DRAFT
PROPOSED ACTION MEMORANDUM
HOT SPOT REMOVAL

Rocky Flats Plant
(Operable Unit No. 1)

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

July 1994

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LIST OF ACRONYMS

Am	americium
ARAR	Applicable or Relevant and Appropriate Requirements
Be	beryllium
CDH	Colorado Department of Health
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CHWA	Colorado Hazardous Waste Act
CX	Categorical Exclusion
DOE	Department of Energy
EPA	U.S. Environmental Protection Agency
FIDLER	Field Instrument for the Detection of Low Energy Radiation
FGSS	Field Gamma Spectroscopy System
gpm	gallons per minute
HPGe	High Purity Germanium Detector
IAG	Inter-Agency Agreement
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
NCP	National Contingency Plan
nCi/g	nanoCuries per gram
NEPA	National Environmental Policy Act
NPL	National Priorities List
NTS	Nevada Test Site
OU	Operable Unit
PAH	Polynuclear or Polycyclic Aromatic Hydrocarbon
PAM	Proposed Action Memorandum
PCB	polychlorinated biphenyl
PCE	tetrachloroethene or perchloroethene
pCi/g	picoCuries per gram
PGSS	portable gamma spectroscopy system
Pu	Plutonium
QQRS	quantitative and qualitative radiological survey
RCA	Radiologically Controlled Area
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RFP	Rocky Flats Plant
RI	remedial investigation
U	uranium
UV	ultraviolet
μg/kg	micrograms per kilogram

1.0 PURPOSE

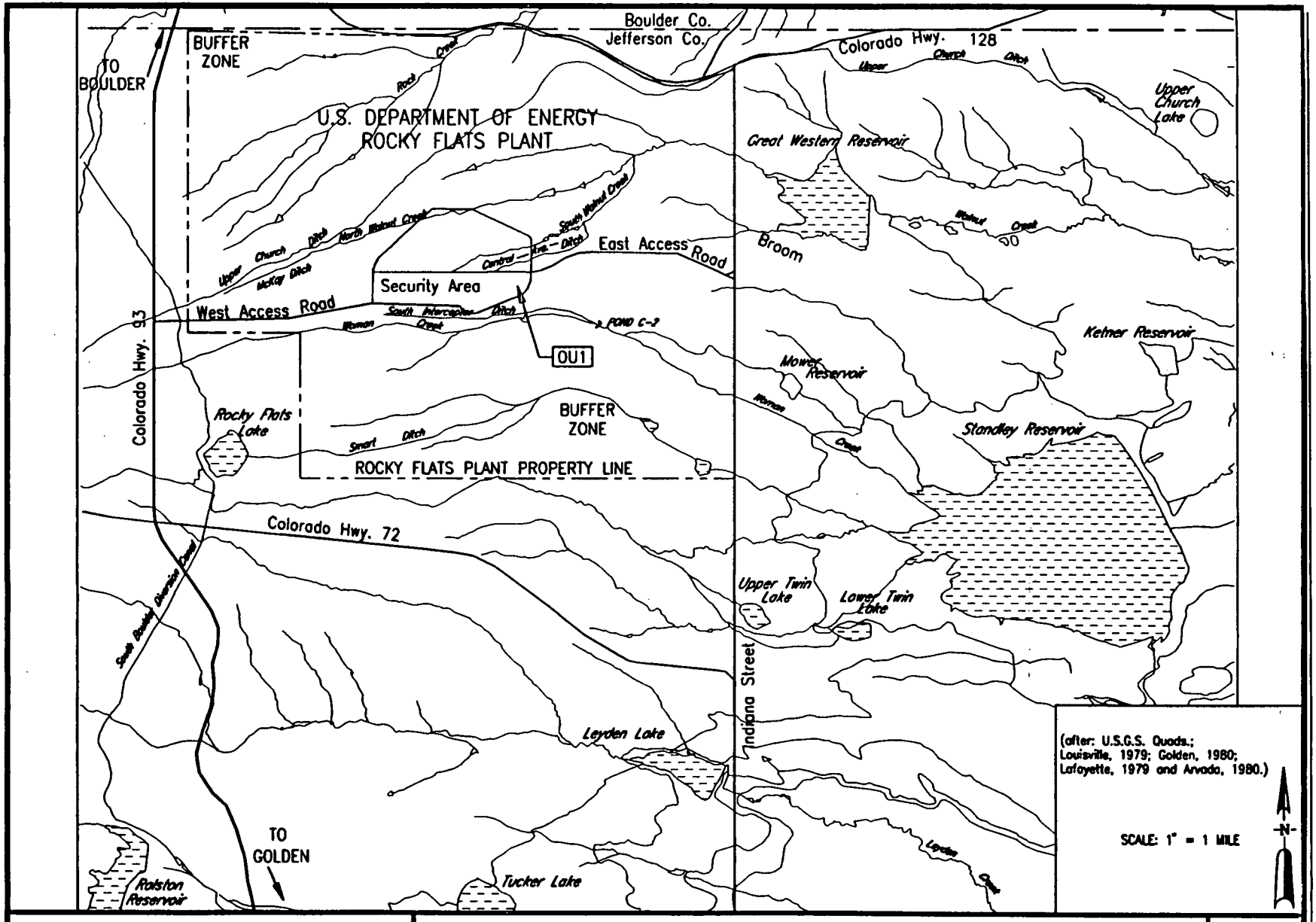
The purpose of this Proposed Action Memorandum (PAM) is to request and document approval of the Department of Energy's (DOE's) proposed removal action of radionuclide contaminated soils ("hot spots") at four specific locations within the Individual Hazardous Substance Site (IHSS) 119.1 and near IHSS 119.2 at the Rocky Flats Plant (RFP) located in Golden, Colorado. These IHSSs are located within Operable Unit No. 1 (OU1) (Figure 1-1). The objective of this removal action is to significantly reduce potential risks to the public posed by radionuclides present in the hot spots. The surface and shallow subsurface soil at these locations contain substantial activities of the radioactive elements uranium (U), americium (Am) and plutonium (Pu), as well as traces of several organic compounds. This proposed removal action will include excavating, containerizing, and storing surface and shallow subsurface soils from these hot spots.

This removal action is being conducted as an Accelerated Response Action because the radionuclides in the surface soil pose an immediate potential threat to on-site workers, are sources for potential radionuclide migration, and the removal action can be implemented within 6 months. The PAM has been prepared in accordance with the draft revised 1994 Inter-Agency Agreement (IAG) between DOE, the Environmental Protection Agency (EPA), and the Colorado Department of Health (CDH).

2.0 SITE BACKGROUND

RFP is a government-owned, contractor operated facility that is part of the nationwide nuclear weapons production complex. Until January 1992, RFP was operated as a nuclear weapons research, development, and production complex. RFP fabricated nuclear weapons components from Pu, U, beryllium (Be), and stainless steel. Support activities included chemical recovery, purification of recyclable transuranic radionuclides, and research and development of metallurgy, machining, nondestructive testing, coatings, remote engineering, chemistry, and physics. The RFP is currently a Resource Conservation and Recovery Act (RCRA) hazardous waste treatment/storage facility. RFP is in transition from a defense production facility to a facility that will be used for such future missions as environmental restoration, waste management, maintaining production contingency, and eventually decontamination and decommissioning.

The IAG, signed by the DOE, the EPA, and the CDH in 1991, grouped RFP-contaminated areas into 16 OUs. The IAG requires the investigation, study, and remediation of OU1 as well as the other OUs at RFP.



U.S. DEPARTMENT OF ENERGY Rocky Flats Plant Golden, Colorado	OU1 LOCATION MAP	FIGURE 1-1

2.1 SITE DESCRIPTION

IHSSs 119.1 and 119.2 at OU1 have historically (1968–1971) been used for temporary storage of drums of wastes containing radionuclides, solvents, and oils. A combined RCRA Facility Investigation (RFI)/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Remedial Investigation (RI) was conducted in three phases to evaluate the nature and extent of contamination resulting from releases of hazardous substances at IHSSs 119.1/119.2 and other IHSSs at OU1. The Phase III final RFI/RI report was submitted to EPA and CDH in June 1994 (DOE, 1994). The RFI/RI confirmed the presence of soil and groundwater contaminated by radionuclides and/or organic chemical compounds. The soil and groundwater contamination at IHSS 119.1 described in the Phase III RFI/RI report was consistent with leaks from drums containing radionuclide-contaminated lathe coolant or other process wastes generated by historical operations at RFP.

A detailed radiological survey identified the hot spots, which are discrete areas of soil contaminated with uranium, plutonium, and americium (see Section 2.4.1). These areas are identified in the RFI/RI report as locations SS100193, SS100293, SS100393, and SS100493. Three of these contaminated areas are clustered within a small area (approximately 10 feet square) in IHSS 119.1. The fourth contaminated area is located near IHSS 119.2 (Figure 2-1).

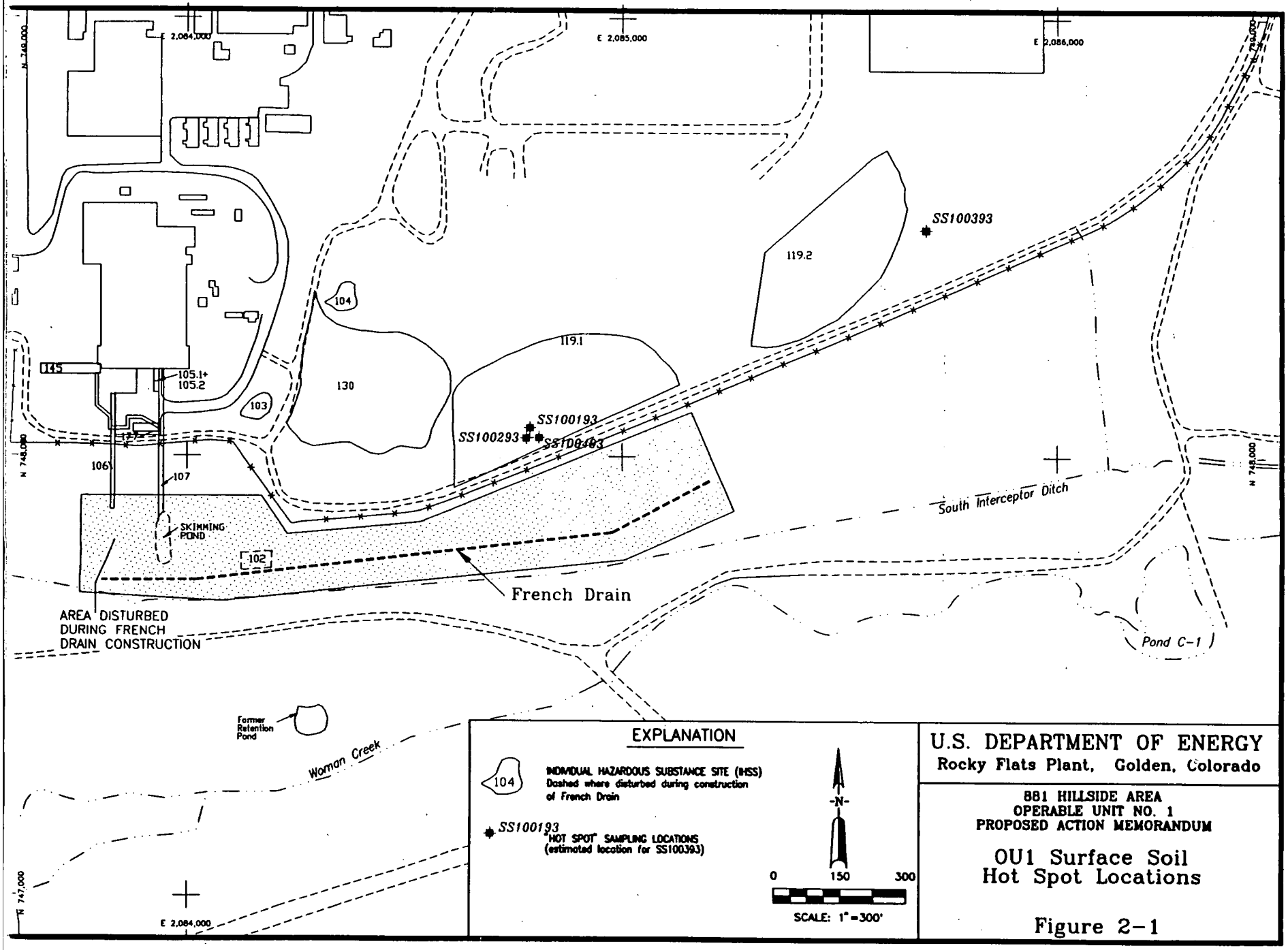
2.2 PHYSICAL LOCATION AND LAND USE

RFP is located in rural northern Jefferson County approximately 16 miles northwest of Denver. Cities within a 10-mile radius from the center of RFP include Boulder to the northwest; Broomfield, Lafayette, and Louisville to the northeast; Westminster to the east; Arvada to the southeast; and Golden to the south. Approximately 50% of the area within 10 miles of RFP is in Jefferson County, 40% in Boulder County, and 10% in Adams County.

RFP consists of approximately 6,500 acres of federally owned land in Township 2 South, Range 70 West, Sections 1 to 4 and 9 to 15, 6th Principal Meridian (T2S R70W 1-4, 9-15, 6PM). A secured area of approximately 400 acres is centrally located within RFP. The secured area is surrounded by a buffer zone of approximately 6,150 acres in area. OU1 is located in the southeast portion of the secured area adjacent to its southern boundary (Figure 1-1).

There is little residential or commercial development within a 4-mile radius of the center of RFP. Approximately 9,100 people reside within a 5-mile radius. Approximately 316,000 people reside within a 10-mile radius. The population within a 50-mile radius is approximately 2.2 million.

Generally, those areas closest to RFP are zoned for industrial development and those farther away are zoned for residential development. Since 1973, several new residential subdivisions



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have been developed to varying degrees within a few miles of the buffer zone, particularly to the east and southeast. Additionally, several ranches are located within 10 miles of RFP. These ranches are associated with equestrian activities and produce crops, beef cattle, and milk. Two small cattle herds of approximately 10 to 20 cattle each are located southeast and east of RFP. The predominant uses immediately southeast of OU1 appear to be open space, single family detached dwellings, and horse boarding operations. In all, 70 parcels in Jefferson County surrounding RFP to the east, south, and west have been identified and designated. The land use data are summarized in Table 2-1. Land to the north is in Boulder County and has not been identified.

Table 2-1

Jefferson County Land Use Surrounding RFP

Number of Parcels	Land Use Type	Generalized Zoning
11	Single Family Detached	Agricultural, Planned Development, Residential
30	Industrial	Industrial, Planned Development, Mining-Conservation
4	Office/Retail	Restricted Commercial, Planned Development
1	Mining	Mining-Conservation
1	Farm/Ranching	Agricultural
5	Water/Utilities	Agricultural, Industrial, Mining-Conservation
18	Vacant or not designated	Agricultural, Industrial

Adapted from DOE, 1994, App. F, Table F4-1. Original Source: Jefferson County Land Use Inventory.

2.3 PHYSICAL ENVIRONMENT AND ECOLOGY

There are no floodplains, natural wetlands, or historical/archeological features at OU1. OU1 is not intended for development of any unique natural resource. There is a constructed wetland located in the vicinity of OU1, which was built because of damage to wetlands during construction of the french drain, an Interim Measure/Interim Remedial Action (IM/IRA) implemented at OU1. Wetlands occur along Woman Creek and Pond C-2, which are south of OU1. The wetlands will not be affected by this removal action.

Unique ecosystems were not found at RFP during extensive biological studies. The bald eagle (endangered), black footed ferret (endangered), peregrine falcon (threatened), and whooping crane (endangered) were identified by the U.S. Fish and Wildlife Service as potentially present

at RFP. (Peregrine falcons nest on high cliff sides and river gorges, which are absent at RFP. Peregrine falcon nesting sites have been recorded 4 to 5 miles west of RFP.) However, the U.S. Fish and Wildlife Service found no adverse affect on endangered species resulting from current activities at OU1.

2.4 RELEASE OR THREATENED RELEASE INTO THE ENVIRONMENT OF A HAZARDOUS SUBSTANCE, POLLUTANT OR CONTAMINANT

2.4.1 Hot Spot Investigation

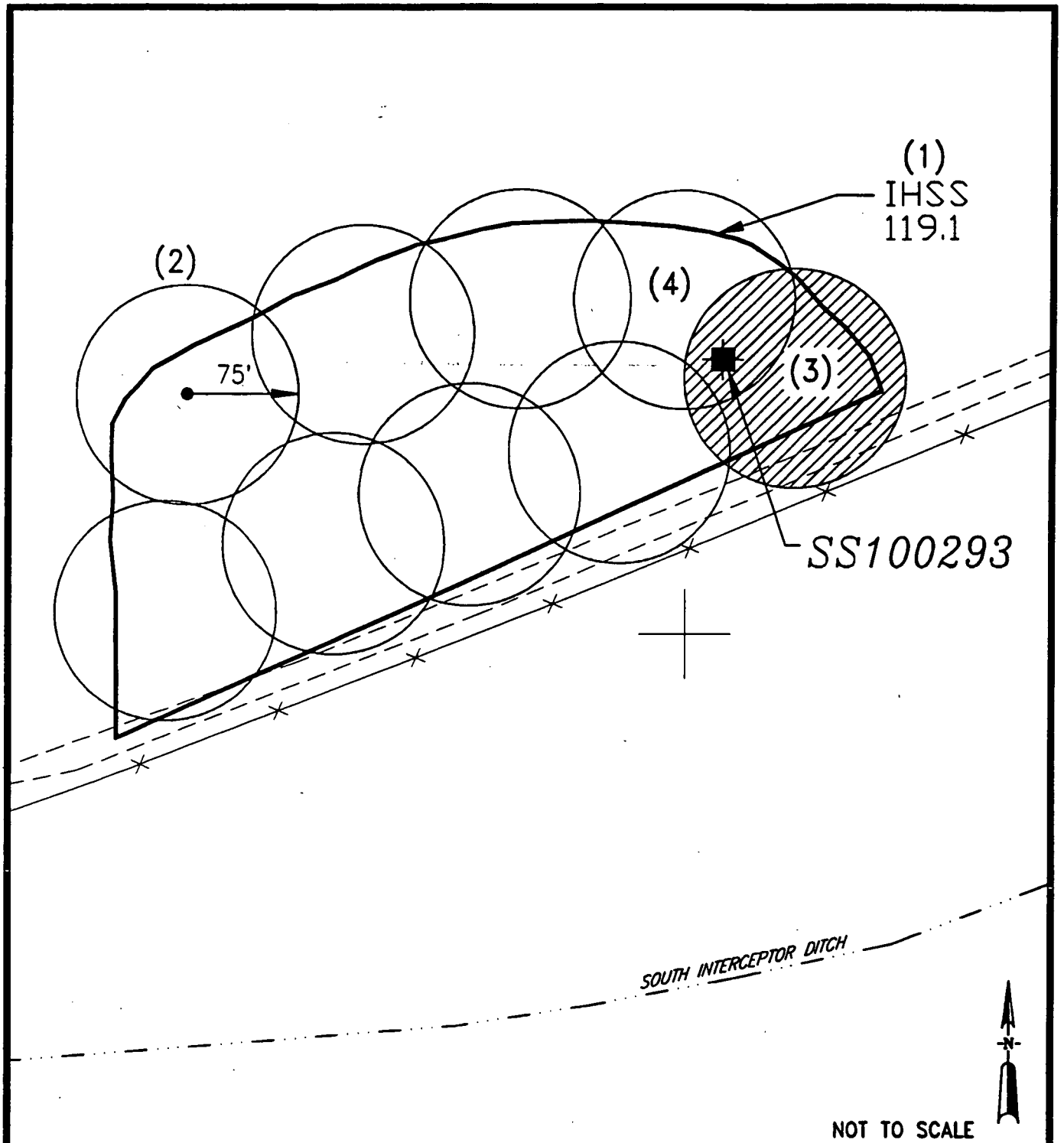
A hot spot was discovered unexpectedly during a pre-job survey for the maintenance of the IM/IRA extraction well within IHSS 119.1. The hot spot dimensions were preliminarily determined to be roughly 10 inches in diameter by 12 inches deep with activities ranging from 10 nanoCuries per gram (nCi/g) (surface) to 50 picoCuries per gram (pCi/g) (at 1-foot). The area was posted and staked off in August 1992 to control access.

EG&G prepared a Supplemental Surficial Radiological Characterization Action Plan to evaluate whether other hot spots exist at OU1. The action plan presented a two-part field characterization approach as follows:

- Part I: Characterizing the areal extent of the identified anomaly using a Field Gamma Spectroscopy System (FGSS) consisting of a truck-mounted High Purity Germanium (HPGe) Detector, and characterizing the vertical extent through subsurface sampling and analysis.

- Part II: Conducting a quantitative and qualitative radiological survey (QQRS) to identify other "hot spots" using multiple field measurement techniques. These techniques included FGSS followed by walk-over Field Instrument for the Detection of Low Energy Radiation (FIDLER) surveys followed by portable gamma spectroscopy system (PGSS) surveys of identified areas of elevated activity.

This approach, as well as the details of the plan, was reviewed and approved by EPA and CDH. Figure 2-2 exhibits the conceptual design of the characterization plan. Table 2-2 summarizes the actual events of the hot spot sample activities.



EXPLANATION

104 INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS)

CHARACTERIZATION APPROACH:

1) Identify IHSS with Potential Surface Radionuclide Contamination
2) Use HPGe FGSS to get 100% Coverage of IHSS and Identify Potential "Hot Spots".
3) Conduct Walk-over Survey with FIDLER to Locate "Hot Spot".
4) Sample "Hot Spot" Locations Identified in Step 3.

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Conceptual Depiction of the OU1 Surficial Radiological Characterization Action Plan

Figure 2-2

JULY, 1994

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Table 2-2

Hot Spot History

Event	Date
Original hot spot identified	August 1992
HPGe Survey (identifies 9 areas in 119.1, 119.2, and 130)	December 1992 to January 1993
Sampling of original hot spot	January 1993
FIDLER Survey (identifies 4 hot spots)	March to April 1993
Hot spot sampling	April 1993
Receipt of validated data	September 1993
Draft Report	February 1994
Final Report	June 1994

EG&G conducted preliminary characterization and comprehensive sampling of the originally identified hot spot on January 14 and 15, 1993. The original location is identified on Figure 2-1 as location SS100493. A PGSS was used to count each sample for radioactivity during the sampling activities. Using a shovel and trowel, soil was sampled at approximately 1/2-inch intervals. Samples for chemical analyses were collected at 0.75 inches, 4 to 5 inches, and 9 to 10 inches below ground surface. The sample hole was terminated at approximately 10 inches below ground surface due to the samplers encountering a large rock. The samples were temporarily stored on-site pending determination of an appropriate laboratory to conduct the analyses.

The Supplemental and Surficial Radiological Characterization Action Plan Part I and II FGSS surveys were conducted in December 1992 and January 1993. Based on waste history, IHSSs 119.1, 119.2, and 130 were investigated. Each survey measurement covered a 75-foot radius (150 foot diameter), providing approximately 90% to 100% detection coverage. Each FGSS survey location with an integrated point source activity greater that 20 microcuries of americium-241 was surveyed using the FIDLER. The FGSS survey identified nine anomalous areas, and a FIDLER survey was conducted to isolate and delineate potential anomalies identified by the FGSS survey.

The FIDLER survey was subsequently conducted in March and April 1993 to characterize the nine anomalous areas. Based on the survey, four hot spot locations were identified for soil

sampling (Figure 2-1). The soil sampling was performed on April 29, 1993, by EG&G personnel with subcontractor support. Surface soil samples were collected using the CDH protocol that specifies the collection of surface scrapes to a depth of 1/4-inch below ground surface. Samples were then collected using a hand auger at depth until auger refusal. Each sample was screened using a PGSS. A summary of the samples collected, sample depth, and the analyses requested is provided in Table 2-3. It has been noted that the samples originally collected from SS100493 were not submitted for organic analyses due to the time lapse between collection and laboratory selection; however, the location was resampled in April 1993 to collect samples for organic analysis.

2.4.2 Hot Spot Soil Sampling Results

2.4.2.1 Radionuclides

Hot spots were generally found to be markedly contaminated with either plutonium/americium or uranium.

Uranium was below background levels at SS100393, slightly above background at SS100493, and significantly above background at SS100193 and SS100293 (Table 2-4). The highest activities of uranium at SS100193 and SS100293 occur just beneath the surface, as the deeper composites have the higher activities. Although there is insufficient data to determine the depth of uranium contamination at SS100193, the significantly lower uranium activity in the 0- to 3.7-foot composite sample versus the 0- to 2-foot composite at SS100293 suggest the uranium contamination is largely in the upper 2 feet. The maximum total uranium activities at SS100193 and SS100293 are 566 pCi/g and 248 pCi/g, respectively.

Plutonium at activities greater than 10 nCi/g, which is three to four orders of magnitude higher than the activity of any other soil sample at OU1, was found in soil samples from hot spot SS100493 located in IHSS 119.1 (Table 2-4). This is the original location that prompted the hot spot investigation. The plutonium activity is 6,670 pCi/g at the lowest depth sampled (9 to 10 inches below ground surface), which suggests the potential presence of significant plutonium contamination at depths greater than 10 inches. Plutonium was below background levels at SS100193 and SS100293 but was 22.7 pCi/g at SS100393 (0 to 0.25 inches) located just east of 119.2 This activity is consistent with OU2 surface soil data, indicating the 903 Pad as a plutonium source. However, the 0- to 1-foot composite sample had an activity of 14.7 pCi/g, which is somewhat inconsistent with the near-surface contamination hypothesis. The distribution of americium parallels that of plutonium. The highest activities (2,000 to 4,260 pCi/g) were detected in samples from SS100493 (Table 2-4). Considering the immobility of plutonium and americium in the environment and considering the uranium (a more mobile radionuclide) contamination at SS100293 appears confined to the upper 2 feet, it can be reasonably assumed the plutonium/americium contamination at SS100493 is also confined to the upper 2 feet.

Table 2-3

Soil Samples Collected During the Hot Spot Investigation

Sample Location	Sample Number	Depth Collected	Analyses Requested				
			Metals	Radionuclides	VOCs	SVOCs	Pesticides/ PCBs
SS100193 (IHSS 1191.)	SS10002ST	0-0.25"	X	X	X	X	X
	SS10003ST	0-1.4'	X	X	NS	X	X
		1.4-1.7'	NS	NS	X	NS	NS
SS100293 (IHSS 119.1)	SS10004ST	0-0.25"	X	X	X	X	X
	SS10005ST	0-2.0'	X	X	NS	X	X
		2.0-2.3'	NS	NS	X	NS	NS
	SS10006ST	2.0-3.7'	X	X	NS	X	X
		3.7-4.0'	NS	NS	X	NS	NS
SS100393 (IHSS 119.2)	SS10007ST	0-0.25"	X	X	X	X	X
	SS10008ST	0-1.0'	X	X	NS	X	X
		1.0-1.3'	NS	NS	X	NS	NS
SS100493 (IHSS 119.1)	SS10009ST	0-0.25"	NS	NS	X	NS	NS
	SS10010ST	2.0-2.3'	NS	NS	X	NS	NS
	SS10011ST	3.3-3.6'	NS	NS	X	NS	NS
SS100493 (IHSS 119.1)	SS10001EG*	0.75"	X	X	NA	NS	NS
	SS10002EG*	4"- 5"	X	X	NA	NS	NS
	SS10003EG*	9"- 10"	X	X	NA	NS	NS

* Original hot spot location (same location as SS100493) sampled by EG&G 14 and 15 January 1993.

NA = Not analyzed; resampled at SS100493
NS = Not sampled

Refer to Figure 2-1 for sample locations.

Table 2-4

Radionuclides Detected in OU1 Hot Spot Samples*

Sample Location	Depth	Americium-241		Plutonium -239,240		Uranium -233,234		Uranium -235		Uranium -238	
		Activity (pCi/g)	+/-	Activity (pCi/g)	+/-	Activity (pCi/g)	+/-	Activity (pCi/g)	+/-	Activity (pCi/g)	+/-
SS100193	0.0 to 0.25"	0.0294	0.0208	0.0735	0.0527	6.09	1.3	0.176	0.066	3.38	0.74
SS100193	0.0 to 1.4'	0.0493	0.0505	0.133	0.106	429	101	14.6	4.1	122	29
SS100293	0.0 to 0.25"	0.153	0.099	0.429	0.0202	25.4	5.6	0.843	0.358	1.39	0.46
SS100293	0.0 to 2.0'	0.192	0.298	0.878	0.598	240	51	6.23	2	1.51	0.75
SS100293	0.0 to 3.7'	0.0372	0.0437	0.0539	0.0634	8.27	1.93	0.301	0.179	0.779	0.295
22100393	0.0 to 0.25"	4.15	1.27	22.7	5.6	1.49	0.66	0.107	0.214	0.892	0.5
SS100393	0.0 to 1.0'	1.9	0.53	14.7	3.4	0.64	0.259	0.0557	0.0812	0.75	0.283
SS100493	0.75"	2650	570	11100	2700	9.68	6.32	0	0	4.69	3.96
SS100493	4.0 to 5.0"	4260	930	17400	4400	7.46	5.56	0.92	1.85	8.22	5.81
SS100493	9.0 to 10.0"	2010	450	6670	1540	0.91	2.33	2.07	3.45	1.22	2.25

*Adapted from DOE, 1994

2.4.2.2 Organic Contaminants

Polychlorinated Biphenyls (PCBs)

As mentioned, PCBs were analyzed in each sample collected from SS100193, SS100293, and SS100393 (Table 2-3). No sample from SS100493 was submitted for PCB analysis. Of the seven samples analyzed, PCBs (Aroclor-1254) were detected in three of the samples: the 0- to 1.4-foot composite at SS100193 (260 micrograms per kilogram [μg/kg]); the 0- to 0.25-inch surface scrape at SS100393 (780 μg/kg); and the 0- to 1.0-foot composite at SS100393 (460 μg/kg) (Table 2-5). The PCB concentrations are similar to those found in samples from nearby surface soil sampling stations (range 132.5 to 1,200 μg/kg) (DOE, 1994). The nearby surface soils do not contain hot spot levels of radionuclides; therefore, it does not appear that fluids associated with released radionuclides contained PCBs, although this cannot be entirely ruled out.

Polynuclear Aromatic Hydrocarbons (PAHs)

Eleven PAHs were detected in the hot spot samples collected in OU1. The total PAH concentrations are shown on Table 2-5. Concentrations are similar to the results of the OU1-wide surface soil sampling results. PAHs are ubiquitous in surface soils in urban areas, and the elevated concentrations do not appear to be associated with waste-related activities at the IHSSs.

Volatile Organic Compounds

Toluene was present in samples collected from each of the four hot spot locations, and tetrachloroethene (PCE) was present in the sample collected from location SS100493, located in IHSS 119.1. The reported concentrations are summarized in Table 2-5. The toluene results indicate a trend of increasing concentrations with depth. The surface samples at each location generally show the lowest concentration, and the highest concentration was generally reported in the deepest interval. This is true for each hot spot, with the exception of location SS100493, where the highest concentration (120 μg/kg) was found in the middle interval (2.0 to 2.3 feet below ground surface). The deeper interval (3.3 to 3.6 feet) showed a marked decrease in the toluene concentration (28 μg/kg).

PCE was only detected in the samples collected from location SS100493. The lowest concentration was reported in the surface scrape sample (0 to 0.25 inch), and the middle zone (2.0 to 2.3 feet) exhibited the highest concentration of 170 μg/kg. The deeper interval, collected at 3.3 to 3.6 feet, showed a marked decrease in the PCE concentration (15 μg/kg), which is consistent with the toluene trend.

Table 2-5

Organic Compounds Detected in Hot Spot Samples

Sample Location	Sample Depth	Concentrations (µg/kg)			
		Toluene	PCE	Total PAHs	PCB
SS100193	0–0.25"	ND	ND	3219	ND
	0–1.4'	NA	NA	ND	260*
	1.4–1.7'	100	NA	NA	NA
SS100293	0–0.25"	23	ND	2907	ND
	0–2.0'	NA	NA	NA	ND
	2.0–2.3'	54	ND	NA	NA
	2.0–3.7'	NA	NA	ND	ND
	3.7–4.0'	69	ND	NA	NA
SS100393	0–0.25"	13	ND	4602	780*
	0–1.0'	NA	NA	3179	460*
	1.0–1.3'	85	ND	NA	NA
SS100493	0–0.25'	ND	6	NA	NA
	2.0–2.3'	120	170	NA	NA
	3.3–3.6'	28	15	NA	NA

Refer to Figure 2-1 for sample locations.
* Aroclor 1254
NA = Not analyzed
ND = Not detected
µg/kg = micrograms per kilogram.

2.4.3 Potential for Radionuclide Migration

At this time, radionuclide contamination at the hot spots is confined to small areas. However, the radionuclides in the surface soils could be mobilized by wind action (sustained winds over 50 miles per hour are not unusual at RFP). This mobilization could result in transport of radionuclides to distant downwind locations. Winds prevail from the west/northwest. Air flow and dispersion characteristics indicate winds come from the mountains to the west, turn and move north and northeast along the South Platte River valley, and pass west and north of Brighton, Colorado. The hot spot soils may also be eroded and transported in overland runoff into the Woman Creek drainage. Surface water migration is most likely to occur during periods of intense rainfall, such as that associated with the summer thunderstorms common to the RFP vicinity. It appears that the radionuclides are in a chemical form with limited water solubility. Limited solubility reduces the potential for radionuclides to leach into deep vadose soils or groundwater. The RFI/RI report indicates that radionuclides are not contaminants of OU1 groundwater.

2.5 NATIONAL PRIORITIES LIST (NPL) STATUS

RFP was proposed for inclusion on the NPL on October 15, 1984, pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, and became final on September 21, 1989. Accelerated Removal Actions are being planned pursuant to the draft revised 1994 IAG, and 40CFR 300.415.

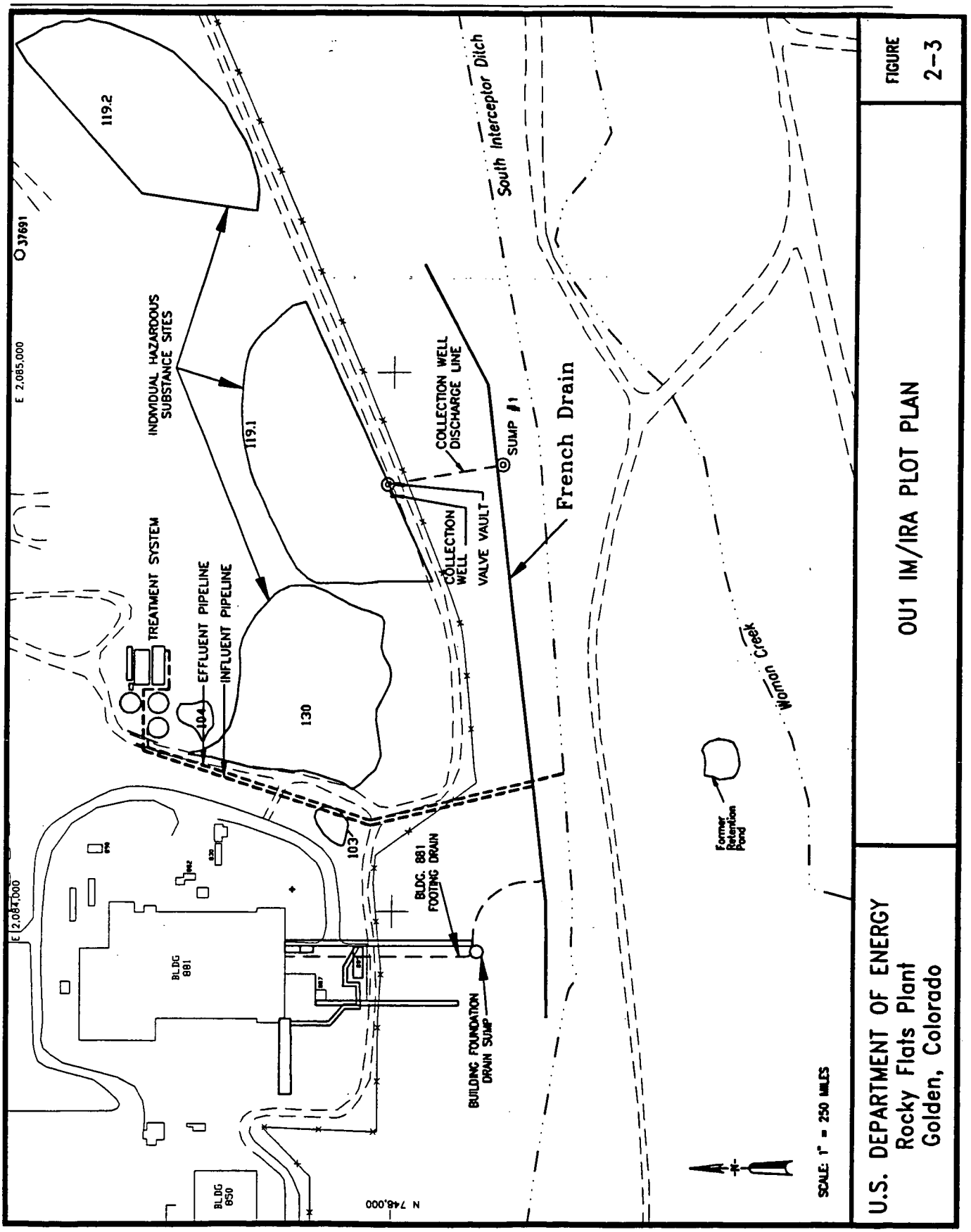
2.6 OTHER ACTIONS TO DATE

2.6.1 Previous Actions

Previous actions at OU1 include implementation of an IM/IRA to collect and treat contaminated groundwater, which began operation in August 1991 (Figure 2-3). Groundwater is collected by a downgradient french drain as well as from a building footing drain (Building 881) and an extraction well, and is treated by a system consisting of ultraviolet (UV)/peroxide oxidation for removal of organics, and ion exchange for removal of trace metals and salts. Treated groundwater is discharged to surface water after it has been treated to meet the Applicable and Relevant and Appropriate Requirements (ARARs) established for OU1. The treatment system capacity is 30 gallons per minute (gpm).

2.6.2 Current Actions

Actions being conducted at OU1 are limited and include normal operation of the French Drain and treatment facility. Collected waters are also sampled for subsequent chemical analysis.



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2.7 STATE AND LOCAL AUTHORITIES' ROLE

2.7.1 State and Local Actions to Date

Through its authority pursuant to the IAG, CDH has provided oversight during the RFI/RI process. To date, neither CDH nor local authorities have taken specific actions to address removal of the hot spots.

2.7.2 Potential for Continued State and Local Response

CDH will continue regulatory oversight through the revised 1994 IAG. It will not be necessary for local authorities to undertake response actions as the responsibility lies completely with DOE. By way of this PAM, DOE is aggressively pursuing the removal action.

3.0 POTENTIAL THREATS TO PUBLIC HEALTH AND ENVIRONMENT

This Accelerated Response Action is being undertaken because the site conditions specified in 40 CFR 300.415(b)(2) have been observed, and the response action can be conducted in less then 6 months per the draft revised IAG. Based upon the review of the potential for exposure to and migration of chemicals present in the surface and shallow subsurface soils at the hot spots locations, the conditions specified at 40 CFR 300.415(b)(2)(i, iv, and v) have been met, i.e., actual or potential exposure to human populations, high levels of hazardous substances largely at or near the surface, and weather conditions that may cause hazardous substances to migrate.

3.1 THREATS TO PUBLIC HEALTH

There is significant immediate risks to workers and future risks to the public health posed by the radionuclides (plutonium and americium) in the hot spot soils (DOE, 1994). The dominant pathways for exposure to the radionuclides are incidental ingestion of soils and inhalation of dust. As shown in Table 3-1, the estimated carcinogenic risk for a current on-site worker (security specialist) is 1.1×10^{-4}. This risk exceeds EPA's 10^{-6} to 10^{-4} range for acceptable exposure [40 CFR 300.430(e)(2)(i)(A)(2)]. The risk to an on-site future resident is 2.7×10^{-2} if the hot spots are present, and only 9.8×10^{-6} if the hot spots are removed (DOE, 1994). Although the risk estimation is conservative because the hot spot radionuclide activities were averaged with the other surface soil data without consideration for area weighting, it is clear that the presence of the hot spots pose unacceptable current and future risk to workers and the public.

Furthermore, the hot spot soils proposed for removal are currently subject to erosion and subsequent migration of radioactive contaminants into the Woman Creek drainage area. The

potential for migration and spreading of contamination through runoff is increased by permitting the contaminants to remain in place.

Table 3-1

Estimated Carcinogenic Risk from Exposure to Plutonium and Americium in OU1 Soils*

Exposure Scenario	Exposure Pathway	Carcinogenic Risk		
		Pu-239, 240	Am-241	Total
Current On-Site Worker (w/hot spots present)	Ingestion of soil Inhalation of dust	3.6×10^{-6} 8.5×10^{-5}	1.1×10^{-6} 2×10^{-5}	4.7×10^{-6} 1.05×10^{-4}
			Total Risk	1.1×10^{-4}
Future On-Site Resident (w/hot spots present)	Ingestion of soil Inhalation of dust	1.8×10^{-3} 2.1×10^{-2}	4.5×10^{-4} 4.3×10^{-3}	2.2×10^{-3} 2.5×10^{-2}
			Total Risk	2.7×10^{-2}
Future On-Site Resident (w/hot spots removed)	Ingestion of soil Inhalation of dust	6.6×10^{-7} 7.9×10^{-6}	1.2×10^{-7} 1.1×10^{-6}	7.8×10^{-7} 9.0×10^{-6}
			Total Risk	9.8×10^{-6}

*Adapted from DOE, 1994.

3.2 THREATS TO THE ENVIRONMENT

The RFI/RI concluded that while some contaminants in OU1 soils occur at potentially toxic levels, the contaminated areas are not large enough to result in a significant threat to the populations of plants or animals at and in the vicinity of OU1 (DOE, 1994). PCBs and PAHs, but not radionuclides, are at concentrations in surface soils potentially toxic to ecological receptors. The concentrations of PCBs and PAHs in the hot spots are typical of those found sporadically in surface soils at OU1. However, the restricted distribution of these contaminants limits the duration and frequency of contact with the receptors, and therefore limits exposure. With respect to the radionuclides, the activities at the hot spots were lower than the calculated soil activities that are estimated to result in a critical dose of 0.1 rad/day in animal tissues. [The International Atomic Energy Agency states that dose rates below 0.1 rad/day do not result in adverse effects in plants or animals (IAEA, 1992)]. The soil activities that could result in the critical dose are 600,000 pCi/g, 560,000 pCi/g, and 1,800,000 pCi/g for plutonium, americium,

and uranium, respectively. The maximum activities in the hot spots for these radionuclides are 17,400 pCi/g, 4,260 pCi/g, and 566 pCi/g, respectively.

4.0 ENDANGERMENT DETERMINATION

Actual or threatened releases of radionuclides from this site, if not addressed by implementing the response action selected in this action memorandum, may present an imminent and substantial endangerment to the public health.

5.0 ALTERNATIVE ACCELERATED RESPONSE ACTIONS

5.1 DESCRIPTION OF OPTIONS

Three alternative accelerated response actions have been identified to address the hot spots at OU1:

1) Excavation with On-Site Storage;
2) *In Situ* Stabilization; and
3) Capping.

These options are subsequently described.

5.1.1 Option 1: Excavation with On-Site Storage

Option 1 will consist of simple excavation of contaminated surface and shallow subsurface soil. The removal will be conducted in accordance with a site-specific Health and Safety Plan (HSP) and Sampling and Analysis Plan (SAP) by trained RFP staff. The HSP addresses the physical and chemical hazards associated with the work. The removal action will include real-time monitoring of suspended particulates and radioactivity.

Prior to excavation of the soils, the FGSS will be used to establish baseline radionuclide specific activities at the hot spots. The soils will then be excavated using hand tools or a backhoe while applying appropriate dust control measures to mitigate potential contaminant migration during excavation. Excavation will proceed in 6-inch depth increments and continue until the remaining soil exhibits local background levels of radioactivity as measured with a FIDLER [3,700 counts per minute (cpm)]. [Surficial soils throughout OU1 are contaminated with radionuclides due to deposition of wind blown contaminated dust originating from the 903 Pad Area (DOE, 1994). The radiological survey described in Section 2.4.1 established that the locally contaminated soils at OU1 register 3,700 cpm on a FIDLER (local background).] After soils have been excavated

to achieve local background levels, an additional six inches of soil will be excavated to ensure the hot spot has been removed. The FGSS will again be used to establish post-removal radionuclide specific activities in the excavation. Confirmatory samples will be collected and shipped for off-site laboratory analysis (Pu-239,240, Am-241, U-233,234, U-235, and U-238) to document the hot spot was removed and local background levels of radionuclides remain. If it is determined local background levels have not been achieved, additional excavation of hot spot(s) will continue until the objective has been met.

The excavated material will be placed in lined, steel drums, sealed, and managed in accordance with RCRA/Colorado Hazardous Waste Act (CHWA) requirements. It is estimated that the volume of contaminated soil will be approximately 1.5 cubic yards per hot spot, which should fill a total of approximately 10 to 20 55-gallon drums for all 4 hot spots. It is anticipated that this material will be stored at RFP RCRA Site 18.04. A treatment plan may be developed after characterization samples are evaluated. The Nevada Test Site (NTS) does not currently accept mixed waste for disposal. Depending on the exigencies of mixed waste storage and disposal at RFP, excavated soils may be treated to render them non-hazardous, i.e., soley low level waste suitable for disposal at the NTS.

Due to the small areal extent of the proposed removal action locations and site-specific conditions, the proposed removal action is not likely to adversely impact sensitive ecological receptors or their habitats.

5.1.2 Option 2: *In Situ* Stabilization

Each of the hot spots will be stabilized in place by grouting. The grouting will involve the injection of either cement, clay, inorganic chemicals (e.g., alkali silicates), or organic polymers (e.g., acrylimide, phenolic, urethane, urea-formaldehyde, epoxy, or polyester grouts). The choice of grout would require a treatability study to be performed to determine effectiveness in solidifying and rendering the radionuclides immobile, i.e., resistant to erosion. Grout would be injected to a depth of approximately 2 feet with an areal coverage that includes all above local background levels of radioactivity as measured by a FIDLER instrument.

5.1.3 Option 3: Capping

In this option, caps will be emplaced over the hot spots to prevent human contact with the radionuclide-contaminated soils. The caps would consist of a low permeability soil-bentonite admixture. The cap would be 6 inches in thickness with an areal coverage that includes all above local background levels of radioactivity, as measured by a FIDLER.

5.2 EVALUATION OF OPTIONS

The alternatives have been evaluated in a two step process: screening of options with respect to required response time and public health and environmental effectiveness; and analysis of options with respect to technical feasibility, institutional factors, and cost. Of the three options for the accelerated response action, only the first passes the first stage screening of options.

5.2.1 Screening of Options

5.2.1.1 Option 1

Option 1 reduces the potential risk to on-site workers associated with exposure to contaminated soil through direct contact or inhalation of suspended particulates, and prevents radionuclide migration into the Woman Creek drainage through erosion or surface water transport in overland runoff. This is achieved by removing field-detectable radionuclide contamination from the areas, thus eliminating the potential for human exposure or radionuclide migration. Although the long-term cleanup plan for OU1 has not been formulated, the objectives of permanently reducing health risks and contaminant migration potential at OU1 should be consistent with future long-term cleanup plans. The response action can be performed within 6 months. It is noted that this action is not intended to remove all radionuclide contamination or to be a final action for the specific IHSSs. Any remaining contamination will be addressed in the OU1 Corrective Measures Study/Feasibility Study.

5.2.1.2 Option 2

Option 2 would reduce the potential for further radionuclide migration; however, the required response time for Option 2 is longer than for the other options. As previously mentioned, a treatability study would have to be performed to select the appropriate grout. Such a treatability study followed by the actual response action could not be performed within 6 months, which is inconsistent with an Accelerated Response Action. Also, stabilization of such small volumes of soil is not cost effective. Furthermore, there is still a potential for human contact as the radionuclides are still present at the hot spots. This removal action may not be consistent with the final remedy for OU1 soils; therefore, Option 2 is not considered further.

5.2.1.3 Option 3

Capping could be performed within 6 months and would reduce exposure and the potential for contaminant migration. However, caps can be disrupted by freeze/thaw cycles and exposure to the atmosphere can result in drying with consequent shrinkage and cracking. Capping does not provide a permanent remedy that addresses future exposure to the radionuclides and thus may be inconsistent with the final remedy for OU1; therefore, Option 3 is not considered further.

5.2.2 Analysis of Option 1

5.2.2.1 Technical Feasibility

Option 1 will achieve a high degree of performance, reliability, implementability, and safety. In terms of performance, Option 1 will permanently reduce potential public health risks and migration of radionuclides that are posed by the present disposition of the hot spots. Excavation is a reliable technology for removal of contamination, and long-term operation and maintenance is not required. Excavation can also be implemented easily and readily. Special permits will not be required, and mixed waste storage capacity is available at RFP for the excavated soils. The soils will be treated to render them low level waste for disposal at the NTS or another appropriate site if a permitted mixed waste disposal site does not become available. In terms of safety, the hot spots are relatively small and their excavation will not present a risk to the public or result in adverse affects to the environment. Appropriate health and safety precautions will be taken to ensure safety of both workers and the public.

5.2.2.2 Institutional Factors

The action will meet all ARARs and will be in compliance with the National Environmental Policy Act (NEPA). The federal ARARs determined to be practicable for this removal action include the applicable statutory provisions of and regulations promulgated pursuant to the RCRA (42 U.S.C. §§ 6901 et seq. and 40 CFR §§ 260-270) for managing the excavated soil as hazardous waste, the Occupational Safety and Health Act (29 U.S.C. §§ 651 et seq. and 29 CFR §§ 1900 et seq.) and Atomic Energy Act (42 U.S.C. § 2210 et seq. and 10 CFR §§ 20 et seq.) for protecting worker health and safety during implementation, and applicable DOE Orders.

The Colorado ARARs relevant to this removal action include the applicable statutory provisions and regulations promulgated pursuant to the CHWA (CRS §§ 25-15-101 to -313 and 6 CCR §§ 1007-2 to -3) for managing hazardous waste, Colorado Radiation Control Act (CRS §§ 25-11-101 to -305 and 6 CCR § 1007-1) for managing radioactive waste and protecting against worker exposure, and the Colorado Air Quality Control Act (CRS §§ 25-7-101 to -609 and 5 CCR §§ 1001-3, -5, -8-10) for controlling air emissions.

With respect to NEPA compliance, the RFP NEPA Compliance Committee has reviewed the action, completed an environmental checklist review form, and has recommended a Categorical Exclusion (CX) from further NEPA documentation requirements. A draft CX Determination is under review by the DOE.

5.2.2.3 Cost

As shown in Table 5-1, the total estimated cost for removal of the four hot spots is $390,000. The scope estimate considers the cost of planning, sampling, testing, removing, packaging, storing, and reporting. There is no operation and maintenance cost associated with excavation storage of the soil. The estimate does not include any costs for treatment or disposal of the soils.

Table 5-1

OU1 Hot Spot Removal Costs

Capital	Cost ($)
Planning and Management	180,357
Construction and Contingency	209,643
Subtotal Capital Cost	390,000
Operation and Maintenance	0
Subtotal O&M Cost	0
TOTAL COST	390,000

6.0 PROPOSED ACTION

6.1 PROJECT DESCRIPTION AND RATIONALE FOR SELECTION

The proposed action considered for reducing potential health risk and environmental migration of radionuclides in soil at the designated locations in IHSS 119.1 and 119.2 is small volume excavation. Excavation was selected because it is (1) capable of permanently reducing health risk and migration potential at the selected locations, (2) timely, (3) cost-effective, and (4) consistent with future actions. Although contaminants will remain in the subsurface soil, they are anticipated to be addressed in future response actions. Excavated soils may be treated, as necessary, prior to disposal at an appropriate off-site facility.

6.2 PROJECT SCHEDULE

The proposed removal action is scheduled to begin on September 20, 1994, and is expected to continue for a period of 10 working days. Any delay in initiating the proposed action will result in a delay in completion of the removal.

7.0 EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

Any delay in the proposed removal action will result in additional potential, unacceptable exposure of on-site workers to radionuclides through direct contact and particulate inhalation, and further environmental migration through wind action and surface water runoff from summer showers. Therefore, removal of the hot spots prior to the final remedial action at OU1 is necessary.

8.0 RECOMMENDATION

It is recommended that the DOE initiate and execute the proposed removal action scheduled on September 20, 1994.

9.0 REFERENCES

DOE (U.S. Department of Energy). 1994. *Final Phase RFI/RI Report: 881 Hillside Area (Operable Unit No. 1).* Department of Energy, Rocky Flats Plant, Golden, Colorado, June 1994.

IAEA (International Atomic Energy Agency). 1992. *Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards.* Technical Reports Services 332. IAEA, Vienna.