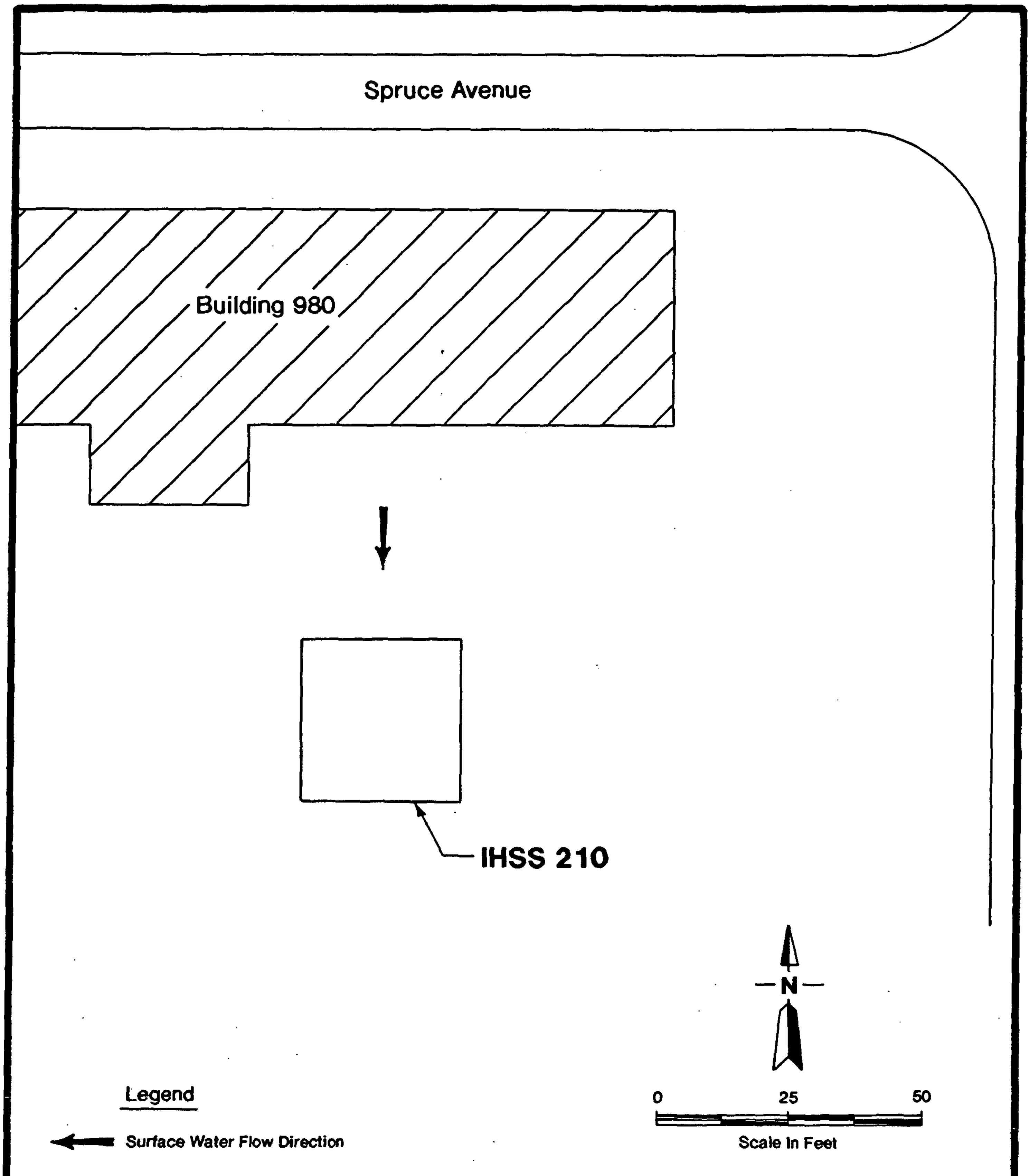

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FIGURE 2.1-32
Unit 16, Building 980 Cargo Container (IHSS 210) Location Map

IHSS 210 had been used for several years to store drummed hazardous waste generated from paint work, automotive work, and machine work performed in Building 980. On May 31, 1988, the IHSS 210 drum storage operation was terminated and the inventory removed. IHSS 210 is currently being used in a 90-day storage unit. As of May 31, 1988, all hazardous waste was removed from IHSS 210.

2.1.14.2 Previous Investigations

Periodic container inspections were performed by RFP personnel. These inspections consisted of visually assessing the structural integrity of the drums and checking for leaks and corrosion.

2.1.14.3 Physical Characteristics

The topography of IHSS 210 gently slopes to the northeast and east (Plate 1). The geologic materials in the vicinity of IHSS 210 consist of Rocky Flats Alluvium, fill, and Arapahoe Formation deposits.

Less than 10 ft of alluvium and fill overlie the bedrock in the vicinity of IHSS 210. The closest well is located approximately 200 ft northeast of the site. For a more detailed description of the geology, reference the bore log for Well 3887 found in Appendix B. The groundwater flows to the southeast intercepting the south Walnut Creek drainage. The depth of groundwater is approximately 10 ft below the ground surface.

2.1.14.4 Nature and Extent of Contamination

No analytical data are available, so the extent of contamination is unknown. No upgradient or downgradient analytical groundwater data are available for this area.

2.1.15 Unit 15, 904 Pad Pondcrete Storage (IHSS 213)

The following discussion is summarized from the Closure Plan for Unit 15, Storage Pad 904 (Rockwell International, 1989c).

2.1.15.1 Location and History

The Unit 15, 904 Pad Pondcrete Storage is located in the southeastern portion of the RFP production area and occupies a 129,505-ft^2 rectangular area, measuring 439 ft north-south and 295 ft east-west (Figures 2.1-33 and 2.1-34).

The 904 Pad is used for the storage of pondcrete, a low-level mixed waste resulting from the solidification of Solar Evaporation Ponds sludge or sediment with Portland cement. The material is placed in polyethylene-lined 3/4-inch plywood boxes measuring 4 by 2-1/2 by 7 ft. Metal boxes measuring 4 by 4 by 7 ft are also used. Boxes are stacked three high on the 904 Pad. Saltcrete, a material similar in nature to pondcrete, is treated and stored in the same fashion as pondcrete. Saltcrete reuslts from evaporation of liquid process water. Pondcrete and saltcrete are stored within the berm area of the 904 Pad.

The maximum pondcrete and saltcrete storage capacity of the 904 Pad is 6,136 wooden and 102 metal boxes of waste, accounting for approximately 103,464 ft^3 of waste (5,000 tons, assuming a density of 100 pounds per ft^3). Pad 904 is at maximum capacity. Materials will be removed from the 904 Pad by October 1991.

The 904 Pad was constructed in August 1987 of 3-inch-thick hot bituminous pavement placed over 6 inches of Class 6 coarse aggregate. The aggregate had been placed on regraded native soil. The 904 Pad was located adjacent to the 903 Pad, a documented source of plutonium release to the environment at the RFP. Prior to construction, soil samples taken at a depth of

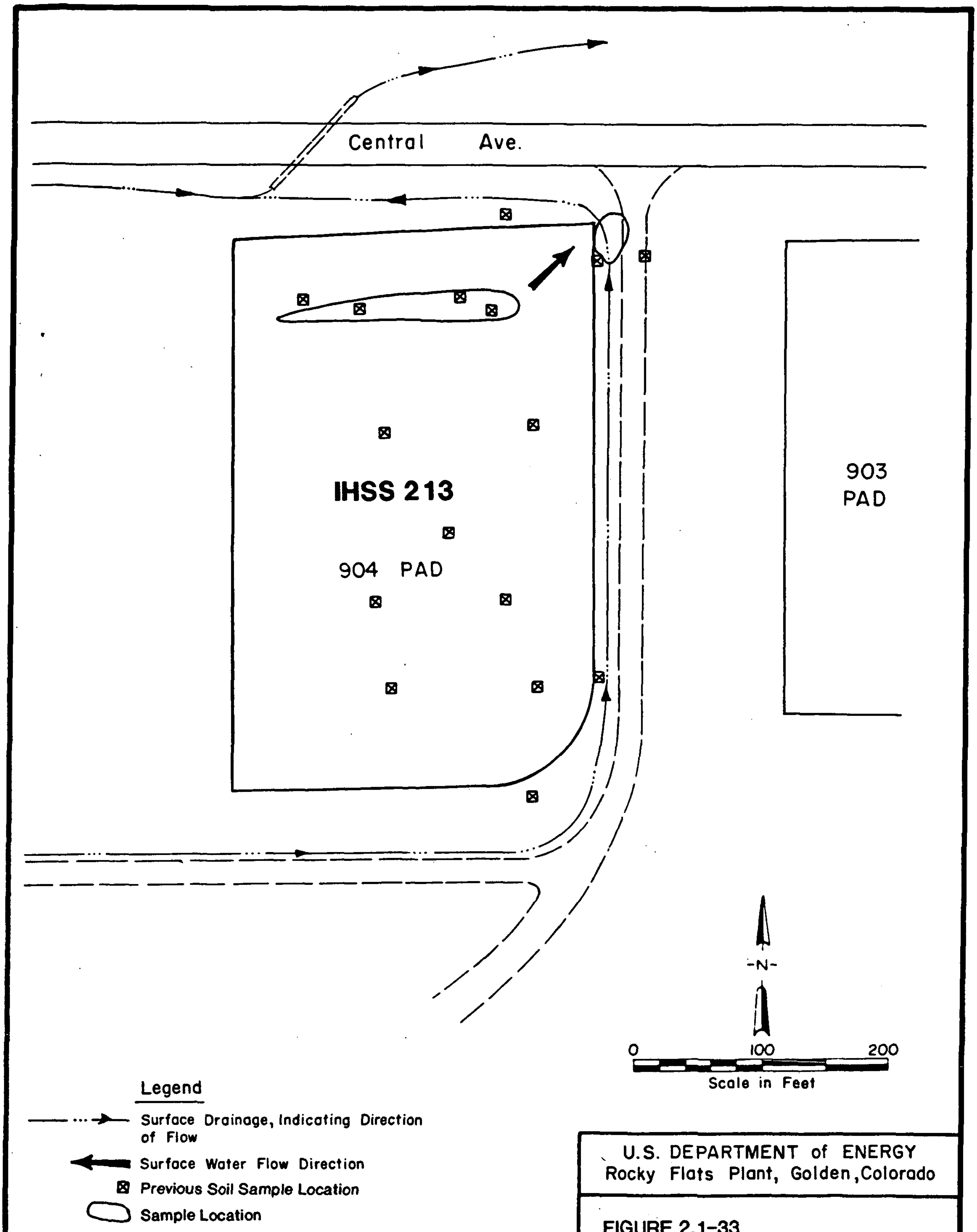

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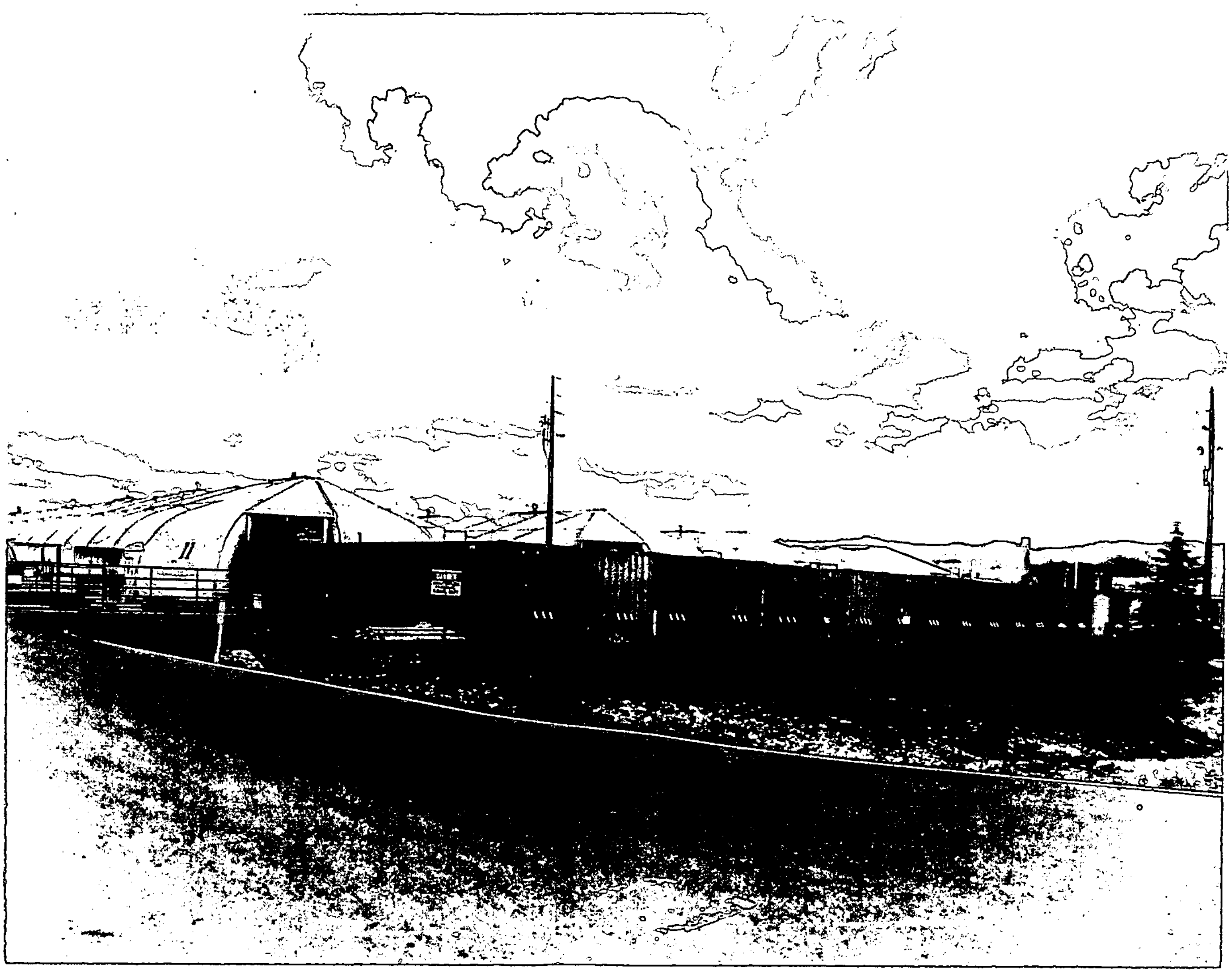
FIGURE 2.1-33
Unit 15, 904 Pad Pondcrete Storage (IHSS 213) Location Map



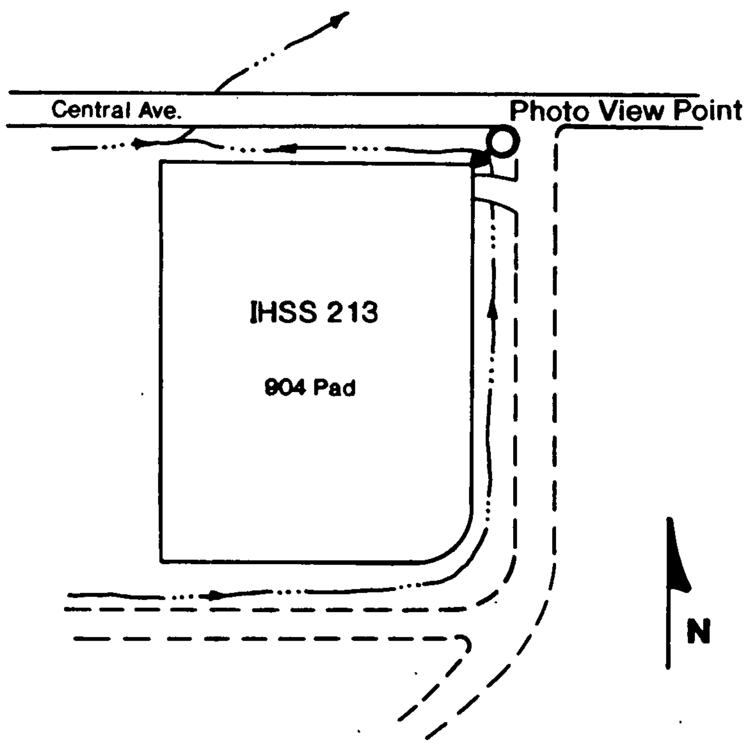


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FIGURE 2.1-34
Unit 15, 904 Pad Pondcrete Storage
(IHSS 213) Site Photo

approximately 2 inches were collected and analyzed. Plutonium 239 concentrations were generally above background levels, indicating some plutonium contamination was present at the 904 Pad location prior to construction. The area was resampled when the top 6 to 12 inches of soil was removed after grading for the 904 Pad construction. Plutonium 239 concentrations were found to be more than an order of magnitude higher than the previous shallow samples. These sampling results indicated that relatively clean soil material has been laid down over previously contaminated soil material in the area of the 904 Pad. Covering plutonium-contaminated soils with clean soils was a practice at the RFP during the late 1960s and early 1970s. Excavated contaminated material was stockpiled along the west border of the 904 Pad, covered with clean soil, and vegetated to prevent wind dispersal.

The 904 Pad began receiving waste during October 1987. The initial pad was not constructed with a containment berm. Pondcrete accumulation was temporarily halted in May 1988 as the result of a spill. On June 6, 1988, a 6-inch-high asphalt berm was constructed around the west, north, and east perimeter of the 904 Pad in an attempt to collect surface water runoff samples. Spills and leakage of both pondcrete and saltcrete have been a recurrent problem at the 904 Pad. A number of incidences are related to the incomplete solidification of the waste material which results in failure of the container and in releases to the pad surface. Spills of pondcrete are cleaned using water and brooms to scrub the pad surface. The brooms are used to remove contaminants from the crevices in the asphalt. Water is collected using a wet vacuum cleaner. The cleaning process is continued until radiation levels are below the detection limit for the monitoring instrument. Saltcrete spills tend to be composed of dry material which is cleaned by vacuuming the surface until radiation levels are below the detection limit for the monitoring instrument. Portable air monitors are moved to the pad shortly after spill incidence. Based on these monitors, there have been no releases that exceed the RFP Screening Guide for plutonium in air of 0.01 picocuries per cubic meter (pCi/m^3).

2.1.15.2 Previous Investigations

Soil sampling prior to and during grading activities associated with the 904 Pad construction have documented pre-existing radioactive contamination. Samples of runoff water from the 904 Pad taken after spills have detected gross alpha and beta concentrations above drinking water standards. Seepage of runoff water below the asphalt berm has been reported as very common by RFP employees. Analysis of runoff data indicates 41 percent of all runoff samples equal or exceed the gross alpha drinking water standard of 15 pCi/L and 37 percent of all runoff samples are equal to or exceed the gross beta drinking water standards of 50 pCi/L. The surface water background value for gross alpha is 177 pCi/l and for gross beta is 163 pCi/l. Analysis of existing data indicates that runoff from the 904 Pad may be contributing to the elevated analyte concentrations in the South Walnut Creek water. South Walnut Creek is diverted into Pond B-4 which intermittently discharges to Pond B-5, the last control point on the South Walnut Creek drainage (Plate 1). Pond B-5 discharges must meet the RFP NPDES permit.

A memo dated January 26, 1989, 89-RF-0332, addresses the possible impact of runoff from Pad 904 and Pad 750. The runoff may result in chronic low levels of contaminants being released into Pond B-5 that discharge from the pond would violate the NPDES permit. Therefore, the potential for contamination exists along the path from Pad 904 to Pond B-5.

2.1.15.3 Physical Characteristics

Approximately 10 to 20 ft of Rocky Flats alluvium overlies the Arapahoe Formation in the vicinity of the 904 Pad. It appears to maintain a thickness of 10 to 20 ft east to west and is completely eroded approximately 150 and 900 ft north of the 904 Pad, where surface drainages exist. South of the 904 Pad, the Rocky Flats Alluvium attains a maximum thickness of approximately 40 ft, and then rapidly reduces in thickness as it enters the north flank of the

Woman Creek Valley. The Arapahoe Formation consists of subcropping claystones and isolated subcropping siltstones/sandstones.

An approximately 100-ft-thick sandstone/siltstone unit of the Arapahoe Formation is present as a subcrop at a depth of approximately 10 ft directly below the 904 Pad. This unit appears to be dipping to the southeast at approximately 6 degrees (Rockwell International, 1989c).

For a more detailed description of the geology, see the bore log for Well 1087 found in Appendix B. Well 1087 is located within of IHSS 213.

The topography and drainage of the 904 Pad is approximately 0.7 percent to the northeast (Plate 1). Because of this slope, water tends to accumulate along the north berm, and in the northeast corner of the pad adjacent to the berm. Any runoff or berm overflow is intercepted by a ditch sloped to drain to the northeast to intercept the South Walnut Creek drainage. The ditch is located east of the 904 Pad. The west, north, and east perimeters of the 904 Pad are enclosed by a 6-inch-high berm, added approximately 1 year after storage operations began. The berm was designed to collect surface water runoff samples from the 904 Pad, and additionally to minimize runon. The bedrock aquifer potentiometric surface slopes away from the 904 Pad, roughly consistent with the dip of the sandstone/siltstone units of the Arapahoe Formation. This again results in groundwater movement towards the north, east, and south.

Groundwater flow in the alluvial aquifer below the 904 Pad appears to be strongly influenced by the east-northeast sloping topography and the configuration of the base of weathering in the Arapahoe Formation. In addition, the alluvial aquifer potentiometric surface slopes away from the 904 Pad toward the north, east, and south, thus groundwater flows radially in those three directions. After examining data from logs of Well 10-87, which is an alluvial well on the site, the depth of groundwater was determined to be approximately 12 ft as of December 1988.

Analyses of the alluvium potentiometric data indicates that water in the alluvial aquifer in the vicinity of the 904 Pad flows toward the south and southeast at a rate of about 5.26×10^{-3} ft/day (based on a saturated hydraulic conductivity of 1.36×10^{-2} ft/day, an assumed effective porosity of 0.1, and a gradient of 0.039 ft/ft) and toward the northeast at a rate of about 2.72×10^{-3} ft/day (based on a saturate hydraulic conductivity of 1.36×10^{-2} ft/day, an assumed effective porosity of 0.1, and a gradient of 0.020 ft/ft) (Rockwell International, 1989c).

Analysis of bedrock aquifer potentiometric data indicates that groundwater in the bedrock aquifer, which is assumed to occur predominately in the sandstone/siltstone units in the vicinity of the 904 Pad, flows toward the south at a rate of 1.92×10^{-3} ft/day under a gradient of 0.170 ft/ft, toward the east at a rate of 1.15×10^{-3} ft/day under a gradient of 0.102 ft/ft, and toward the northeast at a rate of 1.38×10^{-3} ft/day under a gradient of 0.122 ft/ft. These groundwater flow rates assume an effective porosity of 0.1 and a sandstone-saturated hydraulic conductivity of 1.13×10^{-3} ft/day. The hydraulic conductivity values used are based on slug and packer test data (Rockwell International, 1989c).

2.1.15.4 Nature and Extent of Contamination

Analysis of soil samples taken from borings in the area indicate levels above background for gross alpha, gross beta, total plutonium, total uranium, uranium 234, unranium 238, americium 241, and plutonium 239. Table 2-13 presents radionuclides above background and the background values.

Table 2-13 IHSS 213 Soil Sampling Summary (4/87-6/89, Weston Analytics).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
<u>Radionuclides (pCi/g)</u>				
Gross Alpha	38.4	904 Pad	1/1	53 ± 18
		904 Pad	1/1	47 ± 20
		904 Pad	1/1	40 ± 18
Gross Beta	36.8	904 Pad	1/1	49 ± 19
		904 Pad	1/1	63 ± 21
		904 Pad	1/1	60 ± 33
		904 Pad	1/1	110 ± 40
		904 Pad	1/1	51 ± 30
		904 Pad	1/1	50 ± 27
		904 Pad	1/1	77 ± 30
		904 Pad	1/1	51 ± 27
		904 Puddle	1/1	41 ± 15
		904 Puddle	1/1	39 ± 16
		904 Pad	1/1	69 ± 23
		904 Pad	1/1	43 ± 22
		904 Pad	1/1	57 ± 24
		904 Pad	1/1	100 ± 30
		904 Pad	1/1	44 ± 25

Note: Data not validated
pCi/g - picocurie per gram

Table 2-13 IHSS 213 Soil Sampling Summary (4/87-6/89, Weston Analytics).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
Plutonium Total	0.0150	1	1/1	3.7 ± 0.20
		2	1/1	2.8 ± 0.20
		3	1/1	0.30 ± 0.10
		4	1/1	0.20 ± 0.10
		5	1/1	16 ± 1.0
		6	1/1	34 ± 1.0
		7	1/1	4.0 ± 0.20
		8	1/1	3.3 ± 0.10
Uranium Total	0.0741	1	1/1	2.3
		2	1/1	1.9
		3	1/1	2.4
		4	1/1	2.7
		5	1/1	3.7
		6	1/1	3.1
		7	1/1	3.4
		8	1/1	4.0
Uranium 234	0.6558	1	1/1	0.95 ± 0.10
		2	1/1	1.12 ± 0.12
		5	1/1	0.72 ± 0.080
		6	1/1	1.11 ± 0.18

Note: Data not validated
pCi/g - picocurie per gram

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Table 2-13 IHSS 213 Soil Sampling Summary (4/87-6/89, Weston Analytics).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
Uranium 238	0.6830	1	1/1	0.98 ± 0.10
		2	1/1	1.08 ± 0.12
		6	1/1	1.01 ± 0.11
Americium 241	0.0135	1	1/1	0.14 ± 0.010
		2	1/1	1.5 ± 0.08
		3	1/1	24 ± 1.0
		4	1/1	3.6 ± 0.15
		5	1/1	0.23 ± 0.010
		6	1/1	0.35 ± 0.020
Plutonium-239	0.0150	87-903NW	1/1	0.030
		87-903NE	1/1	1.8
		87-903SW	1/1	0.12
		87-903SE	1/1	4.2
		W-903-1	2/2	8.1 ± 0.66
				9.2 ± 0.88
		W-903-2	1/2	19 ± 1.8
		W-903-3	2/2	14 ± 1.2
				17 ± 1.5
		W-903-4	2/2	67 ± 5.4
				67 ± 8.1

Note: Data not validated
pCi/g - picocurie per gram

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Table 2-13 IHSS 213 Soil Sampling Summary (4/87-6/89, Weston Analytics).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
Plutonium-239 contd.		1	1/1	0.24 ± 0.0028
		2	1/1	2.3 ± 0.22
		5	1/1	0.23 ± 0.022
		6	1/1	0.26 ± 0.026

Note: Data not validated
pCi/g - picocurie per gram

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In addition, analysis of surface water samples taken in the area of IHSS 213 indicate levels above background for nitrate, cyanide, and cadmium. Table 2-14 presents the metals and other inorganics above background and the background values.

The sampling locations and concentrations of the analytes detected above background are illustrated in Figure 2.1-35.

Analysis of groundwater samples taken from upgradient Well 1087 indicates detections above background for the metals and other inorganics, barium, calcium, iron, magnesium, manganese, nickel, sodium, zinc, and sulfate. Radionuclides detected above background include americium 241 and uranium 233, 234. Table 2-15 presents metals, inorganics, and radionuclides above background and the background values.
No downgradient groundwater analytical data are known to have been collected. In order to assess the possibility of groundwater contamination from IHSS 213, further data are needed.

2.1.16 Unit 25, 750 Pad Pondcrete and Saltcrete Storage (IHSS 214)

The following discussion is summarized primarily from the Closure Plan for Unit 25, Storage Pad 750 (Rockwell International, 1989d).

2.1.16.1 Location and History

The Unit 25, 750 Pad Pondcrete and Saltcrete Storage (IHSS 214) was initially constructed as a parking lot for Building 750 (Figures 2.1-36 and 2.1-37). One hundred forty-two thousand ft^2 of the original 220,000 ft^2 surface are used for storage.

The 750 Pad is used for the storage of pondcrete, a low-level mixed waste resulting from the solidification of Solar Pond sludge or sediment with Portland cement. The material is placed in

Table 2-14 IHSS 213 Surface Water Sampling Summary (9/88-2/90, Analytical Data).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/l)				
Cadmium	0.064	904 Pad Puddle	5/7	4.60 - 10.2
Nitrate	3.99	904 Pad	20/23	4.02 - 72.6
		904 Pad Puddle	7/14	5.80 - 25.1
Cyanide	0.045	904 Pad Puddle	1/7	< 2.50

mg/l - milligram per liter

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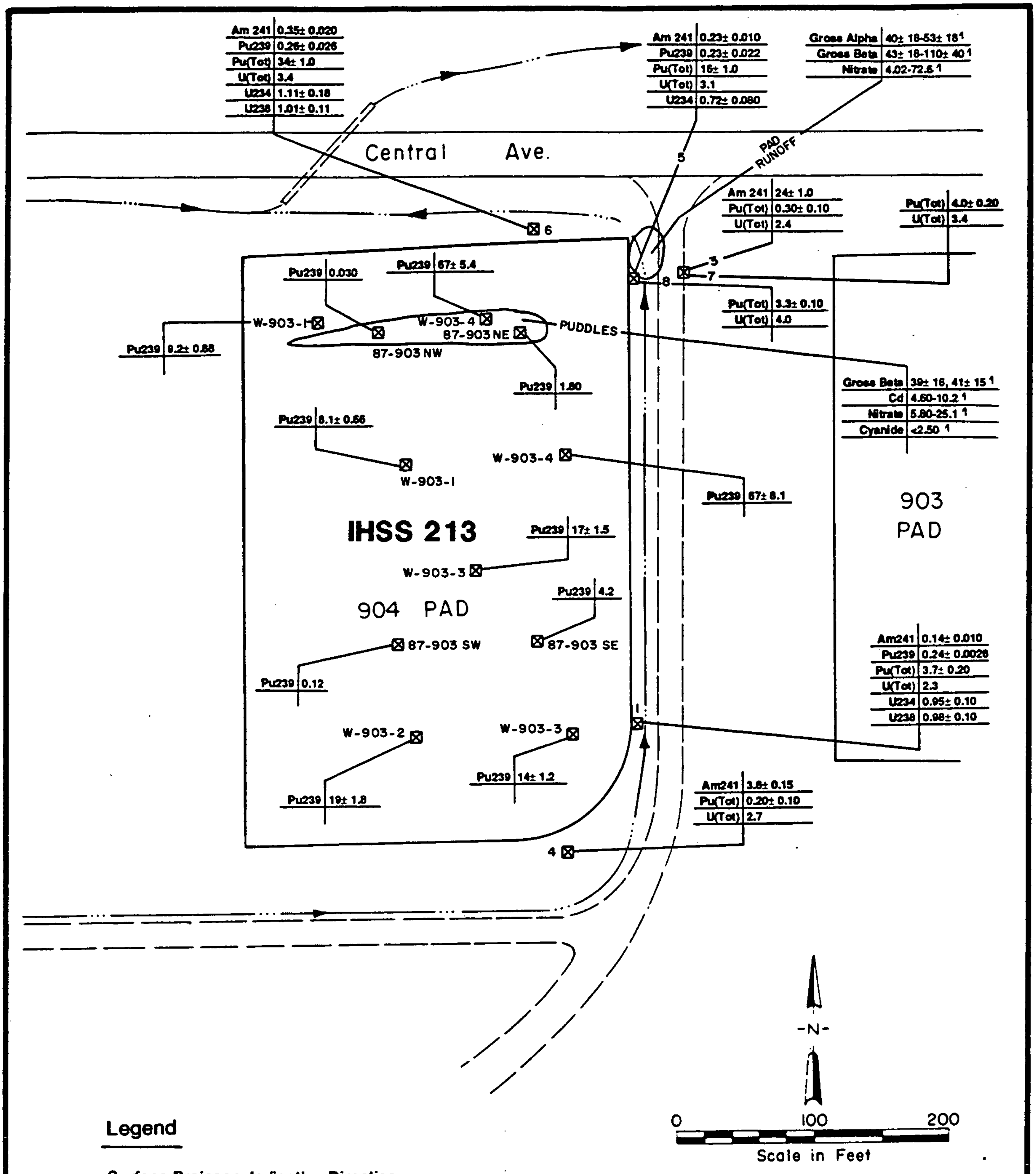

Legend

Surface Drainage, Indicating Direction of Flow

Previous Soil Sample Location

Sample Location

UNITS

Organics are ug/kg for soils: ug/l for water
Inorganics are mg/kg for soils: mg/l for water
Radionuclides are pci/g for soils: pci/l for water

1 – Surface Water Concentrations

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FIGURE 2.1-35
Analytes Detected Above Background
Unit 15, 904 Pad Pondcrete Storage
(IHSS 213)

Table 2-15 IHSS 213 Upgradient Groundwater Sampling Summary (Rocky Flats Groundwater Database).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/l)				
Barium	0.222	0187	4/4	0.244 - 0.281
Calcium	0.011	0187	4/4	136 - 162
Iron	0.944	0187	4/4	1.06 - 5.82
Magnesium	16.1	0187	4/4	36.4 - 41.0
Manganese	0.213	0187	4/4	0.941 - 3.33
Nickel	0.043	0187	2/4	0.229 - 0.370
Sodium	46.7	0187	4/4	9.13 - 117
Zinc	0.141	0187	1/4	0.260
Sulfate	67.1	0187	4/4	96.0 - 120
Radionuclides (pCi/l)				
Americium 241	0.0167	0187	1/2	0.030[N]
Uranium 233, 234	0.100	0187	4/4	8.40 - 14.7[N]

[N] - Data not validated
mg/l - milligram per liter
pCi/l - picocurie per liter

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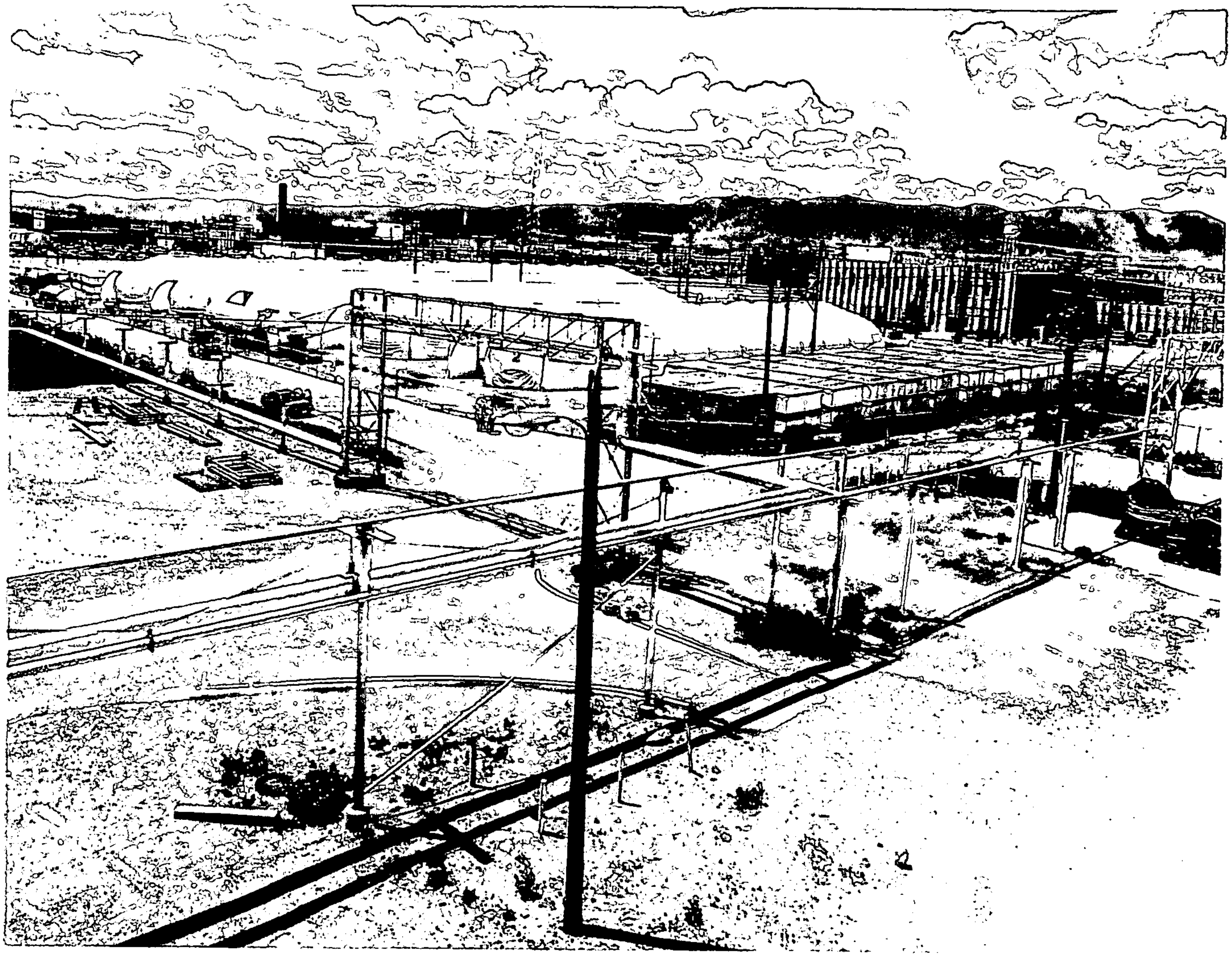

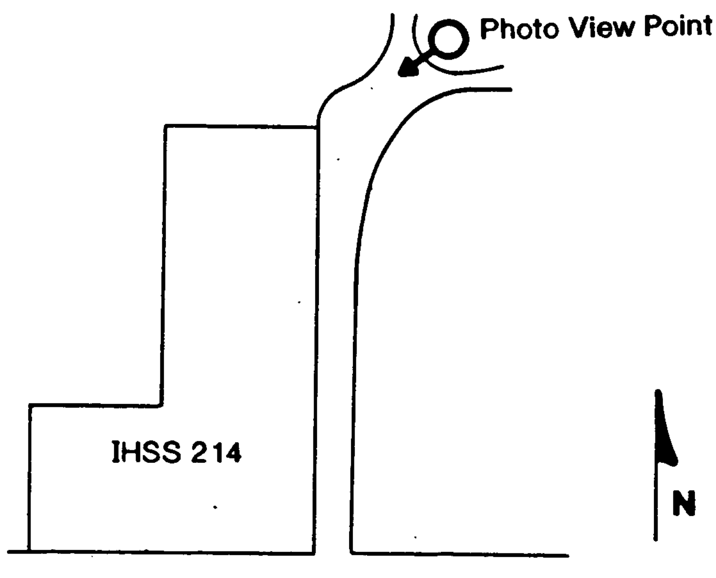

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FIGURE 2.1-37
Unit 25, 750 Pad Pondcrete and Saltcrete Storage (IHSS 214)
Site Photo

polyethylene-lined, 3/4-inch plywood boxes measuring 4 ft by 2.5 ft by 7 ft. Boxes are stacked three high on the Pad. Metal boxes measuring 4 ft by 4 ft by 7 ft are also used. Saltcrete, a material similar in nature to pondcrete resulting from evaporation of liquid process waste, is treated and stored in the same fashion as pondcrete on the pad. Pondcrete and saltcrete are stored within the berm area of the 750 Pad.

The maximum waste storage inventory of the 750 Pad is 12,168 boxes of waste, accounting for approximately 183,000 ft^3 of waste (9,000 tons, assuming a density of 100 pounds/ft^3). The inventory as of September 30, 1989, consisted of 8,881 wooden boxes of pondcrete, 157 metal boxes of pondcrete, and 855 wooden boxes of saltcrete.

The 750 Pad was initially constructed as a 220,000-ft^2 parking lot for Building 750 in 1969. The 750 Pad was constructed with a 6-inch-thick aggregate overlain by a 2-inch-thick asphaltic concrete. In 1986, prior to the storage of waste, 142,000 ft^2 of the 750 Pad was overlaid with Petromat and 3 inches of asphalt. Eight-inch-high asphalt berms were constructed along the east and portions of the north and south sides. Waste storage began on November 18, 1986.
Production of pondcrete ceased on May 23, 1988, in response to spills on the 904 Pad. A detailed inspection of waste stored on the 750 Pad identified approximately 5 percent (440) of pondcrete boxes were of poor quality (i.e., containing unhardened pondcrete). Severely deformed boxes of waste were transferred to metal boxes or to Building 788 to await reprocessing. Storage of pondcrete resumed in November 1986 and continues to the present.

From November 18, 1986, to September 1, 1989, two spills of pondcrete occurred. The spills, totaling approximately 0.5 ft^3, were released to the asphalt pad. Both spills consisted of unhardened Solar Evaporation Pond sludge and cement. Following each incident, the entire contents of the failed container and spilled pondcrete were transferred to metal boxes. The spill locations were then cleaned by using water and brooms to scrub the 750 Pad surface. The brooms are used to remove pondcrete from the crevices in the asphalt. Water was collected using wet vacuums. Cleaning continued until radiation levels were below detection limits for the instruments being used.

Routine inspections of the 750 Pad on November 1, 1988, and April 7, 1989, identified deformed and leaking boxes of saltcrete. All saltcrete spills have consisted of a fine, dry, powder. From November 1, 1988, through July 25, 1989, a total of 64 leaking boxes were identified that had released approximately 113 pounds of saltcrete to the 750 Pad. The location of spills were cleaned by vacuuming until radiation levels were below detection limits of the instruments being used. Analytical results from samplers S-2 and S-17 located upwind from the 750 Pad identified no total long-lived alpha activity above plant standards. No soil monitoring has been conducted at the 750 Pad to confirm if precipitation migrated contaminants to the soil (Rockwell International, 1989d). Berms 8 inches in height existed on the south, north, and east sides of the pad, so surface runoff would have been minimized. The quantity of saltcrete that was retrieved is unknown.

A site visit in May 1990 observed wet, severely deformed cardboard boxes being transported into storage tents. Torn boxes with exposed plastic inner liners were also observed. There is a high probability that leakage of material will continue until all materials are removed.

Portable air monitors were moved to the 750 Pad shortly after the spill incidences. Based on these air monitors, there have been no releases that exceed the RFP Screening Guide for plutonium (0.01 pCi/m^3).

2.1.16.2 Previous Investigations

Soil and surface water samples were taken at the 750 Pad puddle and the culvert outlet. Section 2.1.16.4 discusses analytes detected above background

2.1.16.3 Physical Characteristics

The asphalt pad at IHSS 214 is located approximately at grade, sloped 2 percent to the east. Prior to storage of waste material, an overlay was installed consisting of 3 inches of asphalt underlain by Petromat, a rubberized material intended to prevent permeation through the 750 Pad. An 8-inch-high asphalt berm was added to the east and portions of the north and south sides to minimize runon and provide runoff water samples from the 750 Pad. Runoff from the 750 Pad is collected in seven stormwater inlets between 10th Street and the 750 Pad. All runoff water storage behind the 8-inch berm occurs in the immediate vicinity of the stormwater inlets. Calculated storage potential behind the berm is approximately 500 ft^3. Any precipitation event that exceeds approximately 0.03 inch will cause overlapping of the berms. The stormwater inlets are directly piped to culvert which drains to South Walnut Creek.

Approximately 10 to 15 ft of Rocky Flats Alluvium underlie IHSS 214. The alluvium appears to be completely eroded approximately 250 ft east of Pad 750, in the South Walnut Creek drainage.

An approximately 100 ft thick sandstone/siltstone unit of the Arapahoe Formation is present as a subcrop at a depth of approximately 10 ft, approximately 400 ft east of IHSS 214. This unit appears to be dipping to the southeast at approximately three degrees. The sandstone/siltstone unit of the Arapahoe Formation is present at a depth of approximately 120 ft below IHSS 214.

For a more detailed description of the geology, see the bore log for Well P207489 found in Appendix B. Well P207489 is located north of IHSS 214.

The alluvial aquifer potentiometric surface slopes away from IHSS 214 primarily to the east. Groundwater flow in the alluvial aquifer appears to be strongly influenced by the topography and the configuration of the base of weathering in the Arapahoe Formation (Rockwell International, 1989d).

Depth of groundwater is approximately 5 ft below the ground surface. Groundwater elevation information for alluvial wells suggests that groundwater levels have remained relatively stable in Wells 4-87, 10-87, 15-87, 26-86, and 61-86 (with a variance between 1 and 6 ft), and have dropped below the lowest screened interval during most of the period of record in Wells 24-86 and 44-87 causing a variance of approximately 1 to 2 ft thus producing dry wells. Alluvial aquifer potentiometric maps for the first through fourth quarters of 1988 (Rockwell International, 1989d) indicate that alluvial aquifer flow directions and gradients remain fairly constant throughout the year. Areas of unsaturated surficial materials are present north of IHSS 214 near Well 38-87, and east of Pad 750 near Well 33-86. These unsaturated surficial materials may represent areas where bedrock is very near the surface causing no flow boundaries or where building footing drains dewater the local alluvial aquifer. Groundwater flowing east from IHSS 214 will most likely be discharged to the headwaters of South Walnut Creek prior to being monitored by Well 33-86.

Analyses of the alluvium potentiometric data indicate that water in the alluvial aquifer in the vicinity of the 750 Pad flows to the east at a rate of about 2.45×10^{-3} ft/day (based on a saturated hydraulic conductivity of 1.36×10^{-2} ft/day, an assumed effective porosity of 0.1, and a gradient of 0.018 ft/ft) and toward the northeast at a rate of about 2.72×10^{-3} ft/day (based on a saturated hydraulic conductivity of 1.36 x 10^{-2} ft/day, an assumed effective porosity of 0.1, and a gradient of 0.020 ft/ft). Hydraulic conductivity estimates for the alluvial aquifer are based on slug test data (Rockwell International, 1989).

Groundwater elevation information for bedrock wells suggests that groundwater levels have remained relatively stable in Wells 5-87BR, 9-87BR, and 45-87BR (with a variance between 1 and 3 ft), moderately stable in Wells 16-87BR, and 23-86BR (with a variance between 15 and 30 ft), and relatively unstable in Well 25-86 (with a variance of approximately 60 ft). Bedrock aquifer potentiometric maps for the first through fourth quarters of 1988 (Rockwell International, 1989d) indicate that bedrock aquifer flow directions and gradients remain fairly constant throughout the year. Groundwater flowing north from IHSS 214 may be monitored using information collected from Well 23-86BR; and groundwater flowing east from IHSS 214 may be monitored using information collected from Well 22-87BR.

Analysis of bedrock aquifer potentiometric data indicate that groundwater in the bedrock aquifer, which is assumed to occur predominately in the sandstone/siltstone units in the vicinity of IHSS 214, flow toward the northeast at a rate of 1.03 x 10^{-3} ft/day under a gradient of 0.091 ft/ft. This assumes an effective porosity of 0.10 and a sandstone saturated hydraulic conductivity of 1.13 x 10^{-3} ft/day. The hydraulic conductivity values used are based on slug and packer test data (Rockwell International, 1989d).

2.1.16.4 Nature and Extent of Contamination

Radionuclide analysis of soil samples taken from borings in the area indicate levels above background for gross alpha and gross beta. Table 2-16 lists radionuclides above background and

Table 2-16 IHSS 214 Soil Sampling Summary (9/88-1/89, Weston Analytics).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
Radionuclides (pCi/g)				
Gross Alpha	38.4	750 culvert	1/1	55 ± 28
		750 culvert	1/1	49 ± 20
Gross Beta	36.8	750 culvert	1/1	42 ± 28
		750 puddle	1/1	45 ± 16

Note: Data not validated
pCi/g - picocurie per gram

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the background values. Analysis of surface water samples taken in the area of IHSS 214 indicate levels above background for nitrate, cyanide, and cadmium. Table 2-17 lists the metals and other inorganics above background and the background values.

Figure 2.1-38 illustrates the sampling locations and concentrations of the analytes detected above background.

Analysis of groundwater samples taken from upgradient Well P207489 indicates detections above background for the metals and other organics, calcium, magnesium, manganese, and sulfate. Table 2-18 presents metals and other inorganics detected above background and the background values. Radionuclides detected above background include americium 241, tritium; uranium 233, 235; and uranium 235, 236. Table 2-18 presents metals, inorganics, and radionuclides above background and the background values.

No downgradient analytical data are available. In order to assess the possibility of groundwater contamination from IHSS 214, further data are needed.

2.2 SITE CONCEPTUAL MODEL

The following discussion contains descriptions of contaminant sources, release mechanisms, contaminent migration pathways and potential receptors for each IHSS. Figure 2.2-1 is an idealized conceptual model for OU10. The IHSS-specific conceptual models are described following and relate to this idealized conceptual model.

Table 2-17 IHSS 214 Surface Water Sampling Summary (9/88-3/90, Analytical Data).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/l)				
Cadmium	0.064	750 Pad Puddle	5/9	2.20 - 5.60
Nitrate	3.99	750 Pad Culvert	3/52	4.12 - 5.90
		750 Pad Culvert & Puddle	5/18	4.53 - 9.51
		750 Pad Puddle	15/32	4.08 - 87.4
Cyanide	0.045	750 Pad Puddle	1/9	< 2.50

mg/l - milligram per liter

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Table 2-18 IHSS 214 Upgradient Groundwater Sampling Summary (Rocky Flats Groundwater Database).

Analyte	Background Value	Station Number	Frequency of Detection	Concentration Range
Metals and Other Inorganics (mg/l)				
Calcium	62.6	P207489	3/6	88.2 - 95.6
Magnesium	16.1	P207489	3/6	23.4 - 26.1
Manganese	0.213	P207489	2/6	0.269 - 0.413
Sulfate	67.1	P207489	5/5	70.0 - 130
Radionuclides (pCi/l)				
Americium 241	0.017	P207489	1/1	1.15
Tritium	359	P207489	3/3	775 - 810
Uranium 233, 234	0.100	P207489	2/2	1.49 - 1.82
Uranium 235, 236	2.09	P207489	1/1	4.50

mg/l - milligram per liter
pCi/g - picocurrie per gram

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2.2.1 Radioactive Liquid Waste Storage Tanks (IHSS 124, 124.1, 124.2, 124.3)

2.2.1.1 Sources of Contamination

The primary source of contamination is a large overflow that occurred at the radioactive liquid waste storage tanks and possible unreported spills or leaks. Soils beneath the tanks and associated pipelines may have been contaminated and constitute a potential secondary source.

2.2.1.2 Types of Contamination

The tanks were used primarily to store treated liquid decanted from the second-stage batch precipitation process in Building 774. These wastes may include plutonium, americium, and/or uranium which are generated as a result of caustic liquid processing (Stage 2) in Building 774. One of the tanks (IHSS 124.3) was also used to store waste from miscellaneous sources such as spills in Buildings 460, 483, and 484, and surface water overflows on the 904 Pad. Spilled liquids issuing from a pipe break during the late 1970s contained plutonium, americium, and possible uranium. This spill was immediately cleaned up. No soil investigations have been completed to confirm whether the cleanup was successful. There remains the possibility that soils beneath the tanks, and adjacent to Building 774, were contaminated.

2.2.1.3 Release Mechanisms

The primary release mechanism was leakage or spillage from the tanks or the pipe lines connecting the tanks to Building 774.

2.2.1.4 Contaminant Migration Pathways

Caustic wastes containing plutonium, americium, and/or uranium have been spilled onto the ground at the site and during a spill in the late 1970s flowed downhill toward the front (north side) of Building 774. If some of this liquid infiltrated appreciably, it is expected that most of the principal contaminants would sorb to soils and not migrate to the water table. Soil particles that were contaminated by direct spillage are susceptible to further migration through wind action or surface runoff. Because the tank in IHSS 124.3 contained wastes from numerous and varied sources, there is a potential for contaminants exhibiting greater mobility than radionuclides, such as solvents, to be present beneath the site. If such contaminants are present, they could percolate to and migrate with groundwater toward Walnut Creek.

2.2.1.5 Receptors

Potential receptors include humans and terrestrial biota through inhalation of windblown dust and through dermal contact or ingestion of contaminated soils. If the groundwater has been impacted, receptors would include humans and aquatic biota through ingestion and dermal contact with contaminated surface water or sediments in Walnut Creek which is recharged by groundwater.

2.2.2 Oil Leak (IHSS 129)

2.2.2.1 Sources of Contamination

Spills or leakage related to tank No. 4 and its five associated pipe lines are the primary sources of contamination at IHSS 129. The adjacent contaminated soils are a secondary source.

2.2.2.2 Types of Contamination

Spills and leakage at IHSS 129 have resulted in the contamination of soil and groundwater. The volatile organic compounds trichloroethylene, 1,1,1-trichloroethane, methylene chloride, and trichlorofluoromethane were detected in materials stored in tank No. 4. With the exception of trichloroethylene, these compounds were also detected in the liquid sample collected from the fence post hole and visually identified as compressor oil.

Several HSL VOAs were above detection limits in soils adjacent to tank No. 4 including benzene, 2-butanone, ethylbenzene, methylene chloride, toluene, total xylenes, and 1,1,1-trichloroethane.

1,1,1-Trichloroethane was detected by using a portable gas chromatograph during field sampling. Cadmium, copper, mercury and lead were also detected above background levels.

2.2.2.3 Release Mechanisms

Soils and groundwater adjacent to and beneath tank No. 4 may have been contaminated by leakage or spills from the tank and/or associated pipelines. Further leaching of volatile and semivolatile contaminants from contaminated soil is a potential secondary release mechanism. Volatilization of solvents from contaminated soils and groundwater is possible and could temporarily increase if portions of the site are excavated in the future.

2.2.2.4 Contaminant Migration Pathways

The primary migration pathway is percolation of nonaqueous-phase product or downward migration of leached contaminants to the water table. Levels of liquid in tank No. 4 reportedly were affected by interaction with groundwater indicating that any sludge remaining in the tank may be an active source of contamination to groundwater. Any contaminated groundwater may recharge surface water in Walnut Creek and/or South Walnut Creek. Of the contaminants present in the tank No. 4 area, solvents and fuel oil constituents, such as benzene, toluene, and xylenes, are the most likely to reach the water table and migrate to the creeks. Cadmium salts and some industrially produced lead compounds are water soluble and could leach to groundwater.

2.2.2.5 Receptors

If the site is excavated, potential receptors could include humans through dermal contact, ingestion, and inhalation of soils. Because the leaks occurred below grade, surface soils are not expected to be contaminated. Potential receptors of contaminated groundwater could include humans through dermal contact, ingestion, and inhalation of vapors volatized from contaminated groundwater. Surface water and sediments contaminated by groundwater recharge could impact humans and terrestrial or aquatic biota through ingestion.

2.2.3 P.U.&D. Storage Yard - Waste Spills (IHSS 170)

2.2.3.1 Sources of Contamination

The P.U.&D. Storage Yard has been used to store containers such as barrels, drums, cargo boxes, spent batteries, machinery, and dumpsters (Rockwell International, November 1986). Releases of solvents and waste oils from drums and dumpsters have been reported and represent a primary source of contamination. The release of battery acids have occurred in the past during removal of the batteries by recyclers (Rockwell International, November 1986). Drums, dumpsters, batteries, and machinery are presently located on site.

Because many of the drums, dumpsters, and batteries were stored directly on the ground, without secondary containment, leaks and spills could easily infiltrate the ground surface and contaminate the soil. Any soil contaminated in this manner would then be a source of secondary contamination.

2.2.3.2 Types of Contamination

The types of contaminant releases at IHSS 170 would suggest the presence of organics, inorganics, metals, radionuclides, and anions in the soil and possibly the groundwater.

2.2.3.3 Release Mechanisms

The primary release mechanism is leaks or spills from drums, dumpsters, and batteries while either being stored directly on the ground surface or transported to and from the site. A secondary release mechanism may result from leaching of previously contaminated soil. Volatilization is not expected to impact air quality on site due to the open surroundings.

2.2.3.4 Contaminant Migration Pathway

The primary migration pathway is the percolation or leaching of contaminants downward through soil to groundwater, with potential migration downgradient towards the Present Landfill. Contaminated soils may be dispersed by wind dispersion or by surface runoff during periods of precipitation. A secondary migration pathway may result from volatilization of contaminants.

Some on-site volatile organic compounds (e.g., acetone) are moderately mobile in soil and may leach to groundwater. However, acetone volatilizes and biodegrades rapidly in soil and water, reducing its potential for broad migration at low concentration. Nitrates are mobile in soil and are likely to leach to and migrate with groundwater over a greater distance because of its lower volatility.

The mobility and adsorptive properties of metals are variable. While metals tend to be absorbed to clays or organic matter in soils, various ionic species, metallic salts, and organic metal compounds can leach to groundwater and migrate downgradient of IHSS 170. The presence of spilled battery acid may have locally enhanced the downward migration of metals to the water table. Because metals tend to sorb to soil particles, surface runoff and wind dispersion may be more effective as pathways for contaminant migration on and off site.

Radioactive elements are expected to migrate in combination with soil or sediment particulate as either airborne dust or surface runoff. Leaching of radioactive elements in soil could be a secondary migration pathway.

2.2.3.5 Receptors

Due to the general location of the site, potential receptors of contaminants could include humans and terrestrial biota through inhalation of contaminated windblown dust or through dermal contact or ingestion of soil, sediments, or surface water runoff and from ingestion of contaminated groundwater discharged to surface water or water supply wells.

2.2.4 P.U.&D. Container Storage Facilities (IHSS 174)

2.2.4.1 Sources of Contamination

Stored drums of waste oils, paints and paint thinners, and a dumpster of stainless steel chips coated with lathe coolant have been identified as the primary sources of potential contamination at P.U.&D. Container Storage Facilities. The drums and dumpster were stored directly on the ground surface without secondary containment and may have contributed to soil contamination by leaks and spills. At present, no dumpsters and drums were observed at their respective storage areas at the site.

Stained soil has been observed at several locations within the P.U.&D. Container Storage Facilities, suggesting possible secondary contamination.

2.2.4.2 Types of Contamination

Surficial soil samples (0 to 1 ft), previous drum characterization sampling, and observation of stained ground provide evidence of potential contamination at the P.U.&D. Container Storage Facilities. Contaminated soil in P.U.&D. Container Storage Facilities was confirmed by observations of stained soil on the ground surface and detection of volatile and semivolatile organics and above background concentrations of metals in soil samples. Tetrachloroethene and 1,1,1-trichloroethane were detected in one soil sample each. Bis(2-ethylhexyl) phthalate was detected in several soil samples and 4-chloro-3-methylphenol was detected in two soil samples.

Radionuclides detected above background levels include uranium 233, 234; uranium 238; americium 241; gross alpha; and plutonium 239, 240. Gross alpha was detected in one soil sample and plutonium 239, 240 was detected in two soil samples. All other radionuclides were found in several soil samples in the IHSS 174 drum storage area.

Metals detected above background include arsenic, barium, beryllium, cadmium, copper, iron, potassium, manganese, vanadium, and zinc. Arsenic, iron, and manganese were detected in one soil sample. Beryllium was detected in two soil samples, and the remaining metals were detected at elevated concentrations in several soil samples. Inorganics detected were not above background concentrations.

Samples analyzed during the drum characterization contained contaminants similar to those detected in the soil samples including volatile hydrocarbon solvents, silicone lubricants, and metals.

Volatiles and semivolatiles were detected in soil samples taken from the Dumpster Storage Area. Many of the lathe coolants used were either freon based or 70 percent hydraulic oil and 30 percent carbon tetrachloride. Several metals including manganese and zinc were detected at levels above background concentrations. The inorganics and radionuclides detected were not above background concentrations.

Only isolated detections of volatile organics have been detected in groundwater from wells located approximately 600 ft downgradient of IHSS 174. This suggests that contaminants at IHSS 174 have had little or no impact on groundwater quality at that distance from the site.

2.2.4.3 Release Mechanisms

The primary release mechanism was contaminant leaks or spills from drums and dumpsters stored directly on the ground surface. A secondary release mechanism may result from leaching of previously contaminated soil.

2.2.4.4 Contaminant Migration Pathways

The primary pathway of contaminants from leaking drums or dumpsters is percolation through the soil to the water table. The contaminants may migrate and impact downgradient groundwater quality but contaminants would most likely be detected by monitoring wells at the Present Landfill. Other pathways may include dispersal of contaminants by surface runoff and subsequent ground saturation during periods of precipitation or by wind action. A secondary migration pathway may result from volatilization of contaminants during exposure to atmospheric conditions.

Solvents found at the site (e.g., carbon tetrachloride) are likely to migrate through the soil or volatilize rapidly from soil. This is due to the short distance to the water table and high vapor pressures. Migration of metals and radionuclides is relatively slow through soil; however, metals and radionuclides may be transported in surface water and groundwater. Surface runoff and/or wind dispersion of metals and radionuclides absorbed to soil particles is a potential secondary pathway.

2.2.4.5 Receptors

Due to the general location of the site, potential receptors for contaminants include humans and terrestrial biota through inhalation of contaminated windblown dust or volatile emissions or through dermal contact or ingestion of soil or surface water runoff. It is unlikely that ingestion or dermal contact with groundwater are significant exposure routes at IHSS 174.

2.2.5 S&W Building 980 Container Storage Facility (IHSS 175)

2.2.5.1 Sources of Contamination

Potentially leaking drums of waste from vehicle maintenance and painting activities were stored directly on the ground surface and may be the primary source of contamination. Contaminants include metals, semivolatile organics, polyaromatic hydrocarbons, and radionuclides. Some of the contaminants, metals and radionuclides for example, may be partly the result of wind dispersion of contaminated dust from other primary sources. Contaminated soils at the former location of the stored drums may constitute a secondary source.

2.2.5.2 Types of Contamination

Contents of the drums and soils at IHSS 175 were sampled and analyzed. Components of the drummed waste included paraffinic based mineral oil, a mixture of paraffinic- and napthenic-based mineral oil, xylenes, freon TF, and glycol ether/bornate-based brake fluid. Metals detected in the drummed samples included aluminum, barium, beryllium, calcium, sodium, lead, silicon, and zinc. Constituents detected in the soil samples included acetone, methylene chloride, cadmium, copper, lead, mercury, calcium, potassium, magnesium, and zinc. Radionuclides including gross alpha; gross beta; uranium 233, 234; and uranium 238; plutonium 239, 240; and americium 241 were detected at concentrations slightly above background concentrations. Nitrate/nitrite was detected above background in two soil samples. The analytical results indicate that soils have been impacted by the storage of drums at IHSS 175. There is a potential that air, surface water, and groundwater quality may also be impacted by contaminants at IHSS 175.

2.2.5.3 Release Mechanisms

The primary release mechanism is potential past leakage from drums stored directly on the ground surface. Soils that have been contaminated may release contaminants through leaching to the groundwater or surface water runoff. A secondary release mechanism may result from the volatilization of contaminants in the soil.

2.2.5.4 Contaminant Migration Pathways

Potentially leaked or spilled liquid wastes may have percolated through the underlying soils to groundwater. Constituents such as acetone, methylene chloride, and nitrate/nitrite would likely migrate downward to groundwater more readily than the various oils, metals, and radionuclides. However, because the area is not paved, infiltration of precipitation may continually transport these contaminants through leaching to the water table. Contaminated surface soils can be further dispersed through surface water runoff and wind action. Contaminated surface water and groundwater from IHSS 175 could potentially impact water quality in South Walnut Creek. Some of the organic compounds will volatilize and degrade air quality.

2.2.5.5 Receptors

Potential receptors for contaminants include humans and terrestrial biota through dermal contact or ingestion of contaminated soil, humans and terrestrial biota through inhalation of contaminated windblown dust or volatile emissions, humans and terrestrial and aquatic biota through ingestion or dermal contact with storm water runoff or contaminated sediments, and humans through ingestion or dermal contact with contaminated groundwater.

2.2.6 S&W Contractor Storage Yard (IHSS 176)

2.2.6.1 Sources of Contamination

Leaking containers of waste oils and solvents that were removed in 1985 may be the primary sources of contamination. The contaminants include volatile organics, polyaromatic hydrocarbons, and metals. There is also the potential for leaks of oils or hydraulic fluids from machinery and equipment stored in the area. Because only construction- or maintenance-related materials were stored at IHSS 176, it is not likely that the waste containers or equipment were primary sources of plutonium and americium contamination. The wide spatial distribution of plutonium and americium across the yard suggests windblown distribution of the radionuclides. The Solar Evaporation Ponds located immediately upwind (to the west) of IHSS 176 are the probable source of this radionuclide contamination. Soils at IHSS 176 that have been contaminated represent a secondary source of contamination.

2.2.6.2 Types of Contamination

Numerous HSL VOAs and BNAs were identified in soil samples, but with the exception of acetone and methylene chloride, all were estimated values that were below the detection limits. Arsenic, aluminum, cadmium, calcium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, vanadium, zinc, and nitrate/nitrite were detected above background concentrations. Americium 241; uranium 233, 234; uranium 238; and plutonium 239, 240 were detected above background concentrations in several samples.

2.2.6.3 Release Mechanisms

Surface water, air, and groundwater media may potentially be impacted by contaminant releases from IHSS 176. The primary release mechanism is probable leaks or spills from drums or other storage containers that were stored directly on the ground surface. A secondary release mechanism may result from leaching of previously contaminated soil.

2.2.6.4 Contaminant Migration Pathways

The primary migration pathways of contaminants at IHSS 176 are direct leaks or spills from containers onto the ground surface, with potential downward percolation of liquid contaminants to the water table and further dispersal of contaminated soils by wind or surface runoff. Fractions of the spilled contaminants including the VOAs, and to a lesser extent, polycyclic aromatic hydrocarbons and pentachlorophenol, can percolate or migrate through leaching downward to the water table. Nitrates are mobile in soil and are likely to leach to and migrate with groundwater. Some lead compounds are water soluble and could leach to groundwater. Because of the proximity of IHSS 176 to Walnut Creek and South Walnut Creek, mobile contaminants can potentially migrate with groundwater and discharge to these drainages. The polycyclic aromatic hydrocarbons, lead, mercury, and most other metals may also be adsorbed to near surface soils and be transported as adsorbed matter on suspended particles by wind action or surface runoff. Surface runoff may also dissolve portions or certain species of these compounds and transport them off site and to Walnut Creek. Volatilization no doubt occurred historically, but would not be an important pathway unless deeper soils are disturbed. Radionuclides appear to be widespread at IHSS 176 and could be redistributed by wind action and runoff. Because of their low mobility, only low concentrations of radionuclides would be expected to leach to groundwater.

2.2.6.5 Receptors

Potential receptors for contaminants include humans and terrestrial biota through inhalation of contaminated wind blown dust; humans and biota through dermal contact and ingestion of contaminated surface water, including portions of Walnut Creek and South Walnut Creek which are recharged by contaminated groundwater; humans or livestock through ingestion and dermal contact with contaminated groundwater discharged from wells; and humans and terrestrial biota through dermal contact or ingestion of contaminated soils.

2.2.7 <u>Building 885 Drum Storage Area (IHSS 177)</u>

2.2.7.1 Sources of Contamination

Stored drums of oils, paints, and paint solvents may have been the primary sources of contamination due to spill or leakage. The drums of waste material could have also contained low-level radioactive wastes. The potential for contaminated concrete, asphalt floors, and soil may constitute secondary contamination.

2.2.7.2 Types of Contamination

The detection of polyaromatic hydrocarbons and volatile compounds in soil is consistent with releases of oils and solvents. The volatiles that were detected above detection limits at IHSS 177 are acetone, 2-butanone, and trans-1,2-dichloroethene. Trans-1,2-dichloroethene and 2-butanone were detected in one soil sample each. Acetone was detected above detection limit in several soil samples.

Gross alpha; gross beta; plutonium 239, 240; and americium 241 were detected in two soil samples each. Uranium 233, 234 and uranium 238 were detected in several soil samples. Numerous metals including aluminum, barium, cadmium, calcium, copper, iron, lead, magnesium, mercury, potassium, vanadium, and zinc were detected above background levels in soil samples collected directly beneath the asphalt. No anions were detected above background concentrations. Ground staining was observed at various locations prior to the area being paved with asphalt. Contaminated soils could also contribute to the degradation of surface water and air quality in the area. Leaching of contaminants from the soils could impact groundwater quality. Tables 2-10 and 2-11 illustrate detections of organics, inorganics, metals, and radionuclides in the groundwater at this IHSS. Further investigation is required to determine if there is any contribution of contaminants by IHSS 177.

2.2.7.3 Release Mechanisms

A primary release mechanism of contaminants is possible spills or leaks from 55-gallon drums onto the soil prior to installation of the pavement or concrete. A secondary release mechanism may result from leaching of previously contaminated soil.

2.2.7.4 Contaminant Migration Pathways

The primary contaminant migration pathway is leakage or spills of contaminants directly onto the soil surrounding the southern portion of the site, infiltration through the soil to the water table, and groundwater flow toward Woman Creek. It is also possible that leaks or spills would flow from the asphalt or concrete surface through cracks to the soil and groundwater. Surface runoff of precipitation could cause contaminants to be distributed around the perimeter of the drum storage facility. Airborne particulates are another possible migration pathway.

2.2.7.5 Receptors

The potential receptors of contamination from this site could include humans through dermal contact and inhalation of contaminated windblown dust or volatile emissions. Receptors of potentially contaminated groundwater could include humans through dermal contact and ingestion of groundwater and inhalation of vapors eminating from contaminated groundwater. Potential receptors also include terrestrial biota through ingestion, inhalation, and dermal contact with soils, asphalt, and concrete, and storm water runoff.

2.2.8 Building 334 Cargo Container Area (IHSS 181)

2.2.8.1 Sources of Contamination

The primary source of contamination is potential leakage from 55-gallon drums containing waste oils, solvents, coolants and, possibly, low-level radioactive wastes.

2.2.8.2 Types of contamination

The Cargo Container Area contained drums of waste machine oils, solvents, and machine coolants and, possibly, low-level radioactive wastes. Although unlikely, there is a potential for wastes from leaking drums to have contaminated the asphalt and underlying soil.

2.2.8.3 Release Mechanisms

The potential primary release mechanism from this site would be a leaking drum if the event had occurred or occurs. Because of secondary containment within IHSS 181, it is expected that any leaks or spills would be cleaned up and would not be a hazard. There is no documented or visual evidence of releases from the drums at this time.

2.2.8.4 Contaminant Migration Pathways

In the event of a major spill (55 gallons or the contents of one drum), liquid waste would likely overflow secondary containment, seep out of the container, and flow onto the ground. At this point the primary migration pathway would be infiltration into the ground and migration downward to the water table where it may be transported to a point of discharge down gradient. This is expected to be a primary pathway for solvents, which are mobile in soil and groundwater.

Surface water runoff and wind dispersion of contaminants may be other migration pathways for less mobile solvents, oils, and low-level radioactive wastes. A secondary migration pathway may be volatilization of contaminants from the soils.

2.2.8.5 Receptors

Potential receptors for contaminants would include humans and terrestrial biota through dermal contact or ingestion of contaminated soils or asphalt, humans and terrestrial biota through inhalation of contaminated windblown dust or volatile emissions, humans and terrestrial and aquatic biota through ingestion or dermal contact with storm runoff, and humans through ingestion or dermal contact with contaminated groundwater.

2.2.9 Building 444/453 Drum Storage Area (IHSS 182)

2.2.9.1 Sources of Contamination

The primary source of possible contamination is leakage of oils and solvents from drums stored directly on the ground surface and on asphalt paved areas. The potentially contaminated soils underlying the site may constitute a secondary source of contamination.

2.2.9.2 Types of Contamination

The prevalence of ground staining, ionizing radiation levels above background, and the detection of volatile and semivolatile constituents and uranium 238 and uranium 233, 234 above background indicate potential soil contamination. Stored materials included waste hydraulic oils and chlorinated solvents, some of which were contaminated with beryllium and low-level uranium.

Based on ground staining and preliminary sample results, most of the asphalt pavement and soils underlying the pavement may be contaminated. Volatile and semivolatile constituents present in soils include acetone, 1,1,1-trichloroethane, toluene, ethylbenzene, total xylenes, naphthalene, phenanthrene, fluoranthene, and pyrene. Acetone and 1,1,1-trichloroethane were detected in two samples, each above the detection limit. Methylene chloride was detected in two blanks. Metals including aluminum, cadmium, copper, iron, mercury, potassium, manganese, magnesium, nickel, vanadium, and zinc were detected above background. Cadmium, copper, iron, potassium, magnesium, and zinc were detected above background in two samples each. All remaining metals were detected above background in one sample each. Uranium 233, 234 and uranium 238 were detected above background in one sample each.

2.2.9.3 Release Mechanisms

The primary mechanism for release of possible contamination is leakage from drums at the site. The leaks may have impacted the asphalt pavement and soils directly under the pavement. Leaching of contaminants from surficial materials and downward migration via infiltration of precipitation to the water table may have occurred prior to the mid-1970s (before the asphalt pavement was installed). Since the installation of the pavement, however, the potential for infiltration is no longer likely.

2.2.9.4 Contaminant Migration Pathways

The primary migration pathway for possible contaminants at IHSS 182 is downward percolation and leaching of spilled or leaked contaminants to the groundwater. If the groundwater has been contaminated, it may discharge to surface water or wells downgradient of the site. Minor amounts of contaminants could have been transported off site with surface water runoff during heavy rainfalls because the site is not bermed. Wind speeds necessary for erosion and dispersal of contaminated soil particles were reduced due to the shielding provided by the adjacent buildings. Volatile portions of contaminants which were spilled on soils or pavement may have volatilized in the past. Volatile emissions from the present stained asphalt pavement are likely to be very low. If solvents from this site have migrated to the groundwater, some volatilization to the atmosphere will occur. Dispersal of contaminated soils around the pavement through wind action and surface water runoff may also occur.

2.2.9.5 Receptors

The potential receptors could be humans exposed to windblown contaminated soil, contaminated surface water, or groundwater. Exposure routes to humans include ingestion and dermal contact with soils, surface water, sediments, and oily residues. It is unlikely that inhalation is an important exposure route. Because the site is paved, the contaminants probably have little effect on terrestrial biota. Discharge of contamination by groundwater to surface water and sediments could impact aquatic biota or terrestrial biota downgradient of the site.

2.2.10 Building 460 Sump #3 Acid Side (IHSS 205)

2.2.10.1 Sources of Contamination

The potential exists for leakage of acid waste from failure or cracking of the dumpsters. There is also potential for leakage associated with piping and fillings used to transfer waste from the sump to the dumpsters and from the dumpsters to drums.

2.2.10.2 Types of Contamination

Leaked materials would consist of approximately 80 percent water and 20 percent acid. The acid is composed of nitric acid and Nitradd, a combination of hydrofluoric acid and ammonium salts. Operation of the acid dumpsters, most likely, will not impact air, surface water, groundwater, or soils in the area.

2.2.10.3 Release Mechanisms

The primary release mechanism would potential leakage from the acid dumpsters and associated pipe connections. Any such leaks would initially be contained by the concrete containment berm around the acid dumpsters. Assuming the development of cracks in the berm or a large enough spill to overflow the bermed containment, acid waste could contaminate soil and groundwater beneath the building or dumpsters. One spill reportedly occurred at the acid dumpsters. Whether the acid wastes were contained or whether they potentially contaminated underlying soils or groundwater is unknown. Some volatilization of acid wastes probably occurred during this spill.

2.2.10.4 Contaminant Migration Pathways

The primary pathway of contaminant migration would be direct leakage from the dumpster or associated piping. Although unlikely, if spilled acid wastes were allowed to infiltrate through the concrete and containment, they could continue downward to the water table and migrate with groundwater flow. Due to the small volumes of contaminants expected to pass through the concrete and infiltrate to the water table, it is unlikely that impacts to groundwater quality would persist very far downgradient of the site. If a leak or spill did occur, volatilization of acid wastes in the immediate area would be no real concern on impacts to air quality.

2.2.10.5 Receptors

Assuming a leak or spill when emptying the acid dumpsters, potential receptors for contamination would be RFP workers performing the operation, through dermal and inhalation contact with the acid wastes. Assuming that a future spill would be cleaned up in a timely manner, it is not probable that there would be sufficient migration of acid wastes to the groundwater to cause exposure to humans and terrestrial and aquatic biota through that pathway.

2.2.11 Inactive D-836 Hazardous Waste Tank (IHSS 206)

2.2.11.1 Sources of Contamination

The potential source of contamination is the potentially contaminated soil underneath the area where the tank and associated pipes connecting the tank to Building 374 were previously located.

2.2.11.2 Type of Contamination

If any spills or leaks occurred in this area, the potential contaminants would consist primarily of elevated nitrates from the off-specification Building 374 product water (Cypher, 1990). No spills or leaks from the tank have been reported (Cypher, 1990). However, if spills or leaks have occurred soils, surface water, and groundwater may have been impacted. No previous sampling of the site has been conducted; therefore, the nature and extent of possible contamination is not known.

2.2.11.3 Release Mechanisms

Contaminants may have impacted soils, surface water, and groundwater. The primary release mechanism is possible leaks or spills from the tank and associated pipes. Leaching of contaminated soils and associated migration of contaminants to the water table may constitute a secondary release mechanism.

2.2.11.4 Contaminant Migration Pathways

Potential contaminant migration pathways would include groundwater flow, wind dispersal of contaminated surface soils, and surface water runoff and sediment transport. Nitrates or other contaminants could migrate with groundwater and be discharged to surface water or to water supply wells. Wind erosion and transport of potentially contaminated soil particles could disperse contaminants downwind of the site. Soil particles could also be transported by surface water runoff. A high rate of surface water infiltration is expected because of the coarse-grained texture of surficial soils and the flat topography at the site. Therefore, surface water transport of contaminants would probably be limited in extent.

2.2.11.5 Receptors

Potential receptors may include humans through dermal contact with soil and inhalation of fugitive dust. The site is unvegetated and within a fenced area; therefore, impacts to biota are expected to be minimal. If contaminants were to migrate to the groundwater, potential receptors could include humans and biota through ingestion of groundwater discharged to surface water or pumped from water supply wells.

2.2.12 Inactive Building 444 Acid Dumpsters (IHSS 207)

2.2.12.1 Sources of Contamination

A potential source for contamination would be unidentified leaks or spills from the acid dumpsters. The dumpsters were contained by a concrete floor and berm; however, a drain pipe originally served as an exit from the bermed area. The drain pipe was plugged by concrete at some time while the dumpsters were still in place on the pad. If a spill ever occurred prior to the plugging of the drain pipe, it could have flowed to an unlined ditch located across the street and east of the dumpster site. If such a spill occurred, soils within the ditch may be a potential secondary source.

2.2.12.2 Types of Contamination

Based on analyses of grab samples from the waste inputs, spilled wastes would be composed of phosphoric acid and sulfuric acid, chromium trioxide, and metals. Spilled water not contained by the bermed pad could have flowed through cracks in the asphalt pavement that surrounds the pad and into underlying soils. If a sufficiently large spill occurred to reach the ditch across the road, soils in the ditch could be contaminated with metals. Acids would no longer be expected to be present.

Additional contaminants of concern found in the acid waste stream of Building 444 include the metals cadmium, chromium, lead, and silver and the radionuclides uranium 233, 234; uranium 238; americium 241; and tritium (Closure Plan Inactive Interim Status Facility Building 444 Acid Dumpsters IHSS 207). These contaminants have no IHSS associated with actual storage. There is a possibility some of these waste acids could have been stored at IHSS 207.

2.2.12.3 Release Mechanisms

The primary release mechanisms were from possible leaks or spills. If leaks or spills overflowed the berm, soils in the ditch may have been contaminated and could also release contaminants to the environment. The primary release mechanism for these contaminants would be leaching of metals from the soils by surface water flow or infiltration of precipitation.

2.2.12.4 Contaminant Migration Pathways.

The primary migration pathway would be overland flow of wastes not contained by the berm. If soils have been contaminated by a spill, then they could be transported by wind or surface water away from the site. Infiltration of precipitation/surface water in the unlined ditch could leach contaminants and transport them to groundwater. Unless large volumes of acid were spilled, it is unlikely that these relatively immobile metals would have migrated to the water table.

2.2.12.5 Receptors

Potential receptors would include humans or terrestrial biota through inhalation of windblown dust; humans through dermal contact with contaminated concrete, asphalt, or soil. Ingestion of contaminated soils by humans or terrestrial biota is possible, but the existence of significantly contaminated soil is unlikely.

2.2.13 <u>Inactive 444/447 Waste Storage Area (IHSS 208)</u>

2.2.13.1 Sources of Contamination

A potential source at this site would be unidentified leaks or spills from or near the cargo container. Soils underneath this location may have been contaminated and could be a potential secondary source.

2.2.13.2 Types of Contamination

No spills or leaks were reported at the site. In the event that a small leak or spill went undetected, soils underneath the area could have been contaminated with wastes including a composite of nitric acid with silver, sodium fluoride, plating acids (hydrochloric acid, nitric acid, and hydrofluoric acid) with concentrated chromium plating solution, concentrated cadmium cyanide solution, nickel sulfamate, and developer/fixer. The cargo container appears to have been placed either directly over or adjacent to an unlined drainage ditch; therefore, if a spilled occurred, surface water and sediments in the ditch could also have been contaminated.

2.2.13.3 Release Mechanisms

The primary release mechanism is potential leaks or spills from or near the cargo container. Soils underneath the site may have been contaminated and could release contaminants through leaching caused by infiltration of precipitation or surface water.

2.2.13.4 Contaminant Migration Pathways

Spilled or leaked contaminants could flow directly along the unlined ditch to an underground storm drain, which apparently drains to Woman Creek. Wastes could have contaminated underlying soils and sediments that could be transported and dispersed by wind or surface water runoff. Surface water may also dissolve and transport contaminants off site. Infiltration of precipitation through soils or sediments could leach contaminants out of the soils and transport them to groundwater. Contaminated groundwater could transport contaminants away from the site. Ditch runoff could contribute to carrying diluted contamination down to the water table. Direct infiltration would probably require large individual spills or numerous spills of small volume. No leaks or spills were reported and there is no ground staining suggesting that spills occurred.

2.2.13.5 Receptors

Potential receptors would include humans and terrestrial biota through dermal contact with contaminated soil and sediments, humans and terrestrial and aquatic biota through ingestion and dermal contact with surface water and sediments, and humans and terrestrial biota through inhalation of fugitive dust.

2.2.14 Unit 16, Building 980 Cargo Container (IHSS 210)

2.2.14.1 Sources of Contamination

The primary source of contamination is potential leakage of wastes from drums stored directly on the ground adjacent to the cargo container. Potentially contaminated soil located east and adjacent to the cargo container may constitute a secondary source.

2.2.14.2 Types of Contamination

Both solid and liquid wastes were stored at the site; however, it is probable that the liquid wastes had a greater impact at the site. Liquids that were stored and may have leaked from drums include automotive oils, stoddard solvent, paints, paint thinner, gasoline, diesel fuel, and solvents. Media that could be affected by these contaminants include air, surface water, groundwater sediments, and soils. Volatile fractions of these contaminants are not expected to remain in surface soils or surface runoff, but may be present at depth in soils or groundwater. Residue metals or semivolatile compounds may be present in all media, but are likely sorbed to clayey material in shallow soils.

2.2.14.3 Release Mechanisms

The primary release mechanism is possible historical leakage or spillage of contaminants onto the soil. Subsequent leaching of contaminants from potentially contaminated soils due to infiltration of precipitation or possibly by groundwater flow through contaminated, saturated materials may have or may presently be occurring. Volatilization of organic compounds may occur, particularly if contaminated soils in the area are excavated.

2.2.14.4 Contaminant Migration Pathways

Spilled or leaked wastes would percolate downward through the soils to the groundwater. Some contaminants such as the less soluble oily fractions of these wastes may have sorbed to soils and later desorbed by additional infiltration of more liquid wastes or infiltration of precipitation. Solvents, gasoline, diesel fuel, and paint thinner could potentially migrate with groundwater toward South Walnut Creek where contaminants could be discharged to surface water and sediments or volatilized to the atmosphere. Contaminated soil on the surface could also be distributed by surface water or wind. Surface water may also leach contaminants from the soils and transport them in a dissolved phase. These leached contaminants may accumulate in the sediments by deposition. Some volatilization of solvents from soils or groundwater may occur.

2.2.14.5 Receptors

Potential receptors include humans and terrestrial biota through dermal contact with contaminated soil, humans and terrestrial and aquatic biota through ingestion and dermal contact with surface water and sediments, humans and terrestrial biota through inhalation of volatile compounds or fugitive dust, and humans and livestock through ingestion of groundwater from water supply wells, and humans and terrestrial and aquatic biota through ingestion and dermal contact with surface water recharged by contaminated groundwater.

2.2.15 Unit 15, 904 Pad Pondcrete Storage (IHSS 213)

2.2.15.1 Sources of Contamination

Contaminated soils were present at the 904 Pad prior to its construction in 1987. Chronic spillage of pondcrete and saltcrete, which are both low-level mixed waste, from storage boxes has occurred throughout the history of the 904 Pad. Contaminated runoff from the pad has overflowed and underflowed the berm and been transported through a north-draining ditch through South Walnut Creek, Pond B-4, and Pond B-5, thus creating secondary sources downstream from the 904 Pad. Contaminated soils dust and sediment have potentially been dispersed by wind or surface water runoff creating additional near-surface contaminant sources away from the pad.

2.2.15.2 Types of Contamination

Soils, surface water, and groundwater investigations indicate that all of these media have been contaminated at the 904 Pad. A wide range of contaminants are associated with the stored mixed waste. Indicator parameters including plutonium 239, americium 241, and nitrate have been detected. Elevated levels of gross alpha and gross beta radiation were also detected. Cadmium, cyanide, and nitrate concentrations above drinking water standards have been detected in surface runoff that flows from the 904 Pad and eventually enters Pond B-5. Sediments within the ditch and drainages are also likely to contain contaminants. Soil samples taken indicate levels above background for gross alpha, gross beta, total plutonium, total uranium, uranium 234, uranium 238, americium 241, and plutonium 239. Groundwater contaminants flow radially away from the pad toward the north, east, and south. Generation of contaminated dust could impact air quality.

2.2.15.3 Release Mechanisms

The primary mechanism for release of contaminants from the 904 Pad is leaks or spills from storage boxes. Secondary releases due to leaching could occur from the stockpiled soils west of the pad, sediments in drainages, and adjacent soils, which have been contaminated by surface water runoff or by settled contaminated dust.

2.2.15.4 Contaminant Migration Pathways

Spills of poorly solidified pondcrete and dry saltcrete may migrate via surface water and sediment runoff. Storm runoff from the 904 Pad may transport suspended or dissolved contaminants north to South Walnut Creek and Ponds B-4 and B-5. Infiltration and percolation of liquid wastes and contaminated surface water or precipitation can further contaminate the asphalt pad, underlying soils, and groundwater. Contaminated dust on the pad, in potentially contaminated soils adjacent to the pad, and in ditch sediments can be transported by the wind. Contaminated groundwater flowing radially away from the site may recharge surface water in the South Walnut Creek drainage and potentially in the Woman Creek drainage.

2.2.15.5 Receptors

Potential receptors include humans through inhalation, ingestion, and dermal contact with dry wastes, and ingestion and dermal contact with liquid wastes. Humans and terrestrial biota are potential receptors through inhalation of windborne contaminants and ingestion and dermal contact with contaminated surface water and sediments. Aquatic biota are also potential receptors of surface water and sediment contamination through ingestion and dermal contact.

2.2.16 Unit 25, 750 Pad Pondcrete and Saltcrete Storage (IHSS 214)

2.2.16.1 Sources of Contamination

The primary source of contamination is spillage of saltcrete and pondcrete from storage boxes on IHSS 214. Runoff due to precipitation has apparently overflowed the berm and transported contaminants downstream to the South Walnut Creek drainage, creating a secondary source. Contaminated soils, dust, and sediments have potentially been dispersed by wind or runoff creating additional near surface contaminant sources away from the pad.

2.2.16.2 Types of Contamination

Analyses of surface water exiting IHSS 214 indicate that cadmium, nitrate, and cyanide concentrations have exceeded background values. Because of the pad design and the short time between spills and cleanup by RFP personnel, the probability of soils beneath IHSS 214 being contaminated is reduced. However, localized infiltration of contaminated surface water through cracks in the pad could result in contamination of the underlying soils. Soils sampled from the 750 Pad culvert drainage outlet and the surface runoff puddle indicate levels above background for gross alpha and gross beta. Soils outside of the pad area may have been contaminated by dispersal of contaminants off the pad by wind or surface water runoff. Infiltration of contaminated surface water could impact groundwater quality. Air monitoring indicates that wind dispersal of plutonium during monitoring periods has not exceeded the Plant screening guide for plutonium in air of 0.01 pCi/m^3. A wide range of contaminants are associated with low-level mixed wastes themselves. Elevated levels of gross alpha and beta have been detected. Indicator parameters have also been detected for plutonium 239 and 240, americium 241, and nitrate. Table 2-18 illustrates available groundwater data in the vicinity containing metals, inorganics, and radionuclides.

2.2.16.3 Release Mechanisms

The primary release mechanism for release of contaminants from IHSS 214 is leaks or spills from storage boxes. A secondary release of contaminants could occur through leaching of potentially contaminated sediments in the large, east-trending drainage, with subsequent transport as solute in surface water or downward migration to groundwater.

2.2.16.4 Contaminant Migration Pathways

Spills of pondcrete and saltcrete may migrate via surface water and sediment runoff. Contaminants transported by surface water may flow east through a large drainage that ultimately empties into South Walnut Creek. Infiltration and percolation of liquid wastes or contaminated surface water runoff may contaminate the upper portion of the pad above the Petromat layer. Infiltration of contaminated surface water to groundwater is possible. Discharge of contaminated alluvial groundwater to South Walnut Creek is possible. The large east trending drainage is separated from a 100-ft-thick subcropping sandstone unit by approximately 10 ft of alluvium. Infiltration from the ditch to this sandstone could result in migration of contaminants into bedrock aquifers to the east of RFP. Contaminated dust on the pad, potentially contaminated adjacent soils and ditch sediments can be transported by the wind.

2.2.16.5 Receptors

Potential receptors include RFP employees working on the pad through inhalation, ingestion, and dermal contact with dry wastes, and ingestion and dermal contact with liquid wastes. Humans and terrestrial biota outside of the pad are potential receptors through inhalation of windborne contaminants and ingestion and dermal contact with contaminated surface water and sediments. Aquatic biota are also potential receptors of surface water and sediment contamination through ingestion and dermal contact. Continued migration of contaminants through bedrock aquifer could impact water quality discharged from water supply wells for human or livestock use.

3.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section provides a preliminary identification of potential chemical-specific ARARs for surface water and groundwater at OU10. The summary of potential sitewide ARARs presented is based on current federal and state health and environmental statues and regulations. The ARARs presented are not specific to OU10 because insufficient validated data exist to justify inclusion or exclusion of specific constituents. The preliminary identification and examination of potential ARARs will provide for the use of appropriate analytical detection limits during the RFI/RI. As data become available during the Phase I RFI/RI, specific ARARs will be proposed for OU10. Location-specific ARARs will be addressed in the RFI/RI report. The CMS/FS report will further address chemical-specific ARARs as well as action- and location-specific ARARs in the development and evaluation of remedial alternatives.

3.1 THE ARAR BASIS

Section 121(d) of CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), requires that Superfund-financed, enforcement, and federal facility remedial actions comply with federal ARARs or more stringent promulgated state requirements. CDH Water Quality Control Commission (WQCC) groundwater standards became effective on April 30, 1991, and are therefore considered in the process for development potential sitewide ARARs for RFP.

3.2 THE ARAR PROCESS

A screening and analysis process will be used to determine which of the potential ARARs will be applied to OU10. The analysis will address compliance with chemical-, location-, and action-specific ARARs in accordance with the NCP. When more than one ARAR is identified dealing with a single subject, the more stringent of the applicable ARARs will be used.

Potential ARARs are identified in this work plan. After the initial RFI/RI field investigation, chemicals present at the site and any location-specific characteristics at the site will be identified. After the chemicals have been identified, the presence or absence of chemical-specific ARARs will be determined. Chemical-specific ARARs will be derived primarily from federal and state health and environmental statutes and regulations including the following:

- Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) applicable to both surface water and groundwater

- Clean Water Act (CWA) Ambient Water Quality Criteria (AWQC) potentially applicable to surface water and alluvial groundwater

- RCRA, Subpart F, Groundwater Concentration Limits (40 CFR 264.94) applicable to groundwater, and proposed Subpart S, the Corrective Action Rule (55 Fed. Reg. 30798, July 27, 1990).

- CDH surface water standards for Woman Creek and Walnut Creek (5 CCR 1002-8, Section 3.8.29, Final Rule Effective March 30, 1990) applicable to surface water

- CDH WQCC proposed statewide and classified groundwater area standards (5 CCR 1002-8, Section 3.11) effective April 30, 1991.

A summary of chemical-specific standards or potential ARARs (based on the above regulations and contaminants that may be found potentially sitewide) is presented in Table 3-1, Potential Chemical-Specific ARARs/TBCs Groundwater Quality Standards; Table 3-2, Potential Chemical-Specific ARARs/TBCs - Federal Surface Water Quality Standards; and Table 3-3, Potential Chemical-Specific ARARs/TBCs - State (CDH/WQCC) Surface Water Quality Standards. These potential chemical-specific ARARs and accompanying regulations will be screened to determine their jurisdictional requirements and applicability to OU10. If the requirements are not applicable, they will be further screened to determine whether they are relevant and appropriate to the particular site-specific conditions at OU10. Where ARARs do not exist for a particular chemical, or where existing ARARs are not protective of human health and the environment, to-be-considered criteria (TBC) (such as guidance, proposed standards, and advisories developed by EPA, other federal agencies, or states) will be evaluated for use. Where ARARs or TBC criteria are not available or are less than laboratory practical quantitation limits (PQLs), PQLs will be used. For any parameters to be analyzed in groundwater, surface water, or soil and for which no ARARs or TBCs were found, use of the methods that achieve the detection limits provided in the General Radiochemistry and Routine Analytical Services Protocol (GRRASP) (EG&G, 1991), which are CLP contract-required quantitation limits, should enable meaningful interpretation of sample results. In addition, whenever a potential standard is below the GRRASP-derived detection limit, the detection limit will be used as the standard. Risk-based concentrations taken from the baseline risk assessment will be used in establishing the remediation goals for the parameters for which no potential ARARs could be identified, thus ensuring environmental protectiveness.

EPAs proposed Corrective Action Rule is not yet final and may be changed substantially before it is promulgated as a final regulation. The activities caused by this work plan consist only of sampling to determine the extent of the problem at OU10. When the results of this work at OU10 are available it will then be necessary to review all potential ARARs as revised at that time, to determine their applicability or relevance and appropriateness and to determine if any standards or criteria are exceeded.

3.2.1 ARARs

"Applicable requirements," as defined in 40 CFR 300.5, are "those standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable." "Relevant and appropriate requirements," also defined in 40 CFR 300.5 are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws, that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate." The most stringent promulgated standards are applied as ARARs (Preamble to NCP, 55 FR 8741). According to the NCP [40 FR 300.400(g)(4)], the term "promulgated" means that standards are of general applicability and are legally enforceable.

3.2.2 TBCs

In addition to ARARs, advisories, criteria, or guidance may be identified as TBCs for a particular release. As defined in 40 CFR 300.400(g)(3), the TBC category consists of advisories, criteria, or guidance developed by EPA, other federal agencies, or states that may be useful in developing remedies. Use of the TBCs is discretionary rather than mandatory, as is the case with ARARs.

3.2.3 ARAR Categories

In general, there are three categories of ARARs:

- Contaminant or chemical-specific requirements
- Location-specific requirements
- Performance, design, or other action-specific requirements.

ARARs are generally considered to be dynamic in nature in that they evolve from general to very specific in the CERCLA site cleanup process. Initially, during the RFI/RI work plan stage, probable chemical-specific ARARs may be identified, usually on the basis of limited data. Chemical-specific ARARs at this point have meaning only in that they can be used to ensure that appropriate detection limits have been established so that data collected in the RFI/RI will be amenable for comparison to ARAR standards. It is also appropriate to identify location-specific ARARs early in the RFI/RI process so that information can be gathered to determine whether restrictions can be placed on the concentrations of hazardous substances or on the conduct of an activity solely because it occurs in a special location. As discussed in the introductory paragraph of this section, detailed, location-specific ARARs will be proposed in the RFI/RI report. Identification of action-specific ARARs and remediation goals is part of the feasibility study process and will be addressed in the CMS/FS report. Chemical-specific ARARs may be deleted if they are found to be inappropriate at any time in the RFI/RI process. Deletion of chemical-specified ARARs will be based on analytical information obtained from sampling at OU10.

One medium for which chemical-specific ARARs do not currently exist is soils; however, some chemical-related, action-specific requirements do exist, such as Colorado's construction standard for plutonium in soils. Relative to chemical-specific ARARs, a risk assessment will be performed to determine acceptable contaminant concentrations in soils to ensure environmental "protectiveness." At this time, with respect to establishing analytical detection limits for soil, use of method detection limits provided in GRRASP (EG&G, 1991), which are Contract Laboratory

Program (CLP) required quantitation limits, should enable meaningful interpretation of soil sample results.

For appropriate management of investigation-derived wastes, as required in the IAG (Attachment 2, Statement of Work, Section IV), DOE has developed standard operating procedures (SOPs) for field investigation activities. All waste generated by the various investigations conducted at RFP will follow SOPs approved by EPA and CDH. The SOPs satisfy the IAG requirement to comply with ARARs as they relate to investigation activities. This approach is consistent with EPA policy as provided in the Draft Guide to Management of Investigation-Derived Waste (EPA, 1991).

3.2.4 Remedial Action

CERCLA Section 121 specifically requires attainment of all ARARs. Moreover, a remedial action that complies with the most stringent requirement is likely to ensure attainment of similiar, but less stringent ARARs dealing with the same subject. Furthermore, CERCLA requires that the remedies selected attain ARARs and be protective of human health and the environment. Remediation goals will be based on the baseline risk assessment to be conducted for protection of human health and the environment.

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - GROUNDWATER QUALITY STANDARDS (August 1, 1991)

				Federal Standards (µg/L)					State Standards (TBCs) CDH WQCC Groundwater Quality Standards (µg/L) (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit 40CFR264.94 (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
Bicarbonate	A	10	E310.1													
Carbonate	A	10	E310.1													
Chloride	A	5	E325	250,000*							250,000					
Fluoride	A	5	E340	4,000; 2,000*		4,000				4,000		2,000				
N as Nitrate	A	5	E353.1	10,000			10,000			10,000						
N as Nitrate+Nitrite	A	5	E353.1		10,000		10,000					100,000				
N as Nitrite	A	5	E354.1		1,000		1,000			1,000		10,000				
Sulfate	A	5	E375.4	250,000*							250,000					
Sulfide	A															
Coliform (total)	B	1	SM9221C	1/100 ml						1/100 ml						
Ammonia as N	C	5	E350						$2.2x10^{7}$					$1.3x10^{8}$		
Dioxin	D		d						.00000022 (7)					$1.3x10^{6}$		
Sulfur	E	100,000	E600													
Dissolved Oxygen	FP	0.5	SM4500													
pH	FP	0.1	E150.1	6.5-8.5*							6.5-8.5	6.5-8.5				
Specific Conductance	FP	1	E120.1													
Temperature	FP															
Boron	I	5	E6010									750				
Total Dissolved Solids	I	10	E160.1	500,000*									400,000 (1)			

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - GROUNDWATER QUALITY STANDARDS (August 1, 1991)

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									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit 40CFR264.94 (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
Aluminum	M	200	CT		50 to 200*							5,000				
Antimony	M	60	CT													
Arsenic	M	10	CT	50				50		50		100				
Arsenic III	M															
Arsenic V	M															
Barium	M	200	CT	1,000	2,000 (e)		2,000 (e)	1,000		1,000						
Beryllium	M	5	CT									100				
Cadmium	M	5	CT	10	5		5	10		10		10				
Calcium	M	5,000	CT													
Cesium	M	1,000	NC													
Chromium	M	10	CT	50	100		100	50		50		100				
Chromium III	M	5	SW8467196													
Chromium VI	M	10	E218.5													
Cobalt	M	50	CT									50				
Copper	M	25	CT	1,000*			1,300 (f)				1,000	200				
Cyanide	M	10	CT							200						
Iron	M	100	CT	300*							300	5,000				
Lead	M	5	CT	50			0 (f)	50		50		100				
Lithium	M	100	NC									2,500				
Magnesium	M	5,000	CT													
Manganese	M	15	CT	50*							50	200				
Mercury	M	0.2	CT	2	2		2	2		2		10				
Molybdenum	M	200	NC													

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - GROUNDWATER QUALITY STANDARDS (August 1, 1991)

				Federal Standards (µg/L)					State Standards (TBCs) CDH WQCC Groundwater Quality Standards (µg/L) (d)							
									Statewide	Site-Specific (g)						
															Table 6 Radionuclides	
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit 40CFR264.94 (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Woman Creek	Walnut Creek
Nickel	M	40	CT									200				
Potassium	M	5,000	CT													
Selenium	M	5	CT	10	50		50	10		10		20				
Silver	M	10	CT	50	100*			50		50						
Sodium	M	5,000	CT													
Strontium	M	200	NC													
Thallium	M	10	CT													
Tin	M	200	NC													
Titanium	M	10	B6010													
Tungsten	M	10	B6010													
Vanadium	M	50	CT									100				
Zinc	M	20	CT	5,000*							5,000	2,000				
2,4,5-TP Silvex	P		d	10	50		50	10	10							
2,4-Dichlorophenoxyacetic acid (2,4-D)	P		d	100	70		70	100	100							
Aldicarb	P				3 (e)		1 (e)		10							
Aldrin	P	0.05	CP						0.002 (7)					0.0000784		
Bromacil	P															
Carbofuran	P		d		40		40		36							
Chloranil	P															
Chlordane (alpha)	P	0.5	CP		2		0		0.03 (7)					0.00046		
Chlordane (gamma)	P	0.5	CP		2		0		0.03 (7)					0.00046		

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - GROUNDWATER QUALITY STANDARDS (August 1, 1991)

				Federal Standards (µg/L)					State Standards (TBCs) CDH WQCC Groundwater Quality Standards (µg/L) (d)							
									Statewide	Site-Specific (g)						
															Table 6 Radionuclides	
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit 40CFR264.94 (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Woman Creek	Walnut Creek
DDT	P	0.1	CP						0.1 (7)					0.000024		
DDT metabolite (DDD)	P	0.1	CP													
DDT metabolite (DDE)	P	0.1	CP													
Demeton	P															
Diazinon	P															
Dieldrin	P	0.1	CP						0.002 (7)					0.000071		
Endosulfan I	P	0.05	CP													
Endosulfan II	P	0.1	CP													
Endosulfan sulfate	P	0.1	CP													
Endrin	P	0.1	CP	0.2				0.2	0.2							
Endrin Ketone	P	0.1	CP													
Guthion	P															
Heptachlor	P	0.05	CP		0.4		0		0.008 (7)					0.00028		
Heptachlor Epoxide	P	0.05	CP		0.2		0		0.004 (7)							
Hexachlorocyclohexane, Alpha	P	0.05	CP											0.0092		
Hexachlorocyclohexane, Beta	P	0.05	CP											0.0163		
Hexachlorocyclohexane, Delta	P	0.05	CP													
Hexachlorocyclohexane, Technical	P		f											0.0123		
Hexachlorocyclohexane, Lindane	P	0.05	CP	4	0.2		0.2	4.0	4					0.0186		
Malathion	P															
Methoxychlor	P	0.5	CP	100	40		40	100	100	100						

Parameter	Type (5)	PQL MDL	Method (6)	Federal Standards (µg/L) SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit 40CFR264.94 (c)	State Standards (TBCs) CDH WQCC Groundwater Quality Standards (µg/L) (d): Statewide Tables A & B (d)	Site-Specific (g): Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides: Woman Creek	Table 6 Radionuclides: Walnut Creek
Mirex	P															
Parathion	P															
PCBs	P	0.5	CP		0.5		0		0.005 (7)					0.000079		
Simazine	P		e											4.0		
Toxaphene	P	1	CP		3		0	5.0	5	5						
Vaponite 2	P															
Aroclor 1016	PP	0.5	CP													
Aroclor 1221	PP	0.5	CP													
Aroclor 1232	PP	0.5	CP													
Aroclor 1242	PP	0.5	CP													
Aroclor 1248	PP	0.5	CP													
Aroclor 1254	PP	1	CP													
Aroclor 1260	PP	1	CP													
Atrazine	PP		e		3		3							3.0		
Americium (pCi/l)	R														0.05	0.05
Americium 241 (pCi/l)	R	0.01														
Cesium 134 (pCi/l)		1							80 (2)						80	80
Cesium 137 (pCi/l)	R	1														
Gross Alpha (pCi/l)	R	2		15						15					7	11
Gross Beta (pCi/l)	R	4		50 (4 mrem/ yr)						4 mrem/yr					5	19
Plutonium 238+239+240 (pCi/l)	R	0.01							15 (2)							

				Federal Standards (µg/L)					State Standards (TBCs) CDH WQCC Groundwater Quality Standards (µg/L) (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit 40CFR264.94 (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
Plutonium (pCi/l)															0.05	0.05
Radium 226+228 (pCi/l)	R	0.5/0.1 (4)		5					5 (2)							
Strontium 89+90 (pCi/l)	R	1														
Strontium 90 (pCi/l)	R			8 (3)					8 (2)						8	8
Thorium 230+232 (pCi/l)	R								60 (2)							
Tritium (pCi/l)	R			20,000 (3)					20,000 (2)						500	500
Uranium 233+234 (pCi/l)	R															
Uranium 235 (pCi/l)	R	0.6														
Uranium 238 (pCi/l)	R	0.6														
Uranium (total) (pCi/l)	R														5	10
1,2,4,5-Tetrachlorobenzene	SV		b						2 (7)							
1,2,4-Trichlorobenzene	SV	10	CS													
1,2-Dichlorobenzene (ortho)	SV	10	CS		600		600		620							
1,2-Diphenylhydrazine	SV		b						0.05 (7)							
1,3-Dichlorobenzene (meta)	SV	10	CS						620							
1,4-Dichlorobenzene (para)	SV	10	CS	75		75			75							
2,4,5-Trichlorophenol	SV	50	CS						700							
2,4,6-Trichlorophenol	SV	10	CS						2 (7)					1.2		
2,4-Dichlorophenol	SV	10	CS						21							
2,4-Dimethylphenol	SV	10	CS													
2,4-Dinitrophenol	SV	50	CS													

Parameter	Type (5)	PQL MDL	Method (6)	Federal Standards (µg/L): SDWA Maximum Contaminant Level (a)	Federal Standards (µg/L): SDWA Maximum Contaminant Level TBCs (b)	Federal Standards (µg/L): SDWA Maximum Contaminant Level Goal (a)	Federal Standards (µg/L): SDWA Maximum Contaminant Level Goal TBCs (b)	Federal Standards (µg/L): RCRA Subpart F Concentration Limit 40CFR264.94 (c)	State Standards (TBCs) CDH WQCC Groundwater Quality Standards (µg/L) (d): Statewide Tables A & B (d)	Site-Specific (g): Table 1 Human Health	Site-Specific (g): Table 2 Secondary Drinking	Site-Specific (g): Table 3 Agriculture	Site-Specific (g): Table 4 TDS	Site-Specific (g): Table 5 Chronic	Site-Specific (g): Table 6 Radionuclides Woman Creek	Site-Specific (g): Table 6 Radionuclides Walnut Creek
2,4-Dinitrotoluene	SV	10	CS													
2-Chloronaphthalene	SV	10	CS													
2-Chlorophenol	SV	10	CS													
2-Methylnaphthalene	SV	10	CS													
2-Methylphenol	SV	10	CS													
2-Nitroaniline	SV	50	CS													
2-Nitrophenol	SV	10	CS													
3,3-Dichlorobenzidine	SV	20	CS													
3-Nitroaniline	SV	50	CS													
4,6-Dinitro-2-methylphenol	SV	50	CS													
4-Bromophenyl Phenylether	SV	10	CS													
4-Chloroaniline	SV	10	CS													
4-Chlorophenyl Phenyl Ether	SV	10	CS													
4-Chloro-3-methylphenol	SV	10	CS													
4-Methylphenol	SV	10	CS													
4-Nitroaniline	SV	50	CS													
4-Nitrophenol	SV	50	CS													
Acenaphthene	SV	10	CS													
Anthracene	SV	10	CS													
Benzidine	SV		d						0.0002 (7)	0.1				0.00012		
Benzoic Acid	SV	50	CS													
Benzo(a)anthracene	SV	10	CS													
Benzo(a)pyrene	SV	10	CS													

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				Federal Standards (µg/L)					State Standards (TBCs) CDH WQCC Groundwater Quality Standards (µg/L) (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit 40CFR264.94 (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
Benzo(b)fluoranthene	SV	10	CS													
Benzo(g,h,i)perylene	SV	10	CS													
Benzo(k)fluoranthene	SV	10	CS													
Benzyl Alcohol	SV	10	CS													
bis(2-Chloroethoxy)methane	SV	10	CS													
bis(2-Chloroethyl)ether	SV	10	CS						0.03 (7)					0.0000037		
bis(2-Chloroisopropyl)ether	SV	10	CS													
bis(2-Ethylhexyl)phthalate	SV	10	CS													
Butadiene	SV															
Butylbenzylphthalate	SV	10	CS													
Chlorinated Ethers	SV															
Chlorinated Napthalenes	SV															
Chloroalkylethers	SV	10	CS													
Chlorophenol	SV									1						
Chrysene	SV	10	CS													
Dibenzofuran	SV	10	CS													
Dibenz(a,h)anthracene	SV	10	CS													
Dichlorobenzenes	SV															
Dichlorobenzidine	SV	20	CS											0.01		
Diethylphthalate	SV	10	CS													
Dimethylphthalate	SV	10	CS													
Dinitrotoluene	SV	10	CS													
Di-n-butylphthalate	SV	10	CS													

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - GROUNDWATER QUALITY STANDARDS (August 1, 1991)

				Federal Standards (µg/L)					State Standards (TBCs) CDH WQCC Groundwater Quality Standards (µg/L) (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit 40CFR264.94 (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
Di-n-octylphthalate	SV	10	CS													
Ethylene glycol	SV		d						7,000							
Fluoranthene	SV	10	CS													
Fluorene	SV	10	CS													
Formaldehyde	SV															
Haloethers	SV															
Hexachlorobenzene	SV	10	CS						0.02 (7)					0.00072		
Hexachlorobutadiene	SV	10	CS						14					0.45		
Hexachlorocyclopentadiene	SV	10	CS						49							
Hexachloroethane	SV	10	CS											1.9		
Hydrazine	SV															
Indeno(1,2,3-cd)pyrene	SV	10	CS													
Isophorone	SV	10	CS						1,050							
Naphthalene	SV	10	CS													
Nitrobenzene	SV	10	CS						3.5 (7)							
Nitrophenols	SV															
Nitrosamines	SV															
Nitrosodibutylamine	SV		b											0.0064		
Nitrosodiethylamine	SV		b											0.0008		
Nitrosodimethylamine	SV		b											0.0014		
Nitrosopyrrolidine	SV		b											0.016		
N-Nitrosodiphenylamine	SV	10	CSb											4.9		

				Federal Standards (µg/L)					State Standards (TBCs) CDH WQCC Groundwater Quality Standards (µg/L) (d)							
									Statewide	Site-Specific (g)						
															Table 6 Radionuclides	
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit 40CFR264.94 (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Woman Creek	Walnut Creek
N-Nitroso-di-n-dipropylamine	SV	10	CSb													
Pentachlorinated Ethanes	SV		b													
Pentachlorobenzene	SV		b						6 (7)							
Pentachlorophenol	SV	50	CS		1 (e)		0 (e)		200							
Phenanthrene	SV	10	CS													
Phenol	SV	10	CS							1						
Phthalate Esters	SV															
Polynuclear Aromatic Hydrocarbons	SV		b											0.0028		
Vinyl Chloride	SV	10	CV	2		0			2							
1,1,1-Trichloroethane	V	5	CV	200		200			200							
1,1,2,2-Tetrachloroethane	V	5	CV											0.17		
1,1,2-Trichloroethane	V	5	CV						28							
1,1-Dichloroethane	V	5	CV											0.6		
1,1-Dichloroethene	V	5	CV	7		7			7							
1,2-Dichloroethane	V	5	CV	5		0			5							
1,2-Dichloroethene (cis)	V		a		70		70		70							
1,2-Dichloroethene (total)	V	5	CV													
1,2-Dichloroethene (trans)	V		a		100		100		70							
1,2-Dichloropropane	V	5	CV		5		0		0.56 (7)							
1,3-Dichloropropene (cis)	V	5	CV													
1,3-Dichloropropene (trans)	V	5	CV													

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - GROUNDWATER QUALITY STANDARDS (August 1, 1991)

				Federal Standards (µg/L)					State Standards (TBCs) CDH WQCC Groundwater Quality Standards (µg/L) (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit 40CFR264.94 (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
2-Butanone	V	10	CV													
2-Hexanone	V	10	CV													
4-Methyl-2-pentanone	V	10	CV													
Acetone	V	10	CV													
Acrylonitrile	V		c											0.058		
Benzene	V	5	CV	5		0			5							
Bromodichloromethane	V	5	CV													
Bromoform	V	5	CV													
Bromomethane	V	10	CV													
Carbon Disulfide	V	5	CV													
Carbon Tetrachloride	V	5	CV	5		0			5							
Chlorinated Benzenes	V	10	CV/CS													
Chlorobenzene	V	5	CV/CS		100		100		300							
Chloroethane	V	10	CV													
Chloroform	V	5	CV	Tot THM <100**					Tot THM <100**					0.19		
Chloromethane	V	10	CV													
Dibromochloromethane	V	5	CV													
Dichloroethenes	V															
Ethyl Benzene	V	5	CV		700		700		680							
Ethylene dibromide	V		d		0.05		0		0.0004							
Ethylene Oxide	V															

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - GROUNDWATER QUALITY STANDARDS (August 1, 1991)

				Federal Standards (µg/L)					State Standards (TBCs) CDH WQCC Groundwater Quality Standards (µg/L) (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit 40CFR264.94 (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
Halomethanes	V			100					100					0.19		
Methylene Chloride	V	5	CV													
Pyrene	V	10	CS													
Styrene	V	5	CV		100		100									
Tetrachloroethanes	V	5	CV													
Tetrachloroethene	V	5	CV		5		0		10					0.8		
Toluene	V	5	CV		1,000		1,000		2,420							
Trichloroethanes	V	5	CV													
Trichloroethene	V	5	CV	5		0			5							
Vinyl Acetate	V	10	CV													
Xylenes (total)	V	5	CV		10,000		10,000									

EXPLANATION OF TABLE

* = secondary maximum contaminant level; TBCs
** = total trihalomethanes: chloroform, bromoform, bromodichloromethane, dibromochloromethane

CDH = Colorado Department of Health
CLP = Contract Laboratory Program
EPA = Environmental Protection Agency
MDL = Minimum Detection Limit for radionuclides (pCi/l)
mrem/yr = millirems per year
pCi/l = picocuries per liter
PCB = polychlorinated biphenyl
PQL = Practical Quantitation Limit
RCRA = Resource Conservation and Recovery Act
SDWA = Safe Drinking Water Act
TAL = Target Analyte List
TBCs = To Be Considereds
TDS = Total Dissolved Solids
THM = Total Trihalomethanes
TIC = Tentatively Identified Compound
µg/L = micrograms per liter
VOA = Volatile Organic Analysis
WQCC = Water Quality Control Commission

(1) TDS standard - see Table 4 in (d); standard is 400 mg/l or 1.25 times the background level, whichever is least restrictive.
(2) Radionuclide standards - see sec. 3.11.5(c)2 in (d).
(3) If both strontium-90 and tritium are present, the sum of their annual dose equivalents to bone marrow shall not exceed 4 mrem/yr.
(4) MDL for Radium 226 is 0.5; MDL for radium 228 is 1.
(5) Type abbreviations are: A=anion; B=bacteria; C=cation; I=indicator; FP=field parameter; M=metal; P=pesticide; PP=pesticide/PCB; R=radionuclide; SV=semivolatile; V=volatile.
(6) Method abbreviations are: CT=CLP-TAL; NC=non-CLP; CV=CLP-VOA; CS=CLP-SEMI; EP=EPA-PEST; CP=CLP-PEST; E=EPA; a=detected as total in CV; b=detected as TICs in CS; c=detected as TIC in CV; d=not routinely monitored; e=monitored in discharge ponds; f=mixture-individual isomers detected.
(7) Standard is below (more stringent than) PQL, therefore, PQL is standard.

(a) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR 141 and 40 CFR 143 (as of 5/1990).
(b) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141, 142, 143, Final Rule, Effective July 30, 1992 (56 Federal Register 3526; 1/30/1991).
(c) NCP, 40 CFR 300; NCP Preamble 55 FR 8764; CERCLA Compliance with Other Laws Manual, EPA/540/G-89/006, August 1988.
(d) CDH/Water Quality Control Commission, The Basic Standards for Ground Water, 3.11.0 (5 CCR 1002-8) 1/15/1987 amended 9/11/1990.
(e) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141, 142, 143, Final Rule, Effective January 1, 1993 (56 FR 30266; 7/1/1991).
(f) EPA Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper, 40 CFR 141 and 142 (56 FR 26460; 6/7/91) effective 11/6/91.
(g) CDH/Water Quality Control Commission, Classifications and Water Quality Standards for Ground Water, 3.12.0 (3/5/1991).

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Bicarbonate	A	10	E310.1								
Carbonate	A	10	E310.1								
Chloride	A	5	E325	250,000*				860,000	230,000		
Flouride	A	5	E340	4,000; 2,000*		4,000					4,000
N as Nitrate	A	5	E353.1	10,000			10,000			10,000	
N as Nitrate+Nitrite	A	5	E353.1		10,000		10,000				
N as Nitrite	A	5	E354.1		1,000		1,000				
Sulfate	A	5	E375.4	250,000*							
Sulfide	A										
Coliform (Fecal)	B	1	SM922 1C	1/100 ml							
Ammonia as N	C	5	E350					Criteria are pH and temperature dependent - see criteria document			
Dioxin	D		d					0.01	0.00001	0.000000013	0.000000014

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Sulfur	E	100,000	E600								
Dissolved Oxygen	FP	0.5	SM4500					5,000			
pH	FP	0.1	E150.1	6.5-8.5*					6.5-9		
Specific Conductance	FP	1	E120.1								
Temperature	FP							SS	SS		
Boron	I	5	E6010								
Total Dissolved Solids	I	10	E160.1	500,000*				SS	SS	250,000	
Aluminum	M	200	CT		50 to 200*						
Antimony	M	60	CT					9,000	1,600	146	45,000
Arsenic	M	10	CT	50						.0022	.0175
Arsenic III	M							360	190		
Arsenic V	M							850	48		
Barium	M	200	CT	1,000	2,000 (f)		2,000 (f)			1,000	
Beryllium	M	5	CT					130	5.3	.0068**	.117**
Cadmium	M	5	CT	10	5		5	3.9 (3)	1.1 (3)	10	

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Calcium	M	5,000	CT								
Cesium	M	1,000	NC								
Chromium	M	10	CT	50	100		100				
Chromium III	M	5	SW846 7196				1,700	210	170,000	3,433,000	
Chromium VI	M	10	E218.5					16	11	50	
Cobalt	M	50	CT								
Copper	M	25	CT	1,000*			1,3000 (f)	18 (3)	12 (3)		
Cyanide	M	10	CT					22	5.2	200	
Iron	M	100	CT	300*					1,000	300	
Lead	M	5	CT	50			0 (g)	82 (3)	3.2 (3)	50	
Lithium	M	100	NC								
Magnesium	M	5000	CT								
Manganese	M	15	CT	50*						50	100
Mercury	M	0.2	CT	2	2		2	2.4	0.012	0.144	0.146
Molybdenum	M	200	NC								

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Nickel	M	40	CT					1,400 (3)	160 (3)	13.4	100
Potassium	M	5000	CT								
Selenium	M	5	CT	10	50		50	20 (e)	5 (e)	10	
Silver	M	10	CT	50	100*			4.1 (3)	0.12	50	
Sodium	M	5000	CT								
Strontium	M	200	NC								
Thallium	M	10	CT					1,400 (1)	40 (1)	13	48
Tin	M	200	NC								
Titanium	M	10	E6010								
Tungsten	M	10	E6010								
Vanadium	M	50	CT								
Zinc	M	20	CT	5,000*				120 (3)	110 (3)		
2,4,5-TP Silvex	P		d	10	50		50				

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
2,4-Dichloro-phenoxyacetic acid (2,4-D)	P	d	100	70	70						
Aldicarb	P				3 (f)		1 (f)				
Aldrin	P	0.025	CP					3.0		0.000074	0.000079
Bromacil	P										
Carbofuran	P		d		40		40				
Chlordane (alpha)	P	0.5	CP		2		0	2.4	0.0043	0.00046	0.00048
Chlordane (gamma)	P	0.5	CP		2		0	2.4	0.0043	0.00046	0.00048
Cloranil	P										
DDT	P	0.1	CP					1.1	0.0011	0.000024	0.000024
DDT metabolite (DDD)	P	0.1	CP					0.06			
DDT metabolite (DDE)	P	0.1	CP					1,050			
Demeton	P								0.1		
Diazinon	P										

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Dieldrin	P	0.1	CP					2.5	0.0019	0.00007	0.000076
Endosulfan I	P	0.05	CP					0.22	0.056	74	159
Endosulfan II	P	0.1	CP								
Endosulfan Sulfate	P	0.1	CP								
Endrin	P	0.1	CP	0.2				0.18	0.0023	1	
Endrin Ketone	P	0.1	CP								
Guthion	P								0.01		
Heptachlor	P	0.05	CP		0.4		0	0.52	0.0038	0.00028	0.00029
Heptachlor Epoxide	P	0.05	CP		0.2		0				
Hexachlorocyclo-hexane, Alpha	P	0.05	CP							0.0092	0.031
Hexachlorocyclo-hexane, Beta	P	0.05	CP							0.0163	0.0547
Hexachlorocyclo-hexane, Delta	P	0.05	CP								
Hexachlorocyclo-hexane, Technical	P		f							0.0123	0.0414

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Hexachlorocyclo-hexane, (Lindane) Gama	P	0.05	CP	4	0.2		0.2	2.0	0.08		
Malathion	P								0.01		
Methoxychlor	P	0.5	CP	100	40		40		0.03	100	
Mirex	P								0.001		
Parathion	P							0.065	0.013		
PCBs	P	0.5	CP		0.5		0	2.0	0.014	0.000079	0.000079
Simazine	P		e								
Toxaphene	P	1	CP		3		0	0.73	0.0002	0.0071	0.00073
Vaponite 2	P										
Aroclor 1016	PP	0.5	CP								
Aroclor 1221	PP	0.5	CP								
Aroclor 1232	PP	0.5	CP								
Aroclor 1242	PP	0.5	CP								
Aroclor 1248	PP	0.5	CP								
Aroclor 1254	PP	1	CP								

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - FEDERAL SURFACE WATER QUALITY STANDARDS (August 1, 1991)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Aroclor 1260	PP	1	CP								
Atrazine	PP		e		3		3				
Americium (pCi/l)	R										
Americium 241 (pCi/l)	R	0.01									
Cesium 134 (pCi/l)	R	1									
Cesium 137 (pCi/l)	R	1									
Gross Alpha (pCi/l)	R	2		15							15
Gross Beta (pCi/l)	R	4		50 (4mrem/yr)							
Plutonium (pCi/l)	R										
Plutonium 238+239+240 (pCi/l)	R	0.01									
Radium 226+228 (pCi/l)	R	0.5/0.1 (4)		5							5
Strontium 89+90 (pCi/l)	R	1									

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - FEDERAL SURFACE WATER QUALITY STANDARDS (August 1, 1991)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Strontium 90 (pCi/l)	R			8 (6)							8
Thorium 230+232 (pCi/l)	R										
Tritium (pCi/l)	R			20,000 (6)							
Uranium 233+234 (pCi/l)	R										
Uranium 235 (pCi/l)	R	0.6									
Uranium 238 (pCi/l)	R	0.6									
Uranium (Total) (PCi/l)	R										
1,2,4,5-Tetrachloro-benzene	SV	b								38	48
1,2,4-Trichloro-benzene	SV	10	CS								
1,2-Dichlorobenzene (ortho)	SV	10	CS		600		600				
1,2-Diphenylhydrazine	SV		b					270 (1)			

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
1,3-Dichlorobenzene (meta)	SV	10	CS								
1,4-Dichlorobenzene (para)	SV	10	CS	75		75					
2,4,5-Trichlorophenol	SV	50	CS							2,800	
2,4,6-Trichlorophenol	SV	10	CS						970 (1)	1.2**	3.6**
2,4-Dichlorophenol	SV	10	CS					2,020 (1)	365 (1)	3,090	
2,4-Dimethylphenol	SV	10	CS					2,120 (1)			
2,4-Dinitrophenol	SV	50	CS								
2,4-Dinitrotoluene	SV	10	CS							0.11**	9.1**
2-Chloronaphthalene	SV	10	CS								
2-Chlorophenol	SV	10	CS					4,360 (1)	2,000 (1)		
2-Methylnaphthalene	SV	10	CS								
2-Methylphenol	SV	10	CS								
2-Nitroaniline	SV	50	CS								

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - FEDERAL SURFACE WATER QUALITY STANDARDS (August 1, 1991)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
2-Nitrophenol	SV	10	CS								
3,3-Dichlorobenzidine	SV	20	CS							0.01	0.02
3-Nitroaniline	SV	50	CS								
4,6-Dinitro-2-methylphenol	SV	50	CS								
4-Bromophenyl Phenylether	SV	10	CS								
4-Chloroaniline	SV	10	CS								
4-Chlorophenyl Phenyl Ether	SV	10	CS								
4-Chloro-3-methylphenol	SV	10	CS					30 (1)			
4-Methylphenol	SV	10	CS								
4-Nitrolaniline	SV	50	CS								
4-Nitrophenol	SV	50	CS					230 (1)	150 (1)		
Acenaphtene	SV	10	CS					1,700 (1)	520 (1)		
Anthracene	SV	10	CS								

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Benzidine	SV		d					2,500		0.00012	0.00053
Benzoic Acid	SV	50	CS								
Benzo(a)anthracene	SV	10	CS								
Benzo(a)pyrene	SV	10	CS								
Benzo(b)fluoranthene	SV	10	CS								
Benzo(g,h,i)perylene	SV	10	CS								
Benzo(k)fluoranthene	SV	10	CS								
Benzyl Alcohol	SV	10	CS								
bis(2-Chloroethoxy) methane	SV	10	CS								
bis(2-Chloroethyl) ether	SV	10	CS							0.03**	1.36**
bis(2-Chloroiso-propyl) ether	SV	10	CS							34.7	4,360
bis(2-Ethylhexyl) phthalate	SV	10	CS							15,000	50,000
Butadiene	SV										

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Butylbenzylphthalate	SV	10	CS								
Chloridated Ethes	SV										
Chlorinated Napthalenes	SV							1,600 (1)			
Chloroalkylethers	SV	10	CS					238,000 (1)			
Chlorophenol	SV										
Chrysene	SV	10	CS								
Dibenzofuran	SV	10	CS								
Dibenz(a,h)anthracen e	SV	10	CS								
Dichlorobenzenes	SV							1,120 (1)	763 (1)	400	2,600
Dichlorobenzidine	SV	20	CS							0.01	0.02
Diethylphthalate	SV	10	CS							350,000	1,800,000
Dimethylphtalate	SV	10	CS							313,000	2,900,000
Dinitrotoluene	SV	10	CS					330 (1)	230 (1)	70	14,300

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - FEDERAL SURFACE WATER QUALITY STANDARDS (August 1, 1991)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Di-n-butylphthalate	SV	10	CS								
Di-n-octylphthalate	SV	10	CS								
Ethylene glycol	SV		d								
Fluoranthene	SV	10	CS					3,980 (1)		42	54
Fluorene	SV	10	CS								
Formaldehyde	SV										
Haloethers	SV							380 91)	122 (1)		
Hexachlorobenzene	SV	10	CS							0.00072**	0.00074**
Hexachlorobutadiene	SV	10	CS					90 (1)	9.3 (1)	0.45**	50**
Hexachloro-cyclopentadiene	SV	10	CS					7 (1)	5.2 (1)	206	
Hexachloroethane	SV	10	CS					980 (1)	540 (1)	1.9	8.84
Hydrazine	SV										
Indeno (1,2,3-cd)-pyrene	SV	10	CS								

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - FEDERAL SURFACE WATER QUALITY STANDARDS (August 1, 1991)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Isophorone	SV	10	CS					117,000 (1)		5,200	520,000
Naphthalene								2,300 (1)	620 (1)		
Nitrobenzene	SV	10	CS					27,000 (1)		19,800	
Nitrophenols	SV	10	CS					230 (1)	150 (1)		
Nitrosamines	SV							5,850 (1)			
Nitrosodibutylamine	SV		b							0.0064	0.587
Nitrosodiethylamine	SV		b							0.0008	1.24
Nitrosodimethylamine	SV		b							0.0014	16
Nitrosopyrrolidine	SV		b							0.016	91.9
N-Nitrosodiphenylamine	SV	10	b							4.9**	16.1**
N-Nitroso-di-n -dipropylamine	SV	10	b								
Pentachlorinated Ethane	SV		b					7,240 (1)	1,100 (1)		

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Pentachlorobenzene	SV		b							74	85
Pentachlorophenol	SV	50	CS		1 (f)		0 (f)	20 (4)	13 (4)	1,010	
Phenanthrene	SV	10	CS								
Phenol	SV	10	CS					10,200 (1)	2,560 (1)	3,500	
Phthalate Esters	SV		e					940 (1)	3 (1)		
Polynuclear Aromatic Hydrocarbons	SV		b							0.0028**	0.0311**
Vinyl Chloride	SV	10	CV	2		0				2**	525**
1,1,1-Trichloroethane	V	5	CV	200		200				18,400	1,030,000
1,1,2,2-Tetrachloroethane	V	5	CV						2,400	0.17**	10.7**
1,1,2-Trichloroethane	V	5	CV						9,400	0.6**	41.8**
1,1-Dichlroethane	V	5	CV								
1,1-Dichlorethene	V	5	CV	7		7					
1,2-Dichloroethane	V	5	CV	5		0		118,000	20,000	0.94**	243**

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - FEDERAL SURFACE WATER QUALITY STANDARDS (August 1, 1991)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
1,2-Dichloroethene (cis)	V		a		70		70				
1,2-Dichlroethene (total)	V	5	CV								
1,2-Dichlroethene (trans)	V		a		100		100				
1,2-Dichloropropane	V	5	CV		5		0	23,000	5,700		
1,3-Dichlorpropene (cis)	V	5	CV					6,060	244 (1)	87	14,100
1,3-Dichloropropene (trans)	V	5	CV					6,060	244 (1)	87	14,100
2-Butanone	V	10	CV								
2-Hexanone	V	10	CV								
4-Methyl-2-pentanone	V	10	CV								
Acetone	V	10	CV								
Acrylonitrile	V		c					7,500	6,000	0.058	0.65
Benzene	V	5	CV	5		0		5,300		0.66**	40**

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - FEDERAL SURFACE WATER QUALITY STANDARDS (August 1, 1991)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (μg/L) (a)	SDWA Maximum Contaminant Level TBCs (μg/L) (b)	SDWA Maximum Contaminant Level Goal (μg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (μg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (μg/L) (c) Acute Value	CWA AWQC for Protection of Aquatic Life/TBCs (μg/L) (c) Chronic Value	CWA AWQC for Protection of Human Health/TBCs (μg/L) (c) Water & Fish Ingestion	CWA AWQC for Protection of Human Health/TBCs (μg/L) (c) Fish Consumption Only
Bromodichlorometha ne	V	5	CV								
Bromoform	V	5	CV								
Bromomethane	V	10	CV								
Carbon Disulfide	V	5	CV								
Carbon Tetrachloride	V	5	CV	5		0		35,200 (1)		0.4**	6.94**
Chlorinated Benzenes	V	10	CV/CS					250 (1)	50 (1)		
Chlorobenzene	V	5	CV/CS		100		100				
Chloroethane	V	10	CV								
Chloroform	V	5	CV	Tot THM<100 (2)				28,900 (1)	1,240 (4)	0.19**	15.7**
Chloromethane	V	10	CV								
Dibromochloro-methane	V	5	CV								
Dichloroethenes	V							11,600 (1)		0.033**	1.85**

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (μg/L) (a)	SDWA Maximum Contaminant Level TBCs (μg/L) (b)	SDWA Maximum Contaminant Level Goal (μg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (μg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (μg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (μg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Ethyl benzene	V	5	CV		700		700	32,000 (1)		1,400	3,280
Ethylene dibromide	V		d		0.05		0				
Ethylene oxide	V										
Halomethanes	V			100				11,000 (1)		0.19**	15.7**
Methlyene Chloride	V	5	CV								
Pyrene	V	10	CS								
Styrene	V	5	CV		100		100				
Tetrachloroethanes	V	5	CV					9,320 (1)			
Tetrachloroethene	V	5	CV		5		0	5,280 (1)	840 (1)	0.80**	8.85**
Toluene	V	5	CV		1,000		1,000	17,500 (1)		14,300	424,000
Trichloroethanes	V	5	CV					18,000 (1)			
Trichloroethene	V	5	CV	5		0		45,000 (1)	21,900 (1)	2.7**	80.7**

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - FEDERAL SURFACE WATER QUALITY STANDARDS (August 1, 1991)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (µg/L) (a)	SDWA Maximum Contaminant Level TBCs (µg/L) (b)	SDWA Maximum Contaminant Level Goal (µg/L) (a)	SDWA Maximum Contaminant Level Goal TBCs (µg/L) (b)	CWA AWQC for Protection of Aquatic Life/TBCs (µg/L) (c)		CWA AWQC for Protection of Human Health/TBCs (µg/L) (c)	
								Acute Value	Chronic Value	Water & Fish Ingestion	Fish Consumption Only
Vinyl Acetate	V	10	CV								
Xylenes (total)	V	5	CV		10,000		10,000				

EXPLANATION OF TABLE

* = secondary maximum contaminant level, TBCs
** = Human health criteria for carcinogens reported for three risk levels. Value presented is the 10-5 risk level.

AWQC = Ambient Water Quality Criteria
CLP = Contract Laboratory Program
CWA = Clean Water Act
EPA = Environmental Protection Agency
ml = milliliters
mrem/yr = millirems per year
pCi/l = picocuries per liter
PCB = polychlorinated biphenyl
PQL = Practical Quantitation Level
SDWA = Safe Drinking Water Act
SS = Species Specific
TAL = Target Analyte List
TBCs = To Be Considereds
THM = Total Trihalomethanes
TIC = Tentatively Identified Compound
MDL = Minimum Detection Limit for radionuclides (pCi/l)
μg/l = micrograms per liter
VOA = Volatile Organic Analysis

(1) criteria not developed; value presented to lowest observed effects level (LOEL)
(2) total trihalomethanes: chloroform, bromoform, bromodichloromethane, dibromochloromethane
(3) hardness dependent criteria
(4) pH dependent criteria (7.8 pH used)
(5) standard is not adequately protective when chloride is associated with potassium, calcium, or magnesium, rather than sodium
(6) if both strontium-90 and tritium are present, the sum of their annual dose equivalents to bone marrow shall not exceed 4 mrem/yr
(7) Type abbreviations are: A=anion; B=bacteria; C=cation; I=indicator; FP=field parameter; M=metal; P=Pesticide; PP=Pesticide/PCB; R=radionuclide; SV=semi-volatile; V=volatile
(8) method abbreviations are: CT=CLP-TAL; NC=non-CLP; CV=CLP-VOA; CS=CLP-SEMI; EP=EPA-PEST; CP=CLP-PEST; E=EPA; a = detected as total in CV; b = detected as TIC in CS; c = detected as TIC in CV; d = not routinely monitored; e = monitored in discharge ponds; f = mixture-individual isomers detected.

(a) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR 141 and 40 CFR 143 (as of May 1990)
(b) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141, 142, and 143, Final Rule, effective July 30, 1992
(c) EPA, Quality Criteria for Protection of Aquatic Life, 1986
(d) EPA, National Ambient Water Quality Criteria for Selenium - 1987
(e) EPA, National Ambient Water Quality Criteria for Chloride - 1988
(f) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141,142, and 143, Final Rule (56 FR 30266; 7/1/1991) effective 1/1/1993
(g) EPA Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper, 40 CFR 141, and 142 (56 FR 26460; 6/7/1991) effective 11/6/1991

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (AUGUST 1, 1991)

Parameter	Type (10)	PQL MDL	Method (11)	Statewide Standards (µg/L) (a): Tables A,B Carcinogens/ Noncarcinogens (2)	Statewide: Tables I, II, III (1): Table C Aquatic Life: Acute Value	Table C Aquatic Life: Chronic Value	Aquatic Life: Acute Value (2)	Aquatic Life: Chronic Value (2)	Agricultural Standard (5)	Domestic Water Supply (6)	Basin Standards (µg/L) (b): Organics (12): Aquatic Life	Organics (12): Water Supply	Segment 4 & 5 Stream Classification and Water Quality Standards (µg/L) (b)(7): Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radionuclide	Stream Segment Table (8): Acute Value	Stream Segment Table (8): Chronic Value	Table 2 Radionuclides: Woman Creek	Table 2 Radionuclides: Walnut Creek
Bicarbonate	A	10	E310.1																
Carbonate	A	10	E310.1																
Chloride	A	5	E325							250,000						5	5		
Fluoride	A	5	E340							2,000									
N as Nitrate	A	5	E353.1						100,000	10,000						10,000	10,000		
N as Nitrate+Nitrite	A	5	E353.1						100,000	10,000									
N as Nitrite	A	5	E354.1				SS	SS	10,000	1,000						1,000	1,000		
Sulfate	A	5	E375.4							250,000						250,000	250,000		
Sulfide	A							2		50									
Coliform (Fecal)	B	1	SM9221C							2000/ 100 ml									
Ammonia as N	C	5	E350				620	60		5,000						620	60		
Dioxin	D		d	0.00000022 (13)	0.01	0.00001							0.00000022 (13)	0.000000013			.000000013		
Sulfur	E	100,000	E600													2.0	2.0		
Dissolved Oxygen	FP	0.5	SM4500				5,000	5,000	3,000	3,000						5,000	5,000		
pH	FP	0.1	E150.1				6.5-9.0	6.5-9.0		5.0-9.0						6.5-9	6.5-9		
Specific Conductance	FP	1	E120.1																
Temperature	FP						30 deg.	30 deg.											
Boron	I	5	E6010						750							750	750		
Total Dissolved Solids	I	10	E160.1																
Aluminum	M	200	CT				950	150											
Antimony	M	60	CT																
Arsenic	M	10	CT				360	150	100	50						50			

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (AUGUST 1, 1991)

				Statewide Standards (µg/L) (a)							Basin Standards (µg/L) (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (µg/L) (b)(7)						
							Tables I, II, III (1)												
				Tables A,B Carcinogens/ Noncarcinogens (2)	Table C Aquatic Life		Aquatic Life		Agricultural Standard (3)	Domestic Water Supply (6)	Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radionuclide	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	PQL MDL	Method (11)		Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)			Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Arsenic III	M																		
Arsenic V	M																		
Barium	M	200	CT							1,000									
Beryllium	M	5	CT						100										
Cadmium	M	5	CT				TVS	TVS	10	10						TVS	TVS		
Calcium	M	5,000	CT																
Cesium	M	1,000	NC																
Chromium	M	10	CT																
Chromium III	M	5	SW8467196				TVS	TVS	100	50						50			
Chromium VI	M	10	E218.5				16	11	100	50						TVS	TVS		
Cobalt	M	50	CT																
Copper	M	25	CT				TVS	TVS	200							TVS	TVS		
Cyanide	M	10	CT				5	5	200	1,000						5	5		
Iron	M	100	CT					1,000		300 (dis)							300 (5)		
Lead	M	5	CT				TVS	TVS	100	50						TVS	TVS		
Lithium	M	100	NC																
Magnesium	M	5,000	CT																
Manganese	M	15	CT					1,000	200	50 (dis)							50 (5)		
Mercury	M	0.2	CT				2.4	0.1		2.0							0.01		
Molybdenum	M	200	NC																
Nickel	M	40	CT				TVS	TVS	200							TVS	TVS		
Potassium	M	5,000	CT																
Selenium	M	5	CT				135	17	20	10						10			
Silver	M	10	CT				TVS	TVS		50						TVS	TVS		
Sodium	M	5,000	CT																

Parameter	Type (10)	PQL MDL	Method (11)	Statewide Standards (µg/L) (a): Tables A,B Carcinogens/ Noncarcinogens (2)	Statewide: Table C Aquatic Life: Acute Value	Statewide: Table C Aquatic Life: Chronic Value	Statewide: Tables I, II, III (1): Aquatic Life: Acute Value (2)	Statewide: Tables I, II, III (1): Aquatic Life: Chronic Value (2)	Statewide: Tables I, II, III (1): Agricultural Standard (3)	Statewide: Tables I, II, III (1): Domestic Water Supply (6)	Basin Standards (µg/L) (b): Organics (12): Aquatic Life	Basin Standards (µg/L) (b): Organics (12): Water Supply	Segment 4 & 5 Stream Classification and Water Quality Standards (µg/L) (b)(7): Tables A,B (2)	Segment 4 & 5: Table C Fish & Water Ingestion	Segment 4 & 5: Table D Radionuclide	Segment 4 & 5: Stream Segment Table (8): Acute Value	Segment 4 & 5: Stream Segment Table (8): Chronic Value	Segment 4 & 5: Table 2 Radionuclides: Woman Creek	Segment 4 & 5: Table 2 Radionuclides: Walnut Creek
Strontium	M	200	NC																
Thallium	M	10	CT					15											
Tin	M	200	NC																
Titanium	M	10	E6010																
Tungsten	M	10	E6010																
Vanadium	M	50	CT																
Zinc	M	20	CT				TVS	TVS	2,000	5,000						TVS	TVS		
2,4,5-TP Silvex	P		d	10									10						
2,4-D	P		d	100								100	100						
Aldicarb	P			10									10						
Aldrin	P	0.05	CP	0.002 (13)	3						0.003		0.002 (13)	0.000074			0.000074		
Bromacil	P																		
Carbofuran	P		d	36									36						
Chloranil	P																		
Chlordane (alpha)	P	0.5	CP	0.03 (13)	2.4	0.0043							0.03 (13)	0.00046			0.00046		
Chlordane (gamma)	P	0.5	CP	0.03 (13)	2.4	0.0043							0.03 (13)	0.00046			0.00046		
DDT	P	0.1	CP	0.1 (13)	1.1	0.001					0.001		0.1 (13)	0.000024			0.000024		
DDT metabolite (DDD)	P	0.1	CP		0.6						0.001								
DDT metabolite (DDE)	P	0.1	CP		1,050						0.001								
Demeton	P					0.1					0.1								
Diazinon	P																		
Dieldrin	P	0.1	CP	0.002 (13)	2.5	0.0019					0.003		0.002 (13)	0.000071			0.000071		
Endosulfan I	P	0.05	CP		0.22	0.056					0.003								
Endosulfan II	P	0.1	CP																

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (AUGUST 1, 1991)

				Statewide Standards (µg/L) (a)							Basin Standards (µg/L) (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (µg/L) (b)(7)						
					Tables I, II, III (1)														
				Tables A,B Carcinogens/ Noncarcinogens (2)	Table C Aquatic Life		Aquatic Life		Agricultural Standard (3)	Domestic Water Supply (6)	Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radionuclide	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	PQL MDL	Method (11)		Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)			Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Endosulfan Sulfate	P	0.1	CP																
Endrin	P	0.1	CP	0.2	0.18	0.0023					0.004		0.2						
Endrin Ketone	P	0.1	CP																
Guthion	P					0.01					0.01								
Heptachlor	P	0.05	CP	0.008 (13)	0.52	0.0038					0.001	0.2	0.008 (13)	0.00028			0.00028		
Heptachlor epoxide	P	0.05	CP	0.004 (13)									0.004 (13)						
Hexachlorocyclohexane, Alpha	P	0.05	CP											0.0092			0.0092		
Hexachlorocyclohexane, Beta	P	0.05	CP											0.0163			0.0163		
Hexachlorocyclohexane, Delta	P	0.05	CP																
Hexachlorocyclohexane, Tech.	P		f											0.0123			0.0123		
Hexachlorocyclohexane, Lindane	P	0.05	CP	4	2.0	0.08					0.01	4.0	4	0.0186			0.0186		
Malathion	P					0.1					0.1								
Methoxychlor	P	0.5	CP	100		0.03					0.03	100	100						
Mirex	P					620					0.001								
Parathion	P					0.013					0.04								
PCBs	P	0.5	CP	0.005 (13)	2.0	0.014					0.001		0.005 (13)	0.000079			0.000079		
Simazine	P		e											4			4		
Toxaphene	P	1	CP	5	0.73	0.0002					0.005	5.0	5						
Vaponite 2	P																		
Aroclor 1016	PP	0.5	CP																
Aroclor 1221	PP	0.5	CP																
Aroclor 1232	PP	0.5	CP																
Aroclor 1242	PP	0.5	CP																

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (AUGUST 1, 1991)

Parameter	Type (10)	PQL MDL	Method (11)	Statewide Standards (µg/L) (a): Tables A,B Carcinogens/ Noncarcinogens (2)	Statewide: Table C Aquatic Life: Acute Value	Statewide: Table C Aquatic Life: Chronic Value	Statewide: Tables I, II, III (1): Aquatic Life: Acute Value (2)	Statewide: Tables I, II, III (1): Aquatic Life: Chronic Value (2)	Statewide: Tables I, II, III (1): Agricultural Standard (3)	Statewide: Tables I, II, III (1): Domestic Water Supply (6)	Basin Standards (µg/L) (b): Organics (12): Aquatic Life	Basin Standards (µg/L) (b): Organics (12): Water Supply	Segment 4 & 5 Stream Classification and Water Quality Standards (µg/L) (b)(7): Tables A,B (2)	Segment 4 & 5: Table C Fish & Water Ingestion	Segment 4 & 5: Table D Radionuclide	Segment 4 & 5: Stream Segment Table (8): Acute Value	Segment 4 & 5: Stream Segment Table (8): Chronic Value	Segment 4 & 5: Table 2 Radionuclides: Woman Creek	Segment 4 & 5: Table 2 Radionuclides: Walnut Creek
Aroclor 1248	PP	0.5	CP																
Aroclor 1254	PP	1	CP																
Aroclor 1260	PP	1	CP																
Atrazine	PP		e											3			3		
Americium (pCi/l)	R																	0.05	0.05
Americium 241 (pCi/l)	R	0.01													30				
Cesium 134 (pCi/l)	R	1		80 (6)									80		80			80	80
Cesium 137 (pCi/l)	R	1																	
Gross Alpha (pCi/l)	R	2																7	11
Gross Beta (pCi/l)	R	4																5	19
Plutonium (pCi/l)	R																	0.05	0.05
Plutonium 238+239+240 (pCi/l)	R	0.01		15 (6)											15				
Radium 226+228 (pCi/l)	R	0.5/0.1 (4)		5 (6)											5				
Strontium 89+90 (pCi/l)	R	1																	
Strontium 90 (pCi/l)	R			8 (6)											8			8	8
Thorium 230+232 (pCi/l)	R			60 (6)											60				
Tritium (pCi/l)	R			20,000 (6)											20,000			500	500
Uranium 233+234 (pCi/l)	R																		
Uranium 235 (pCi/l)	R	0.6																	
Uranium 238 (pCi/l)	R	0.6																	
Uranium (total) (pCi/l)	R						TVS	TVS							40			5	10
1,2,4,5-Tetrachlorobenzene	SV		b	2 (13)									2						

Parameter	Type (10)	PQL MDL	Method (11)	Statewide Standards (µg/L) (a): Tables A,B Carcinogens/ Noncarcinogens (2)	Statewide, Tables I, II, III (1): Table C Aquatic Life Acute Value	Table C Aquatic Life Chronic Value	Aquatic Life Acute Value (2)	Aquatic Life Chronic Value (2)	Agricultural Standard (3)	Domestic Water Supply (6)	Basin Standards (µg/L) (b) Organics (12): Aquatic Life	Organics (12): Water Supply	Segment 4 & 5 Stream Classification and Water Quality Standards (µg/L) (b)(7): Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radionuclide	Stream Segment Table (8) Acute Value	Stream Segment Table (8) Chronic Value	Table 2 Radionuclides Woman Creek	Table 2 Radionuclides Walnut Creek
1,2,4-Trichlorobenzene	SV	10	CS																
1,2-Dichlorobenzene (ortho)	SV	10	CS	620									620						
1,2-Diphenylhydrazine	SV		b	0.05 (13)									0.05 (13)						
1,3-Dichlorobenzene (meta)	SV	10	CS	620									620						
1,4-Dichlorobenzene (para)	SV	10	CS	75									75						
2,4,5-Trichlorophenol	SV	50	CS	700									700						
2,4,6-Trichlorophenol	SV	10	CS	2.0 (13)		970							2.0 (13)	1.2			1.2		
2,4-Dichlorophenol	SV	10	CS	21	2,020	365							21						
2,4-Dimethylphenol	SV	10	CS		2,120														
2,4-Dinitrophenol	SV	50	CS																
2,4-Dinitrotoluene	SV	10	CS																
2-Chloronaphthalene	SV	10	CS																
2-Chlorophenol	SV	10	CS		4,380	2,000													
2-Methylnaphthalene	SV	10	CS																
2-Methylphenol	SV	10	CS																
2-Nitroaniline	SV	50	CS																
2-Nitrophenol	SV	10	CS																
3,3-Dichlorobenzidine	SV	20	CS											0.01			0.01		
3-Nitroaniline	SV	50	CS																
4,6-Dinitro-2-methylphenol	SV	50	CS																
4-Bromophenyl Phenylether	SV	10	CS																
4-Chloroaniline	SV	10	CS																

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (AUGUST 1, 1991)

Parameter	Type (10)	PQL MDL	Method (11)	Statewide Standards (µg/L) (a): Tables A,B Carcinogens/ Noncarcinogens (2)	Statewide: Table C Aquatic Life: Acute Value	Statewide: Table C Aquatic Life: Chronic Value	Statewide: Tables I, II, III (1): Aquatic Life: Acute Value (2)	Statewide: Tables I, II, III (1): Aquatic Life: Chronic Value (2)	Statewide: Tables I, II, III (1): Agricultural Standard (3)	Statewide: Tables I, II, III (1): Domestic Water Supply (6)	Basin Standards (µg/L) (b): Organics (12): Aquatic Life	Basin Standards (µg/L) (b): Organics (12): Water Supply	Segment 4 & 5 Stream Classification and Water Quality Standards (µg/L) (b)(7): Tables A,B (2)	Segment 4 & 5: Table C Fish & Water Ingestion	Segment 4 & 5: Table D Radionuclide	Segment 4 & 5: Stream Segment Table (8): Acute Value	Segment 4 & 5: Stream Segment Table (8): Chronic Value	Segment 4 & 5: Table 2 Radionuclides: Woman Creek	Segment 4 & 5: Table 2 Radionuclides: Walnut Creek
4-Chlorophenyl Phenyl Ether	SV	10	CS																
4-Chloro-3-methylphenol	SV	10	CS		30														
4-Methylphenol	SV	10	CS																
4-Nitroaniline	SV	50	CS																
4-Nitrophenol	SV	50	CS																
Acenaphthene	SV	10	CS		1,700	520													
Anthracene	SV	10	CS																
Benzidine	SV		d	0.0002 (13)	2,500						0.1	0.01	0.0002 (13)	0.00012			0.00012		
Benzoic Acid	SV	50	CS																
Benzo(a)anthracene	SV	10	CS																
Benzo(a)pyrene	SV	10	CS																
Benzo(b)fluoranthene	SV	10	CS																
Benzo(g,h,i)perylene	SV	10	CS																
Benzo(k)fluoranthene	SV	10	CS																
Benzyl Alcohol	SV	10	CS																
bis(2-Chloroethoxy) methane	SV	10	CS																
bis(2-Chloroethyl)ether	SV	10	CS	0.03 (13)									0.03 (13)	0.0000037			0.0000037		
bis(2-Chloroisopropyl) ether	SV	10	CS																
bis(2-Ethylhexyl) phthalate	SV	10	CS																
Butadiene	SV																		
Butyl Benzylphthalate	SV	10	CS																
Chlorinated Ethers	SV																		
Chlorinated Napthalenes	SV																		

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (AUGUST 1, 1991)

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Chloroalkylethers	SV	10	CS																
Chlorophenol	SV										1.0	1.0							
Chrysene	SV	10	CS																
Dibenzofuran	SV	10	CS																
Dibenz(a,h)anthracene	SV	10	CS																
Dichlorobenzenes	SV																		
Dichlorobenzidine	SV	20	CS											0.01			0.01		
Diethylphthalate	SV	10	CS																
Dimethylphthalate	SV	10	CS																
Dinitrotoluene	SV	10	CS		330	230													
Di-n-butylphthalate	SV	10	CS																
Di-n-octylphthalate	SV	10	CS																
Ethylene glycol	SV		d																
Fluoranthene	SV	10	CS		3,980														
Fluorene	SV	10	CS																
Formaldehyde	SV																		
Haloethers	SV																		
Hexachlorobenzene	SV	10	CS	0.02 (13)									0.02 (13)	0.00072			0.00072		
Hexachlorobutadiene	SV	10	CS	14	90	9.3							14	0.45			0.45		
Hexachlorocyclopentadiene	SV	10	CS	49	7	5.2							49						
Hexachloroethane	SV	10	CS		980	540								1.9			1.9		
Hydrazine	SV																		
Indeno(1,2,3-cd)pyrene	SV	10	CS																
Isophorone	SV	10	CS	1,050	117,000								1,050						

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TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (AUGUST 1, 1991)

Parameter	Type (10)	PQL MDL	Method (11)	Statewide Standards (µg/L) (a): Tables A,B Carcinogens/ Noncarcinogens (2)	Statewide Standards: Tables I, II, III (1): Table C Aquatic Life: Acute Value	Table C Aquatic Life: Chronic Value	Aquatic Life: Acute Value (2)	Aquatic Life: Chronic Value (2)	Agricultural Standard (3)	Domestic Water Supply (6)	Basin Standards (µg/L) (b): Organics (12): Aquatic Life	Organics (12): Water Supply	Segment 4 & 5 Stream Classification and Water Quality Standards (µg/L) (b)(7): Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radionuclide	Stream Segment Table (8): Acute Value	Stream Segment Table (8): Chronic Value	Table 2 Radionuclides: Woman Creek	Table 2 Radionuclides: Walnut Creek
Naphthalene	SV	10	CS		2,300	620													
Nitrobenzene	SV	10	CS	3.5 (13)	27,000								3.5 (13)						
Nitrophenols	SV																		
Nitrosamines	SV																		
Nitrosodibutylamine	SV		b											0.0064			0.0064		
Nitrosodiethylamine	SV		b											0.0008			0.0008		
Nitrosodimethylamine	SV		b											0.0014			0.0014		
Nitrosopyrrolidine	SV		b											0.016			0.016		
N-Nitrosodiphenylamine	SV	10	CSb											4.9			4.9		
N-Nitroso-di-n-dipropylamine	SV	10	CSb																
Pentachlorinated Ethanes	SV		b																
Pentachlorobenzene	SV		b	6 (13)									6 (13)						
Pentachlorophenol	SV	50	CS	200	9	5.7							200						
Phenanthrene	SV	10	CS																
Phenol	SV	10	CS		10,200	2,560					500	1.0							
Phthalate Esters	SV		e																
Polynuclear Aromatic Hydrocarbons	SV		b											0.0028			0.0028		
Vinyl Chloride	SV	10	CV	2									2						
1,1,1-Trichloroethane	V	5	CV	200									200						
1,1,2,2-Tetrachloroethane	V	5	CV			2,400								0.17			0.17		
1,1,2-Trichloroethane	V	5	CV	28		9,400							28	0.60			0.60		
1,1-Dichloroethane	V	5	CV																
1,1-Dichloroethene	V	5	CV	7									7						

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (AUGUST 1, 1991)

Parameter	Type (10)	PQL MDL	Method (11)	Statewide Standards (µg/L) (a): Tables A,B Carcinogens/ Noncarcinogens (2)	Statewide Standards (µg/L) (a): Table C Aquatic Life: Acute Value	Statewide Standards (µg/L) (a): Table C Aquatic Life: Chronic Value	Statewide Standards (µg/L) (a): Tables I, II, III (1): Aquatic Life: Acute Value (2)	Statewide Standards (µg/L) (a): Tables I, II, III (1): Aquatic Life: Chronic Value (2)	Statewide Standards (µg/L) (a): Tables I, II, III (1): Agricultural Standard (3)	Statewide Standards (µg/L) (a): Tables I, II, III (1): Domestic Water Supply (6)	Basin Standards (µg/L) (b): Organics (12): Aquatic Life	Basin Standards (µg/L) (b): Organics (12): Water Supply	Segment 4 & 5 Stream Classification and Water Quality Standards (µg/L) (b)(7): Tables A,B (2)	Segment 4 & 5: Table C Fish & Water Ingestion	Segment 4 & 5: Table D Radionuclide	Segment 4 & 5: Stream Segment Table (8): Acute Value	Segment 4 & 5: Stream Segment Table (8): Chronic Value	Segment 4 & 5: Table 2 Radionuclides: Woman Creek	Segment 4 & 5: Table 2 Radionuclides: Walnut Creek
1,2-Dichloroethane	V	5	CV	5	118,000	20,000							5						
1,2-Dichloroethene (cis)	V		a	70									70						
1,2-Dichloroethene (total)	V	5	CV																
1,2-Dichloroethene (trans)	V		a	70									70						
1,2-Dichloropropane	V	5	CV	0.56 (13)	23,000	5,700							0.56 (13)						
1,3-Dichloropropene (cis)	V	5	CV		6,060	244													
1,3-Dichloropropene (trans)	V	5	CV		6,060	244													
2-Butanone	V	10	CV																
2-Hexanone	V	10	CV																
4-Methyl-2-pentanone	V	10	CV																
Acetone	V	10	CV																
Acrylonitrile	V		c		7,550	2,600								0.058			0.058		
Benzene	V	5	CV	5	5,300								5						
Bromodichloromethane	V	5	CV																
Bromoform	V	5	CV																
Bromomethane	V	10	CV																
Carbon Disulfide	V	5	CV																
Carbon Tetrachloride	V	5	CV	5	35,200								5						
Chlorinated Benzenes	V	10	CV/CS																
Chlorobenzene	V	5	CV/CS	300									300						
Chloroethane	V	10	CV																
Chloroform	V	5	CV	Tot THM <100 (4)	28,900	1,240							Tot THM <100 (4)	0.19			0.19		
Chloromethane	V	10	CV																

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs - STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (AUGUST 1, 1991)

Parameter	Type (10)	PQL MDL	Method (11)	Statewide Standards (µg/L) (a): Tables A,B Carcinogens/ Noncarcinogens (2)	Statewide: Table C Aquatic Life: Acute Value	Statewide: Table C Aquatic Life: Chronic Value	Statewide: Tables I, II, III (1): Aquatic Life: Acute Value (2)	Statewide: Tables I, II, III (1): Aquatic Life: Chronic Value (2)	Statewide: Tables I, II, III (1): Agricultural Standard (5)	Statewide: Tables I, II, III (1): Domestic Water Supply (6)	Basin Standards (µg/L) (b): Organics (12): Aquatic Life	Basin Standards (µg/L) (b): Organics (12): Water Supply	Segment 4 & 5 Stream Classification and Water Quality Standards (µg/L) (b)(7): Tables A,B (2)	Segment 4 & 5: Table C Fish & Water Ingestion	Segment 4 & 5: Table D Radionuclide	Segment 4 & 5: Stream Segment Table (8): Acute Value	Segment 4 & 5: Stream Segment Table (8): Chronic Value	Segment 4 & 5: Table 2 Radionuclides: Woman Creek	Segment 4 & 5: Table 2 Radionuclides: Walnut Creek
Dibromochloromethane	V	5	CV																
Dichloroethenes	V																		
Ethyl benzene	V	5	CV	680	32,000								680						
Ethylene dibromide	V		d																
Ethylene oxide	V																		
Halomethanes	V			100									100	0.19			0.19		
Methylene Chloride	V	5	CV																
Pyrene	V	10	CS																
Styrene	V	5	CV																
Tetrachloroethanes	V	5	CV											0.8			0.8		
Tetrachloroethene	V	5	CV	10	5,280	840							10						
Toluene	V	5	CV	2,420	17,500								2,420						
Trichloroethanes	V	5	CV																
Trichloroethene	V	5	CV	5	45,000	21,900							5						
Vinyl Acetate	V	10	CV																
Xylenes (total)	V	5	CV																

EXPLANATION OF TABLE

CLP =Contract Laboratory Program
CDH =Colorado Department of Health
dis =dissolved
EPA =Environmental Protection Agency
ml =milliliter
pCi/l =picocuries per liter
PCB =polychlorinated biphenyl
PQL =Practical Quantitation Level
ss =species specific
TAL =Target Analyte List
THM =Total Trihalomethanes
TIC =Tentatively Identified Compound
TVS =Table Value Standard (hardness dependent), see Table III in (a)
MDL =Minimum Detection Limit for radionuclides (pCi/l)
µg/l =micrograms per liter
VOA =Volatile Organic Analysis
WQCC =Water Quality Control Commission

(1) Table I = physical and biological parameters
Table II = inorganic parameters
Table III = metal parameters
Values in Tables I, II, and III for recreational uses; cold water biota and domestic water supply are not included.
(2) In the absence of specific, numeric standards for non-naturally occurring organics, the narrative standard is interpreted as zero with enforcement based on practical quantification levels (PQLs) as defined by CDH/WQCC or EPA.
(3) All are 30-day standards except for nitrate+nitrite.
(4) Total trihalomethanes: chloroform, bromoform, bromodichloromethane, dibromochloromethane.
(5) Lowest value given: dissolved or total recoverable
(6) Ammonia, sulfide, chloride, sulfate, copper, iron, manganese, and zinc are 30-day standards, all others are 1-day standards.
(7) Segment 4 standards for inorganics and metals are ARARs, organics and radionuclides are TBC and Segment 5 standards are goals (TBCs).
(8) Includes Table 1: Additional Organic Chemical Standards (chronic only).
(9) See Section 3.1.11(f)(2) in (a).
(10) Type abbreviations are: A=anion; B=bacteria; C=cation; I=indicator; FP=field parameter; M=metal; P=pesticide; PP=pesticide/PCB; R=radionuclide; SV=semivolatile; V=volatile.
(11) Method abbreviations are: CT=CLP-TAL; NC=non-CLP; CV=CLP=VOA; CS=CLP=SEMI; EP=EPA-PEST; CP=CLP-PEST; E=EPA; a=detected as total in CV; b=detected as TICs in CS; c=detected as TIC in CV; d=not routinely monitored; e=monitored in discharge ponds; f=mixture-individual isomers detected.
(12)See Section 3.8.5(2)(a) in (b)
(13)Standard is below (more stringent than) PQL, therefore, PQL is standard.
(a) CDH/WQCC, Colorado Water Quality Standards 3.1.0 (5 CCR 1002-8) 1/15/1974; amended 9/30/1989 (Environmental Reporter 726:1001-1020:6/1990).
(b) CDH/WQCC, Classifications and Numeric Standards for S. Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin 3.8.0 (5 CCR 1002-8) 4/6/1981; amended 2/15/1990.

4.0 DATA NEEDS AND DATA QUALITY OBJECTIVES

As required by the IAG to meet CERCLA and RCRA requirements, data are necessary to characterize the sources/soils contamination, support risk assessment, and determine the nature and extent of contamination. This data will also support the evaluation of the need for corrective/remedial action in the BRAP and the development and evaluation of remedial alternatives. Data requirements for this work plan are presented below and derived from guidance documents previously cited.

In accordance with the IAG, The RFI/RI for OU10 has been divided into two phases. The objectives of Phase I of the RFI/RI are to characterize the sources/soils of each OU10 IHSS and to provide information necessary to determine the risk associated with the source of contamination at each OU10 IHSS. The objective of Phase II of the RFI/RI is to evaluate the impact of each OU10 IHSS on surface water, ground water, air, the environment, and biota. This work plan defines the DQOs, FSP, and BRAP for the Phase I program only.

DQOs are established to ensure that the data collected are sufficient and of adequate quality for their intended uses (EPA, 1987). DQOs were established for the OU10 Phase I RFI/RI in accordance with Appendix A of the Rocky Flats Plant Site-Wide Quality Assurance Project Plan (EG&G, 1991). The DQO process is divided into three stages: Stage 1 identifies decision types, Stage 2 identifies data uses/needs, and Stage 3 is the design of a data collection program.

Through application of the DQO process, site-specific goals were established for the Phase I RFI/RI and data needs were identified for achieving those goals. This section explains the DQO process specific to the Phase I RFI/RI for OU10.

4.1 STAGE 1 - IDENTIFY DECISION TYPES

The major elements of Stage 1 include identifying and involving data users, evaluating available data, developing a conceptual model, and specifying objectives and decisions. The following sections address each of these elements.

4.1.1 Identify and Involve Data Users

Data users are divided into three groups: decision makers, program management staff, and technical personnel. The principal decision makers for OU10 are federal officials responsible for RFP operations and the federal and state regulatory officials responsible for environmental protection. These include the DOE Office of Environmental Restoration and Waste Management, DOE Rocky Flats Office, EPA Region VIII, and CDH. The program management staff are the prime EG&G contractor personnel responsible for ER Program activities, which includes the EG&G Rocky Flats Plant Environmental Management Department. Technical personnel include EG&G RFP technical specialists and subcontractors responsible for supervising, coordinating, and performing ER Program activities.

The data users are brought into the RFI/RI process during planning stages to help define data quality requirements. The work plan is reviewed by the data users and their comments are incorporated in the work plan structure.

4.1.2 Evaluate Available Data

Section 2.0 describes the historical and current conditions of the IHSSs and associated areas within OU10. The following is a brief discussion of the completeness and usability of existing information, based on the data presented in Section 2.0.

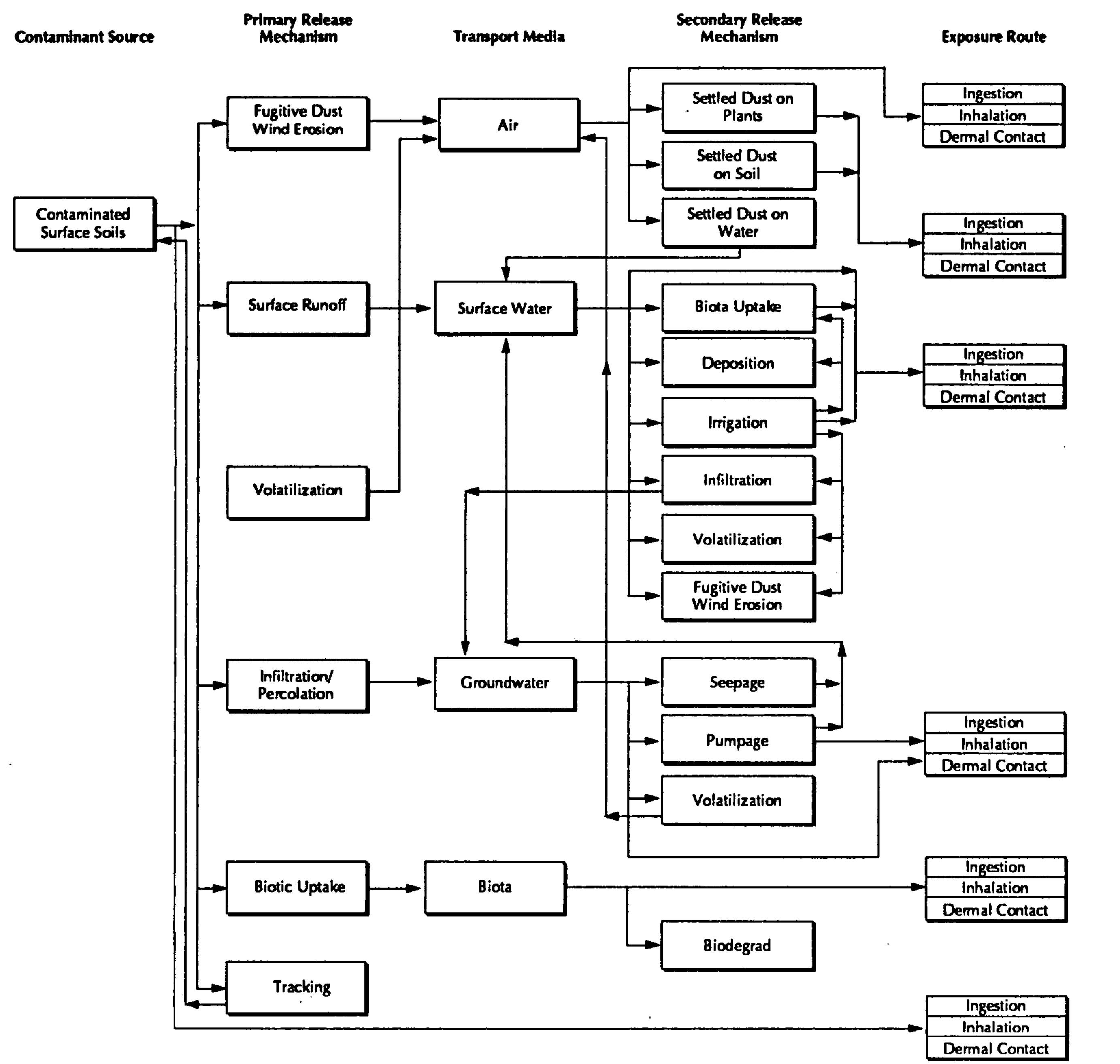
Limited analytical data are available for waste and soil samples collected from IHSSs 129, 174, 175, 176, 177, 182, 213, and 214. Section 2.0 and Appendix A present these data. The soil data were collected in late 1988 and have not been validated. Therefore, these data cannot be used for quantitative analysis, but can be used in a qualitative manner for the design of the field investigation program.

Section 2.0 and Appendix A also present validated groundwater data available for wells in the vicinity of OU10 IHSSs. The groundwater data are of sufficient quality to be used in a qualitative manner to design the field investigation program and for use in the RFI report and the baseline risk assessment.

The available data are insufficient in quantity or quality to identify the characteristics of potential soils contamination at the OU10 IHSSs. The data were useful for identifying potential contaminants that may be found at the site and were used to determine the field sampling analyte lists (Section 7.5).

4.1.3 Develop Conceptual Model

Conceptual models for each OU10 IHSS were developed based on available data (Section 2.2). Figure 4.1-1 is a diagram showing the general risk assessment conceptual model that is applicable to OU10. The models include descriptions of potential sources, release mechanisms, contaminant



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Rocky Flats Plant, Golden, Colorado

Figure 4.1-1

RISK ASSESSMENT CONCEPTUAL MODEL

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migration pathways, receptors, and exposure routes. These preliminary models are very generic at this time because site-specific contaminant and physical data are lacking. However, these conceptual models were used to develop the FSP (Section 7.0) and they will be reevaluated after the field data are collected and analyzed.

4.1.4 Specify Phase I RFI/RI Objectives

As stated in the IAG, the primary objectives of the Phase I RFI/RI are to characterize the sources/soils of each OU IHSS and to provide information necessary to determine the risk associated with the source of contamination at each OU IHSS. From the information generated by the RFI/RI, decisions can be made as to whether remediation is necessary and which remedial alternatives would be appropriate. In accordance with the IAG, the specific objectives of the Phase I RFI/RI field investigation for OU10 are:

Characterize Sources/Soils

The intent of the field sampling program to be performed during the Phase I RFI/RI is to determine the physical characteristics of the soils and determine the nature and the horizontal and vertical extent of existing soil contamination at each OU10 IHSS. The objective of the proposed investigation is to provide data from which informed decisions can be made regarding the risk presented by the site and the appropriate remedial responses. Therefore, an analytical level is required that yields data of sufficient quality for the baseline risk assessment, subsequent analysis, and determination of remedial alternatives. Objectives will be met by implementation of and adherence to GRRASP protocols for sample analysis and RFP Environmental Management Department Operating Procedures (EMD OPS) for sample collection.

IHSS-specifi surface and subsurface physical soil data, including stratigraphy, porosity, total organic carbon content, and permeability are needed to characterize the site in terms of potential contaminant migration pathways.

Determine Risks Associated with Contamination

To meet the objectives of the baseline risk assessment, specific data need to be obtained to accomplish the five tasks of the assessment (contaminant identification, exposure assessment, toxicity assessment, risk characterization, and uncertainty analysis).

These tasks will rely on data collected under a sampling plan that is sufficient to determine all contaminants present and the concentrations at which they occur. Contamination within different environmental media must be sufficient to characterize the lateral and vertical extent of contamination and be representative of sampled areas. Background or control data must also be collected at uncontaminated areas to establish baseline conditions to determine the degree to which contamination may affect receptors.

This specifically requires an inventory of contaminants detected and associated concentrations and presentation of the spatial distribution of contaminants in the lateral and vertical extent. In addition, data pertaining to physical characteristics of topography, soil, aquifers, and weather patterns need to be collected both to determine potential migration pathways and to conduct computer modeling studies. Characteristics and locations of possible human populations and biological populations must be determined.

Since the IAG stipulates that the Phase I RFI/RI is to characterize sources/soils only, assessing risk will be limited to only a few pathways and for the most part will exclude surface water and ground water transport.

Recent toxicity information on all identified contaminants must also be collected to evaluate and determine potential risks to the identified receptors.

Support Selection of Remedial Action Alternatives

Data requirements for the evaluation of remedial action alternatives include an identification of the nature of contamination at sites of concern. In addition, the volumes and areas of contaminated media must be determined. This work plan addresses the sampling required to characterize contaminated soil at OU10. Other supportive studies for alternative selection include treatability studies and geological characterization. Generally, remedial alternatives for soils at OU10 fall into one of four classes: removal and treatment, insitu treatment, containment, and no action.

Table 4-1 summarizes the specific data quality objectives and data needs.

4.2 STAGE 2 - IDENTIFY DATA USES/NEEDS

The major objectives of Stage 2 are the following:

- Identify data uses
- Identify data types
- Identify data quality needs
- Identify data quantity needs

Specific Objective (Data Need)	Data Type	Sampling/Analysis Activity	Analytical Level	Data Use
Determine site-specific transport characteristics of the vadose zone materials	Soil physical parameters	Drill borings and collect samples for moisture content, sieve analysis, determination of porosity, permeameter tests, and analysis of total organic carbon content	I	• Source/Soil Characterization • Baseline Risk Assessment • Evaluation of Remedial Alternatives
Characterize subsurface stratigraphy and depth to groundwater	Geologic parameters	Drill borings and log subsurface geology	I	• Source/Soil Characterization • Baseline Risk Assessment • Evaluation of Remedial Alternatives
Characterize groundwater flow regime around each Individual Hazardous Substance Site (IHSS)	Water level data	• Obtain quarterly water level measurements form existing monitoring wells around each IHSS • Install monitoring wells at each IHSS where wells are absent	I I	• Source/Soil Characterization • Baseline Risk Assessment • Evaluation of Remedial Alternatives
Characterize movement of water in the unsaturated zone	Soil moisture levels	• Install tensiometers at selected IHSSs	I	• Source/Soil Characterization • Baseline Risk Assessment • Evaluation of Remedial Alternatives

Specific Objective (Data Need)	Data Type	Sampling/Analysis Activity	Analytical Level	Data Use
Characterize presence or absence of soil contamination at each IHSS	Soil chemical data	• Conduct radiological (FIDLER) surveys	I	• Source/Soil Characterization • Baseline Risk Assessment • Environmental Evaluation • Evaluation of Remedial Alternatives
		• Conduct soil gas surveys at appropriate IHSSs; analyze vapor samples for volatile organic compounds (VOCs)	II	
		• Collect surficial soil samples; analyze for parameters appropriate for each IHSS	IV (V for radiological analysis)	
		• Collect soil core samples along depth profiles; analyze for parameters appropriate for each IHSS	IV (V for radiological analysis)	
Characterize presence or absence of sediment contamination at appropriate IHSSs	Sediment chemical data	Collect sediment samples from drainages downgradient of selected IHSSs	IV (V for radiological analysis)	• Source/Soil Characterization • Baseline Risk Assessment • Environmental Evaluation • Evaluation of Remedial Alternatives

- Evaluate sampling/analysis options

- Review precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters.

The following sections discuss each of these elements.

4.2.1 Identify Data Uses

Data collected by the Phase I RFI/RI will be used to characterize the source/soils, and support the baseline risk assessment and environmental evaluation, and to evaluate remedial alternatives. Samples will be collected to determine the extent and type of soils contamination present at each IHSS. Data will also be collected to determine the physical characteristics of the soils and vadose zone material for use in contaminant transport and pathways analysis.

Data collected for the OU10 Phase I RFI/RI will be used in the development of contaminant transport conceptual and computer models for the risk assessment. Conceptual and computer models that may be developed for the OU10 IHSSs include air and vadose zone transport models. If needed, surface water and groundwater models may also be developed during the OU10 Phase II RFI/RI.

As this is a Phase I RFI/RI, characterization of each IHSS is limited to the surface of the site and the vadose zone (Table 4-1). Some groundwater data will be collected to provide input to the baseline risk assessment and for the planning of Phase II.

4.2.2 Identify Data Types

Data types will consist of field survey and laboratory analytical results of samples for each RFI/RI objective (Table 4-1). The media that will be sampled during the Phase I RFI/RI include terrestrial, aquatic, and physical media. The terrestrial and aquatic media will include vegetation, invertebrates, and vertebrates. Section 9.0 describes the sampling of these media. The physical media include soils, sediments, soil gas, surface water, asphalt/concrete, and groundwater. Additionally, radiation surveys will be performed at certain IHSSs.

Risk assessment modeling requires additional data types. Data necessary for air dispersion modeling generally includes relative wind direction and frequency, atmospheric stability and wind speeds, ambient concentrations of airborne particulates, soil adsorption coefficients, solubility, particle size, and precipitation. Most of these parameters will be determined from RFP-wide atmospheric studies or from literature values. The OU10 Phase I field program will collect data pertaining to particle size of the surficial soils.

Risk assessment vadose zone modeling and alternatives analyses will generally need data to determine vadose zone physical characteristics as well as chemical characteristics. Data necessary for these analyses generally includes infiltration rates, soil porosity, unsaturated hydraulic conductivity, bulk density, soil moisture content, soil pH, and total organic carbon content (TOC).

4.2.3 Identify Data Quality Needs

Tables 4-1 and 4-2 list the analytical levels appropriate to intended data uses. The five levels of data quality as presented in EPA's Data Quality Objectives for Remedial Response Activities Development Process (EPA, 1987) are as follows:

Table 4-2 Appropriate Analytical Levels by Data Use

Analytical Level	Data Use			
	Site Characterization	Risk Assessment	Enviromental Evaluation	Evaluation of Alternatives
I	X			X
II	X			X
III				
IV	X	X	X	X
V	X	X	X	X
Other				

- Screening (DQO Level I) provides the lowest data quality but the most rapid results, and is used for purposes of site health and safety monitoring, preliminary comparison to ARARs, and initial site characterization to define areas for further study. The data generated provides presence/absence of certain constituents and is generally qualitative rather than quantitative.

- Field Analysis (DQO Level II) provides less rapid results but better data quality. Analysis includes some mobile laboratory-generated data and data generated by use of field analytical instruments. The data may be qualitative or quantitative.

- Engineering (DQO Level III) provides an intermediate level of data quality and may be used for site characterization or risk assessment. Engineering analysis includes mobile laboratory-generated data and standard commercial laboratory analyses without full CLP documentation. These data are both qualitative and quantitative. If analysis are conducted in support of treatability models, it will be performed to Level III.

- Confirmational (DQO Level IV) provides the highest level of data quality and is used for purposes of risk assessment, engineering design, and cost recovery documentation. Confirmation analyses require full CLP analytical and data validation procedures.

- Nonstandard (DQO Level V) refers to analysis by nonstandard procedures, for example, exacting detection limits, or analyses of an unusual chemical compound. These analyses often require method development or adoption. The data validation procedures of Level IV can be applied to Level V, if required.

Data quality for the Phase I RFI/RI will be achieved by adhering to the data collection protocols provided in agency-approved EMD OPS (Volumes I through VI).

4.2.4 Identify Data Quantity Needs

Data quantity needs are based on an evaluation of available data for characterizing the source/soils of OU10 and for providing input to the risk assessment and assessment of remedial alternatives. This is consistent with guidance provided in Data Quality Objectives for Remedial Response Activities (EPA, 1987) and Guidance for Data Useability in Risk Assessment (EPA, 1990). Data presently available is insufficient to meet the objectives defined by the IAG; therefore, the collection of additional data is warranted. The rationale for sampling quantities is described in the FSP (Section 7.0).

To ensure that a sufficient amount of valid data are generated, the FSP was designed to include a rationale for all field activities and a phased approach using surficial soil sampling and screening-level techniques to identify critical sampling sites. Section 7.0 further discusses these components of the FSP.

4.2.5 Evaluate Sampling/Analysis Options

The Phase I RFI/RI for OU10 will consist of a phased approach in which field screening and surficial soil sampling techniques are used to direct subsurface data collection activities. This approach maximizes collection of useful data because surficial soil sampling and field screening techniques are used to properly locate and minimize borehole drilling. Additionally, this approach minimizes the volume of generated hazardous waste material that requires special management, the potential exposure of field personnel to hazardous waste material, and the overall time to perform the field activities.

Five types of activities will be performed during the Phase I field program: (1) installation and sampling of monitoring wells; (2) surficial soil sampling and screening activities; (3) borehole drilling and subsurface soil sampling; (4) borehole drilling and groundwater grab sampling; and (5) installation of tensiometers and lysimeters. Section 7.0 describes in detail the field activities.

Section 7.5 of this work plan discusses the analytical program requirements for OU10. Appendix B of the QAPjP (EG&G, 1991) provides a listing of the CLP analytes and detection/quantification limits for Target Compound List (TCL) volatile and semivolatile organics, Target Analyte List (TAL) metals, radionuclides, pesticides/PCBs, inorganic parameters, and other surficial soil sampling parameters. These analytical methods are appropriate for meeting the data quality requirements for analytical Levels I through V during the Phase I RFI/RI.

4.2.6 Review of PARCC Parameter Information

The PARCC parameters (precision, accuracy, representativeness, comparability, and completeness) are indicators of data quality. The end use of the measurement data should define the necessary objectives for the PARCC parameters. The PARCC goals are specified in the Quality Assurance Addendum (QAA) (Section 10.0) of this work plan. The PARCC parameters are discussed below. Analyte-specific precision and accuracy objectives are also listed in the QAPjP Appendix B.

Precision measures the reproducibility or degree of agreement among replicate measurements under a given set of conditions. The closer the numerical values of the measurements are to each other, the more precise the measurements. During the OU10 Phase I RFI/RI, collection of data using field instrumentation such as water level meters, pH meters, and conductivity meters will be checked by reporting at least three measurements taken at one location and comparing the results. Field analysis instruments such as a field gas chromatograph (GC) will be checked by the analysis of replicate samples. Sample collection precision will be measured in the laboratory with analysis of field replicates and laboratory duplicates.

Accuracy measures the bias in a measurement system. Sources of error include the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and sample analysis techniques. Sampling accuracy of the OU10 Phase I RFI/RI will be assessed by evaluating the results of field rinse and trip blanks. The accuracy of the laboratory analysis will be determined from the results of matrix spike recovery.

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Given the lack of previous usable data from the OU10 IHSSs, designing a representative sampling program is difficult in Phase I. However, representativeness can be assured for the OU10 Phase I RFI/RI by the use of proper sampling techniques. Section 7.7 describes the sampling rationale and techniques. Representativeness will also be assessed by the collection and analysis of field duplicate samples.

Completeness is defined as the percentage of measurements made that are judged to be valid. The target completeness objective for the OU10 field and analytical data is 100 percent; 90 percent will be the minimum acceptable level. To ensure that a sufficient amount of valid data are generated, the FSP was designed to include a rationale for all field activities and a phased approach using screening level techniques to identify and locate critical sampling sites. Section 7.0 further discusses these components of the FSP.

Comparability is a qualitative measure defined by the confidence with which one data set can be compared to another. Differences in field and laboratory procedures greatly affect comparability. To optimize comparability, all OU10 Phase I RFI/RI sampling techniques and analytical methods will be in accordance with approved EMD OPS.

4.3 STAGE 3 - DESIGN DATA COLLECTION PROGRAM

The intent of Stage 3 is to compile the information and DQOs developed for specific tasks in Stage 2 into a comprehensive data collection program. The data collection program has been prepared for the OU10 Phase I RFI/RI and is presented in the FSP (Section 7.0). The FSP includes a detailed list of all samples to be collected including media, sample type, and number of samples. The FSP also includes sample location maps for each IHSS and lists of the number and type of QC samples to be collected.

The QAA (Section 10.0) and QAPjP describe the policy, organization, functional activities, and QA/QC protocols necessary to achieve the DQOs dictated by the intended use of the data.

5.0 RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION TASKS

5.1 TASK 1 - PROJECT PLANNING

The project planning task involves all efforts required to initiate the Phase I RFI/RI of OU10 Other Outside Closures. Activities conducted for this project have included review of topographic maps and historical aerial photographs, a site visit, evaluation of existing data, and development of conceptual models. Results of these activities are presented in Section 2.0. Preliminary identification of ARARs and TBCs are presented in Section 3.0. Identification of data requirements and DQOs are presented in Section 4.0.

Several project planning documents were prepared which pertain to this Phase I RFI/RI as required by IAG (1991). The FSP identifies sampling locations and frequencies for each of OU10 Other Outside Closure sites and is included as Section 7.0 of the work plan. Other documents required by the IAG (1991) are a Sampling and Analysis Plan (SAP) and a Health and Safety Plan (HSP). Included in the SAP are a Quality Assurance Project Plan (QAPjP) and Environmental Management Department Operating Procedures (EMD OPS) for all field activities. The QAPjP and EMD OPS exist as separate stand-alone documents. A QAA has been prepared describing quality assurance/quality control (QA/QC) requirements specific to the OU10 investigation. The QAA is included as Section 10.0 of this work plan. The HSP is a separate stand-alone document.

The objective of the QAPjP is to identify the QA requirements and specific measures for implementing these requirements, that are applicable to the quality-affecting investigations and remediation activities at locations on RFP. The QAA supplements the QAPjP and provides additional QA information specific to the OU10 Phase I RFI/RI.

5.2 TASK 2 - COMMUNITY RELATIONS

In accordance with the IAG, the RFP Communications Department is developing a sitewide community relations plan (CRP) to develop an interactive relationship with the public relating to environmental restoration activities. A draft CRP was issued for public comments in January 1991 and was revised to reflect public comment. Following EPA and CDH approval, a final CRP was scheduled to be released in August 1991. Accordingly, a site-specific CRP is not required for OU10. The ER Program community relations activities include participation by RFP representatives in informational workshops, Rocky Flats Environmental Monitoring Council meetings, public briefings on proposed remedial action plans, and public meetings held to solicit comment on various ER Program plans and actions.

The RFP Communications Department is continuing other public information efforts to keep the public informed of environmental restoration activities and other issues related to RFP operations. A Speakers Bureau Program sends speakers to civic groups and educational organizations, while a public tour program allows the public to visit RFP. In addition, an Outreach Program sends RFP officials to visit elected officials, the news media, and business and civic organizations to further discuss any issues related to RFP and environmental restoration activities. The RFP Communications Department responds to numerous public inquiries by telephone or by sending written informational materials to the requestor.

5.3 TASK 3 - FIELD INVESTIGATION

A field investigation will be conducted to delineate the vertical and horizontal extent of soil contamination associated with the operation of OU10 IHSSs and to provide data for evaluating the actual or potential risk posed by the site to human health and the environment. The field investigations program is designed to collect data to meet the DQOs for the Phase I RFI/RI described in Section 4.0. As this is a Phase I program, data collection will be primarily restricted to soil, surface water, asphalt/concrete, and sediment sampling. Some monitoring wells will be installed to determine groundwater flow directions and quality at individual IHSSs and to aid in the planning of Phase II. A detailed description of the field investigation program is presented in Section 7.0.

5.4 TASK 4 - SAMPLE ANALYSIS AND DATA VALIDATION

All analytical procedures will be in accordance with the ER Program QAPjP (EG&G, 1991a). Also provided in the QAPjP are the analytical detection limits, sample container and volume requirements, preservation requirements, and sample holding times. Sample analysis will be conducted under a separate work order contract.

Data will be reviewed and validated by the ER Program staff or a designated contractor. Results of data review and validation activities will be documented in data validation reports. EPA data validation functional guidelines will be used for validating organic and inorganic (metals) data (EPA, 1988a). Validation methods for radiochemistry and major ions data have not been published by the EPA; however, data and documentation requirements have been developed by the ER Program QA staff. Data validation methods for these data are derived from these requirements. Details of the data validation process are described in the QAPjP (EG&G, 1991a) and the Data Validation Guidelines (EG&G, 1990).

When the guidelines for validating radiochemistry analytical data are published, it should be noted that the validation criteria contained in the guidelines (both EPA CLP and EG&G Rocky Flats documents) will not strictly parallel EPA CLP or EG&G Rocky Flats scopes of work in all cases. These documents were created as guidelines rather than SOPs to allow data reviewers to exercise appropriate discretion and professional judgment in evaluating data.

5.5 TASK 5 - DATA EVALUATION

Data collected during Phase I will be incorporated with existing data describing soil and water contamination at OU10 IHSSs. The objectives of the data evaluation effort include analysis of actual and potential magnitude of releases from sources, horizontal and vertical spread of contamination, and mobility and persistence of contaminants. Analysis of the data will focus on the refinement of the conceptual models described in Section 2.0.

5.5.1 Site Characterization

The physical data collected during Phase I RFI/RI will be used, along with previously collected site and historical information, to define the surface and subsurface characteristics of each IHSS. Geologic maps and cross sections will be prepared from the boring logs to identify the characteristics of the vadose zone. This information, along with geotechnical data from the physical soil samples, will be used to revise and quantify the conceptual models developed in this work plan. This information will be used in the baseline risk assessment and environmental evaluation.

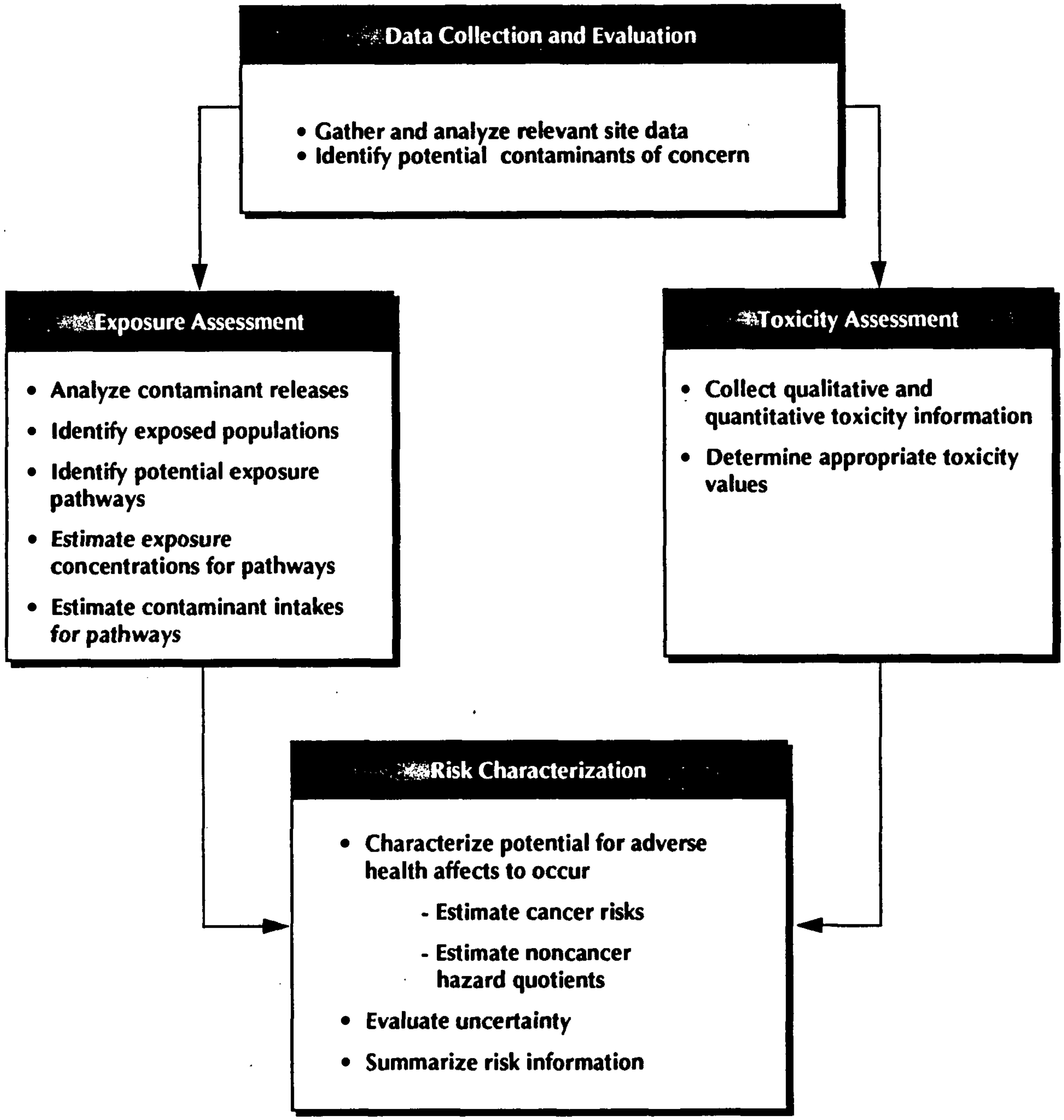
Water level information collected from the borings and the monitoring wells will be used to develop groundwater potentiometric surface maps and depth to groundwater maps. Hydrographs will be prepared for selected wells around the IHSSs from data collected during Phase I RFI/RI and from historical records. The hydrographs will provide information on the seasonal fluctuation of the water table in the vicinity of the IHSSs. All the groundwater information will be used to revise the conceptual models and will be used in the baseline risk assessment.

5.5.2 Source Characterization

Standard graphical and, where appropriate, statistical analysis methods will be employed to: 1) identify the major organic, inorganic, and radiogenic contaminants present in asphalt/cement, soils, surface water, and sediment; 2) determine the concentrations and spatial distribution of contaminants in soil and sediment; 3) evaluate contamination associated with the operation of IHSSs. Numerous types of work products, such as soil and sediment chemical tables, soil concentration isopleth maps, soil concentration versus depth profiles, and overlays of soil concentrations and IHSS boundary maps will be used in the characterization of the nature and extent of soil contamination.

5.6 TASK 6 - BASELINE RISK ASSESSMENT

A baseline risk assessment will be prepared for OU10 as part of the Phase I RFI/RI to evaluate the potential threat to human health from contaminated soils in the absence of remedial action. The baseline risk assessment will provide the basis for determining whether or not remedial action is necessary in the area and serve as the justification for performing remedial action (EPA, 1988b). EPA's interim final Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual" (EPA, 1989) provides detailed guidance on evaluating potential human health impacts as part of this baseline risk assessment. The development of a baseline risk assessment is shown in Figure 5.6-1.



U.S. Department of Energy
Rocky Flats Plant, Golden, Colorado

Figure 5.6-1

BASELINE RISK ASSESSMENT DEVELOPMENT PROCESS

November 1991

Several objectives will be accomplished under the baseline risk assessment task, including identification and characterization of the following (EPA, 1988b):

- Toxicity and levels of hazardous and radioactive contaminants present in soils
- Environmental fate and transport mechanisms within soils and cross-media fate and transport where appropriate
- Potential human and environmental receptors
- Potential exposure routes and extent of actual or expected exposure
- Extent of expected impact or threat and the likelihood of such an impact or threat occurring (i.e., risk characterization)
- Level(s) of uncertainty associated with any of the above.

The baseline risk assessment will address the potential human health associated with the site under the no-action alternative (no remedial action taken). This assessment will aid in the selection of site remedies based on the contaminants of concern and the environmental media associated with potential risks to human health.

The risk assessment process is divided into five tasks, including the following:

- Contaminant identification
- Exposure assessment
- Toxicity assessment
- Risk characterization
- Uncertainty analysis.

The objectives and description of work for the baseline risk assessment are described in detail in Section 8.0. The environmental evaluation work plan is presented in Section 9.0.

5.7 TASK 7 - DEVELOPMENT, SCREENING, AND DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

5.7.1 Remedial Alternatives Development and Screening

This section identifies potential technologies applicable to remediation of contaminated soils, wastes, surface water, sediments, and groundwater at OU10. The identified technologies are based on the preliminary site characterization developed in Section 2.0. Identification and screening of technologies, assembling an initial screening of alternatives, and identification of interim response actions will be conducted while the Phase I RFI/RI is being conducted. However, investigation of OU10 is in its early states; thus, remedial alternatives are only briefly reviewed in this section. A more detailed evaluation of the remedial alternatives for OU10 will be performed as more data are collected.

The process employed to develop and evaluate alternatives for OU10 will follow guidelines provided in the NCP. Although RCRA regulations will direct the RI at OU10 as stipulated in the IAG, CERCLA guidance will be followed because is specifies in greatest detail the steps that should be followed for selection of remedial alternatives. In addition, the IAG requires general compliance with both RCRA and CERCLA guidance.

The steps followed to develop remedial alternatives for the OU10 IHSSs are as follows:

1. Develop a list of general types of actions appropriate for the IHSS areas constituting OU10 (such as containment, treatment, and/or removal). These general types or classes of actions are generally referred to as "general response actions" in EPA guidance.

2. Identify and screen technology groups for each general response action. Screening will eliminate groups that are not technically feasible at the site.

3. Identify and evaluate process options for each technology group to select a process option representing each technology group under consideration. Although specific process options are selected to represent a technology group for alternative development and evaluation, these processes are intended to represent the broader range of options within a general technology group.

4. Assemble the selected representative technologies into site closure and corrective action alternatives for the IHSS areas of OU10 that represent a range of treatment and containment combinations, as appropriate.

5. Screen the assembled alternatives in terms of the short- and long-term aspects of three broad criteria: effectiveness, implementability, and cost. Because the purpose of the screening evaluation is to reduce the number of alternatives that will undergo thorough and extensive analysis, alternatives will be evaluated in less detail than subsequent evaluations.

6. Develop preliminary risk-based remedial action goals for affected media. Preliminary remedial action goals will be applied as performance objectives for evaluating the effectiveness of specific technology processes identified as candidate components of viable remedial action alternatives. Consistent with the NCP, preliminary remediation goals will be established at a 1×10^{-6} excess cancer risk point of departure and at other intervals within the 1×10^{-4} to 1×10^{-6} decision range. As the CMS/FS evolves, preliminary remediation goals may be revised to a different risk level on the basis on consideration of appropriate factors that include, but are not limited to, exposure, uncertainty, and technical issues.

For the Phase I RFI/RI work plan, the appropriate level of alternatives analysis is the listing of general response actions most applicable to the type of site under investigation. General response actions are defined as those broad classes of actions that may satisfy the objectives for remediation defined for OU10. Table 5-1 provides a list, which is not all-inclusive, and description of general response actions and typical technologies associated with remediating soils,

Table 5-1 General Response Actions, Typical Associated Remedial Technologies, and Evaluation

General Response Action	Description	Typical General Response Technologies	Action to Potential Pathways
No Action	No remedial action taken at site.	Some monitoring and analyses may be performed.	National Contingency Plan requires consideration of no action as an alternative. Would not address potential pathways, although existing access restriction would continue to control on-site contact.
Access and use restrictions	Permanent prevention of entry into a contaminated area of site. Control of land use.	Site security; fencing; deed use restrictions; warning signs.	Could control on-site exposure and reduce potential for off-site exposure. Site security fence and some signs are in place. Additional short-term or long-term access restrictions would likely be part of most remedial actions.
Containment	In-place actions taken to prevent migration of contaminants.	Capping; groundwater containment barriers; soil stabilization; enhanced vegetation.	If applied to source, could be used to control all pathways. If applied to transport media, could be used to mitigate past releases (except air).
Pumping	Transfer of accumulated subsurface or surface contaminated water, usually to treatment and disposal.	Groundwater pumping; leachate collection; liquid removal from surface impoundments.	Applicable to leachate removal prior to *in situ* treatment or waste removal. Applicable removal of contaminated groundwater and bulk liquids (for example, from buried drums).
Removal	Excavation and transport of primarily nonaqueous contaminated material from area of concern to treatment or disposal area.	Excavation and transfer of drums, soils, sediments, wastes, and contaminated structures.	If applied to source, could be used to control all pathways. If applied to transport media, will control corresponding pathway. Must be used with treatment or disposal response actions to be effective.
Treatment	Application of technology to change the physical or chemical characteristics of the contaminated material. Applied to material that has been removed.	Solidification: biological, chemical, and physical treatment.	Applied to removed source material; could be used to control all pathways. Applied to removed transport media, could control air, surface water, groundwater, and sediment pathways.

Table 5-1 General Response Actions, Typical Associated Remedial Technologies, and Evaluation

General Response Action	Description	Typical General Response Technologies	Action to Potential Pathways
In Situ Treatment	Application of technologies *in situ* to change the in-place physical or chemical characteristics of contaminated material.	*In situ* vitrification; bioremediation.	Applied to source, could be used to control all pathways. Applied to transport media, could be used to control corresponding pathways.
Storage	Temporary stockpiling of removed material in a storage area or facility prior to treatment or disposal.	Temporary storage structures.	May be useful as a means to implement removal actions, but definition would not be considered a final action for pathways.
Disposal	Final placement of removed contaminated material or treatment residue in a permanent storage facility.	Permitted landfill; repositories.	With source removal, could be used to control all pathways. With removal of contaminated transport media, could be used to control corresponding pathway (except air).
Monitoring	Short- and/or long-term monitoring is implemented to assess site conditions and contamination levels.	Sediment, soil, surface water, and groundwater sampling and analysis.	RCRA requires post-closure monitoring to assess performance of closure and corrective action implementation.

wastes, groundwater, sediments, and surface water. Table 5-1 also includes a general statement regarding the applicability of the general response action to potential exposure pathways.

Table 5-1 does not list all possible actions nor may all of the alternative response actions and typical technologies listed be appropriate for the IHSS areas of OU10. Some will be discarded during the screening of alternatives.

The response actions outlined in Table 5-1 must be applied to the potential exposure pathways that will be identified for OU10. The response actions must be capable of providing control over all or some of the potential pathways. Partially effective response actions can be combined to form complementary sets of response actions that provide control over all pathways.
In general terms, potential human exposure can be avoided by prevention of contaminant release, transport, and/or contact. Thus, application of the response actions may be considered at three different points in each potential exposure pathway: (1) at the point where the contaminant could be released from the source; (2) in the transport medium; and (3) at the point where the contact could occur with the released contaminant.

The existing data do not adequately characterize the source, release mechanisms, and migration pathways for contamination at OU10. Therefore, the existing data are not sufficient for implementing the screening of alternatives. Phase I will generate data (Table 5-2) necessary to characterize the source and soils. Phase II of the RFI/RI will evaluate the impact of OU10 on surface water, groundwater, air, sediments, and biota in addition to characterizing potential contaminant migration pathways. Data obtained from these investigations will:

- Characterize the nature, rate and extent of contamination
- Define pathways and methods of migration
- Identify areas threatened by releases from the facility

General Response Actions	Associated Remedial Technologies	Data Purpose	Data Need
Complete or Partial Removal and Treatment of Contaminated Soils	Disposal (off-site)	Evaluate RCRA Land Bank and Radioactivity Restrictions	- 40 CFR 268 Table CCWE and Appendix III Analyses
			- Full Suite of Radionuclide Analyses
		Cost Analysis	- Vertical and Horizontal Extent of Contamination
In Situ Contaminated Soils Treatment	Immobilization	Determine Viscosity of Grout Material	- Soil Grain Size Distribution (sieve analysis)
		Effectiveness	- Full Suite of Organic and Inorganic Analyses
	Soil Flushing	Effectiveness	- Full Suite of Organic and Inorganic Analyses - Soil Organic Matter Content - Soil Classification - Soil Permeability - Treatability Study
	Vapor Extraction	Effectiveness	- Full Suite or Organic and Inorganic Analyses - Subsurface Geological Characteristics - Depth to Groundwater - Soil Permeability - Treatability
	Vitrification	Cost Effectiveness	- Full Suite of Organic and Inorganic Analyses - Treatability Study
Groundwater Collection	Well Array/Subsurface Drains	Storativity (transient flow)	- Aquifer Tests

General Response Actions	Associated Remedial Technologies	Data Purpose	Data Need
Infiltration and Groundwater Containment Controls	Capping/Subsurface Barriers	Suitability of Off-Site Soil for Use	- Gradation (Sieve Analysis) - Atterberg Limits (Plasticity Tests) - Percent Moisture - Compaction (Proctor) - Permeability (Triaxial Permeability) - Strength (Triaxial or Direct Shear)
		Effectiveness	- Location of Subcroping Sandstones - Hydraulic Conductivity of Bedrock Materials
		Construction Feasibility	- Grade - Depth to Bedrock
In Situ Groundwater Treatment/Immobilization	Immobilization	Determine Viscosity of Grout Material	- Soil Grain Size Distribution (sieve analysis)
		Effectiveness	- Full Suite of Organic and Inorganic Analyses
	Aeration	Effectiveness	- Full Suite of Organic and Inorganic Analyses - Subsurface Geological Characteristics - Depth the Groundwater - Soil Permeability - Treatability Study
Groundwater/Surface Water Treatment	UV/Peroxide or UV/Ozone	Process Control	- Iron and Manganese
		Effectiveness	- Full Suite of Organic and Inorganic Analyses - Treatability Study

General Response Actions	Associated Remedial Technologies	Data Purpose	Data Need
Groundwater/Surface Water Treatment (cont)	Air Stripping	Process Control	- Hardness
		Effectiveness	- Full Suite of Organic and Inorganic Analyses - Treatability Study
	Other Water Treatment Technologies (carbon adsorption, ion exchange, electrodialysis, and reverse osmosis)	Process Control	
		Effectiveness	

- Determine short and long-term threats to human health and the environment.

These data will provide information for the preliminary screening of alternatives and a thorough, comparative evaluation of the technologies with respect to implementability, effectiveness, and cost. This information will allow for informed decisions to be made with respect to the selection of preferred technologies. The FSP (Section 7.0) describes the methodology that will be followed to obtain the required information for the Phase I RFI/RI characterization.

5.7.2 Detailed Analysis of Remedial Alternatives

Sufficient data may not be generated during the Phase I RFI/RI to allow for a detailed analysis of alternatives; however, this is not a requirement of the Phase I RFI/RI. The detailed analysis of each alternative will be performed when sufficient data are generated during Phase II. The detailed analysis and selection of alternatives is not a decision-making process; rather, it is the process of analyzing and comparing relevant information in order to select a preferred remedial action. In accordance with the NCP, containment technologies will generally be appropriate remedies for wastes that pose a relatively low-level threat or where treatment is impracticable (EPA, 1991). Each appropriate alternative will be assessed in terms of nine evaluation criteria, and the assessments will be compared to identify the key attributes among the alternatives. Assessment in terms of eight evaluation criteria is necessary for the CMS/FS and the subsequent Corrective Action Decision (CAD)/Record of Decision (ROD). The nine specific evaluation criteria are as follows:

- Overall protection of human health and the environment
- ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume

- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance.

These criteria are described in recently revised guidelines provided in the NCP. The first two criteria are considered threshold criteria because they must be evaluated before further consideration of the remaining criteria. The next five criteria are considered the balancing criteria on which the analysis is based. The final two criteria are addressed during the final decision-making process after completion of the CMS/FS.

5.8 TASK 8 - TREATABILITY STUDIES/PILOT TESTING

The primary objectives of a treatability study are to provide sufficient technology performance information and to reduce cost and performance uncertainties to acceptable levels so that treatment alternatives can be fully developed and evaluated during detailed analysis. The task includes efforts to evaluate whether treatability studies are necessary and, if so, to prepare for and conduct treatability studies. If remedial alternatives are developed, the data collected as part of the field investigation will be reviewed in terms of whether the alternatives can be evaluated. If additional data are required, treatability studies or additional field investigations will occur.

If it is determined that a treatability study is necessary, a treatability work plan will be prepared. The plan will identify treatability tests that need to be conducted as well as the test materials and equipment needed.

The treatability work plan will discuss the following:

- The scale of the treatability study
- Key parameters to be varied and evaluated and criteria to be used to evaluate the tests
- Specifications for test samples and the means for obtaining these samples
- Test equipment and materials and procedures to be used in the treatability test
- Identification of where and by whom the tests and any analytical services will be conducted, as well as any special procedures and permits required to transport samples and residues and conduct the test
- Methods required for residue management and disposal
- Any special QA/QC needed for the tests.

5.9 TASK 9 - PHASE I RFI/RI REPORT

5.9.1 Report Content

The Phase I RFI/RI report will summarize the findings of the Phase I soil contamination RFI/RI program for OU10 Other Outside Closures IHSSs. The report will be organized into sections that provide an overview of the RI program, describe the physical features of the site and individual IHSSs, and present the results of the Phase I RFI/RI. The report will also include sections describing soil, surface water, sediment, groundwater, and asphalt/concrete contamination related to activities of the IHSSs and the baseline risk assessment.

5.9.2 Report Reviews

The Phase I RFI/RI report will be issued as a draft final report that will undergo formal review by EPA and CDH. The final report will incorporate agency comments from EPA and CDH.

6.0 SCHEDULE

Figure 6.0-1 summarizes the schedule for conducting the Phase I RFI/RI. Dates from the IAG, dated January 22, 1991, were used where appropriate. The OU10 Phase I RFI/RI project began in January 1990 with the commencement of project planning and will continue until May 1995 when the treatability studes are completed.

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OPERABLE UNIT 10 RFI/RI

Tasl	Activity	Start	Finish
1	Project Planning	1/25/90	6/2/92
2	Community Relations	1/25/90	5/18/95
3	Field Investigations	6/3/92	3/1/94
4	Sample Analysis & Data Validation	6/3/92	6/1/94
5	Data Evaluation	1/1/93	6/1/94
6	Baseline Risk Assessment	6/3/92	2/28/95
7	Development & Screening of Remedial Alternatives	8/26/94	5/18/95
8	Treatability Studies	8/26/94	5/18/95
9	Phase I RFI/RI Report	3/2/94	2/28/95

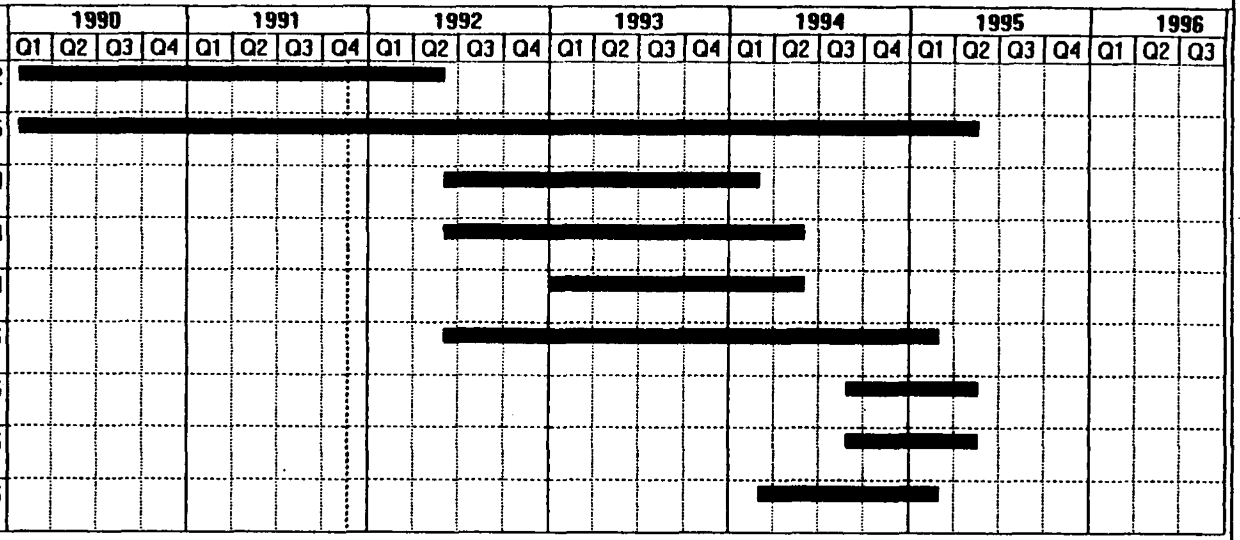

Figure 6.0-1 OU10 Phase I RFI/RI Schedule

NOTICE

This document (or documents) is oversized for 16mm microfilming, but is available in its entirety on the 35mm fiche card referenced below:

Document # 000003

Titled: Plate 1 General Location Map of OU10 Individual Hazardous Substance Sites

Fiche location: A-OU10-M1

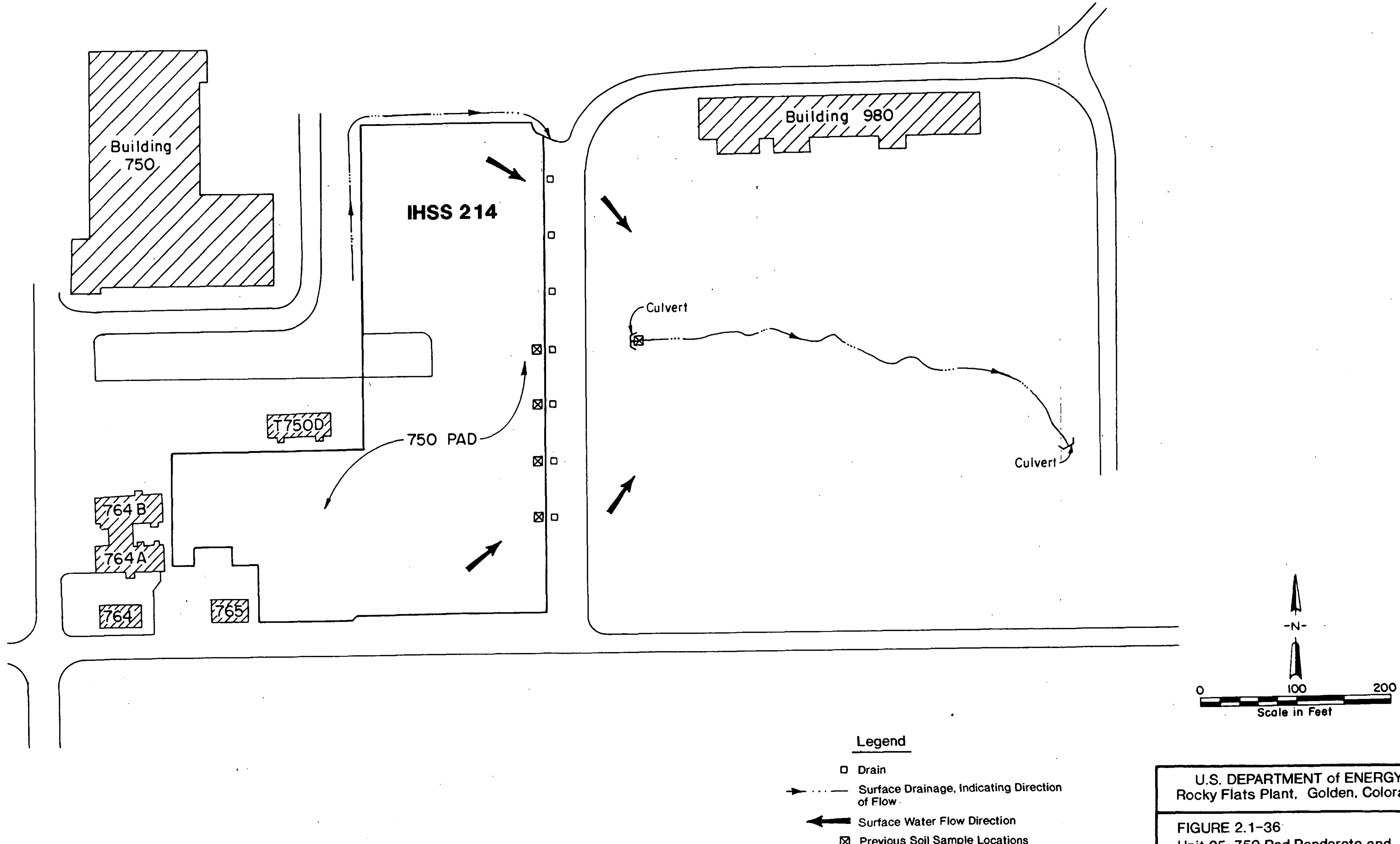

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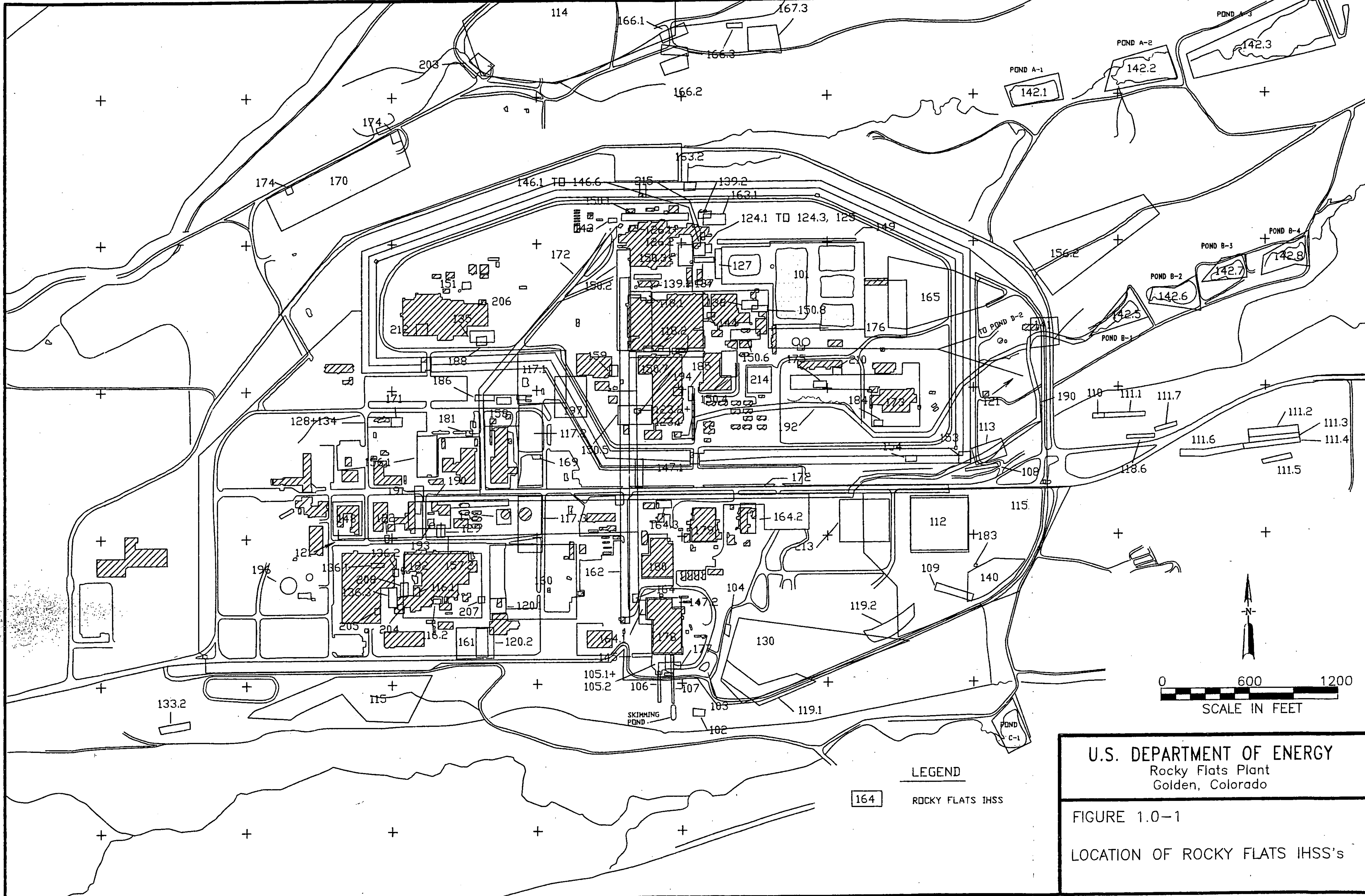
FIGURE 2.1-36
Unit 25, 750 Pad Pondcrete and Saltcrete Storage (IHSS 214) Location Map



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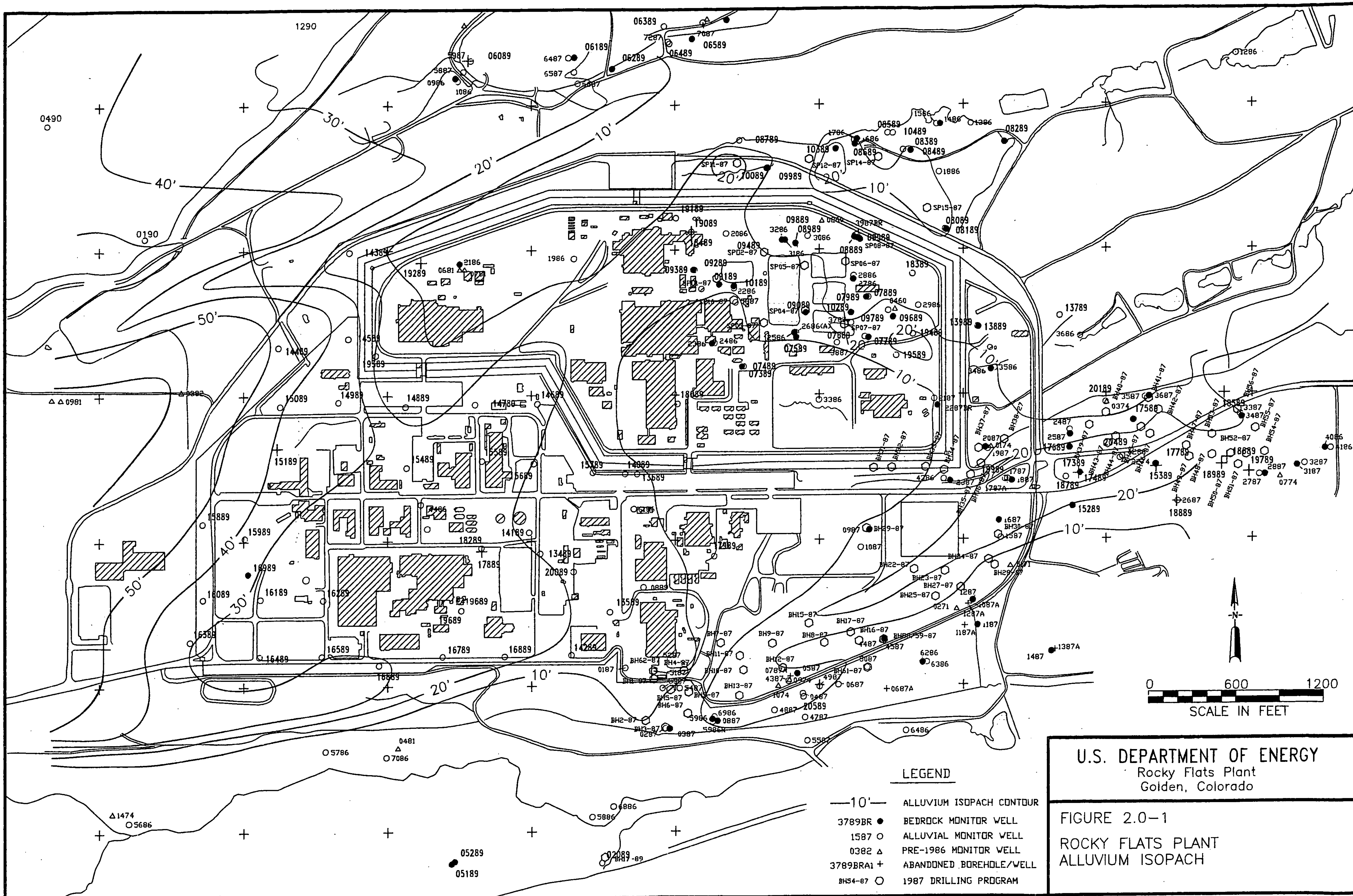
Golden, Colorado

FIGURE 1.0–1

LOCATION OF ROCKY FLATS IHSS's


LEGEND
—10'— ALLUVIUM ISOPACH CONTOUR
3789BR ● BEDROCK MONITOR WELL
1587 ○ ALLUVIAL MONITOR WELL
0382 △ PRE-1986 MONITOR WELL
3789BRA1 + ABANDONED BOREHOLE/WELL
BH54-87 ⬡ 1987 DRILLING PROGRAM
0 600 1200
SCALE IN FEET
-N-
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Golden, Colorado
FIGURE 2.0-1
ROCKY FLATS PLANT
ALLUVIUM ISOPACH

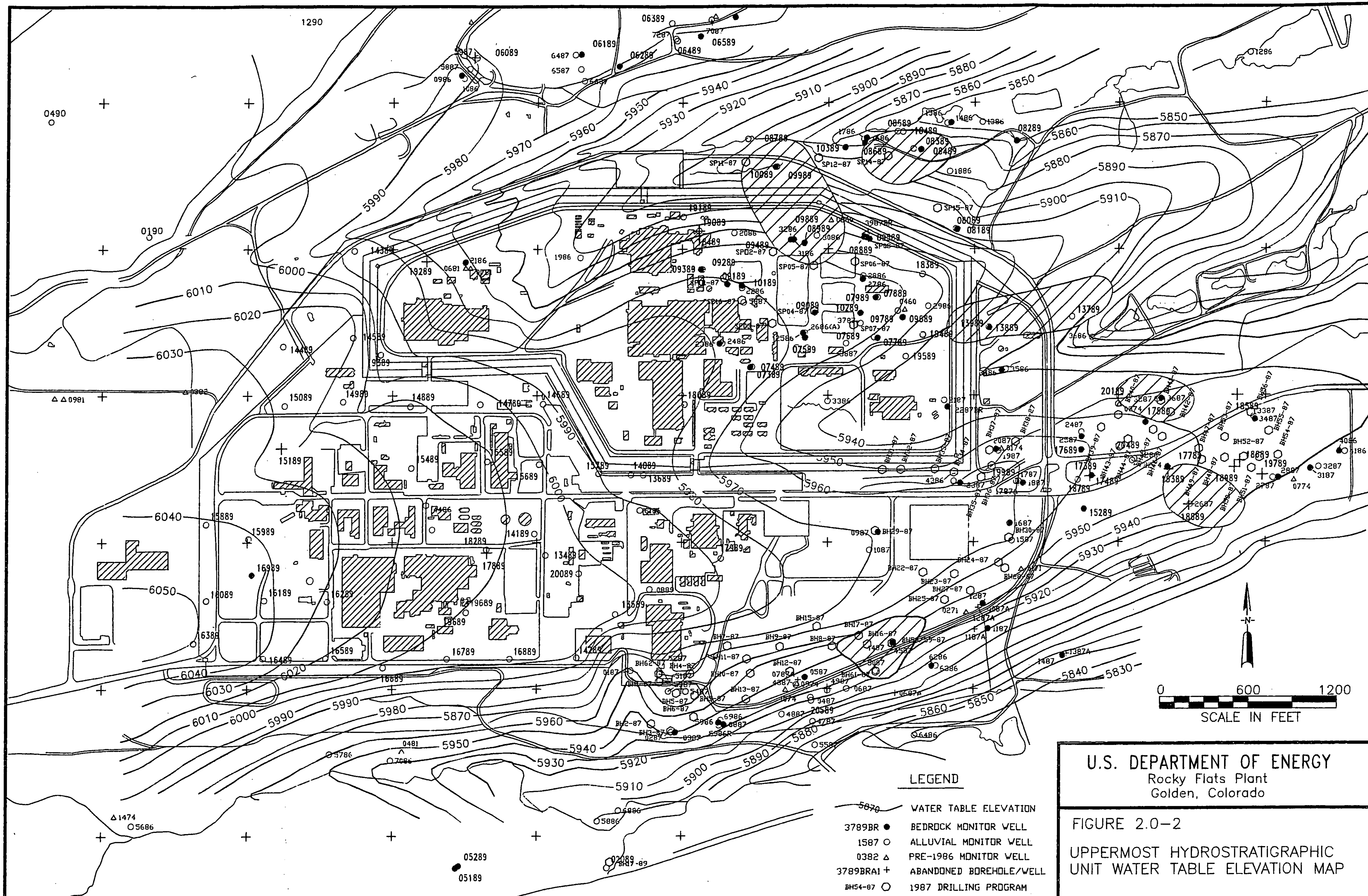

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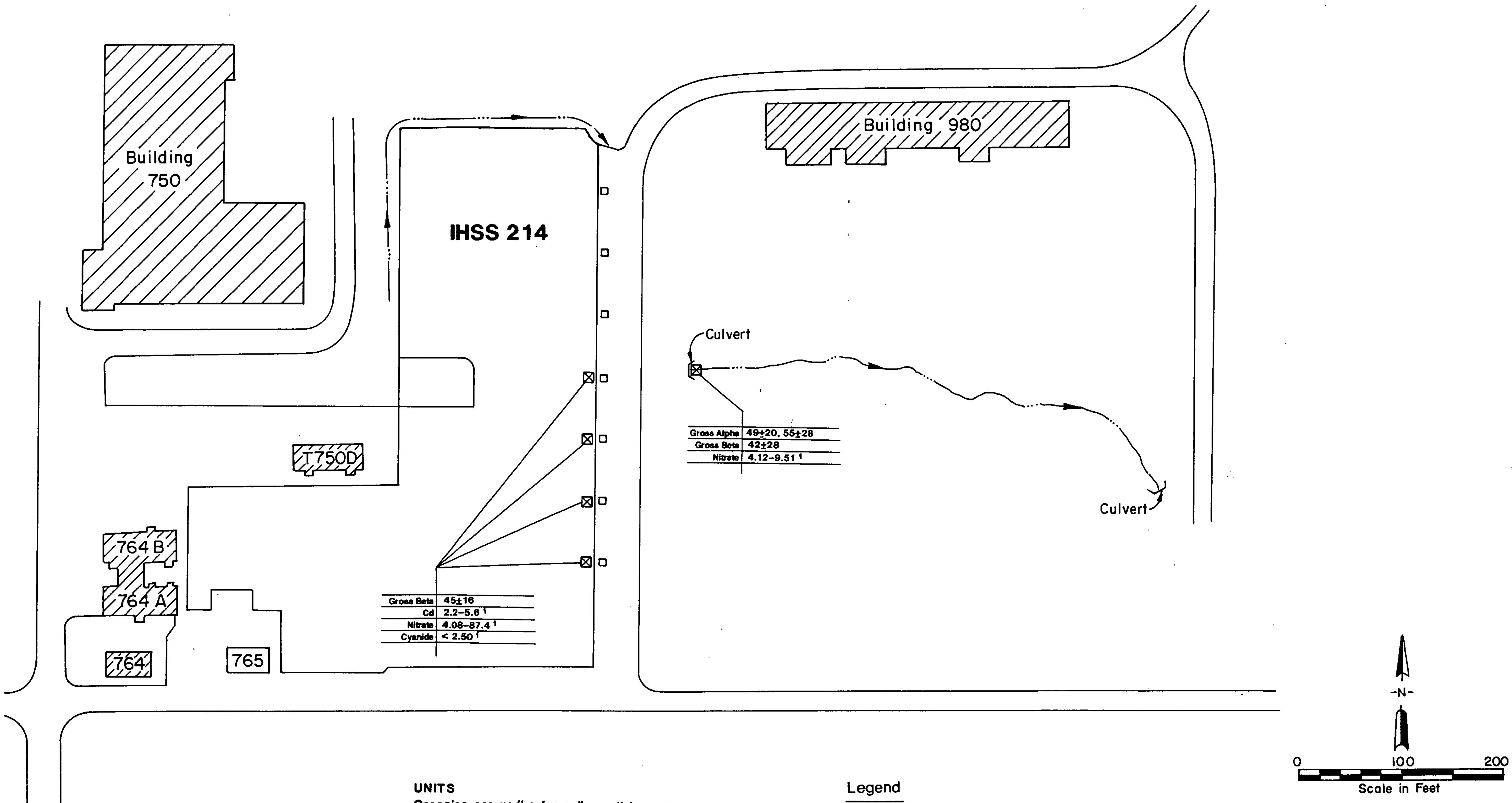
FIGURE 2.0-2

UPPERMOST HYDROSTRATIGRAPHIC UNIT WATER TABLE ELEVATION MAP



UNITS

Organics are ug/kg for soils: ug/l for water
Inorganics are mg/kg for soils: mg/l for water
Radionuclides are pci/g for soils: pci/l for water

1 - Surface Water Concentrations

Legend

Surface Drainage, Indicating Direction of Flow
Drain
Previous Soil Sample Locations

Cd Cadmium

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FIGURE 2.1-38
Analytes Detected Above Background
Unit 25, 750 Pad Pondcrete and
Saltcrete Storage (IHSS 214)

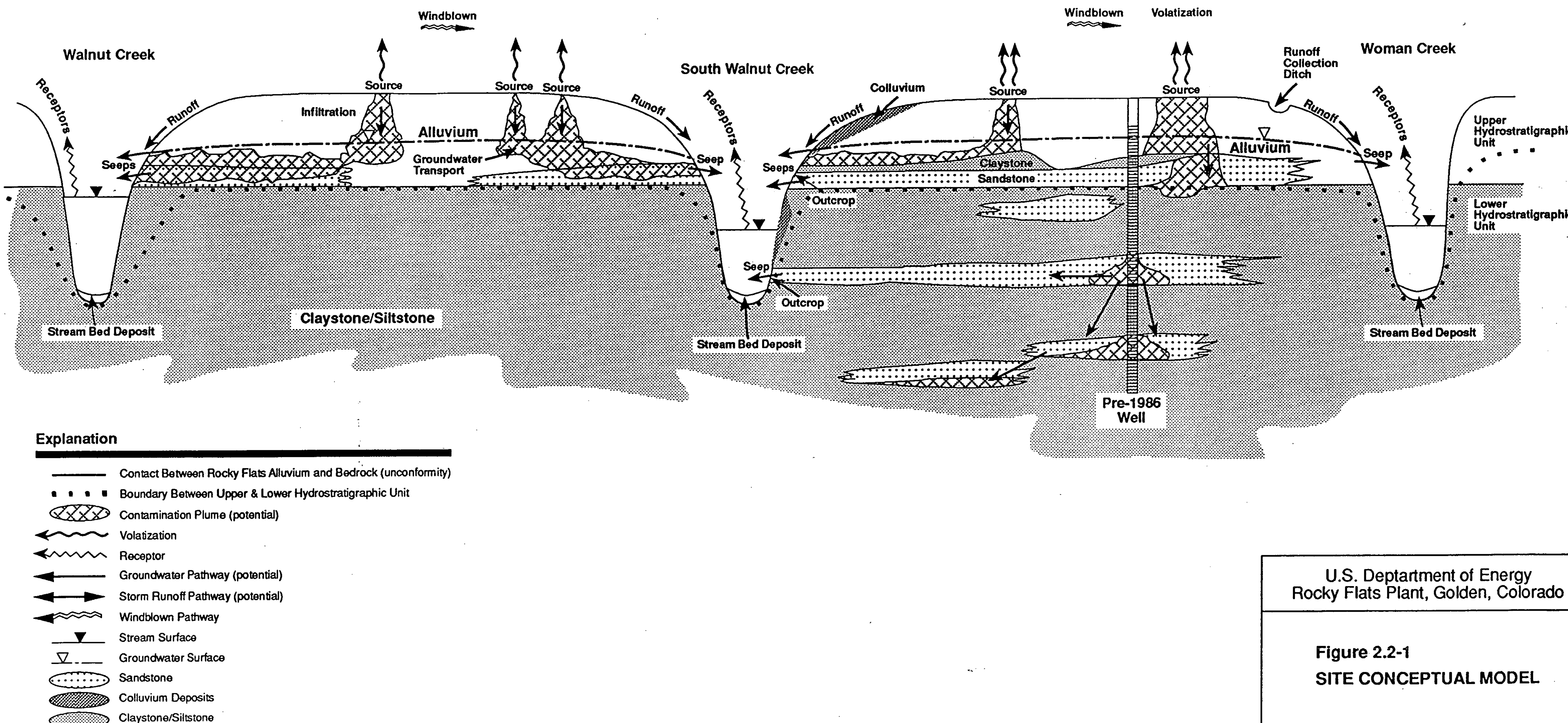

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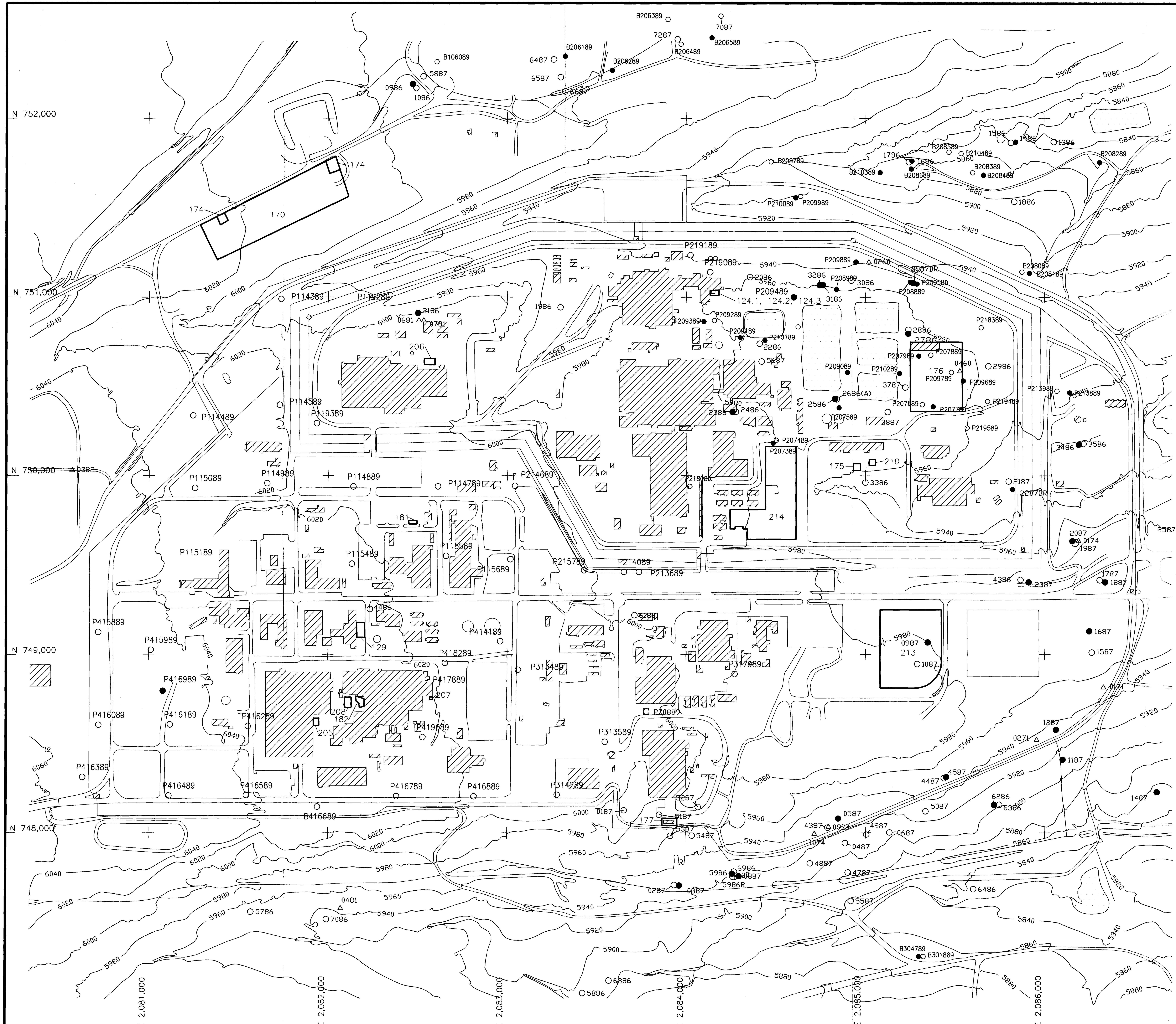
Figure 2.2-1
SITE CONCEPTUAL MODEL

November 1991



LEGEND

214 (box)	INDIVIDUAL HAZARDOUS SUBSTANCE SITE
3789BR ●	BEDROCK MONITOR WELL
1587 ○	ALLUVIAL MONITOR WELL
0382 △	PRE-1986 MONITOR WELL
—5920—	TOPOGRAPHIC CONTOUR CONTOUR INTERVAL = 20'
(stream line)	STREAM

-N-

0 200 400 600 800 1000

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PLATE 1
General Location Map of OU10 Individual Hazardous Substance Sites

SEPT. 30, 1991

OU10-A-000003