# CORRECTIVE ACTION DECISION/ RECORD OF DECISION

## OPERABLE UNIT 3
## THE OFFSITE AREAS
## Rocky Flats Environmental Technology Site

Prepared by:
U.S. Department of Energy
Rocky Flats Field Office
Golden, Colorado

April 1997

ADMIN RECORD 1/26
A-OU03-000551

# CORRECTIVE ACTION DECISION/RECORD OF DECISION DECLARATION

## SITE NAME AND LOCATION

Rocky Flats Environmental Technology Site, Operable Unit 3: Offsite Areas, Jefferson County, Colorado.

## STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action/corrective action for the Rocky Flats Environmental Technology Site (RFETS) Operable Unit (OU) 3: Offsite Areas, located near Broomfield and Westminster, Colorado. The selected remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986. The selected remedy was also chosen in accordance with the Colorado Hazardous Waste Act (CHWA). The Resource Conservation and Recovery Act (RCRA) is administered in Colorado through the CHWA, by the Colorado Department of Public Health and Environment (CDPHE). To the extent practicable, the selected remedy is also consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

OU 3 was investigated and a remedy was selected in compliance with the Federal Facility Agreement and Consent Order - Interagency Agreement (IAG), signed by the U.S. Department of Energy (DOE), the State of Colorado and the U.S. Environmental Protection Agency (EPA) on January 22, 1991. The selected remedy is also consistent with the Federal Facility Agreement and Consent Order - Rocky Flats Cleanup Agreement (RFCA), signed by DOE, the State of Colorado and EPA on July 19, 1996. RFCA now governs cleanup at Rocky Flats. The remedy selection is based on the administrative record for OU 3, and CDPHE and the EPA agree with the remedy selected.

OU 3 is one of sixteen OU's at Rocky Flats originally identified in the IAG, and is the only one not located within the RFETS boundaries. The RFCA consolidated many of the original sixteen OU's, but OU 3 remained separate, owing both to its unique geographic location and to the fact that investigations and administrative activity for OU 3 were nearly completed when RFCA was signed. OU 3 is comprised of four Individual Hazardous Substance Sites (IHSS's): Contamination of the Land Surface (IHSS 199), Great Western Reservoir (IHSS 200), Standley Lake (IHSS 201) and Mower Reservoir (IHSS 202).

## DESCRIPTION OF THE SELECTED REMEDY

The selected remedy for OU 3 is no action. Based upon the Baseline Risk Assessment and the Environmental Risk Assessment contained in the RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report of June 1996, DOE, the lead agency under CERCLA for OU 3, concludes that no action is appropriate for OU 3. The RFI/RI Report concludes that all IHSS's within OU 3 are already in a state protective of human health and the environment. The NCP provides for the selection of a no action remedy when an OU is in such a protective state. Therefore, no remedial action regarding OU 3 or any of its constituent IHSS's is warranted.

## DECLARATION STATEMENT

DOE, in consultation with CDPHE and EPA, has determined that no remedial action is necessary for OU 3 to be protective of human health and the environment. No hazardous substances, pollutants or contaminants will remain within the boundaries of OU 3 above levels that allow for unlimited use and unrestricted exposure, as these levels have been calculated in the OU 3 RFI/RI Report. Since no national health-based standards have been

promulgated for the radioactive contaminants remaining in OU 3, this Corrective Action Decision/Record of Decision will be reviewed in five years, consistent with CERCLA Section 121(c), to ensure consistency with such a national standard, if one is later promulgated. Since the conclusions contained in this Corrective Action Decision/Record of Decision are in part dependent upon calculated radiation exposure levels, the Corrective Action Decision/Record of Decision will additionally be reviewed if necessary, consistent with CERCLA Section 121(c), to ensure consistency with any revisions to those calculated levels that may result from new regulations, or improved calculation methods or modelling parameters.



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Jessie Roberson, Manager
U.S. Department of Energy, Rocky Flats Field Office

April 14, 1997
Date

Max H. Dodson
Assistant Regional Administrator
Office of Ecosystem Protection and Remediation
U.S. Environmental Protection Agency, Region VIII

Date

Howard Roitman, Director
Hazardous Materials and Waste Management Division
Colorado Department of Public Health and the Environment

May 30, 1997
Date

Jessie Roberson, Manager
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April 14, 1997
Date

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June 3, 1997
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Jessie Roberson, Manager Date
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# DECISION SUMMARY

## Site Name, Location and Description

*Rocky Flats Environmental Technology Site*

The Rocky Flats Environmental Technology Site (RFETS) is located about sixteen miles northwest of downtown Denver, Colorado, in northernmost Jefferson County, west of the Cities of Broomfield and Westminster, Colorado (Figure 1). RFETS occupies approximately 6,535 acres of land owned by the federal government. Most of this land (~6,100 acres) is vacant buffer zone surrounding a 385-acre industrial area where most buildings and other structures are located, and where manufacturing activities at RFETS historically took place.

RFETS is located along the eastern edge of the southern Rocky Mountains, immediately east of the Colorado Front Range. The site is located on a broad, eastward-sloping pediment capped by Quaternary alluvial deposits known as the Rocky Flats Alluvium. The pediment surface is dissected by several east to northeast trending stream valleys, the bases of which lie up to two hundred feet below the top of the older pediment surface. In places, these valleys cut into the underlying bedrock, but in most places the bedrock is hidden beneath colluvium that has collected along the valley slopes. RFETS elevations range from about 5,800 feet to about 6,000 feet above mean sea level.

The main surface water features at RFETS are Rock Creek, North and South Walnut Creeks, and Woman Creek. These creeks are ephemeral/intermittent in nature, except in reaches of Walnut Creek that receive discharges from the RFETS sewage treatment plant. North and South Walnut Creeks and Woman Creek are impounded in places along their lengths by three series of holding ponds (the A-, B-, and C-series ponds, respectively). The purpose of these ponds is to retain water in the event of an industrial discharge from RFETS. Water from Pond C-2, located in the Woman Creek drainage and which drains water from the 881 Hillside south of the industrial area, was pumped to the Walnut Creek diversion ditch and routed around Great Western Reservoir. Following completion of the Standley Lake Protection Project, C-2 water is now released directly to Woman Creek.

Land use within ten miles of RFETS (including Operable Unit 3) includes residential, agricultural, industrial, parks and open space, vacant and institutional classifications. Most residential use is located northeast, east and southeast of RFETS. Commercial development occurs near Jefferson County Airport, located about three miles northeast of RFETS, and north and southwest of Standley Lake. Quarrying and mining for sand, gravel and coal take place on RFETS or within five miles of the site. Irrigated and non-irrigated croplands, producing primarily winter wheat and barley, are located primarily northeast and southeast of the site. Much of the vacant land around RFETS is rangeland.

*Operable Unit 3*

Operable Unit 3 (OU 3) is composed of four Individual Hazardous Substance Sites, or IHSS's. IHSS's are specific locations where hazardous substances, solid wastes, pollutants, contaminants, hazardous wastes or hazardous constituents may have been disposed of or released to the environment from Rocky Flats at any time in the past. The four IHSS's that comprise OU 3 are: IHSS 199, Contamination of the Land Surface; IHSS 200, Great Western Reservoir; IHSS 201, Standley Lake; and IHSS 202, Mower Reservoir. Their locations are shown in Figure 1.

## Site History and Enforcement Activities

The Rocky Flats Environmental Technology Site (RFETS) is a government-owned, contractor operated facility that is part of the nationwide nuclear weapons manufacturing complex. RFETS began operation in 1951 under the Atomic Energy Commission, until it was dissolved in 1975. The Energy Research and Development Agency assumed responsibility for Rocky Flats until 1977, when the Department of Energy was created. Prior to 1992, RFETS engaged in the production of nuclear and non-nuclear components of atomic weapons, using plutonium, uranium, beryllium and stainless steel as the primary materials. In 1992, the nuclear production mission was suspended, and by 1995, all production at RFETS had ceased. RFETS has been rededicated to a mission of environmental cleanup and safe management of nuclear materials remaining on site.

Portions of OU 3, primarily as a result of accidental releases from RFETS in the past, contain low-level deposits of radionuclides. Migration via wind-borne dispersal or surface water runoff from the RFETS 903 Pad area is a likely source for some of the observed radionuclides in the OU 3 IHSS's. The deposits of radionuclides at the 903 Pad, located near the RFETS inner east gate, resulted from the storage of numerous 55-gallon drums containing lathe coolants and plutonium. These drums were stored at the 903 Pad from 1958 to 1968, during which time the drums corroded and the lathe coolant and plutonium leaked onto surrounding soils. The drums and surrounding surface soil were removed from the 903 Pad area in 1969 and an asphalt cap was subsequently placed over the entire 903 Pad area.

Reconstruction of the RFETS surface water holding ponds between 1970 and 1973 is also a primary source for some of the deposits of radionuclides observed in IHSS 200. Prior to 1979, process wastewater from decontamination operations and the laundry plant effluent were channeled through a series of ponds located along South Walnut Creek, before the stream left RFETS and entered Great Western Reservoir. The holding pond reconstruction may have resulted in the resuspension of sediments containing radionuclides that were ultimately transported downstream into Great Western Reservoir.

Other potential sources of radionuclides were considered in the RFI/RI Report, and by previous researchers, but are probably less significant than the two aforementioned sources. These other sources include possible low-level air emissions during the early years of Plant operation; a fire in Building 771 on September 11, 1957; and a fire in Building 776 on May 11, 1969.

In 1975, suit was filed naming former RFETS contractors Rockwell International and Dow Chemical Company and the United States as defendants in an action claiming that land immediately east of RFETS (land east of Indiana Street that is within the geographic area of OU 3) had been damaged by the release of radionuclides from RFETS. The suit was settled in December 1984. As part of the settlement, Jefferson County acquired 250 acres of the land in question and the City of Broomfield acquired 100 acres. The City of Westminster has subsequently acquired Jefferson County's interest in the land. The settlement also called for the land in question (known as the "Remedy Lands") to be tilled and then revegetated by seeding in an effort to reduce the surface concentrations of radionuclides. Tilling did successfully reduce the surface concentrations of radionuclides, but revegetation has proven difficult. There have been no other requests to till and revegetate the land since Jefferson County's 1986 request.

On January 22, 1991, the Department of Energy, the U.S. Environmental Protection Agency and the Colorado Department of Health signed the Federal Facility Agreement and Consent Order, also known as the Interagency Agreement or IAG. The IAG divided

RFETS and the surrounding lands into sixteen OU's, and specified that OU 3 be divided into the four IHSS's shown in Table 1. OU 3 was investigated pursuant to the guidance set forth in the IAG, and the RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report was released in August 1996.

On July 19,1996, DOE, EPA and CDPHE signed the Rocky Flats Cleanup Agreement (RFCA), which superseded the IAG. RFCA consolidated many of the OU's at RFETS into two larger OU's: the Buffer Zone and the Industrial Area. OU 3 remained separate under RFCA, owing both to its unique geographic location and to the fact that investigations and administrative actions at OU 3 had been nearly completed at the time RFCA was signed.

## Highlights of Community Participation

DOE submitted the final RFI/RI Report for OU 3 to EPA on July 11, 1996, following resolution of final comments by EPA, CDPHE, the City of Broomfield and the City of Westminster. Regulatory approval to release the OU 3 Proposed Plan for public comment was granted on August 7, 1996. The Proposed Plan was released for public comment on August 7, 1996. A public hearing on the OU 3 Proposed Plan was held on September 18, 1996, at the Arvada Center for the Arts and Humanities in Arvada, Colorado. Citizen comments received at the public hearing were recorded; responses to those comments are included in the attached Responsiveness Summary. The public comment period for the OU 3 Proposed Plan ended on October 11, 1996. Written comments on the Proposed Plan were received from the City of Westminster and the City of Broomfield. Responses to these written comments are also included in the attached Responsiveness Summary.

## The Scope and Role of OU 3

The IAG established OU 3 as one of sixteen original Operable Units at RFETS; it is the only one of these sixteen OU's that addresses past releases of hazardous substances off RFETS property. The selected remedy in this Corrective Action Decision/Record of Decision (CAD/ROD) is no action. Based upon the results of the OU 3 RFI/RI Report, the IHSS's within OU 3 have been determined to be in a protective state with regard to human health and the environment. Therefore, no remedial action regarding these IHSS's is warranted.

The CAD/ROD, and the RFI/RI report upon which the CAD/ROD and the OU 3 Proposed Plan are based, consider past releases of hazardous substances within the IHSS's in OU 3, the risks that these releases pose to human health and the environment, and the need for action, if any, based upon those risks. The CAD/ROD does not consider potential future releases from RFETS, nor does it consider ongoing monitoring or pollution prevention programs that serve to detect or prevent such future releases. Numerous such programs are currently in place at RFETS, mandated by Federal or State law, or by enforceable compliance agreements. None of these programs is a condition of this CAD/ROD. However, examples of such programs include:

- Point source discharge and stormwater monitoring, for non-radiological parameters, conducted under the Site's National Pollutant Discharge Elimination System (NPDES) permit, issued pursuant to the Clean Water Act ;

- Groundwater and surface water monitoring (including stations at the RFETS boundary) for a range of parameters, including plutonium-239/240 and americium-241, conducted pursuant to RFCA requirements;



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- Monitoring for radionuclide air emissions to demonstrate compliance with National Emissions Standards for Hazardous Air Pollutants, required by the Clean Air Act;

- Regular inspection and maintenance of RFETS hazardous waste storage and treatment facilities, required by the Site's permit issued under the Colorado Hazardous Waste Act;

- Maintenance of a Spill Prevention, Control and Countermeasures/Best Management Plan, required by the Site's NPDES permit; and,

- Procedures to Prevent Hazards and a Contingency Plan, contained in the Site's hazardous waste permit, issued pursuant to the Colorado Hazardous Waste Act.

RFETS is continuing to commission a panel of experts to conduct basic research on the environmental chemistry of actinides. While again not a condition of this CAD/ROD, the panel is expected to provide information on the potential for actinide migration at RFETS. In turn, this information will be used to guide future remedial and management actions at RFETS, and help to prevent or mitigate the possibility of off site releases.

## Summary of OU 3 Site Characteristics

### *Geology and Hydrogeology*

Surficial geology in OU 3 is characterized by Quaternary Age unconsolidated deposits of four types: pediment and terrace alluvium, slope-wash colluvium and loess, landslide deposits and valley-fill alluvium. Recognized pediment and terrace alluvium formations in OU 3 include the Verdos Alluvium (weakly cemented boulders, cobbles and coarse sands, located around Standley Lake and Great Western Reservoir), the Slocum Alluvium (cobble gravel and clayey coarse sand with mica, found along Woman Creek and the Smart Ditch), and the Louviers Alluvium (red- to yellow-brown sand, pebbles and cobbles in a clayey silt to sandy matrix, found along Woman Creek). Slope-wash colluvium of Pleistocene age occurs along valley sides on Woman and Walnut Creeks in the western reaches of OU 3 near the RFETS boundary, and Pleistocene loess deposits are found along the higher alluvial terraces south of Standley Lake. Landslide deposits of Pleistocene and Holocene age are most abundant in the Rock Creek drainage. Well records from private wells in OU 3 suggest that in general, surficial deposits in the area range from 15 to about 50 feet in thickness, although landslide deposits along Rock Creek can be up to 100 feet thick.

Bedrock geology in OU 3 is marked by two regional sedimentary formations, the Arapahoe Formation and the Laramie Formation. Both are Cretaceous-age deposits formed by outwash from the Front Range of the Rocky Mountains. The Arapahoe Formation, the uppermost bedrock formation in OU 3, contains primarily claystones and silty claystones as well as some siltstones and sandy conglomerates. The Arapahoe Formation lies unconformably beneath the land surface, and weathering penetrates the Formation to depths between 10 and 40 feet. In the vicinity of RFETS, the Arapahoe Formation has a thickness of up to 50 feet. The Laramie Formation underlies the Arapahoe Formation and consists of two main units, an upper, primarily claystone unit, and a lower unit containing coals and sandstones. The Laramie Formation has a total maximum thickness of about 800 feet, of which the upper unit is 600 to 800 feet thick and the lower unit is about 300 feet thick. The Laramie Formation is underlain by the Fox Hills Sandstone, a regionally important aquifer in the Denver Basin. Recharge to the Laramie-Fox Hills Aquifer takes place along a narrow outcropping west of RFETS along the base of the Front Range.



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At RFETS, groundwater in the Rocky Flats Alluvium (the uppermost unit at RFETS, generally absent from OU 3) is recharged by surface precipitation or man-made sources, and flows laterally along the top of the Arapahoe formation, expressing itself as seeps along the upper reaches of Woman, Walnut and Rock Creeks. The low transmissivities of the Arapahoe and Upper Laramie formations effectively preclude deep vertical migration of groundwater (and any associated contaminants) from the shallow aquifer at RFETS. There is , therefore, no direct connection between the shallow groundwater at RFETS and groundwater in OU 3.

While there are numerous private wells known to have been drilled in OU 3, limited information is available in the form of drilling records held by the Colorado Department of Water Resources. Based upon these records, wells in OU 3 were completed in sandstone deposits within (presumably) the Arapahoe or upper Laramie Formations, at depths ranging from 35 to 275 feet.

*Surface Water Features*

Four main drainages traverse OU 3: Big Dry Creek, Woman Creek, Walnut Creek and Rock Creek. Of these, only Woman Creek and Walnut Creek have significant possibilities of having been affected by activities at RFETS. Woman Creek flows eastward across RFETS and into OU 3, south of the RFETS industrial area. The Woman Creek drainage contains two impoundments on RFETS. Pond C-1 is a small (1.7 million gallon), on channel pond with little retention capability. Pond C-2 is a larger (22.6 million gallons), off-channel pond that collects water from the south side of the RFETS industrial area via the South Interceptor Ditch. Water from Pond C-2 was previously pumped to the Walnut Creek drainage, where it flowed into the diversion ditch around Great Western Reservoir, but is now pumped directly to Woman Creek.

Woman Creek flowed into Standley Lake until November of 1995, when Woman Creek Reservoir, part of the Standley Lake Protection Project, was completed. The Standley Lake Protection Project was constructed by the City of Westminster using grant funds provided by DOE.

Walnut Creek also flows eastward from RFETS into OU 3, and has two main branches (North and South Walnut Creek) which merge before the creek crosses the RFETS east boundary. The two branches of Walnut Creek on RFETS are impounded by two series of holding ponds (A-1 through A-4 on North Walnut Creek and B-1 through B-5 on South Walnut Creek). On RFETS, Walnut Creek drains the majority of the industrial area, and receives discharges from the RFETS sewage treatment plant. Walnut Creek flowed directly into Great Western Reservoir until 1989, when the City of Broomfield constructed a diversion ditch around the reservoir to lower Walnut Creek.

OU 3 contains four significant surface water impoundments: Great Western Reservoir, Standley Lake, Mower Reservoir and Woman Creek Reservoir. Great Western Reservoir is a 3,200 acre-foot capacity reservoir, located about 1/2 mile east of the RFETS east boundary. It was originally constructed as an irrigation supply reservoir, but which now serves as one of the primary drinking water supplies for the City of Broomfield. The primary source of water to Great Western Reservoir is from Clear Creek, delivered via the Church Ditch.

The Great Western Reservoir Replacement Project was begun in 1991 by the City of Broomfield, and is being funded primarily through a DOE grant. This Project will provide an alternate water supply (from the Windy Gap Project) for the City of Broomfield, as well as transmission and treatment facilities for the new water supply. With the completion of

this Project, expected by the end of 1997, Great Western Reservoir will no longer be used as a drinking water supply, and is expected to revert to its original use as an irrigation supply reservoir.

Standley Lake is a 43,000 acre-foot reservoir which supplies drinking water to the Cities of Westminster, Northglenn, Thornton and Federal Heights as well as irrigation water. Standley Lake is located about 2 miles southeast of the RFETS eastern boundary. Its primary source of water is also from Clear Creek, delivered via the Farmers' Highline Canal, Croke Canal and the Church Ditch.

Mower Reservoir is a relatively small (about 45 acre-feet) agricultural reservoir located between Standley Lake and Great Western Reservoir, about 1,400 feet east of the RFETS east boundary. Mower Reservoir is fed by Mower Ditch, which transports water from Woman Creek from a point within the RFETS boundary. Mower Reservoir was privately owned until December 1995, when it was purchased by the City of Westminster. This purchase was funded by DOE as a Supplemental Environmental Project (SEP) pursuant to the Tolling Agreement, which was appended to the IAG. The Tolling Agreement allowed DOE to fund SEP's in lieu of penalties for violations of the IAG.

Woman Creek Reservoir is an 850-acre-foot detention reservoir that captures and holds Woman Creek flows until they are pumped to the Walnut Creek drainage downstream of Great Western Reservoir. The purpose of Woman Creek Reservoir is to capture any contaminated water that might leave RFETS via Woman Creek. Woman Creek Reservoir is designed to capture flows up to the anticipated 100-year flood on Woman Creek, and is compartmentalized so as to allow for the sequential capture, testing and release of water from Woman Creek.

*Terrestrial and Aquatic Ecology*

OU 3's terrestrial ecology has been extensively altered by human activity, especially grazing, agriculture and construction, such that essentially no undisturbed areas remain. The dominant plant community is short-to-mid-grass prairie that has been moderately to heavily grazed. Along the drainages in OU 3 are sparse stands of cottonwoods, mesic grasslands and occasional wetlands along some stream bottoms. Mower Reservoir and the ditch leading to it contain the most well-developed stands of riparian vegetation in the OU 3 study area.

Despite the dissected habitat, a variety of animals reside in, or wander through, OU 3. Notable residents include bull snakes, rattlesnakes, a variety of hawks, black-tailed prairie dogs, coyote and mule deer. Bald eagles are locally common around Standley Lake, especially in winter, and a breeding pair there fledged one young in the spring of 1996.

The Preble's meadow jumping mouse (*Zapus hudsonius preblei*) is a species that occurs in several stream drainages at RFETS, and which is a candidate for listing as an Endangered Species under the Endangered Species Act. Some marginal habitat for this mouse has been identified in OU 3, along the drainages and around the reservoirs. DOE has not conducted any trapping to specifically confirm or deny the presence of Preble's meadow jumping mouse in OU 3. Trapping conducted by Jefferson County Open Space failed to find the mouse in OU 3 east of RFETS, however.

There are both lotic and lentic aquatic habitats in OU 3. The biotic community in streams is limited to a few, opportunistic species because of low, highly variable stream flows. Of the reservoirs in OU 3, Great Western has the least diverse fish assemblage, consisting primarily of carp, suckers and minnows. Mower Reservoir is stocked with smallmouth



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bass. Standley Lake is open for recreation and contains a variety of stocked game fish, including rainbow trout, walleye, catfish and yellow perch. Mower Reservoir is the only one of the three with substantial amounts of emergent and submerged aquatic vegetation. Woman Creek Reservoir has been designed and will be operated to discourage the establishment of fish populations or any other type of aquatic community.

*Population and Land Use*

Over 2.2 million people live within a 60-mile radius of Rocky Flats. The OU 3 RFI/RI Report estimated that, in 1994, approximately 10,800 people lived within a five-mile radius of RFETS. Most of these people lived in subdivisions located either in Broomfield or in Westminster, especially northeast, east and south of Standley Lake. The nearest school to RFETS is Witt Elementary School, about 2.7 miles to the east. The population near RFETS is projected to increase substantially in coming years, with nearly 18,000 persons expected to live within five miles of RFETS in 2005 and about 24,000 persons expected to live in that area by the year 2015.

Land use in OU 3 immediately east of RFETS, covering most of the lands around and between Great Western Reservoir and Standley Lake is open space. The use of these lands is controlled through zoning restrictions and perpetual land use restrictions contained in existing City of Broomfield and City of Westminster deeds of ownership. These restrictions make the development of these lands for residential or commercial use very unlikely. These lands include the land which was the subject of the 1975 lawsuit and 1984 settlement agreement, and the portions of IHSS 199 which exhibit the highest soil concentrations of radionuclides in OU 3.

Eastward, beyond the open space lands immediately to the east of RFETS, commercial and recreational development continues to take place at Interlocken, north of the Jefferson County Airport. Further commercial development is anticipated south of the airport, and immediately south of RFETS at Jefferson Center Properties. Continued suburban expansion is also anticipated in the area south and southeast of RFETS, primarily around Standley Lake, and in western Arvada along the 64th Street corridor.

## The Nature and Extent of Contamination in OU 3

*Contaminants of Concern*

The RFI/RI evaluated sampling data in OU 3. Based on these data, DOE, EPA and CDPHE selected Contaminants of Concern (COC's) for OU 3. COC's are those chemicals that may contribute significantly to human health risks and which in turn were fully evaluated in the Human Health Risk Assessment in the RFI/RI Report. COC's were selected according to the toxicity of a given chemical, the frequency of detection in the sampling, a preliminary screening of the risk posed by the chemical and comparisons of concentrations in OU 3 to background concentrations (Background soil and sediment concentrations were determined using data from the Rock Creek Drainage. Reservoir and stream sediments are not directly comparable to one another, owing to the differences in flow regimes. However, a study conducted by DOE in 1994 to determine regional background concentrations of hevy metals and radionuclides demonstrated that concentrations of these substances in the Rock Creek samples were representative of background, and that their use for comparison purposes was appropriate.). COC's were selected by IHSS and by individual environmental medium within each IHSS. Plutonium-239/-240 and americium-241 in soil in IHSS 199, and plutonium-239/-240 in surface sediment in Great Western Reservoir (IHSS 200) are the only COC's identified for OU 3.



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*Soils in OU 3 (IHSS 199)*

Three data sets were used in the RFI/RI Report to define the nature and extent of hazardous substances in surface soil in IHSS 199. These were the RFI/RI data set (144 samples collected from 61 ten-acre plots in OU 3), the Remedy Lands data set (47 surface soil samples collected from tilled and untilled portions of the Remedy Lands east of RFETS), and the Rock Creek data set. The Rock Creek data set was used to determine background concentrations of plutonium and americium, against which the other soil data sets were compared. Surface soils in OU 3 were not analyzed for other hazardous substances in OU 3, including beryllium and heavy metals. Surface soil sampling for beryllium and heavy metals in OU 2, immediately upwind of OU 3, showed that no metals were present there at levels above background, leading to the conclusion that additional sampling in OU 3 was not warranted.

The Rock Creek data set indicated that upper-bound background values (the mean plus two standard deviations) were 0.09 picoCuries per gram (pCi/g) for plutonium-239/-240 and 0.04 pCi/g for americium-241. Based on these results, 19 of the 61 samples in the RFI/RI data set and all of the surface soil samples in the Remedy Lands data set had levels of plutonium-239/-240 and/or americium-241 that were above background levels. The highest surface soil level for plutonium-239/-240 (6.468 pCi/g) was recorded in sample U1A from the remedy lands data set. Sample U1A was taken from a location approximately 1,800 feet east of the RFETS east gate, and about 1,500 feet south of the western end of Great Western Reservoir. The highest value of americium-241 (0.52 pCi/g) occurred in sample plot PT14192, located across Indiana Street from the RFETS east gate. The arithmetic mean of all values in both the RFI/RI data set and the Remedy Lands data set is 0.057 pCi/g for plutonium-239/-240 and 0.017 pCi/g for americium-241.

The RFI/RI report also included a more comprehensive appraisal of the source, extent and distribution of plutonium-239/-240 and americium-241 at and around RFETS. This appraisal considered numerous surface soil data sets collected by a number of researchers on and off RFETS. About 750 surface soil sample points were available to researchers, who used statistical techniques to plot isopleths of plutonium-239/240 and americium-241 soil concentrations in OU 3. This analysis indicated the presence of a plume of elevated concentrations of plutonium and americium in soils extending directly east of the 903 Pad at RFETS, eastward past the RFETS east gate. The analysis also indicates that soil levels drop quickly east of RFETS, and return to background two to three miles east of the RFETS property boundary. Finally, this analysis suggests that windblown dispersal of contaminants from the 903 Pad is the primary source of plutonium and americium in surface soils in OU 3.

To determine the nature and extent of hazardous substances in subsurface soils in OU 3, the RFI/RI included excavation and sampling of eleven trenches, primarily located immediately east of the RFETS boundary. In each trench, ten soil samples were collected along a profile 96 centimeters deep. In all cases, maximum plutonium and americium levels occurred at the soil surface (to 3 cm deep), and decreased rapidly with depth. The arithmetic means for both plutonium and americium in soils below 10 cm deep were less than calculated background concentrations.

*Sediments in Great Western Reservoir (IHSS 200), Standley Lake (IHSS 201) and Mower Reservoir (IHSS 202)*

The RFI/RI gathered data from 120 samples of surface sediments in the reservoirs and streams in OU 3 as well as 155 subsurface sediment samples from the reservoirs. Additionally, the RFI/RI included data from 114 sediment samples gathered from Standley



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Lake and Great Western Reservoir in 1983 and 1984. Surface and subsurface reservoir sediments were analyzed for heavy metals and radiological parameters, and sediments from Mower Reservoir were additionally analyzed for volatile organic compounds. These data were compared to background values for stream sediments. This comparison concluded that plutonium was the only hazardous substance in reservoir sediments that was elevated above background values, and that levels of plutonium were elevated in at least some sediment samples from all three reservoirs.

Concentrations of plutonium in surface sediments were highest in Great Western Reservoir, reaching 3.3 pCi/g, and averaging 0.27 pCi/g. Plutonium levels in Standley Lake peaked at 0.55 pCi/g, and averaged 0.03 pCi/g. The maximum plutonium value in Mower Reservoir was 0.49 pCi/g, with an average of 0.291 pCi/g.

In subsurface sediments, plutonium concentrations were again highest in Great Western Reservoir, reaching a maximum of 4.3 pCi/g at a sediment depth of approximately 18 inches. This sample was taken at the deepest portion of the reservoir, just west of the dam, at a maximum water depth of about 40 feet. A sample taken at this spot during the 1983-1984 sampling had a plutonium activity of 5.3 pCi/g, also at a depth of about 18 inches. The maximum plutonium value in Standley Lake subsurface sediments was 0.38 pCi/g at a sediment depth of about 18 inches, and the maximum plutonium value in Mower Reservoir subsurface sediments was 1.11 pCi/g at a depth of about 6 inches.

The RFI/RI Report concludes that waterborne transport from RFETS was the most likely means of plutonium deposition to Great Western Reservoir sediments, while aeolian transport was the most significant pathway for contaminants to sediments in Mower Reservoir and Standley Lake. Comparing data gathered during the RFI/RI in 1992, to data gathered in 1983 and 1984, the RFI/RI report finds that, in general, plutonium concentrations in sediments decreased from 10 to 30 per cent in similar locations. The two data sets exhibit strongly similar vertical plutonium profiles, however, indicating that vertical migration of plutonium in reservoir sediments is not occurring.

Plutonium is retained as a COC only in surface sediments in Great Western Reservoir because of the reservoir's somewhat uncertain future in light of the imminent completion of the Great Western Reservoir Replacement Project. Thus, the RFI/RI's Human Health Risk Assessment considers a residential scenario for Great Western Reservoir in the unlikely event that the reservoir is drained at some future time and the land is released for building residences. Such a scenario is not considered likely for either Standley Lake or Mower Reservoir, which in any event have lower plutonium sediment activities than Great Western Reservoir.

*Other Environmental Media: Surface Water, Groundwater and Air*

As mentioned previously, the only environmental media for which COC's were identified in OU 3 were surface soils and Great Western Reservoir surface sediments. However, the RFI/RI gathered and considered a substantial amount of data from other environmental data, including surface water, groundwater and air.

Surface water sampling concentrated on the three reservoirs in OU 3 and included sampling for radionuclides, metals, major ions, pesticides and volatile organic compounds (the latter being sampled only in Mower Reservoir). Fifteen samples were collected during the RFI/RI from Great Western Reservoir, fourteen samples were collected from Standley Lake, and thirteen samples were collected from Mower Reservoir; samples were collected from July to October 1992. All constituents in all reservoirs were either within background levels or were not detected. The mean plutonium activities for surface water in Great

Western Reservoir, Standley Lake and Mower Reservoir were 0.002, 0.002 and 0.005 pCi/l, respectively. Maximum observed plutonium values for Great Western Reservoir and Standley Lake were 0.005 and 0.009 pCi/l; the highest surface water activity for plutonium was observed in Mower Reservoir, at 0.03 pCi/l. All plutonium activities recorded during the RFI/RI were less than site-specific standards set by the Colorado Water Quality Control Commission (0.03 pCi/l for Great Western Reservoir and Standley Lake, and 0.15 pCi/l for Mower Reservoir).

Two groundwater wells were installed during the RFI/RI, one downstream of Great Western reservoir and one downstream of Standley Lake. These wells evaluated the potential interactions between reservoirs and downgradient groundwater. The only radiological constituents that exceeded the maximum background values were uranium-235 and uranium-238 in individual samples in the well downgradient of Standley Lake. However, the mean values for these and all other radionuclides in both wells were less than the upper-bound mean background values (that is, the 95% upper confidence level, based upon the arithmetic mean of the data).

Groundwater was not extensively monitored in OU 3, apart from the two aforementioned wells. Extensive groundwater monitoring at RFETS, including alluvial wells at the site boundary, has shown that hazardous substances are not migrating off site via shallow groundwater. The Upper Laramie Formation, which underlies RFETS, is sufficiently impermeable and robust so as to provide protection for the regional Laramie-Fox Hills Aquifer. Thus, no mechanism for the off site transport of hazardous substances via the regional aquifer exists.

The evaluations of inhalation risk from plutonium in the RFI/RI report were performed using data from the Radioactive Air Monitoring Program (RAAMP), and yielded a risk of approximately 1 x 10-6. However, data from the RAAMP were found to have great uncertainties associated with them, owing to the detection limit of the samplers being used. Therefore, RAAMP data were supplemented with ultra-high volume air samplers, which decreased detection limits and the uncertainties encountered in RAAMP samplers. Ultra-high volume sampling yielded average results for plutonium that were approximately 100 times lower than those provided by the RAAMP sampling (1.9 picoCuries of plutonium per cubic meter of air, on average). Wind tunnel studies were also performed to determine the potential for resuspension of particulates in OU 3. The RFI/RI Report concluded that, over the vast majority of OU 3 (that is, undisturbed terrestrial areas), resuspension of particulates from surficial soils and sediments is limited and occurs only rarely. A higher potential for resuspension was observed at disturbed, unvegetated sites such as reservoir shorelines.

*Contaminant Fate and Transport*

The properties of plutonium and americium, the two COC's identified for OU 3, are such that physical, rather than chemical or biotic, factors predominate in determining methods of transport and the ultimate fate of these two contaminants. The physical factors that have in the past and which continue to determine the distribution of plutonium and americium in OU 3 are:

> 1) Adsorption -- the binding of the contaminant to particulates, often clays, caused by electrical attraction at the molecular level, which often results in reduction in environmental mobility;



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2) Waterborne transport -- the movement of particles and any associated contaminants by moving water (fluvial processes), and their subsequent re-deposition in reservoirs (through lacustrine processes); and,

3) Windborne transport -- the dislodging, transport and subsequent deposition of particles and associated contaminants during high winds.

Plutonium and americium in general do not manifest chemical behavior in the environment that influences their transport or fate. Similarly, there is no known biotic mechanism that would serve to concentrate plutonium or americium in living organisms, nor do concentrations of these elements increase at higher levels of the food chain.

In soils and in surface waters in OU 3 and elsewhere where there are oxidizing conditions, plutonium is present as plutonium dioxide colloids, which are in turn strongly adsorbed onto clay particles. Strongly reducing environments (those with little or no free oxygen) may lessen the affinity of plutonium for clay particles, but the RFI/RI report concluded that this does not significantly affect the mobility of plutonium in OU 3. Basic conditions, above a pH of 9, may also increase the solubility of plutonium, but these conditions were not encountered in OU 3.

Waterborne particulate transport was most significant in OU 3 in transporting sediments from ponds in the Walnut Creek drainage to Great Western Reservoir. Waterborne transport may have also been responsible for movement of some plutonium from soils at RFETS and in OU 3 into the drainages and thence to the three reservoirs. Once in the reservoirs, particles containing plutonium settled out and were deposited in reservoir sediments. There is believed to be no mechanism for transport of plutonium is surface water downstream of the reservoirs in OU 3, based upon stream sediment samples taken from Walnut Creek downstream of Great Western Reservoir, and from Big Dry Creek downstream of Standley Lake.

As mentioned previously, airborne transport of particulates from the 903 Pad at RFETS was the most likely source of plutonium deposition onto surface soils in OU 3, and was probably a source for radionuclides in reservoir sediments as well. Since plutonium shows an affinity for fine particles such as clays, the particles that are most likely to be transported by wind are likely to contain elevated plutonium levels as compared to the soil itself.

## Summary of Site Risks

### *Human Health Risk Assessment*

Following the selection of COC's the RFI/RI Report evaluated the risks posed by these contaminants in the Human Health Risk Assessment (HHRA), one portion of the Report's Baseline Risk Assessment. The HHRA calculated the exposure to COC's under various scenarios, considered the potential toxic effects of the COC's, and then calculated the risks posed by the COC's in OU 3 under each exposure scenario. Risks were then reported as the probability of an individual developing cancer as a result of exposure to OU 3 contamination under one of the scenarios that were evaluated.

The two scenarios evaluated were recreational and residential exposure. The recreational exposure anticipates occasional recreational use of the area (hiking, biking, picnicking, etc.), and assumes that an individual may be exposed to OU 3 contaminants through ingestion and inhalation of soils and through external radiation. The residential exposure scenario assumes exposure pathways through the ingestion of vegetables, milk, and meat raised on the contaminated property, as well as through soil ingestion and inhalation, and

through external radiation. The residential scenario results in higher contaminant exposures, and thus higher calculated risks, than the recreational scenario, primarily due to the much greater exposure times in the residential scenario.

The residential exposure scenario was applied to plutonium and americium in surface soils (IHSS 199) and to plutonium in sediments in Great Western Reservoir (IHSS 200). In IHSS 199, it was assumed that current deed restrictions on property held by Broomfield and Westminster would be lifted, allowing for residential development. In IHSS 200, it was assumed that Great Western Reservoir would be drained and subsequently used for residential development. While both scenarios are considered unlikely, they were evaluated because of the long half-lives of the contaminants involved, the uncertainties surrounding land use planning assumptions far into the future, and because of concerns expressed by local communities. Both scenarios calculated risks associated with reasonable maximum exposures, a set of assumptions that maximizes the individual's presumed exposure to the contaminant, as well as central tendency, a set of assumptions believed to be more representative of the exposures that would be incurred by the average person.

For IHSS 199, risks from both plutonium and americium were calculated and were assumed to be additive. For IHSS 200, only the risks associated with plutonium were calculated, as plutonium was the only COC there. In both IHSS's, the highest contaminant concentration(s) was used in risk calculations. The RFI/RI Report also calculated radiation doses that would be expected as a result of the recreational and residential scenarios described above.

Excess lifetime cancer risk (that is, the incremental additional cancer risk that is incurred through exposure to COC's at OU 3 or any other contaminated site) is calculated by multiplying the average daily chemical intake over a lifetime of exposure by the contaminant's individual slope factor. For radionuclides, slope factors are the average risk per unit intake or exposure for an individual in a stationary population with mortality rates typical of those in the United States in 1970. EPA guidelines indicate that excess lifetime cancer risks which are within or below the one in ten thousand (1 x 10-4) to one in one million (1 x 10-6) range are considered protective of human health.

For IHSS 199, the highest calculated excess cancer risk, assuming reasonable maximum exposures (RME) under a residential exposure was three in one million (3 x 10-6). Using central tendency, the risk under a residential exposure scenario was two in ten million (2 x 10-7). For the recreational exposure, the excess cancer risk was five in one hundred million (5 x 10-8) using the RME, and three in one billion (3 x 10-9) using central tendency.

For IHSS 200, the highest calculated excess cancer risk employing RME and the residential exposure was nine in ten million (9 x 10-7); the corresponding risk using central tendency was six in one hundred million (6 x 10-8). Using the recreational scenario, the highest risk using RME was one in one hundred million (1 x 10-8), and the risk using central tendency was eight in ten billion (8 x 10-10).

The highest calculated radiation doses for IHSS's 199 and 200 occurred using the RME, assuming a residential exposure scenario. The highest Total Effective Dose Equivalent (TEDE, which incorporates both internal and external radiation dose) for IHSS 199 for an adult was 0.12 millirem per year (mrem/yr); the corresponding TEDE for IHSS 200 is .0065 mrem/yr. These calculated doses can be compared with those recently adopted as part of the RFCA Soil Action Levels Framework, which specifies an action be taken at RFETS at a soil radiation dose level in excess of 85 mrem/year. The doses calculated from plutonium-239/240 and americium-241 in OU 3 can also be compared to those received



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from natural background (including radon and cosmic rays) and man-made sources (such as medical x-rays). The average radiation dose in the U.S. is estimated to be about 300 mrem/yr, while the average dose in Colorado may be as much as 700 mrem/yr, owing to the state's higher altitude and relative abundance of naturally occurring radionuclides.

As part of the Baseline Risk Assessment, a qualitative aanalysis of uncertainties was performed. Some of the uncertainties inherent in the Baseline Risk Assessment are as follows:

- Environmental sampling in OU 3 may not have accurately characterized the amounts or distribution of hazardous substances in OU 3, which could lead to either an overestimation or an underestimation of risk posed by these substances.

- The degree to which exposure models fully reflect the activities and processes that may lead to contact with hazardous substances in environmental media cannot be fully estimated, and this may lead to an overestimation or an underestimation of risk.

- Specific land use assumptions, including development of the area now occupied by Great Western Reservoir, residential development of the Remedy Lands within IHSS 199, and reliance on homegrown meat, milk and vegetables by future residents within OU 3 may not take place. This would serve to overestimate the exposure to hazardous substances in OU 3, and thereby overestimate risk.

- No loss of hazardous substances due to leaching or erosion was considered. Since these processes would lower the concentrations of these substances, this would lead to an overestimation of risk.

- Basic uncertainties exist when applying risk factors to radiation dose or radionuclide uptake. These uncertainties relate to the model used for determining the health effects of radiation exposure, which are based on average risk per unit intake for an individual. These uncertainties could overestimate or underestimate risk.

- A final source of uncertainty is the extrapolation of risks from high doses of radiation (for example, those sustained by atomic bomb survivors or uranium miners) to much lower doses, such as those calculated for OU 3. This uncertainty could overestimate or underestimate risk.

DOE submitted the RFI/RI Report to the Agency for Toxic Substances and Disease Registry (ATSDR), a part of the federal Center for Disease Control, for the purposes of obtaining a Health Consultation. The purpose of the Health Consultation was to obtain an independent evaluation as to whether COC's had been adequately identified in OU 3, the risks to human health posed by releases of hazardous substances in OU 3, and whether the proposal for no remedial action in OU 3 was appropriate considering these risks. The ATSDR concluded that the COC selection process was based on reasonable assumptions, and that none of the constituents present in OU 3 posed public health concerns. Further, the ATSDR Health Consultation stated that no additional activities are needed in OU 3 in order to ensure the public's health.

*Ecological Risk Assessment*

The Ecological Risk Assessment (ERA) portion of the RFI/RI Report's Baseline Risk Assessment considered plutonium and americium as Potential Contaminants of Concern (PCOC's) for soils in IHSS 199 and in sediments of all three reservoirs. The ERA included field studies of the abundance and distribution of plants and animals in the aquatic



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and terrestrial ecosystems within OU 3, collection and analysis of tissue samples for radionuclides, and calculation of hazard quotients using calculated exposures and literature-derived No Adverse Effect Levels. Field and laboratory work showed no indications of adverse effects from plutonium or americium on the ecology of OU 3. The highest calculated hazard quotient for OU 3 was 0.02, for plutonium in Great Western Reservoir sediments. Hazard quotients of less than 1.0 indicate no potential adverse ecological effects.

*Conclusions*

The excess cancer risks calculated in the HHRA portion of the RFI/RI Report, resulting from exposure to COC's in OU 3, are all within or well below the EPA guidance for protection of human health. Radiation exposures calculated for OU 3 resulting from contamination there were extremely small as compared with both the soil action levels negotiated for RFETS, and as compared with average background radiation doses. The ERA portion of the RFI/RI Report found no actual or predicted adverse effect on OU 3's ecology as a result of the contamination there.

Conditions in OU 3 pose no unacceptable or significant risks to human health or the environment; future unacceptable or significant exposures will not occur there as a result of past contamination. DOE concludes, therefore, that no action is necessary in OU 3 for the protection of human health or the environment.

Implementation of the no action remedy will not result in any irreversible damage to natural resources. Wetlands will not be injured; flood elevations will not be affected; groundwater will not be affected; and no permanent displacement or loss of wildlife will occur from implementation of the selected remedy. Low levels of hazardous substances will remain in soils and reservoir sediments in OU 3, but at concentrations so low that they pose no threat to human health and the environment, and will not compromise natural resource values. In areas where tilling has taken place under the 1985 Settlement Agreement, there has been substantial damage to the existing plant communities. This damage was subsequently corrected, albeit with some difficulty over the course of several years.

## Explanation of Significant Changes

DOE released the Proposed Plan for OU 3 for public comment on August 7, 1996, and held a public hearing on the Proposed Plan on September 18, 1996. The Proposed Plan identified no action as the preferred remedial alternative. DOE reviewed all written comments received during the public comment period, and verbal comments received at the public hearing. Following review of these comments, DOE determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary.



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# RESPONSIVENESS SUMMARY

## Overview

DOE released the OU 3 Proposed Plan for public review and comment on August 7, 1996, and the comment period extended through October 11, 1996. DOE held a public hearing on the OU 3 Proposed Plan on September 18, 1996, at which oral and written comments were solicited. This Responsiveness Summary provides a summary of DOE responses to public comments received during the comment period. DOE considered all comments received in the final selection of the remedial alternative for OU 3.

The following responsiveness summary identifies commentors and their affiliation, if any. Verbatim comments appear in quotes; comments that have been paraphrased or summarized are so noted.

## Comments Received During the Public Comment Period and DOE Responses

*Commentor #1: Mr. Tom Settle, City of Westminster, Colorado*

Comment #1: "Westminster feels it is premature to come to a final decision and closure on this area. It is our belief that the possibility remains for contamination to move off-site during the cleanup process within the site boundaries. We suggest that this process be held open or allowed to be re-visited at some point in the future, after all cleanup is done. It makes sense to us that cleanup decisions be made starting with the worst areas and then moving outward to ensure that the overall cleanup is most effective."

Response to Comment #1: DOE disagrees that issuance of a no-action CAD/ROD is premature, given the extensive investigations into conditions in OU 3 and the assessment of the risks posed by historic releases of hazardous substances. The RFI/RI Report and the CAD/ROD for OU 3, however, deal only with past releases of hazardous substances, and not the potential for future releases by activities at RFETS. DOE recognizes that there is a possibility, however slight, of the off-site release of hazardous substances during cleanup or other site activities. In such a situation, DOE would respond according to its obligations under the RFCA and according to the statutory mandates contained in CERCLA. DOE is obligated by Federal and State law and by legally binding agreements to maintain an environmental monitoring system designed to detect and help avoid any such releases. In addition, cleanup projects at RFETS will incorporate project-specific environmental monitoring as appropriate, and plans for these projects will be available for public review and comment.

With regard to the suggestion that the process be allowed to be revisited following the completion of all cleanup, DOE intends to issues a Sitewide CAD/ROD following completion of Site cleanup. Among other issues, this document is intended to address any continuing risks posed by the Site to the off-site environment following cleanup.

DOE does not disagree that it makes sense to pursue the cleanup of the most highly contaminated areas at RFETS first. DOE, in consultation with EPA and CDPHE, has developed a priority listing of all IHSS's at RFETS, with the intent to help guide cleanup planning and project selection. Other factors, including budget, IHSS accessibility and the ability to combine similar projects also affect the selection and sequencing of cleanup projects at RFETS. DOE has chosen to pursue a CAD/ROD for OU 3 at this time because



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the data in the RFI/RI Report support one, and because DOE is obligated to share its findings on OU 3 with the public, and to act on these findings.

Comment #2: "An important part of the entire cleanup process is establishing the standards by which the decisions are made. The U. S. Environmental Protection Agency (EPA) is in the process of establishing a nationwide soils standard. Since the OU 3 areas are entirely separated from the plant site, we would urge the application of the new final standard to the OU 3 evaluation process to reinforce to the public that the decisions are appropriate. The final OU 3 Record of Decision (ROD) would have to be delayed in order to accommodate this request. An alternative would be to specify in the ROD that there should be a review of the OU 3 findings based on the new standard when it is promulgated by EPA."

Response to Comment #2: The decision to undertake no action at OU 3 was made based upon an extensive evaluation of the data generated by the RFI/RI, the identified Contaminants of Concern, and the risks posed by past releases of hazardous substances in OU 3. DOE does not believe that it is necessary to delay a CAD/ROD for OU 3 in order to await promulgation of a nationwide soils standard for radionuclides. However, DOE is mindful that a nationwide soils standard, had one been available, would have been an important consideration in the OU 3 CAD/ROD process. Therefore, the OU 3 CAD/ROD will be re-examined at such time as a nationwide soils standard for plutonium and/or americium is promulgated for consistency with such a standard, or on a five-year basis, consistent with CERCLA Section 121. This will be noted in the OU 3 CAD/ROD Declaration.

Comment #3: "In regards to Standley Lake, it is our opinion that the sampling of the reservoir was not done adequately to truly characterize the potential effects of the radiological contaminants which have been deposited there. There are still unanswered questions as to the quantity of Plutonium or Uranium constituents which may be released into the water column during periods of oxygen deficiency at the bottom of the reservoir. These periods can occur twice per year in Standley Lake and can be quite severe, both in oxygen levels and duration. The reduction of other metals back into the water column has already been well documented. Similar problems in Pond C-2 have been discussed in public meetings at various times in the past."

Response to Comment #3: The sampling of surface water in Standley Lake did not detect plutonium or uranium in the water column at concentrations that would be indicative of the remobilization of these contaminants as a result of reducing conditions at or near the bottom of Standley Lake. The RFI/RI Report concludes that, even under reducing conditions, the adsorption of plutonium onto clay particles is not fully reversible. In addition to the water sampling results referenced in the RFI/RI Report, monthly sampling of these constituents in Standley Lake confirms their continued presence at very low levels, consistently below site-specific water quality standard promulgated by the Colorado Water Quality Control Commission. While Standley Lake may experience regular periods of oxygen deficiency at depth, DOE believes that the large body of water quality data available from Standley Lake does not support the hypothesis that uranium or plutonium are being remobilized from sediments in quantities that pose any concern to human health or the environment.

*Commentor #2: Mr. Tim Holeman, City of Broomfield (note: the following are responses to written comments submitted by Mr. Holeman on behalf of the City)*

Comment #1: "In light of DOE's use of conservative health risk scenarios and the risk associated with draining and dredging the reservoir, Broomfield believes that leaving the sediments untouched in the short-term is consistent with its short-term future use of the reservoir as a water reuse facility."



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Response to Comment #1: DOE did not specifically evaluate a scenario in which Great Western Reservoir would be used for water reuse, as such a plan had not been developed at the time that the RFI/RI Report was being written. DOE did strive to employ the most conservative foreseeable use scenarios in evaluating the risks posed by Great Western reservoir sediment contamination. DOE cannot comment specifically on Broomfield's plans for future reservoir uses. The RFI/RI Report considered that Great Western Reservoir would be retained as a drinking water source. Even under this conservative scenario, no constituents were identified as Contaminants of Concern, because of the low concentrations of hazardous substances found in the waters of Great Western Reservoir, and the correspondingly low risks posed by these substances.

Comment #2: "Broomfield is not satisfied that leaving residual plutonium in the sediment, particularly the shoreline sediment, is an appropriate long-term solution. Regular review of sediment contamination levels and remedial alternatives should be a condition of a no-action alternative."

Response to Comment #2: DOE believes that leaving contaminated sediments in place in Great Western Reservoir is not inconsistent with any future use scenario because of the low risks that these sediments have been calculated to pose. Therefore, that review of remedial alternatives is not appropriate. The undertaking of any remediation is not supported by the findings of the RFI/RI Report. However, DOE believes that it is appropriate to re-examine a no action alternative for OU 3 at such time as a national standard for radioactive soil contamination is promulgated by the EPA. If a nationwide standard is set such that remediation would be required in OU 3, the feasibility of various remedial alternatives would be examined at that time.

Comment #3: "Broomfield believes that additional feasibility research into alternatives to 'no action' should be conducted. For instance, are there cost effective ways to remove 'hot spots' in the bottom of the reservoir, on the shoreline, and on the hillside? In the absence of a formal feasibility under CERCLA, DOE should conduct a future review of plutonium health risk and the prospects of using innovative technology to remove even residual quantities of plutonium - particularly along the Great Western Shoreline. What activities is DOE undertaking to locate innovative soil washing techniques?"

Response to Comment #3: As stated earlier, based upon the results of the RFI/RI Report, the risks posed by OU 3 are so low that evaluation of remedial alternatives is unwarranted. With regard to health risk evaluation, DOE has asked the Agency for Toxic Substances and Disease Registry (an agency of the federal Center for Disease Control) to provide DOE with an independent review of the OU 3 RFI/RI Report conclusions in the form of a Health Consultation. This Health Consultation is attached, and supports the RFI/RI Report's conclusion that no action is appropriate in OU 3. With regard to innovative technologies, such as soil washing, to remove residual plutonium in soils, DOE is planning to investigate technologies that would make removal of on-site soils effective and efficient. In the event that soil standards are promulgated at some future time, and a review of the no action alternative in this CAD/ROD indicates that remedial action is necessary to protect human health and the environment, the results of the on-site technology selection process would be available to assist in such a circumstance.

Comment #4: "Future cleanup activities upstream could substantially alter the long-term prospect of plutonium loading in the Walnut Creek Drainage and the reservoir. DOE should conduct additional modeling and documentation of the prospect for future loading. Ongoing studies regarding plutonium mobility and transport must be evaluated to document



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the likelihood of mass loading on an annual basis. Additional analysis of the plutonium solubility will also impact sediment loading issues?"

Response to Comment #4: There are no current or future plans to conduct modeling of future plutonium loadings into Great Western reservoir. DOE does plan, however, to conduct monitoring of off-site discharges to determine concentrations of plutonium and other contaminants in waters leaving RFETS. Such monitoring will be conducted pursuant to the requirements of the RFCA, as well as other statutory and regulatory requirements. DOE will also conduct environmental monitoring, as appropriate, in conjunction with individual on-site cleanup actions.

Comment #5: "Recent alterations in DOE's process water management program - particularly the Interceptor Trench waters - have substantially changed the assumptions made in the RI regarding releases into Great Western. DOE should reassess its assumptions regarding downstream release in light of new budget priorities and the release of the Ten Year Plan."

Response to Comment #5: The RFI/RI Report considers the risks posed by past releases of hazardous substances in OU 3 and determines the need for action, if any, based upon those risks. The RFI/RI Report for OU 3 makes no assumptions regarding ongoing alterations to the RFETS water management program. Ongoing water management at RFETS is governed by a number of statutory controls and regulatory agreements. Of particular note is the RFETS Integrated Water Management Plan, being prepared pursuant to the RFCA. The City of Broomfield (along with other entities such as EPA, CDPHE, the U.S. Fish and Wildlife Service and the Cities of Westminster, Thornton and Northglenn) has been an active participant in the development of this Plan. The RFETS Integrated Water Management Plan will be reviewed annually.

Comment #6: "As DOE undertakes key CERCLA/RCRA decision-making processes, the potential impacts to the Walnut Creek Drainage and Great Western remain unclear. DOE should document the specific future decision-making points where it will re-evaluate the wisdom of a 'no-action' alternative. For instance, will the final CAD/ROD for the entire site include off-site OU's? What is the process of a five-year review anticipated under CERCLA? What is the impact of EPA's future promulgation of a soil radiation standard?"

Response to Comment #6: Section 121(c) of CERCLA (42 USC 9621), which provides for the five-year review process, states: "If the President selects a remedial action that results in any hazardous substances, pollutants or contaminants remaining at the site, the President shall review such remedial action no less often than each 5 years after the initiation of such remedial action to ensure that human health and the environment are being protected by the remedial action being implemented." Consistent with this Section, the OU 3 CAD/ROD will be reviewed in light of a soil radiation standard promulgated at some future time. If a future standard is sufficiently stringent such that additional action at OU 3 may be required, DOE will evaluate such additional actions consistent with its responsibilities under CERCLA and the RFCA, and the action ultimately selected would be subject to public review prior to implementation. The final CAD/ROD for the entire site will consider the potential impacts of on-site activities to off-site areas in reaching a final decision.

Comment #7: "DOE should demonstrate that existing levels of residual plutonium or potential future releases into the soil and sediments of the reservoir do not jeopardize the value and usefulness of this important City asset."



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Response to Comment #7: The RFI/RI Report concludes that the risks posed by residual levels of contamination in OU 3, even under very conservative use scenarios, justify taking no action there. DOE believes that this conclusion is appropriate, well-documented, and protective of human health and the environment. As stated previously, the RFI/RI Report does not consider potential future releases of hazardous substances in OU 3.

Comment #8: "How will a 'no action' level impact the 1985 lawsuit settlement between landowners and DOE, and the third party beneficiary including the City, regarding soils cleanup? The City is not convinced that the proposed action meets the spirit and intent of the 1985 settlement."

Response to Comment #8: The RFI/RI Report meets the spirit and intent of the 1985 settlement by determining the risks posed by past releases of hazardous substances in OU 3. The RFI/RI Report demonstrates that these past releases pose so little risk to human health and the environment that no remedial action is warranted.

*Commentor #3, Ms. Paula Elofson-Gardine, Environmental Information Network (NOTE: the following comments were submitted as oral comments during the public hearing on September 18, 1996. They have been excerpted and summarized from the public hearing transcripts.)*

Comment #1: With the very high winds that we have here, in excess of 100 miles per hour, our contention is that the majority of releases have been blown far beyond the perimeter monitors and far out into the communities. So we feel that a lot of the sampling that has gone on too close to the Plant has not tracked past releases well.

Response to Comment #1: Figure 4-6A of the RFI/RI Report shows concentrations of plutonium in suface soils at RFETS and in OU 3. This Figure uses the "Exhaustive Data Set," that is, the data set that incorporates the findings of historic studies as well as data collected specifically for the RFI/RI Report. Figue 4-6A illustrates that the highest surface soil levels of plutonium occur near the 903 Pad at RFETS, and that levels drop quickly and significantly to the east and south of RFETS. For the most part, samples taken two to three miles from RFETS had plutonium contents that were below the calculated background levels of 0.09 pCi/g. Based upon these data, DOE believes that plutonium distribution in OU 3 soils has been well-defined. DOE also believes that there has been no off-site release of plutonium that has been sufficiently large so as to warrant remedial action.

Comment #2: I haven't seen much tracking of americium, which is a daughter product of plutonium. We would like to see a much broader aerial gamma survey done of the whole area, for example, parts of Westminster, such as Countryside, Walnut Creek, perhaps a little farther out to the south of Standley Lake, Leyden, and northwest Arvada. We feel that these areas have been overlooked for decades and are the maximally exposed communities from the major accidents and releases at the facility.

Response to Comment #2: Figure 4-6B in the RFI/RI Report shows concentrations of americium in surface soils at RFETS and in OU 3. Similar to the plutonium data referred to in the foregoing response, Figure 4-6B shows the highest concentrations of americium in soils near the 903 Pad at RFETS, with levels dropping quickly east and south of there. Levels of americium in surface soils drop to below background (calculated at 0.04 pCi/g) within two to three miles of RFETS. DOE believes that these data adequately define the distribution of americium in OU 3, and that additional aerial gamma surveys for americium are not needed. As with plutonium, DOE believes there are no off-site levels of americium in soils that warrant remedial action.



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Comment #3: We feel that since there is still remediation to occur at the Site, in addition to dismantling or tearing down buildings, there is still a great risk to the community of migration of contaminants off site, and that this is not well addressed in terms of recontamination of OU 3. This should be pursued as an alternative risk pathway workup with respect to OU 3 RI/FS and the final decision.

Response to Comment #3: The OU 3 RFI/RI, and the CAD/ROD, address only past releases of hazardous substances to OU 3. RFETS has a number of environmental monitoring and pollution prevention programs, which are mandated by law or by enforceable agreement, designed to help detect and avoid any future releases; these programs are referenced in the CAD/ROD. Future remedial actions at RFETS, as well as building demolition, will incorporate project-specific environmental monitoring that will be designed to detect and avoid releases from these projects.