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EVALUATION OF EXISTING DATA ON ACTINIDE MIGRATION AT THE ROCKY FLATS ENVIROMENTAL TECHNOLOGY SITE

DRAFT

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Review Comments on manuscript of Litaor et al

EXECUTIVE SUMMARY

Over the past two decades routine monitoring and studies of environmental media at the Rocky Flats Environmental Technology Site (RFETS) have shown that as a result of past production waste storage and waste disposal practices actinides (uranium plutonium and americium) have been released into the environment in and around RFETS A Rocky Flats Draft 10 Year Plan has been developed in order to achieve accelerated risk reduction and significant cleanup including actinides of the Site by calendar year 2006 In light of these developments the U S Department of Energy Rocky Flats Field Office initiated a program to review and evaluate existing data on actinide migration and assess planned remediation activities This review and assessment will help ensure that institutional knowledge of actinide behavior is not lost Independent peer review will be conducted of future studies required to manage or remediate actinide contaminated areas

Data compiled from the Rocky Flats Environmental Database System (RFEDS) and from studies on actinide behavior in the environment at RFETS as well as the results of other studies on the behavior of actinides in the environment have been used herein to evaluate the potential migration of actinides through shallow subsurface soil surface soil groundwater surface water and between environmental media including surface water and sediment

Review of published research and site specific studies indicates that plutonium and americium often behave similarly showing a strong preference to be chemically immobilized by adsorption onto soil particles The primary environmental media in which the plutonium and americium reside at RFETS are surface soil and sediment Soil erosion and sediment transport by surface water are the primary mechanism of transport for these two actinides into the environment In contrast uranium is more soluble than either plutonium or amercium in the RFETS environment Transport of dissolved uranium through groundwater and transport of dissolved and particulate uranium through surface water are the main modes of uranium migration at RFETS Some areas of RFETS surface soil show uranium activities well above those of background

Based on existing analytical data plutonium and americium do not appear to be migrating as contaminant plumes in RFETS groundwater Surface soils contain most of the plutonium and americium contamination However there is evidence for cross-contamination with plutonium contaminated surface soils having been entrained down well bores during drilling and installation of groundwater monitoring wells In addition results of 100-year-event rain simulations and soil monitoring data suggest that changing redox conditions in the shallow subsurface may produce anaerobic conditions which have been proposed as having the potential to facilitate hydrogeochemically induced transport of plutonium and americium Data to support the latter hypothesis are being evaluated

In the Rocky Flats Cleanup Agreement (DOE 1996c) and the Site Vision it has been agreed that groundwater is not a viable exposure pathway for RFETS contaminants due to low yield The dominant exposure pathways for RFETS contaminants are surface water and surface soil

Uranium isotopic data indicate that depleted uranium from RFETS has moved throughout groundwater surface water and sediment downgradient of the RFETS Industrial Area However a high natural background of uranium activities and the presence of uranium ore deposits within several miles of RFETS make remediation of the RFETS contribution of total uranium activities questionable at best Upgradient naturally occurring levels of uranium are as high or higher than levels measured for contaminated areas within RFETS

Data gaps include loading rates of plutonium and americium to surface water bodies from slope erosion understanding of groundwater/surface water interaction the lack of empirically-derived distribution coefficient values for plutonium and americium under the range of oxidizing and reducing environments anticipated at RFETS and whether hydrogeochemically induced transport of plutonium and americium in shallow subsurface soils is a viable transport mechanism for significant amounts of plutonium and americium

1 0 INTRODUCTION

1 1 Purpose and Objectives of the Report

Over the past two decades routine monitoring and studies of environmental media at the Rocky Flats Environmental Technology Site (RFETS) have shown that plant derived actinides (plutonium americium and uranium) have been released and are migrating in the environment at RFETS A Rocky Flats Draft 10 Year Plan (DOE 1996a) has been developed in order to achieve accelerated risk reduction and significant cleanup of the Site by calendar year 2006 In light of these developments the U S Department of Energy Rocky Flats Field Office and the Kaiser Hill Team have initiated a program to review and evaluate the diverse body of existing data on actinide migration and promote the integration of this knowledge into planned remediation activities This data review and evaluation is also intended to identify data needs to support more effective remediation of actinide contaminated media and more efficient site operations Finally this report provides a means of ensuring that institutional knowledge of actinide behavior is not lost and that future analyses and studies build on the body of past knowledge

1 2 Scope of the Report

Data compiled from the Rocky Flats Environmental Database System (RFEDS) RCRA Facility Investigations/Remedial Investigations (RFI/RI) and the results of other studies and reports on the behavior of actinides in the environment have been used herein to evaluate the potential migration of actinides through surface soil shallow subsurface soil groundwater surface water and sediment Data on air transport is not analyzed in this report An assessment of data quality is presented in Appendix A

Past work at the RFETS has described the distribution of uranium plutonium and americium in soils onsite and offsite (Krey and Hardy 1970 Seed et al 1971 Poet and Martell 1972

Loading rates are required to provide for the design of mitigation systems such as erosion controls surface soil removals and other watershed improvements An improved understanding of groundwater/surface water interactions is required to determine the need for remediation and provide information necessary for the design of remediation systems The remaining two data gaps involve subsurface transport issues that require resolution in order to assess and predict the potential for plutonium and americium remobilization at RFETS

Krey et al 1976 Little and Whicker 1978 Johnson 1987 and others) More recently geostatistical analysis of the distribution of uranium plutonium and americium as well as the associated uncertainties has provided a more accurate view of RFETS actinides in the soil environment (Litaor et al 1994 Litaor 1995 Litaor et al 1995 Litaor and Allen 1996 Litaor and Ibrahim 1996 Litaor et al 1996) The approved Remedial Facility Investigations/Remedial Investigations (RFIs/RIs) for the former Operable Unit (OU) 2 (903 Pad Mound and East Trenches Area) OU3 (Offsite Areas) OU5 (Woman Creek Priority Drainage) and OU6 (Walnut Creek Priority Drainage) show the distribution of actinides and related cancer risk in the Woman Creek and Walnut Creek drainages (DOE 1995a DOE 1996b DOE 1996c and DOE 1996d) Background data for actinides in water soil and sediment at RFETS have been compiled and statistically summarized (DOE 1993a 1995b) Sitewide surface water monitoring data on actinides is summarized in the annual Sitewide Environmental Report

This report reviews information available from the above listed sources in order to assess the current state of knowledge with respect to the occurrence and movement of uranium americium and plutonium in the water soil and sediment of RFETS

1 3 Regulatory Framework

The Rocky Flats Cleanup Agreement (RFCA) (DOE 1996e) established cleanup levels and action levels for cleanup and management of radioactive materials and hazardous substances in all environmental media with protection of surface water quality as the primary basis for cleanup or management of contaminated soils and groundwater at RFETS The RFCA text states that groundwater action levels must be protective of surface water standards and quality as well as ecological resources The RFCA framework assumes that all contaminated groundwater emerges to surface water before leaving RFETS that groundwater standards will be protective of surface water for all agreed upon uses and that RFETS groundwater shall not be used for any purpose except as related to cleanup activities During RFCA negotiations

proposed soil action levels and cleanup standards for radionuclides and some metals had not been completely developed Subsequent to the signing of RFCA a *Public Review Draft of Action Levels for Radionuclides in Soils for the Rocky Flats Cleanup Agreement* (DOE 1996f) was issued for 30-day public comment on September 1 1996 This report proposes soil action levels and cleanup standards for radionuclides A final decision on soil action levels is anticipated by mid October 1996

Current and proposed standards for volatile organic compounds (VOCs) as well as those for radionuclides and other inorganic parameters are given in Attachment 5 of RFCA Action levels for metals in subsurface soil are proposed to be equivalent to metals for surficial soil The current and the proposed RFCA standards for actinides are presented in Table 1 1 of this report

1 4 Background

RFETS occupies 6 550 acres and is located approximately 16 miles northwest of Denver Colorado (Figure 1 1) RFETS is a government-owned contractor-operated facility that formerly produced components for nuclear weapons for the U S Department of Energy (DOE) Facility operations began in 1952 Construction of weapons components ceased in 1992 when the primary mission changed from weapons production to environmental restoration waste management decontamination and decommissioning and economic development In July 1994 the site name was changed from Rocky Flats Plant (RFP) to RFETS to reflect the change in mission

Wastes produced at the site include hazardous wastes low level and transuranic wastes and mixed wastes Historically the majority of these wastes have been treated onsite disposed onsite stored in containers onsite or disposed offsite (DOE 1992) As a result of past waste disposal and waste storage practices RFETS was included on the Superfund National Priorities List (NPL) in the October 4 1989 Federal Register Management and cleanup are currently

being conducted under the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) The U S Environmental Protection Agency (EPA) and the Colorado Department of Public Health and Environment (CDPHE) are the regulatory agencies overseeing the assessment and cleanup activities at RFETS The RFCA signed July 19 1996 is the legally binding agreement between DOE EPA and CDPHE to accomplish the required cleanup of radioactive and other hazardous substances contamination at and from RFETS

Known releases and sources of radioactive substances are reviewed in the following sections

Uranium

Both depleted and enriched uranium were used and stored on site According to the *Historical Release Report* for for the Rocky Flats Plant (DOE 1992a) accidental release of oils contaminated with uranium low level airborne emissions and burial of uranium-contaminated materials in shallow trenches have contributed RFETS uranium to the environment However the extent to which RFETS uranium has impacted the local environment is uncertain due to the natural abundance and variable content of uranium bearing minerals in the general area

Plutonium and Americium

Past waste handling and waste storage practices along with fires (September 1957 and May 11 1969) and chronic low level emissions have released plutonium (and associated americium) into the environment in and around RFETS (DOE 1992a) The primary source of plutonium and americium released into the environment at RFETS has been identified as the 903 Pad (Figure 1 2) From 1958 to 1968 plutonium-contaminated industrial oils were stored in steel drums at the 903 Pad The plutonium-contaminated oils leaked from deteriorating drums contaminating the soils under and around the drums Wind resuspension and transport of these contaminated soils distributed plutonium and americium across the downwind

soilscape east and southeast of the 903 Pad Deposition in vegetated areas and attachment to the soil matrix since the initial release has limited further wind dispersion Soil and sediment erosion by surface water and possibly conveyance by near surface flows are suspected to represent the main mechanisms facilitating migration of these actinides

2 0 GEOLOGIC AND HYDROLOGIC SETTING OF RFETS

Geologic and hydrologic conditions are briefly described in the following sections in order to characterize the site groundwater and surface water conditions as they relate to actinide occurrence and transport Natural conditions influence the mode rate and direction of contaminant transport and to a large extent determines the fate of contaminants in the environment Interaction of various environmental media can play an important role in mobilizing or demobilizing the spread of contamination which must be understood in order to evaluate risk and specify appropriate remedial actions if necessary For additional discussion of these media the reader should consult the 1995 RFETS *Sitewide Geoscience Characterization Study* series of reports including the *Geologic Characterization Report* EG&G (1995b) *Hydrogeologic Characterization Report* EG&G (1995c) and *Groundwater Geochemistry Report* EG&G (1995a)

2 1 Geology

At an elevation of 6 000 feet above mean sea level RFETS is located on the Colorado High Plains approximately two to six miles east of the Front Range mountain front Geologic units at RFETS can be grouped into two general categories unconsolidated Quaternary surficial deposits and underlying consolidated Cretaceous bedrock (EG&G 1995b) Figure 2 1 is a generalized geologic cross section that illustrates the surficial and bedrock materials within each group

Prior to the deposition of Quaternary surficial deposits the gently eastward-dipping Cretaceous age bedrock in the Rocky Flats area was subjected to erosion that produced a broad flat erosional surface (a peneplain) During the Pleistocene this bedrock surface was subsequently overlain by a blanket of alluvial fan deposits known as the Rocky Flats Alluvium that were derived from Coal Creek Canyon (EG&G 1995b) Beginning in the Holocene headward erosion by westward progressing drainages incised both the Rocky Flats Alluvium and the underlying bedrock peneplain Approximately half of the surface area covered by RFETS has

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been incised removing the Rocky Flats Alluvium In some areas these Holocene and younger erosional surfaces have been subsequently covered by stream sediments or colluvium A summary of the stratigraphic profile is presented in the following sections Younger units are described first followed by progressively older deeper units

2 1 1 Unconsolidated Deposits

The surface of RFETS is covered almost entirely by an extensive layer of unconsolidated Quaternary deposits consisting of Holocene colluvium and valley fill alluvium and Pleistocene Rocky Flats Alluvium Holocene slump and landslide material is also present locally on valley slopes and indicate that mass movement is an important albeit slow erosional agent in areas of RFETS

Colluvial deposits which are present on the valley slopes in the central portion of RFETS were derived from geologic material exposed on the steep slopes and topographic highs and were formed by slope wash and downslope creep The colluvium ranges in thickness from 0 to 20 feet with the thickest sequences occurring at the base of the valley slopes The colluvium is composed of clay clayey gravels and lesser amounts of sand and silt Slump and landslide deposits were derived from the colluvium and Rocky Flats Alluvium and are most common on valley slopes along the Rock Creek and Walnut Creek drainages in the northern portion of RFETS Valley fill deposits were fluvially derived from upstream materials and consist of clay silt and sand with lenses of gravel These deposits occur along the drainage bottoms in and adjacent to stream beds and are most common in the eastern portions of RFETS Thicknesses range from 0 to 25 feet (EG&G 1995b)

Pleistocene deposits consist primarily of the Rocky Flats Alluvium which is the most prevalent unconsolidated surficial deposit at RFETS The Rocky Flats Alluvium ranges in thickness from 0 to 100 feet and forms a broad layer that extends across most of the western portion of RFETS (EG&G 1995b) The deposit is comprised of poorly sorted clayey gravels and sands with

abundant cobble and boulder sized material and discontinuous lenses of clay silt and sand Caliche a pedogenic deposit of calcium carbonate is found in shallow subsurface soils across the site Significant quantities (25 to 80 percent by volume) of caliche are present in some intervals of the Rocky Flats Alluvium (EG&G 1995b)

2 1 2 Consolidated Bedrock Deposits

The unconsolidated surficial deposits unconformably overlie the claystone siltstone and sandstone bedrock of the Upper Cretaceous Arapahoe and Laramie Formations The Arapahoe Formation ranges from 0 to 50 feet thick at RFETS and has been shown to contain a mappable but discontinuous fine to medium grained basal sandstone unit This unit has been designated the Arapahoe (or Number 1) sandstone (EG&G 1995b) and is known to subcrop beneath the Rocky Flats Alluvium and colluvium in the 903 Pad East Trench and other areas of the eastern Industrial Area It consists primarily of a fine to medium grained locally conglomeratic moderately to poorly sorted sandstone that ranges in thickness from 0 to less than 50 feet (EG&G 1995b) The Arapahoe Formation Sandstone is the uppermost sandstone of significant lateral extent and has been shown to be a pathway for lateral transport of contaminated groundwater

The Laramie Formation conformably underlies the Arapahoe Formation and is approximately 600 to 800 feet thick The Laramie Formation is subdivided into two members The upper member of the Laramie Formation is 500 to 600 feet thick and consists primarily of massive claystone and siltstone The lower member is about 300 feet thick and is composed of sandstones claystones and coal beds The upper member is generally much finer-grained than the lower member but contains several separate and discontinuous clayey sandstone units historically designated as the No 2 through No 5 Sandstones (EG&G 1995b) Unlike the Arapahoe Formation sandstone these sandstone units exhibit lithologic and hydrologic characteristics (i e high matrix clay content and low permeability) that are not indicative of contaminant pathways These lenticular Laramie Formation sandstones are texturally distinct

M

from the Arapahoe Formation sandstone by virtue of their high silt and clay content (EG&G 1995b)

The Upper Cretaceous Fox Hills Sandstone conformably underlies the Laramie Formation and ranges from 90 to 140 feet in thickness In general the Fox Hills Sandstone is a very fine to medium grained angular to subrounded well sorted silty sandstone The Fox Hills Sandstone is an aquifer of regional significance which lies at a depth of 700 to 800 feet below ground surface at RFETS Underlying the Fox Hills Sandstone are several thousand feet of the Lower Cretaceous Pierre Shale and older units

Lithologic logs from boreholes drilled into bedrock indicate the presence a weathered zone in the upper portion of the bedrock Fracturing and weathering increase the permeability of bedrock material The weathered zone is commonly less than 15 feet thick but may be as thick as 60 feet The thickness of the weathered bedrock zone is dependent on factors such as relative abundance of fractures presence of root zones elevation relative to the water table and proximity to valley bottoms

2 1 3 Structural Features

The bedrock strata exposed immediately west of RFETS have been folded into steeply eastward dipping exposures of the Fox Hills Sandstone and Laramie Formations These units receive recharge from precipitation along the exposed hogbacks northwest and southwest of RFETS The formations also receive recharge from the overlying Rocky Flats Alluvium and Arapahoe Formation

Small scale structural features such as joints and fractures are present in the bedrock units Joint and fracture surfaces are commonly coated with secondary oxide and hydroxide minerals in the weathered portion of the bedrock units Slickensides are also present on some fracture surfaces The presence of such features increases secondary porosity and permeability and indicate that

groundwater flow is probably enhanced in the weathered portion of the bedrock Several bedrock faults have been identified in the RFETS Industrial Area however none have been observed to offset alluvial materials EG&G 1995b) The available hydrogeologic and geochemical data suggest that fractures and faults are not significant conduits for downward vertical groundwater flow to deep aquifers (RMRS 1996)

2 2 Hydrogeology

2 2 1 Hydrostratigraphy

Shallow groundwater flow systems at RFETS have been categorized into two hydrostratigraphic units based on contrasts observed between groundwater geochemistry core logging and hydraulic conductivity determinations (EG&G 1995c) This division basically reflects the relative degree of hydrologic activity experienced by the units the uppermost unit being the most active and transmissive of the two The upper hydrostratigraphic unit (UHSU) consists of the distinct lithologic units of the Rocky Flats Alluvium colluvium valley fill alluvium landslide deposits weathered Arapahoe and Laramie Formation bedrock and any sandstone units within the Arapahoe and Laramie Formations that are in hydraulic connection with the overlying unconsolidated surficial deposits or with the ground surface The lower hydrostratigraphic unit (LHSU) is composed of the unweathered bedrock of the Arapahoe and Laramie Formations This unit forms a thick regionally extensive confining layer that serves to isolate shallow groundwater from the underlying Laramie Fox Hills aquifer

2 2 2 Groundwater Occurrence and Flow Conditions

Groundwater is found in all geologic units present at RFETS although not always in predictable amounts and availability In UHSU deposits the quantity of water in storage at any particular locality varies widely and is a function of bedrock topography proximity to drainages seasonality and local sources of recharge The saturated thickness of UHSU alluvium is greatest

in the western portion of RFETS (>40 ft) and thinnest along hillsides and in the eastern portion of the site Areas of thin saturation commonly contain regions of discontinuous seasonally unsaturated alluvium due to irregularities in bedrock topography and water table fluctuations Depth to shallow groundwater varies anywhere from 0 feet at flowing seepage areas to 70 feet at the west end of the site The depth to water is generally shallowest in areas of thinner surficial deposits such as the Industrial area margins of the Rocky Flats Alluvium and creek drainages Average depth to water and saturated thickness at the 903 Pad and Lip areas is on the order of 10 and 5 feet respectively

Seasonal fluctuations in shallow groundwater levels are observed in monitoring wells across the site and normally range from three to six feet (EG&G 1995c) Larger annual fluctuations have been recorded at several locations in and adjacent to the IA with some wells exhibiting water level rises of over 10 feet Well hydrographs indicate that water levels normally peak in May or June shortly following the spring rain season Many hydrographs of older Rocky Flats Alluvium wells (1986 and 1987) indicate that base water levels over the past decade have generally declined possibly as a result of changes in water management practice at the plant

In a broad sense the dramatic response of groundwater levels measured in many UHSU wells during the spring and early summer of 1995 was as noteworthy though less apparent as that observed for surface flow conditions Record high water levels were recorded in many wells during and following the exceptionally wet spring of 1995 Water level rises in the range of 15 to 20 feet were observed in some wells located in the IA East Trenches and eastern buffer zone areas Free flowing conditions were noted at several well points that monitor seeps at the Solar Pond and southern IA The rate of decline observed in some wells was almost equal to the rate of rise suggesting that lateral subsurface drainage was rapid and probably more extensive than expected in normal years

The magnitude of these rises when compared to ground surface elevations indicate that a condition of temporary complete to near-complete saturation (groundwater flooding) probably

formed locally in areas of thin to moderately thick surficial deposits In areas of recharge such as all upland areas occupied by the Rocky Flats Alluvium and the majority of colluvium covered hillslopes the presence of saturated conditions indicate that the capacity of the geologic material to accept and transmit recharge water has been exceeded The direction of soil water movement recharged from incident precipitation and runoff is initially downward until it reaches the water table and is transported laterally to a point of discharge Groundwater discharge areas such as hillside and stream channel seeps are typified by saturated conditions that result from the upward movement of groundwater even if the vertical flow component is small compared to the horizontal flow component The potential significance of these two very different flow regimes on surficial and shallow subsurface soil actinide remobilization will be reviewed in Section 6 0

The geology of the area exerts a controlling influence on groundwater flow due to the existence of sharp lithologic contrasts in the vertical distribution of geological materials (coarse grained surficial deposits underlain by fine grained bedrock) and the resulting bedrock topographic surface configuration The predominantly claystone bedrock impedes the downward vertical migration of groundwater and directs flow laterally through the unconsolidated surficial and weathered bedrock materials Groundwater flow tends to follow the bedrock surface and emerge as seeps drain into the hillside colluvium or migrate vertically into permeable subcropping sandstone units In thinly saturated areas the bedrock surface plays a critical role in directing groundwater flow and where locally high in the development of unsaturated zones in unconsolidated surficial deposits Groundwater in the UHSU regionally flows eastward from broad areas of recharge (located upgradient and on nearby topographic highs) toward the erosional limit of the Rocky Flats Alluvium and then directly toward creeks in the drainage bottoms After groundwater enters the valley fill alluvium from the hillslopes it flows eastward in the direction of stream flow and exits the site at the RFETS east boundary (Indiana Street)

2 2 3 Hydraulic Conductivities

In general the UHSU at RFETS has a low to moderate hydraulic conductivity and typically yields small amounts of water to monitoring wells Hydraulic testing of the wells indicates that the UHSU exhibits a wide range of hydraulic conductivities because of the diverse nature of the individual geologic materials that comprise the unit Values of hydraulic conductivity range from as high as 3 to 5 x 10^{2} centimeters per second (cm/sec) in localized areas of the valley fill and Rocky Flats alluvia to as low as 7 x 10^{-8} cm/sec in the clay lenses of the Rocky Flats Alluvium (EG&G 1995c) Hydraulic conductivities in the weathered bedrock portion of the UHSU range from 9 2 x 10^{3} to 3 x 10^{-8} cm/sec the highest values being associated with the Arapahoe Formation sandstone and the lowest values being associated with weathered claystone bedrock Colluvial deposits indicate a range of 9 3 x 10^{-4} to 4 0 x 10^{-6} cm/sec Average values calculated as geometric means are 4 3 x 10^{5} cm/sec for the colluvium 2 1 x 10^{-4} cm/sec for the Rocky Flats Alluvium and 2 5 x 10^{3} cm/sec for the valley fill alluvium in Woman Creek and Walnut Creek respectively (EG&G 1995c)

Hydraulic conductivities of LHSU materials are significantly lower than those of the overlying unit with values ranging from 10^{-6} to 10^{-8} cm/sec in the unweathered claystone bedrock Discussion of LHSU hydraulic conductivities is presented in more detail in RMRS (1996)

2 2 4 Groundwater Interaction with Surface Water and Surficial Soils

As described later in Section 6 0 the importance of groundwater as an interactive sitewide actinide transport medium is limited to areas of contact with surficial soils and surface water that contain actinide contamination levels which exceed media specific action levels Groundwater is in direct connection with these media only in and immediately downgradient of areas where the water table intersects the ground surface This requirement is met at hillside seeps and along stream beds containing valley fill alluvial deposits as depicted in Figure 2 2

The pattern of seep distribution confirms that seep occurrence is controlled by local geologic conditions Hillside seeps at RFETS are common along the eastern extent of the Rocky Flats Alluvium where the contact between the Rocky Flats Alluvium and underlying claystone subcrops along the upper margin of stream drainage valleys In general seeps occur in greater number and areal extent along the north side of the pediment ridges Most seeps are ephemeral in nature and only discharge in the spring Perennial seeps are relatively rare with most located in the Rock Creek drainage Groundwater seepage also occurs along segments of the Woman Creek stream channel particularly above the Woman Creek stream diversion structure at Pond C 2 as determined from a stream gain/loss study (Fedors and Warner 1993) The stream channels of North and South Walnut Creeks are so extensively interrupted by impoundments that channel seepage measurements have not been attempted nor are they expected to yield meaningful data

Seep flow data are generally unavailable due to difficulties inherent with measuring broad diffuse sources of discharge The results of an incomplete seepage inventory conducted after the 1995 spring recharge event in portions of the Woman Walnut and Rock Creek watersheds revealed that of over 200 seeps surveyed only 32 had a measurable flow and of these 14 had flows of one gallon per minute or less Given the magnitude of the spring recharge event as reflected by sitewide high water table conditions it is likely that seep flows measured during this time were at or near maximum levels It was commonly observed during this survey that surface flow from many ephemeral hillside seeps infrequently reaches a receiving surface water body Under most circumstances seep water infiltrates back into the soil below the discharge point or never emerges as surface flow thus preventing direct contact with surface water Direct contact with surface water may occur during exceptionally wet periods as a result of increased seep flow caused by abnormal water table rises or by mixing with surface runoff Unfortunately data on seep flow conditions at the 903 Pad hillside and adjacent areas to the east were not collected during the survey so the potential for seep discharge to surface water under extremely high water table conditions in the 903 Pad area remains an unknown

The most common type of seep develops at the contact between the Rocky Flats Alluvium and underlying bedrock claystones These seeps are thought to be related to preferential flow channels in bedrock surface topography and/or alluvial stratigraphy (high hydraulic conductivity zones) In the 903 Pad and East Trenches areas some seep occurrences have been attributed to discharge from the subcropping Arapahoe Formation sandstone which receives recharge from the overlying surficial deposits The most notable sandstone seeps in this area include a grouping of seeps situated above the B 1 pond in the South Walnut Creek drainage and the 903 Pad hillside seep located at the soil study area in the Woman Creek drainage

Examination of the most recent sitewide seep location map (EG&G 1995c Plate 9) indicates that there are fewer seeps in the 903 Pad and east buffer zone areas relative to adjacent hillslopes located to the west and north Along the north slope of Woman Creek from the 903 Pad eastward to Indiana Street evidence of present-day seep activity is limited primarily to the 903 Pad hillside seep and potentially a few scattered small seeps Periodic activation of a series of presumably old seepage sites located east of the 903 Pad have occurred from historic spray evaporation operations conducted at the South Spray field however these sites have since returned to a dry state following cessation of spray field operations As shown on Figure 2 2 sites for groundwater interaction with surficial soils and surface water are both limited in extent and predictable based on the high degree of hydrologic control exerted by the local geology

2 3 Surface-Water Hydrology

The climate at RFETS is semi arid with an average precipitation amount of 15 inches per year (DOE 1980) and an approximate annual recharge rate of one inch per year Streams and seeps are largely ephemeral with stream reaches gaining or losing flow depending on the season and precipitation amounts Surface-water flow across RFETS is primarily from west to east with four major drainages traversing the site (see Figure 1 2) The Rock Creek drainage covers the northern most portion of the Buffer Zone and lies largely within a background area that is upgradient of any RFETS contamination There are several small stock ponds lying within the

creek bed but contaminant transport by surface (or subsurface) processes is not envisioned for this drainage

Woman Creek

The Woman Creek drainage basin extends eastward from the base of the foothills near Coal Creek Canyon to Standley Lake (see Figure 1 2) The average annual yield of the basin is 32 acre feet Significant storm events produce surface flows of 4 to 7 cfs Flows greater than 40 cfs may occur during extreme precipitation events The C series Ponds (C 1 and C 2) lie within the Woman Creek drainage these ponds collect surface runoff from the southern half of the Industrial Area The D series Ponds (D 1 and D 2) are within a drainage that is hydrogeologically isolated from the RFETS Industrial Area but these ponds do collect surface runoff from surface soils containing low levels of plutonium and americium

The C 1 and C 2 Ponds are within the eastern reach of the Woman Creek basin Pond C 1 is on the stream channel and has a holding capacity of about 5 ac ft whereas Pond C 2 is off the channel to the south and has a capacity of 70 ac ft The C 2 pond receives drainage water collected from the south side of the Industrial Area by the South Interceptor Ditch (SID) Pond C 2 does not discharge into Woman Creek regularly If discharges from Pond C 2 are necessary due to precipitation events water is sampled and then pumped into Woman Creek Woman Creek ordinarily discharges into Mower Reservoir east of Indiana Street however when flows are greater than 1 cfs Woman Creek water is automatically diverted into the new Woman Creek Reservoir

Walnut Creek

Walnut Creek is a tributary of Big Dry Creek with headwaters near the foothills of the Colorado Front Range about 1 5 miles west of RFETS (see Figure 1 2) Walnut Creek consists of several tributaries (North Walnut Creek South Walnut Creek No Name Gulch and the McKay Ditch)

which join prior to leaving the eastern boundary of RFETS Flows in North and South Walnut Creeks as well as an unnamed creek below the Present Landfill are managed through a series of ponds (see Figure 1 2) The landfill pond lies just below the Present Landfill and is maintained by evaporation or transfer Walnut Creek drains approximately one third of RFETS including portions of the Industrial Area Much of the baseflow of North and South Walnut Creeks downgradient of RFETS is due to discharges of building foundation drains The flow of North Walnut Creek is controlled by the A series Ponds and the flow of South Walnut Creek is controlled by the B-series Ponds Walnut Creek leaves RFETS at Indiana Street and is diverted around Great Western Reservoir by the Broomfield Diversion Ditch

Ponds A 1 A 2 A 3 and A-4 were constructed within the channel of North Walnut Creek and have a combined capacity of about 160 ac ft Their primary purpose is to capture and control surface water runoff from the northern part of the RFETS Industrial Area and the North Walnut Creek drainage area Stream flow is diverted around the Ponds A 1 and A 2 to Pond A 3 Ponds A 1 and A 2 currently collect local runoff and are maintained for emergency spill control water levels in these ponds are controlled by evaporation or transfer Pond A 1 also receives water pumped from the Present Landfill Pond about twice a year Pond A 3 is used as a settling pond and discharges to Pond A-4 which also receives water from Pond B-5 Water in Pond A-4 is isolated sampled and released if it meets water quality standards

The B series Ponds were constructed in the channel of South Walnut Creek and have a combined capacity of approximately 86 ac ft Ponds B 1 and B-2 currently receive only local runoff When necessary water is transferred from Ponds B-1 and B-2 to Ponds A 1 and A 2 Effluent from the Wastewater Treatment Plant also flows into Pond B 3 During daylight hours water from Pond B 3 is released to Pond B-4 The flow from B-4 to B 5 is unregulated On an annual basis about 70 percent of South Walnut Creek flow is from the Wastewater Treatment Plant and 30 percent from the Central Avenue Diversion Ditch which collects runoff from the Industrial Area When Pond B 5 becomes more than 50-percent full (about nine times per year) it is pumped via pipeline to Pond A-4

3 0 THE GEOCHEMISTRY OF URANIUM, PLUTONIUM, AND AMERICIUM

3 1 Geochemistry of Uranium

Uranium (element 92) is a naturally occurring radioactive element that exists as a mixture of isotopes Natural uranium comprises mostly uranium 238 (99 273 percent) with smaller amounts of uranium 234 and uranium 235 (0 005 and 0 72 percent respectively) The minor difference in mass between the uranium isotopes precludes significant isotopic fractionation by natural processes Uranium 238 is a long lived (half life = 4 51 x 10^9 years) alpha emitter that decays through a long series of daughter radioisotopes to the stable lead isotope Pb-206 Uranium 235 (half life = 7 13 x 10^8 years) decays to the stable lead isotope Pb-207 Uranium 234 which is a daughter product in the uranium 238 decay chain has a relatively short half life (248 000 years)

Uranium is a multivalent element (+2 +3 +4 +5 +6) with only +4 +5 and +6 states important in the soil environment The mean concentration of uranium in the earth s crust is 2 7 mg/kg (all isotopes combined) Of all rock types uranium is most abundant in granites (average = 5 ppm) and shales (average = 3 5 ppm) (Krauskopf 1979) Uranium is only slightly soluble in the reduced (U^{+4}) state however more oxidized forms (U^{+6}) or anionic species present at high pH are much more soluble Dissolved uranium will complex with carbonate and sulfate which may facilitate transport carbonate bearing aqueous solutions are excellent solvents for uranium In general uranium is least soluble in reducing environments and most soluble in alkaline oxidizing environments although solution composition will also influence solubility

To provide background soils information Myrick et al (1983) evaluated the concentrations of uranium 238 in surface soils across the United States Background soil samples from 33 states were collected and analyzed to assess natural background levels of uranium 238 (Myrick et al 1983) Surface soils in Colorado ranged from 0 47 to 3 0 pCi/g with a mean and standard deviation of 1 2 pCi/g and 0 91 pCi/g respectively

One study that evaluated uranium distributions in waters and sediments of the Front Range speculated that higher uranium concentrations in water samples are probably due to leaching of uraniferous strata in the Pierre and Laramie formations (Bolivar et al 1978) This same study noted that the granites of the Front Range are known to be rich in uranium and that the South Platte River is anomalously rich in uranium compared to most other rivers of its size In short the types of rocks in the RFETS area (claystones of the Laramie Formation and Precambrian granites) the presence of nearby uranium ore (i e the Schwartzwalder mine) and a generally alkaline and oxidizing environment in the near subsurface contribute to the likelihood that high and variable concentrations of uranium may exist in RFETS waters and soils

Background studies at RFETS evaluated not only surface soils but groundwater surface water sediments and subsurface soils (DOE 1993a 1995a) In general background areas are upgradient with respect to wind and water flow Areas west north and south that are hydrologically upgradient or sidegradient to the Industrial Area of RFETS are considered to be background areas (see Figure 1 2)

Samples collected from RFETS are typically analyzed by alpha spectroscopy for three uranium isotopes — uranium 233+234 uranium 235 and uranium 238 Alpha spectroscopy cannot resolve the 233 and 234 isotopes and provides only an estimation of uranium 235 activity The isotopic abundances (by weight) in naturally occurring uranium are 99 273 percent uranium 238 0 720 percent uranium 235 and 0 006 percent uranium 234 whereas the percentages in enriched uranium for nuclear powered reactors are about 97 3 and 0 03 percent for uranium 238 uranium 235 and uranium 234 respectively although greater proportions of uranium 234 and uranium 235 enrichment may be found in some nuclear weapons components (EG&G 1988) The isotopic abundances in typical depleted uranium are 99 75 percent uranium 238 0 25 percent uranium 235 and 0 0005 percent uranium 234 (EG&G 1988)

3 1 1 Uranium in Background Groundwater at RFETS

Uranium isotopes in samples of filtered (0 45 μm) and unfiltered groundwater collected from the upper hydrostratigraphic unit (UHSU) exhibit a wide range of reported activities The ordered listing of data and summary statistics from the *Background Geochemical Characterization Report* (BGCR Appendix B Tables B 1 and B 2) (DOE 1993a) show that although the combined mean activity of uranium isotopes in background groundwater is less than the Platte River standard of 40 pCi/L (WQCC 1994) the standard is exceeded in at least one background well (B205589) Well B205589 lies along the Rock Creek drainage just south of Highway 128 This well along with all other background wells sits outside the area in which groundwater could be impacted by releases from RFETS (see Figure 1 2)

Statistical calculations performed on the BGCR data for uranium isotopes yield normal upper tolerance limits (UTLs) far in excess of the Platte River standard of 40 pCi/L The values for lognormal UTLs are higher than the normal UTLs for uranium In general concentrations of naturally occurring chemicals exhibit a tendency to form lognormal distributions (Helsel 1990) so the normal UTLs may actually underestimate the upper range of background activities The more conservative of the normal or lognormal UTLs are presented here

Using data for the filtered samples (i e <0 45 μm dissolved) the mean standard deviation and UTL values for uranium isotopes in background groundwater at RFETS (DOE 1993a) were calculated (see Table B 1) The UTL values calculated for uranium 233+234 uranium 235 and uranium 238 were 74 9 1 88 and 52 6 pCi/L respectively Using data for the unfiltered samples (i e dissolved fraction + suspended particulates = total) the mean standard deviation and UTL values for uranium isotopes in background groundwater at RFETS (DOE 1993a) were also calculated (see Table B-2) The UTL values calculated for uranium 233+234 uranium 235 and uranium 238 were 144 8 5 23 and 114 2 respectively

In addition to data from the BGCR (DOE 1993a) evaluations provided in the *Groundwater Geochemistry Report* (EG&G 1995a) show the geochemical evolution in the composition of shallow groundwater along flow paths at RFETS For the Rock Creek area concentrations of major ions and uranium isotopes show a marked increase along the flow path (Figures 3 1a and 3 1b) The observed increase in dissolved uranium may be related to increasing levels of dissolved carbonate (which complexes with uranium to increase the solubility of uranium) or to naturally occurring accumulations of uranium in the Rock Creek drainage Well locations for the Rock Creek flow path are shown in Figure 3 2

The large variability shown for levels of uranium in background groundwater is not surprising considering the inherent heterogeneity of geologic materials and the presence of ore grade uranium deposits (Schwartzwalder mine near Ralston Reservoir) within 10 miles of RFETS In addition a recent study performed by the Jefferson County Health Department (Moody and Morse 1992) found high levels of uranium in the groundwater of Coal Creek Canyon which is upgradient of RFETS The Jefferson County study compiled data for groundwater samples collected from 33 domestic wells in Coal Creek Canyon Uranium (total) ranged from 1 3 to 1 200 pCi/L with a mean and standard deviation of 174 9 and 339 1 pCi/L respectively

3 1 2 Uranium in Background Subsurface Soils at RFETS

Subsurface soils include soils deeper than 5 cm and geologic materials collected from the drilling of boreholes As with groundwater subsurface materials are divided into upper and lower hydrostratigraphic units The UHSU includes alluvium colluvium weathered bedrock and hydraulically connected sandstones the lower hydrostratigraphic unit (LHSU) includes unweathered bedrock of the Arapahoe and Laramie formations For UHSU subsurface soils (boreholes) at RFETS the background data and summary statistics for uranium isotopes are listed in Appendix B Table B-3 The UTL values were calculated as 3 55 3 25 0 14 and 1 73 pCi/g for $uranium_{total}$ uranium 233+234 uranium 235 and uranium 238 respectively

3 1 3 Uranium in Background Surface Soils at RFETS

Surficial soil is defined as the upper 5 centimeters (cm) of soil (see DOE 1995a for more details on the sampling methodology) Data compiled for the *Background Soils Characterization Report* (DOE 1995a) indicate the following UTL activities for uranium isotopes in surface soil samples collected from background areas near RFETS 3 31 pCi/g for uranium 233+234 0 13 pCi/g for uranium 235 and 2 83 pCi/g for uranium 238 (see Table B-4)

3 1 4 Uranium in Background Surface Water and Sediments at RFETS

Sampling locations for background stream water and sediments are discussed in the *Background Geochemical Characterization Report* (DOE 1993a) (Figure 3 3) Background stream water at RFETS contains mean activities of 0 7 and 0 6 pCi/L $uranium_{total}$ for filtered (0 45 μm) and unfiltered samples respectively Mean values are 0 36 and 0 49 pCi/L for uranium 233+234 0 14 and 0 05 pCi/L for uranium 235 and 0 28 and 0 36 pCi/L for uranium 238 for filtered and unfiltered samples respectively (Tables B 5 and B-6) Values for UTLs were calculated as 4 27 4 98 0 76 and 3 66 pCi/L for $uranium_{total}$ uranium 233+234 uranium 235 and uranium 238 respectively

Stream sediments include local surficial soil washed into drainages by overland flow as well as material suspended in the water column and the bed load carried down from upstream locations In general all unconsolidated geologic materials that accumulate in site drainages are susceptible to alluvial transport and can be considered stream sediments For stream sediments at RFETS the background data (DOE 1993a) were used to calculate summary statistics including UTL values of 6 57 5 29 0 21 and 4 82 pCi/g for $uranium_{total}$ uranium 233+234 uranium 235 and uranium 238 respectively (Table B-7)

A comparison with the RFCA action levels for $uranium_{total}$ (5 0 pCi/L for Woman Creek and 10 0 pCi/L for Walnut Creek) shows that uncontaminated surface water from RFETS will

generally not exceed the 10 0 pCi/L standard for $uranium_{total}$ (all isotopes combined) but may exceed the 5 0 pCi/L standard

3 1 5 Use of $^{238}U/^{235}U$ Atom Ratios to Determine Origin of Uranium

A report on surface water and sediments at RFETS concluded that the largest source of radioactivity in the terminal ponds was naturally occurring uranium and its decay product radium (Efurd et al 1993) Efurd et al (1993) also noted that the largest source of anthropogenic radioactivity in the terminal ponds was depleted uranium Results of this study indicated that approximately half the uranium present in Ponds A-4 and C 2 and approximately 20 percent of the uranium present in Pond B 5 originated as depleted uranium

For the above study uranium was determined by thermal ionization mass spectrometry (TIMS) which allows the isotopes uranium 234 235 236 and 238 to be measured separately Because the atom ratio of uranium 238 to uranium 235 in naturally occurring uranium is a constant of 137 8 this atom ratio can be used to separate the components of anthropogenic (i e enriched or depleted) uranium and naturally occurring uranium Additionally uranium 236 does not exist in nature it is produced by neutron capture on uranium 235 in nuclear reactors so its presence is a certain indication of anthropogenic uranium (Efurd et al 1993) The one flaw in Efurd et al (1993) is that they assume all RFETS uranium was depleted uranium in fact both enriched and depleted uranium were used at RFETS

Efurd et al (1993) concluded that the presence of ^{236}U in the surface-water samples collected at RFP and the variable $^{238}U/^{235}U$ atom ratios detected in water samples collected from the holding ponds prove that anthropogenic uranium is present They also noted that "naturally occurring uranium contains 0 7204 atom percent ^{235}U Most of the surface water samples measured at RFP were depleted in ^{235}U Efurd et al (1993) used the following relationship to estimate the proportions of anthropogenic and naturally occurring uranium

$$(^{238}U/^{235}U)obs_{atom\ ratio} = [(^{238}U/^{235}U)dep_{atom\ ratio}][F] + [(^{238}U/^{235}U)nat_{atom\ ratio}][1\ F]$$

Where obs=observed ratio dep=depleted ratio and nat=natural ratio

Analytical data for dissolved uranium in RFETS groundwater were evaluated here for $^{238}U/^{235}U$ atom ratios (Table 3 1) Mean ratios were calculated for each well location Excluded from this evaluation were all nondetect data all records with results less than or equal to zero and all locations for which no result exceeded the background mean activities Unfortunately the ratios calculated from this exercise are ambiguous in their wide range of values This apparent random variability may be due to (1) activities near the detection limit (2) poor analytical precision and accuracy in the standard analytical method (TIMS was not used) (3) the presence of outliers (outlier testing was not performed) or (4) real isotopic variability indicating the presence of enriched or depleted uranium The latter seems unlikely in all cases because some background wells show extreme atom ratios The data for each location of interest should be more carefully scrutinized if contamination is suspected

3 1 6 Use of $^{234}U/^{238}U$ Activity Ratios to Determine Origin of Uranium

Another ratio that has been used to distinguish between natural and anthropogenic uranium is the $^{234}U/^{238}U$ *activity* ratio (as opposed to the $^{238}U/^{235}U$ *atom* ratio) Because uranium 234 is a product of the uranium 238 decay chain its abundance is determined by the abundance of uranium 238 Secular equilibrium between these two uranium isotopes should produce an activity ratio of 1 0 however data show that the ratio ranges from <1 0 to >2 5 for uranium in background areas (DOE 1993a) Clearly there are other factors affecting the $^{234}U/^{238}U$ activity ratio that lessen its usefulness for distinguishing between natural and anthropogenic uranium

As discussed in the *Background Geochemical Characterization Report* (DOE 1993a) the ratios of relative activities of uranium 234 to uranium 238 are approximately 0 09 in depleted uranium 1 06 in natural uranium 5 74 in power reactor fuel and a higher ratio for weapons grade

uranium (Note that the analytical method used for RFETS samples does not resolve uranium 233 from uranium 234 so they are reported together) The *Background Geochemical Characterization Report* (DOE 1993a) reported a range of 1 19 to 2 43 for ratios of uranium isotopes in filtered background groundwater and stream water ratios that are above 3 0 or below 1 0 suggest the presence of artificially enriched or depleted uranium

In contrast with the background range of ratios given in the *Background Geochemical Characterization Report* the 1994 RCRA Report for RFETS (DOE 1995b) reported $^{234}U/^{238}U$ ratios ranging from 0 34 to 18 5 for UHSU groundwater at the Solar Evaporation Ponds (Operable Unit 4 [OU4]) However this reported range of values is highly misleading because it included ratios calculated for uranium activities near the detection limit and did not exclude outliers The extreme uranium ratios reported in the 1994 RCRA Report (DOE 1995b) were the result of calculating ratios for low levels of uranium which have large uncertainties Large uncertainties are typical of analytical results near the detection limit exclusion of such results is recommended when calculating isotopic ratios If mean values for the $^{234}U/^{238}U$ ratios are calculated for each well then the influence of possible outliers is minimized and more representative ratios may be obtained for resolving uranium sources

In summary although the likely presence of RFETS uranium has been suggested by some reported $^{234}U/^{238}U$ ratios (see DOE 1995b) the representativeness of these ratios cannot be taken at face value the underlying data must be examined Using TIMS analysis to measure the precise amount of uranium isotopes is a more decisive means of determining the percentage of anthropogenic uranium present in a given sample Use of TIMS analysis instead of alpha spectroscopy followed by determination of $^{238}U/^{235}U$ atom ratios appears to allow better estimation of the relative proportions of natural and anthropogenic uranium than does the $^{234}U/^{238}U$ activity ratio

3 1 7 Uranium in Sitewide Environmental Media at RFETS

Analytical data for uranium in samples collected across RFETS show a wide range of uranium isotope activities Due to the preponderance of negative and zero values in the data computation of summary statistics for uranium assumed a normal distribution for all isotopes in all environmental media In sitewide groundwater the maximum values are in the hundreds of pCi/L for uranium 233+234 and uranium 238 although the means are 7 6 and 9 6 pCi/L for uranium 233+234 (dissolved and total respectively) and 5 2 and 7 0 pCi/L for uranium 238 (dissolved and total respectively) Data for uranium 235 show maxima of 35 7 and 9 0 pCi/L (dissolved and total respectively) and means of 0 30 and 0 41 pCi/L (dissolved and total respectively) (Tables 3 2a and 3 2b)

Data for uranium isotopes in sitewide surface water also show maximum values in the hundreds of pCi/L for uranium 233+234 and uranium 238 with mean values of 8 3 and 9 6 pCi/L for uranium 233+234 (dissolved and total respectively) and 7 2 and 5 9 pCi/L for uranium 238 (dissolved and total respectively) Data for uranium 235 show mean values of 0 36 and 0 43 pCi/L for in filtered and unfiltered samples respectively (Tables 3 3a and 3 3b)

Uranium isotopes in sitewide surface and subsurface soils show a wide range of activities especially for the former Whereas subsurface soils contain mean activities of 2 5 0 16 and 3 9 pCi/g for uranium 233+234 uranium 235 and uranium 238 respectively (Table 3-4) surficial soils contain mean activities of 3 8 0 49 and 23 5 pCi/g for uranium 233+234 uranium 235 and uranium 238 respectively (Table 3 5) The high mean value for uranium 238 in surface soils is due in part to one extreme value of 38 000 pCi/g (location SS505493 date 6-30-93) the next highest value is 2 000 pCi/g

3 2 Geochemistry of Plutonium and Americium

3 2 1 Origin and Geochemical Behavior of Plutonium and Americium

By bombarding uranium with slow neutrons in a nuclear reactor a number of transuranic elements are created including plutonium (element 94) Plutonium consists of numerous isotopes of which plutonium 239 and plutonium 240 are moderately long lived radionuclides (half lives of 2 44 x 10^4 and 6 580 years respectively) Although plutonium does not currently exist as a naturally occurring element (excepting one occurrence at the prehistoric Oklo natural reactor in Gabon Africa) an anthropogenic background exists worldwide due to fallout from atmospheric nuclear weapons tests as well as the burnup of a nuclear-powered satellite (SNAP 9A) over the Southern Hemisphere in 1964 (Hardy et al 1973) In particular fallout from the nuclear tests and the SNAP burnup have contributed plutonium 238 plutonium 239 and plutonium 240 to the environment Americium 241 a gamma emitter is the decay product of plutonium 241 (half life = 14 4 years) and has ingrown as the relatively short lived plutonium 241 has decayed

The distribution of fallout plutonium across the earth s surface is not uniform geographic orographic and meteorologic effects produced spatial variations in the fallout blanket Hardy et al (1973) studied the distribution of fallout plutonium and measured the isotopic ratios in soil samples collected from around the world They determined that the heaviest fallout of plutonium 239+240 lies in the temperate latitudes in the Northern Hemisphere whereas concentrations of Pu 238 are greatest in the temperate latitudes of the Southern Hemisphere (Hardy et al 1973) Purtymun et al (1990) also studied the deposition and distribution of plutonium from worldwide fallout They concluded that the differences in plutonium concentrations and ratios can be attributed to regional and local weather patterns and to distribution by physical transport and that variability in plutonium particle size also contributes to the inconstancy of plutonium concentrations and ratios found in soils and sediments

Plutonium exists in +3 +4 +5 and +6 oxidation states in the Eh pH range found in nature with the +3 and +4 states dominant in most natural environments (Figure 3-4) Higher pH stabilizes the higher state (+4) which forms dioxo cations PuO_2^+ and PuO_2^{+2} (Pu oxidation states of +5 and +6 respectively) and solid species PuO_2 (plutonium dioxide) and $Pu(OH)_4$ (plutonium hydroxide) However Rai et al (1980) noted that if no Pu solid compounds are present sorption reactions alone may govern the concentration of plutonium in solutions Plutonium cations interact with anionic species by ionic bonding with the trend in complexation strength being +4 > +6 > +3 > +5 (Dozol and Hagemann 1993) Plutonium in the environment tends to exist as oxides dispersed in or agglomerated with natural soil particles however the actual characteristics of the particles is expected to vary depending on the source of formation and release (EPA 1976)

Americium can also exist in multiple oxidation states (+3 +4 +5 +6) but is expected to be in the +3 state in aerated waters in the absence of oxidants other than atmospheric oxygen The geochemical behavior of plutonium and americium in the environment is similar both actinides tend to be strongly adsorbed to the solid phase under neutral to alkaline oxidizing conditions

Cleveland et al (1976) stated that conditions which affect the behavior of plutonium and americium include pH ionic strength temperature and complexing anion concentration and that in fresh water systems pH would be expected to be the most important variable They also note that other studies have found that most plutonium in sediment is associated with metal hydroxides rather than natural humates Most importantly Cleveland et al (1976) found enhanced solubilization of plutonium and americium at pH values of 9 and above Results of filtration studies indicated that solubilized plutonium and americium are present almost entirely in colloidal form at all pH values studied (Cleveland et al 1976) Also the average size of the colloids (~ 1 μm to 1 mm) decreased with increasing pH In many studies involving natural water a standard membrane filter with a 0 45μm pore size is used to separate dissolved constituents from colloidal and other suspended matter

Dozol and Hagemann (1993) reviewed the current state-of the art concerning migration of plutonium americium and neptunium in groundwater they noted that the major chemical parameters influencing actinide distribution between aqueous and solid phases are Eh pH and solution composition In particular the presence in solution of complexing agents such as carbonate will affect the apparent solubility of the actinides The actinides in all their oxidation states (+3 to +6) can form complexes with humic and fulvic acids comparable in strength to the hydroxide and carbonate complexes or interact with molecular components or colloidal particles and the mechanisms of sorption for an element as complex as an actinide in systems as complex as geological media is not perfectly known (Dozol and Hagemann 1993) Additionally the formation of colloidal hydroxides of actinides (primarily tetravalent and some trivalent) could result in an apparent solubility that is orders of magnitude greater than the expected equilibrium solubility (Dozol and Hagemann 1993) Colloids are 0 45 μm to 2 mm particles with high specific surface area and high specific surface energy Tetravalent (and to some extent trivalent) actinides tend to form polymeric colloids (Dozol and Hagemann 1993) Colloids can also be fine clay particles aluminum or iron hydroxides silica silicates silicic acids and humic or fulvic acids

Essington and Fowler (1976) evaluated the literature on plutonium and americium and concluded that both can migrate through soils but that factors such as nature and oxidation state of the source material soil pH soil organic matter content and presence of complexing agents control this migration However plutonium was found to migrate rapidly through cracks and fissures in fractured geologic materials underlying soils suspension (and resuspension) of plutonium and plutonium bearing particles was the principal mode of transport In another study Nevissi et al (1976) also determined that suspension transport (i e transport as plutonium-oxide particles hydrated plutonium-oxide colloids or plutonium particles aggregated to soil particles) was the main mode of plutonium migration in soils

Rai et al (1980) noted that the solubilities of both $PuO_2(c)$ and $Pu(OH)_4(am)$ decrease with increasing pH (see Figure 3-4) However another study (Noshkin 1976) revealed that at the Enewetak Atoll plutonium had migrated 80 m downward to groundwater and that plutonium 239+240 was very mobile throughout the water saturated coral sand environments (Essington and Fowler 1976) Additionally Rusin et al (1994) demonstrated that iron reducing bacteria mediate the solubilization of hydrous $PuO_2(s)$ under anaerobic conditions and that as much as 90 percent of PuO_2 was biosolubilized experimentally in six to seven days As a result of their experimental studies Rusin et al (1994) note that there is a potential for microbially catalyzed reduction as a contaminant migration mechanism for plutonium

In summary environmental plutonium and americium are strongly adsorbed to the solid phase and can be transported via wind and water transport of the host particles In oxidizing environments the strong preference of plutonium and americium to adsorb to the solid phase means that only a small amount of plutonium and americium is dissolved in natural waters The conservative geochemical behavior of these actinides makes physical transport mechanisms the dominant processes for migration in near neutral pH oxidizing environments Secondary processes such as geochemical transport in reducing environments also appear to have the potential for contributing to actinide migration in certain circumstances but are less well documented in the literature

3 2 2 Plutonium and Americium in Background Groundwater at RFETS

There are only three records for americium and one record for plutonium in filtered samples of background groundwater (Table B-8) none of these results is greater than the current 0 05 pCi/L standard For unfiltered samples of background groundwater there are four detections of americium and three detections of plutonium (out of 226 and 262 records respectively) that exceed 0 05 pCi/L (Table B-9) Only one of these few exceedances is greater than the proposed 0 15 pCi/L standard (Well B302989 sampled 12 5 90 plutonium 239+240 = 0 2237 pCi/L

3 2 3 Plutonium and Americium in Background Surface Water and Sediments at RFETS

Data for plutonium and americium dissolved in background stream water show two records for plutonium and three records for americium that exceed the 0 05 pCi/L standard (Table B 10) None of the records for plutonium and americium in samples of unfiltered stream water exceed the 0 05 pCi/L standard (Table B 11) Data for plutonium and americium in filtered samples of background seep water (locations SW080 SW104 and SW108) show that these two actinides are normally below detection (Table B-12) However data for unfiltered samples show sporadic detections (during 1989 only) above the 0 05 pCi/L standard for plutonium and americium (Table B 13)

Plutonium and americium activities in background surface (i e seep and stream) sediments range from essentially zero to 8 93 and 2 53 pCi/g respectively The mean activities for plutonium and americium in seep sediments are 0 61 and 0 13 pCi/g respectively (Table B 14) For stream sediments mean plutonium and americium activities are 0 54 and 0 17 pCi/g respectively (Table B 15)

3 2 4 Plutonium and Americium in Background Subsurface Soils at RFETS

For samples of background subsurface soils plutonium and americium are virtually at the limit of detection with the error terms as large or larger than the results (Table B-16) The maximum activities reported for subsurface soils are 0 03 pCi/g for plutonium and 0 01 pCi/g for americium Samples of background surficial soil also show low levels of plutonium and americium with maxima of 0 031 and 0 072 pCi/g respectively (DOE 1995a see Table E 3)

3 2 5 Plutonium and Americium in Sitewide Environmental Media at RFETS

Sitewide groundwater at RFETS shows a narrow range (approximately 2 pCi/L) of activities for plutonium 239+240 in filtered samples (Table 3-6a) and a much larger range (218 pCi/L) for

plutonium 239+240 activities in unfiltered samples (Table 3-6b) The mean values for dissolved plutonium and americium are less than the 0 05 pCi/L standard The highest activities for both plutonium and americium are those measured in samples collected from piezometers installed downgradient of the 903 Pad

Data for filtered samples of sitewide surface water show higher mean and maximum activities for plutonium and americium (Table 3 7a) than do samples of filtered groundwater (see Table 3-6a) The ranges of actinide activities in unfiltered samples of surface water (Table 3 7b) are roughly equivalent to those for unfiltered groundwater (see Table 3-6b) The mean values of plutonium and americium in both filtered and unfiltered samples of sitewide surface water exceed the 0 05 pCi/L standard

Analytical data for plutonium and americium in sitewide subsurface and surface soils show that surface soils contain significantly higher activities of plutonium and americium than do subsurface soils (Tables 3 8 and 3 9) Samples collected from two locations (12795 and 11895) for subsurface soils show actinide activities significantly higher than other subsurface-soil samples More than 97 percent of the results for plutonium 239+240 and more than 98 percent of results for americium 241 in subsurface soils are less than 1 0 pCi/g By comparison for surface soils about 82 percent of the results for plutonium 239+240 and about 90 percent of the results for americium 241 are less than 1 0 pCi/g

3 2 6 Site-Specific Characteristics of Plutonium and Americium at RFETS

In their site specific study of RFETS Pond B1 Cleveland et al (1976) arrived at the following conclusions

(1) At pH values of 9 or greater plutonium and americium are dispersed from the sediment into the water column and under certain conditions concentrations may approach or exceed 1 667 pCi/L plutonium and 1 330 pCi/L americium

(2) Plutonium is dispersed as colloids with average size (~ 1 μm to 1 mm) decreasing with increasing pH

(3) Americium is also present in colloidal form and follows (less regularly) the behavior of plutonium

(4) Only a small percentage of plutonium and americium in the sediment is present in dispersible form

(5) Pond water has a relatively low saturation value for plutonium and americium and at concentrations well below saturation the colloid is gradually reabsorbed by the sediment

(6) Because of items (4) and (5) migration of plutonium and americium down the stream would be slow but could be significant over an extended period of time

(7) Because of item (4) it would probably not be feasible to remove plutonium and americium from sediment by repeated leaching at high pH

Site specific studies of soils in the RFETS area have also shown that the vertical and lateral distribution of americium 241 is similar to that of plutonium 239+240 (Litaor et al 1994 Litaor et al 1995 Litaor & Allen 1996) More than 90 percent of the plutonium and americium in the soil profile at RFETS was confined to the upper 12 cm of the soil regardless of the soil characteristics or distance and direction from the source (Litaor et al 1994) Within unsaturated (vadose zone) soils the evidence suggests that plutonium and americium move by discrete particle transport within macropores in the upper 20 cm of soil (Litaor et al 1994 1996) Litaor et al (1994) also noted that the plutonium was translocated to a depth of 90 cm along decayed root channels and that earthworm activity was probably important in the redistribution of actinides in the upper 40 cm of soil

3 3 Determining Partition Coefficients for Actinides

Prediction of aqueous actinide transport in soils and groundwater is dependent on an understanding of contaminant mobility in the soil water environment Estimates of contaminant mobility are normally obtained using a parameter known as the partition coefficient (i e

distribution coefficient or K_d values) which is a quantitative measure of the degree of sorption for an individual contaminant that exists between a solution and a solid phase under specific geochemical conditions K_d values are used in contaminant transport equations to calculate migration rates for long term predictions of contaminant movement and behavior

The value of K_d for each compound or element is a function of the geochemical behavior of that compound or element as well as the composition and characteristics of the sorbent In turn the geochemical behavior of a compound is controlled by conditions such as redox potential (Eh) pH and solution composition Low K_d values indicate that contaminants are weakly sorbed to the solid phase resulting in a relatively high aqueous mobility through soils and sediments Conversely high K_d values indicate that contaminants are strongly sorbed to the solid phase resulting in a relatively low aqueous mobility through soils and sediments Due to variable conditions the range of K_d values reported in the literature spans several orders of magnitude for the actinides As reported in the RFI/RI Report for Operable Unit 3 (OU3) at RFETS (DOE 1996) the ranges of published values for uranium plutonium and americium are 0 to 4 400 0 4 to 87 000 000 and 0 to 47 230 respectively (DOE 1996) Representative K_d values given in the OU3 RFI/RI Report are 1 550 for uranium 234 4 500 for plutonium and 700 for americium (DOE 1996)

Jakubick (1976) estimated a K_d of 5 000 for plutonium in partially saturated loamy soil with pH=6 The estimated vertical transport was 0 8 cm/yr Jakubick (1976) suggested that PuO_2 migrated in the form of small discrete particles If this is the case then the migration rate of the plutonium would correspond to physical properties of a given soil A study by Routson et al (1975) experimentally determined K_d values for americium For soils in eastern Washington State K_d values were greater than 1 200 and were not influenced by different concentrations of calcium or sodium ions Glover et al (1976) conducted equilibrium sorption measurements on different soils for plutonium and americium nitrates K_d values for plutonium nitrates ranged from 35 to 14 000 whereas those for americium ranged from 82 to 10 000 Clay and sand content along with cation-exchange capacity (CEC) were determined to be the most important

factors in plutonium and americium immobilization or retardation in the soils suggesting that conventional ion-exchange processes were responsible

As noted in the OU3 RFI/RI Report (DOE 1996) The presence of multiple oxidation states and irreversible reactions between them makes the prediction of long term behavior of plutonium in aquatic systems difficult The environmental behavior of plutonium is further complicated by the existence of ionic particulate and both colloidal and pseudo-colloidal plutonium in the water column It is also noted that the adsorption of plutonium on sediments is not fully reversible due to colloid formation and changes in the oxidation state The OU3 RFI/RI Report states that the K_d of plutonium may be lower under reducing conditions (DOE 1996b)

One suggested method of determining a partition coefficient involves the calculation of apparent K_d values using data for soils and their associated interstitial waters The raw data necessary to perform such a site specific calculation for RFETS have been evaluated for groundwater and surface water unfortunately all dissolved results are close to detection limits and the error ranges for the low level detects and nondetects overlap In another approach preliminary estimates of K_d for plutonium and americium in groundwater and surface water based on plots of total plutonium versus total suspended solids (TSS) and total americium versus TSS have been prepared by assuming that (in the case of plutonium)

$$Pu(tot\ \ pCi/L) = Pu(diss\ \ pCi/L) + Pu(part\ \ pCi/g) * TSS(g/L)$$

and

$$K_d = Pu(part)/Pu(diss)$$

The K_d value is then calculated by dividing the slope of the total Pu TSS regression line (i e Pu(part)) to the intercept value (i e Pu(diss)) and correcting the result for proper units These calculations result in estimated K_d values for plutonium and americium that are in the 10^3 to 10^5 L/kg range The results are not presented herein because further work is necessary to document

the approach and validity of these values prior to their application to site specific transport problems

Hursthouse and Livens (1993) used soil and interstitial water data to estimate K_d values for plutonium and americium in sediment profiles Their K_d values ranged from 1 9 x 10^5 to 9 0 x 10^5 for plutonium and 11 x 10^5 to 39 x 10^5 for americium (Hursthouse and Livens 1993)

In summary the range of plutonium K_d values reported in the literature spans as much as eight orders of magnitude and reliable site specific K_d values have yet to be empirically determined for RFETS soils The heterogeneous nature of geologic materials makes it difficult to extrapolate from one site to another although sites with similar geological geochemical and climatic conditions may be anticipated to have similar K_d values

4 0 ACTINIDE TRANSPORT IN SURFICIAL SOILS AT RFETS

4 1 Uranium in the Soil Profile at RFETS

Litaor (1995) studied the soils east of the RFETS Industrial Area downwind of the 903 Pad where industrial oils contaminated with uranium plutonium and americium were stored in steel drums that deteriorated over time He concluded that Proposed wind-dispersal mechanisms were not consistent with the spatial distribution of U isotopes in surface soils east of the 903 Pad Additionally Litaor (1995) found no clear relationship between known uranium burial and spill sites and the present distribution of U 235 in the soils He noted that the lack of similarity in spatial distribution between Pu 239+240 and U isotopes probably resulted from the higher solubility and leachability of U isotopes compared with Pu 239+240 in the soil system (Litaor 1995) Additionally background sources of uranium contribute to the spatial variability of uranium in the environment

Uranium activities in surface soils east of the RFETS Industrial Area exhibit a range of 0 70 to 3 58 pCi/g for uranium 234 0 004 to 0 68 pCi/g for uranium 235 and 0 83 to 7 74 pCi/g for uranium 238 (DOE 1995c) Isopleth maps of uranium 235 and uranium 238 activities in surface soils show a general lack of spatial relationship to known source areas (Figures 4-1 and 4-2 where 1 Bq/kg equals approximately 37 pCi/g)

Uranium is subject to dissolution and leaching in the near neutral generally oxidizing environment found at RFETS Soil profile studies indicated that uranium leached downward into the A and B horizons under the RFETS 903 Pad (Litaor 1995) The uranium bearing solvents infiltrated into the A and Bw horizons but were retarded in the Bt horizon due to its higher clay content (Litaor 1995) The solubility of uranium allows leaching from contaminated soils followed by transport of uranium through soils and into groundwater and surface water

4 2 Plutonium and Americium in the Soil Profile at RFETS

Plutonium and americium are generally not as chemically mobile as uranium in the soil environment of RFETS The primary mechanism of migration has been physical transport of plutonium and americium-contaminated surface soils by wind which has distributed these two actinides across the downwind soilscape The spatial distribution of RFETS plutonium was estimated by two early studies (Krey and Hardy 1970 and Seed et al 1971) (Figure 4-3) A later study (DOE 1995c) defined the spatial distributions of plutonium and americium in surface soils (Figures 4-4 and 4-5) through the use of a comprehensive data set and geostatisical analysis Plutonium and americium activities are closely correlated in RFETS surface soils (Figure 4-6)

More than 90 percent of the total plutonium activity is contained within the upper 10 to 12 cm of soils downwind of the 903 Pad (Krey et al 1976 Litaor et al 1994) Less than 0 1 percent of the plutonium is found at 40-cm depth (Figure 4-7 Table 4-1) Krey and Hardy (1970) also noted an apparent similarity in the downward transport mechanism at all sites Soil transport modeling suggested that for depths below 6 cm diffusion transport does a better job of describing plutonium distributions than does particle transport via infiltration flow (Krey et al 1976) However physical parameters such as lateral discontinuities and macropores in the soils as well as macrofauna play a role in the physical transport of plutonium within the soil profile (Litaor et al 1994) These processes have been active for the 20 to 30 years since the surficial plutonium was deposited Therefore the soil profile data show the results of all combined migration factors

Plutonium activities in surface soils around RFETS range from 1 450 pCi/g near the 903 Pad to 0 05 pCi/g in the far southeast corner of the sampling area with the data showing a clear west east trend (DOE 1995c) Americium activities and spatial distribution showed a high correlation to those of plutonium Americium activities ranged from 0 005 pCi/g to 270 pCi/g (DOE 1995c) The mean activity ratio for americium 241 to plutonium 239+240 was 0 19 +/ 0 12 (DOE 1995c)

A sequential-extraction study performed on RFETS soils located downwind of the 903 Pad indicated a strong correlation between Pu activity and the submicron sized particles (Litaor and Ibrahim 1996) Plutonium in these soils is largely associated with organic carbon and sesquioxides and resides within the upper 18 cm of the soil profile Litaor and Ibrahim (1996) also found extremely small amounts of soluble and exchangeable Pu (<1%) at all depths within all sampling locations The physical adsorption of plutonium to organic carbon and sesquioxides along with the limited solubility of plutonium under the conditions studied suggests that under the normal oxic conditions observed in the soils of Rocky Flats Pu is largely immobile (Litaor and Ibrahim 1996)

A solvent-extraction study (EG&G 1995d) which was designed to provide data to assess the feasibility of using solvent extraction to remediate radionuclide-contaminated soils at RFETS determined the distribution of plutonium as a function of particle size and evaluated sodium hexametaphosphate (SHMP) as an agent for extraction of plutonium from the soil phase to the liquid phase This study found that virtually all of the plutonium contamination contained in the soil samples exists in the fraction that was small enough to pass through a 40 mesh screen (EG&G 1995d) In addition more than 60 percent of the plutonium was transported from the soil to the aqueous solution by SHMP washing (EG&G 1995d)

A study of the chemical extraction of plutonium and americium from contaminated RFETS soils (LANL/EG&G draft report 1995) found that reducing or oxidizing agents combined with complexants significantly enhanced the removal of radioactivity from plutonium and americium-contaminated soils This same study also determined that extraction time and solution pH had no effect on radionuclide removal Using citrate-dithionite solutions more than 90 percent of the radioactivity was removed from contaminated soil samples within 24 hours (LANL/EG&G draft report 1995)

5 0 ACTINIDE TRANSPORT IN SHALLOW SUBSURFACE SOILS

5 1 Uranium in Shallow Subsurface Soils at RFETS

Uranium isotopes in samples of subsurface soils (i e borehole materials) at RFETS display activities ranging from -0 06 to 971 0 pCi/g for uranium 233+234 -0 17 to 67 61 pCi/g for uranium 235 and -0 12 to 1160 0 pCi/g for uranium 238 Mean activities for the uranium isotopes in sitewide subsurface soils are 2 493 0 164 and 3 925 pCi/g respectively (see Table 3-4) These maximum and mean values are considerably higher than those obtained for samples collected from background areas onsite (see Table B 3) (DOE 1993a)

Based on geochemical behavior uranium is predicted to be much more geochemically mobile than plutonium and americium in the RFETS environment Litaor (1995) found evidence of this mobility in his study of uranium isotope distribution in RFETS surface soils Unlike plutonium and americium at the 903 Pad uranium was geochemically mobilized downward into the soils thus making it unavailable for physical transport via wind The spatial distribution of uranium isotopes in surface soils shows no pattern related to wind transport and deposition (see Figures 4 1 and 4 2) (Litaor 1995) Most of the uranium recovered from below the asphalt cap at the 903 Pad was concentrated between 15 and 40 cm below the original ground surface (Litaor 1995) Because of the solubility of uranium it is likely that lateral and vertical flow through subsurface materials that contain uranium will mobilize the element

5 2 Plutonium and Americium in Shallow Subsurface Soils at RFETS

Plutonium and americium in shallow subsurface soils (i e borehole materials) at RFETS range from -0 12 to 1 744 0 pCi/g and -0 60 to 208 7 pCi/g with mean activities of 1 245 and 0 243 pCi/g respectively (see Table 3 8) Background data show essentially no plutonium (0 03 pCi/g maximum) or americium (0 01 pCi/g maximum) in subsurface soils (see Table B 16) The presence of RFETS plutonium in sitewide soils is not in question

The site specific research of Litaor and Ibrahim (1996) on actinides in RFETS soils indicates that plutonium in the surface horizons is primarily associated with the organic C (45-65%) sesquioxides (20-40%) and the residual fraction (10-15%) A small portion of the Pu 239+240 is associated with soluble (0 09-0 22%) exchangeable (0 04-0 08%) and carbonate (0 57 7 0%) phases Litaor and Ibrahim (1996) noted that under near neutral pH and oxic conditions little plutonium is available for geochemical transport

6 0 ACTINIDE TRANSPORT BY GROUNDWATER

Transport processes that potentially affect the movement of actinides in groundwater include mainly physical processes such as detachment entrainment filtration and settling of colloidal and particulate contaminants in saturated porous media and geochemical processes such as dissolution/precipitation adsorption/desorption and oxidation/reduction Groundwater flowing through geologic materials with moderate to high hydraulic conductivities has the potential to carry both dissolved and finely divided suspended matter Discharge of groundwater through contaminated soils at seeps may also contribute to actinide migration

Actinide contaminants can reach groundwater via dissolution or entrainment of particulates as infiltrating waters pass through contaminated soils and intervening unsaturated soil zones The ability of the receiving groundwater to advectively transport colloids and particulates through a hydrostratigraphic unit is dependent primarily on the grain size distribution and permeability of the geologic medium and the velocity of groundwater flow Coarser grained high permeability materials have a greater ability to transmit water and solids in suspension than do fine grained low permeability materials Likewise high groundwater flow velocities have a greater potential to transport suspended solids than do low velocities

In addition to processes that affect actinide transport within a hydrostratigraphic unit groundwater itself has the potential to act as a chemical or geomorphic agent in situations involving direct interaction with contaminated surficial and shallow subsurface soils At seeps emergent groundwater has the potential to either chemically or physically induce the mobilization of actinides retained in the soil These processes will be evaluated in more detail in Section 6 4

6 1 Groundwater Monitoring

The groundwater monitoring network at RFETS has recently been revised (RFCA 1996) such that a two tier system of wells has been established As noted earlier the proposed groundwater

standards have been established based on protection of surface water quality Groundwater wells downgradient of known contaminant source areas and within drainages are monitored on a regular basis

6 2 Uranium in Groundwater at RFETS

For filtered samples of sitewide groundwater collected from 1990 to 1996 uranium activities ranged from -0 52 to 492 pCi/L -0 27 to 35 7 pCi/L and -0 18 to 325 pCi/L for uranium 233+234 uranium 235 and uranium 238 respectively (see Table 3 2a) In unfiltered samples activities ranged from -0 16 to 290 pCi/L -0 09 to 9 0 pCi/L and -0 02 to 190 pCi/L for uranium 233+234 uranium 235 and uranium 238 respectively (see Table 3 2b)

For the *Groundwater Geochemistry Report* (EG&G 1995a) analytical data for wells along four flow paths were plotted (two through background areas two through plantsite) from upgradient to downgradient Uranium isotopes in RFETS groundwater show increasing activities across the site both for background (see Figure 3 1b) and nonbackground areas (EG&G 1995a) Activities increase by approximately one order of magnitude for uranium 233+234 uranium 235 and uranium 238 (see figures 5 16 and 5 17 in EG&G 1995a) These data suggest that (1) uranium solubility increases downgradient possibly due to increases in carbonate and sulfate ion concentrations or other changes in solution chemistry or (2) uranium bearing minerals are concentrated in downgradient areas and dissolve into groundwater so uranium ions accumulate in groundwater along the flow path

The $^{233+234}U/^{238}U$ activity ratio remains relatively constant along the flow paths hovering between 1 and 2 (see Figure 3 1b) As noted earlier uranium 234 is a decay product of uranium 238 and if the two isotopes are in secular equilibrium the activity ratio should be about 1 The $^{238}U/^{235}U$ atom ratios were not plotted for these flow paths but range from 19 3 to 160 8 with the lowest ratios for lower activity samples The two wells at the end of the Rock Creek flow path (i e wells B201189 and B205589) show reasonable $^{238}U/^{235}U$ ratios of 126 3

and 160 8 respectively suggesting that data for low activity samples provide inaccurate and meaningless ratios

6 3 Plutonium and Americium in Groundwater at RFETS

For groundwater samples collected sitewide at RFETS over the period of 1990 to 1996 analytical data for filtered (0 45 μm) samples exceed the 0 05 pCi/L standard in only eight wells (Table 6 1) Many more wells show at least one exceedance for unfiltered samples of groundwater (Table 6 2) Several wells screened in the lower hydrostratigraphic unit (LHSU) show evidence of plutonium contamination in unfiltered samples LHSU wells 1687 46692 46792 and 46892 show at least one exceedance for plutonium 239+240 in samples of unfiltered groundwater (see Table 6-2) There are no exceedances of the 0 05 pCi/L standard for filtered samples collected from LHSU wells

Harnish et al (1994) investigated the nature of plutonium and americium contamination in UHSU well 1587 just downgradient (east) of the 903 Pad They concluded that the plutonium in groundwater at this well principally occurred in particulate (> 5 μm) and colloidal (0 1 μm 5 μm) phases at 65 percent of the total plutonium activity with the remaining 35 percent of plutonium activity associated with the dissolved phase Colloid concentrations were reported to be very low (much less than 1 mg/L) The study concludes that "particulate and colloidal forms could have the potential for facilitating the transport of plutonium in this groundwater" (Harnish et al 1994) Activities were too low to permit a similar analysis for americium

Cross-contamination of wells by plutonium-contaminated surface soils entrained down the wellbore during drilling may explain the presence of detectable plutonium in some groundwater wells The lack of plutonium exceedances in all but a handful (out of hundreds) of filtered groundwater samples indicates that the plutonium in groundwater wells must exist almost solely as particles larger than the 0 45 μm membrane filters used to filter the groundwater samples If this plutonium represents cross-contamination rather than transport in a groundwater contaminant

plume then plutonium concentrations should correlate with total suspended solids (TSS) and continued purging and redevelopment of the well should produce ever lower concentrations of plutonium in the groundwater samples collected over time

From 1991 until 1993 most of the unfiltered samples collected from boundary well 41691 exceeded 0 05 pCi/L for plutonium 239/240 and americium 241 Because of the location of well 41691 along the eastern site boundary there was concern that the elevated levels of plutonium measured in this well reflected the presence of a groundwater contaminant plume moving offsite This well was sampled and redeveloped throughout 1994 and 1995 and showed an overall decrease in total plutonium activities over time whereas uranium activities fluctuated over time (within a much smaller range) and did not decrease (Figures 6-1a and 6-1b) Because of the greater solubility of uranium its activity in groundwater is less influenced by filtration than are plutonium and americium so uranium activities in well 41691 fluctuated over a narrow range while plutonium and americium activities declined by orders of magnitude during the period of well purging and redevelopment Quarterly samples from well 41691 for 1995 showed only one exceedance (0 11 pCi/L) of 0 05 pCi/L for plutonium In addition the correlation coefficient (r^2) for plutonium versus TSS was 0 988 for all unfiltered samples collected to date (i e 1991 through 4th quarter 1995) from well 41691 (Figure 6 2) Thus these data suggest that cross contamination with plutonium-contaminated surface soils was responsible for the elevated plutonium activities found in well 41691

Correlations between total plutonium and TSS in unfiltered groundwater samples range from good to none for those sitewide wells with multiple detections greater than 0 05 pCi/L The detection limit as a percentage of the result averages approximately 11 percent with a standard deviation of about 45 percent for those samples with plutonium activities greater than 0 05 pCi/L The lack of good correlation for some wells may be due to variability in sampling techniques resulting from changes in field personnel or equipment One extreme value is enough to eliminate a good correlation so the lack of correlation should not be viewed as supporting evidence for the presence of a plume of plutonium-contaminated groundwater rather the data

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are inconclusive The limited number of plutonium exceedances for filtered samples suggests that dissolved (i e <0 45 μm) plutonium and americium are not migrating via groundwater at RFETS

6 4 Groundwater as an Agent for Plutonium Migration from Soils

Recent hydrologic and soil water geochemical data acquired by the soil monitoring system at RFETS during a period of saturated soil conditions suggest that plutonium and americium may be significantly more mobile when surface soils are subjected to groundwater flooding conditions (see Litaor et al 1996 in press for a general description of this system) The data were collected at a 903 Pad hillside seepage site during and after the exceptionally wet spring period of 1995 Heavy rainfall events and high antecedant moisture conditions caused episodes of high surface water runoff local stream flooding and an abnormally high groundwater table response A summary of these data and site conditions are contained in a proposed paper submitted for publication in the journal *Science* by Dr M I Litaor and members of the former RFETS soil study team This paper together with peer review comments provided by RFETS environmental restoration personnel are presented in Appendix C

6 4 1 Background

Litaor et al (Appendix C this report) report that during the spring and summer of 1995 an estimated 8 2 to 50 MBq (221 400 to 1 350 000 pCi) of plutonium were transported across a portion of the slope below the 903 Pad They postulate that the unusually wet spring of 1995 (>200% normal precipitation) combined with groundwater flooding of the area created a situation of temporary saturation and anoxic conditions in local soils that may have hydrogeochemically mobilized plutonium within the surface and shallow subsurface environments of the soil study area Lateral flow in the subsurface lasted for 65 days as measured by two lateral zero-tension samples installed at depths of 0 5 to 0 7 m The flow yield measured 35 to 40 m^3/m^2/day (Litaor et al Appendix C this paper) The previous three years

of monitoring and numerous rain simulations had failed to produce any lateral flow within these samplers Comparison of the calculated plutonium flux at the soils study area to similar calculations performed for influent and effluent water at Pond C 2 suggest that "most of the transported Pu was retained by the soils across the slope and the pond sediments" (Litaor et al Appendix C this report)

The unique hydrogeology of the 903 Pad area (see Litaor et al Appendix C Figure 1 this report) allows drainage through an upgradient alluvium filled paleochannel and subcrop of the Arapahoe Formation sandstone that are capable of producing a continuous flow of shallow groundwater through toeslope soils Plutonium activity in unfiltered samples of soil solutions at the toeslope show an exponential decrease with increased depth of sampling (see Litaor et al Appendix C Figure 3 this report) Samples of unfiltered seep water at location SW 53 near the soil pits exhibited a considerable increase in plutonium activity which may reflect the influence of the top soil layers (Litaor et al Appendix C this report) This suggests that subsurface flow daylighting at the seep transported plutonium-contaminated waters laterally downslope and that there was groundwater soil and surface water interaction with respect to plutonium-contaminated waters at this locality

The following discussion evaluates the geochemical control mechanism proposed by Litaor et al (Appendix C this report) and assesses its implications for localized and sitewide plutonium mobility A second mechanism is also proposed that either independently or in combination with geochemical remobilization could explain the behavior of plutonium in soil solutions and seepage water at the soil study site

6 4 2 Groundwater Geochemical Remobilization of Plutonium

The geochemical mechanism proposed for increased plutonium mobility in soils by Litaor et al (Appendix C this report) agrees with the studies of Hursthouse and Livens (1993) who found evidence of geochemical remobilization of plutonium and americium in gleyed soils (i e water

logged anoxic soils) These tidally inundated soils are water logged for long periods of the year and show no evidence of bioturbation or other physical disturbance (Hursthouse and Livens 1993) Based on knowledge of changes in the $^{238}Pu/^{239\,240}Pu$ and $^{239}Pu/^{240}Pu$ ratios in the discharge from the Selkirk Power Plant the measured homogeneity in isotopic ratios throughout the soil profile — combined with the lack of physical disturbance of these soils — Hursthouse and Livens (1993) hypothesized a geochemical remobilization of the plutonium The effect of differences in solution composition on plutonium migration behavior observed in the sea water system evaluated by Hursthouse and Livens (1993) and the fresh water system at RFETS have however not been evaluated

The potential for geochemical remobilization of plutonium is also reflected by an apparent relationship between aqueous plutonium and dissolved manganese (see Figure 7 17) observed in Pond C 2 As discussed in Section 7 2 6 one plausible explanation for this relationship involves the dissolution of iron or manganese oxides and subsequent release of plutonium to solution or suspension during periods of stagnant (lower oxic or anoxic) pond conditions Temporary anoxic conditions in RFETS soils may have resulted in a similar geochemical remobilization of plutonium (Litaor and Ibrahim 1996 Litaor et al Appendix C this report)

The plausibility of the proposed geochemical remobilization mechanism hinges on the existence of anoxic conditions in soils created by groundwater flooding Formation of anoxic soil conditions implies the existence of an oxygen-deficient groundwater source The redox condition of shallow groundwater is thus a key factor that must be addressed in order to consider the possible influence of geochemical remobilization on plutonium transport at the soil study area

At RFETS drill cores of surficial deposit and shallow bedrock materials in recharge areas show extensive evidence of chemical weathering that is consistent with the presence of an oxidized shallow groundwater environment Organic matter and reactive mineral phases are essentially absent from UHSU deposits having been removed by an estimated one million years of contact with shallow groundwater and ground air The visual evidence for oxidation in UHSU deposits

tends to decrease near the base of the unit where a transitional weathered zone with the LHSU is commonly observed in drill core

Reliable measurements of redox conditions in groundwater at RFETS are limited because of sampling difficulties associated with the routine measurement of these conditions in low yield wells Oxidizing conditions are generally indicated by the presence of dissolved oxygen (DO) and a positive redox potential (Eh) whereas reducing conditions are generally indicated by the lack of DO and negative Eh values Measurement of *in situ* dissolved oxygen concentrations in shallow groundwater undertaken for the Intrinsic Remediation Monitoring Program during the spring of 1995 provide definitive evidence that shallow groundwater at the site is predominantly an oxidizing rather than a reducing environment The results of this survey indicate a range of 0 to 8 6 mg/L DO and an average of 4 9 mg/L DO for the 59 UHSU wells included in the survey (see Table 6-3) Significantly eight wells contain DO concentrations that are less than 2 mg/L and two wells 00291 and B405289 have values of 0 mg/L The lowest values seem to be associated with contaminant plumes and deeper groundwater flow systems of the Arapahoe Formation sandstone Well 00291 (an Arapahoe Formation sandstone well) is located upgradient of the 903 Pad soil study site thus indicating that anoxic conditions may indeed occur in some of the source water for the 903 Pad hillside seeps

In another study (EG&G 1995e) DO and Eh measurements were made in four UHSU wells (41691 1786 2587 and 20591) during a controlled evaluation of groundwater sampling techniques Multiple measurements of DO made for each well using different pumping systems and multi parameter probes ranged from 0 to 15 mg/L with most values occurring between 4 to 5 mg/L The lowest values including a single 0 mg/L result were detected in well 41691 which averaged about 1 mg/L Eh ranged from about 80 to 300 millivolts in all wells thereby indicating a positive redox potential at these sites

Based on consideration of the groundwater field evidence presented above and the limited field observations provided by Litaor et al (Appendix C this report) during the spring 1995 event it

can be concluded that the requisite groundwater redox conditions for the formation of anoxic soil conditions probably exist at the soil study area These data suggest that the subcropping Arapahoe Formation sandstone is the most likely source for anoxic groundwater at this site The widespread occurrence of detectable DO in groundwater indicates that the redox conditions necessary for plutonium remobilization by groundwater are very limited on a sitewide basis and tend to be associated with the deeper flow systems of the UHSU

6 4 3 Groundwater Hydraulic Remobilization of Plutonium

At seeps emergent groundwater has the potential to physically detach and entrain soil particles resulting in gradual erosion and downslope movement of surficial soils away from the seepage face This process combined with mobilization of soils by Coulomb failure and mass movement has been termed *seepage erosion* by Dunne (1990) The efficacy of this process is enhanced as the hydraulic gradient normal to the seepage face and surface flow velocity increases Over the long term seeps can act as dynamic systems that are capable of locally accelerating soil erosion and influencing landform development Evidence of seepage erosion as an important geomorphic and potential transport process at RFETS is reflected by the association of broad headward cutting scarps with active or inactive seep occurrences found along the eastern margin of the Rocky Flats Alluvium

The soil solution and seep plutonium data presented by Litaor et al (Appendix C this report) are consistent with the distribution expected from the action of seepage erosion Groundwater flowing laterally and upward through soils would potentially detach and entrain contaminated soil particles which would then be transported with the flowing groundwater It seems reasonable to assume that this action would be focused along pathways of higher hydraulic conductivity such as soil macropores which have previously been identified as sites for plutonium migration into the soil (Litaor et al 1994) The ability of the groundwater to mobilize soil particles would be greatest during periods of maximum hydraulic gradient and hence hydrostatic pressure

Particle detachment and movement into soil interstitial waters would result from forces exerted on macropore walls by groundwater flowing from the porous matrix into the macropore

Harnish et al (1996 in press) found that 79 percent of the total plutonium activity present in a water sample collected at seep SW053 was retained at the > 5 μm fraction and 99 percent was retained at the > 0 45 μm fraction thus establishing the particulate nature of plutonium in water flowing from the soil study area While this finding does not necessarily invalidate the geochemical mechanism of plutonium mobilization proposed by Litaor et al (Appendix C this report) it is entirely consistent with a physically based transport mechanism such as seepage erosion

6 4 4 Groundwater Flooding Effects on Sitewide Remobilization of Soil Plutonium

Assuming that groundwater redox or hydraulic conditions control the mobility of plutonium in soil solutions it can be expected that the source geochemical history and flow direction of groundwater in contact with the soil has important implications for soil plutonium mobility The unsaturated zone above the water table is essentially an oxidizing environment (Matthess 1982) Recharge water resulting from infiltration of incident precipitation and surface runoff contains dissolved oxygen (DO) which is transported through the unsaturated zone to the water table Dissolved oxygen in groundwater is consumed by reactions involving organic materials or reduced inorganic minerals such as pyrite and siderite as water travels along a flow path (Hem 1989) If little oxidizable material is available in the system oxygen levels in groundwater may persist for long distances As a general rule the DO content of groundwater at recharge areas is typically greater than at discharge areas because of shorter contact times and selective removal of reactive materials near recharge sites over time Further consumption of DO is possible at discharge sites occupied by wetlands Shallow pre-emergent groundwater at seeps has the potential to interact with accumulations of organic soils and decaying wetland vegetation and further reduce DO concentrations potentially forming a local anoxic microenvironment

Groundwater flowing away from the seep would tend to gradually revert back to oxic conditions as a result of exposure to ground air and mixing with downgradient groundwater and recharge

Given the strong evidence of oxidizing conditions in soils and groundwater at recharge areas and the strong preference exhibited by plutonium for sorption to the solid phase under these conditions (see Section 3 2 1) it appears very unlikely that plutonium will geochemically remobilize and migrate at accelerated rates in the subsurface at recharge areas even under temporary groundwater flooding conditions caused by extreme precipitation events Although groundwater levels may rise within the contaminated soil zones downward hydraulic gradients characteristic of water movement through soils in recharge areas will result in a continuous replenishment of oxygen rich recharge water with the soil profile Groundwater monitoring results presented above combined with rapidly declining plutonium activities observed in the soil profile at RFETS corroborate the importance of a clay rich oxic environment in effectively limiting plutonium migration from shallow soil horizons to groundwater

The hydrologic setting of the soil study area at the 903 Pad hillside seep is atypical of much of RFETS because groundwater discharge and highly actinide-contaminated soil areas rarely coincide The potential for geochemical mobilization of soil actinides by groundwater flooding therefore represents a special case that may be unique or possibly limited to only a few areas on site Although the subsurface lateral plutonium fluxes calculated by Litaor et al (Appendix C this report) at the soil study area appear to be large the range of soil solution and seep plutonium activities represented in the soil profile (Litaor et al Appendix C Figure 3 this report) are except for the uppermost 0 to 0 2 meter soil interval below the current 0 05 pCi/L standard (or in 0 3 Pu 239+240 Bq/L) Under the proposed 0 15 pCi/L standard (or in 1 4 Pu 239+240 Bq/L) most of the soil solution plutonium activities in the uppermost interval fall below the standard thus underscoring the low level nature of plutonium contamination in soil interstitial waters at the soil study site Consequently the importance of this site as a potential plutonium source area is related more to potential exposure to surface soils and soil erosional transport to surface water than to shallow soil geochemical remobilization The reported large plutonium

flux via groundwater flooding and geochemical remobilization calculated for shallow soils downslope of the soil study area has not been verified It is however apparent that the flux calculated is less important than the actual activities which have a regulatory compliance basis Nonetheless it is prudent to consider all facets of actinide migration in order to identify probable pathways predict long term fate and develop and implement as necessary appropriate remedial solutions for minimizing the spread of actinides in the environment

6 4 5 Comment on Proposed Paper "*The Hydrogeochemistry of Plutonium in Soils of Rocky Flats Colorado*" by Litaor et al

At the present time it is not possible to provide a thorough critical evaluation of the proposed paper by Litaor et al (Appendix C this report) because the basic data used in the analyses have not been provided for review While the proposed geochemical mechanism responsible for plutonium transport appears to be a plausible explanation given possible support from other sources (i e Hursthouse and Livens 1993) other potential release mechanisms such as the physical process of seepage erosion have not been adequately considered In addition there remains a considerable amount of uncertainty involving the approach used by the authors to determine hydraulic parameters (i e hydraulic conductivity and hydraulic gradient) the results of calculations for the determination of water and plutonium fluxes and the fate of subsurface lateral transport away from the site For example it is possible that the vertical hydraulic conductivity measurements used by Litaor et al to calculate water and plutonium fluxes may overestimate the lateral flux because these measurements include the influence of vertical flow pathways such as macropores and decayed root channels that might not exist in the horizontal dimension Numerous additional review comments have been generated concerning the content and interpretation of the data (see Appendix C) Moreover none of the radiochemical analyses reported in the paper have apparently been assessed for data quality using the procedures described in Appendix A In view of this situation it is likely that the conclusions of the Litaor et al study will remain controversial and unresolved until a more thorough evaluation and substantiation of all data and analyses can be made

7 0 ACTINIDE TRANSPORT BY SURFACE WATERS AND SEDIMENTS

Transport processes that potentially affect the movement of actinides via surface waters include both physical and geochemical processes Overland flow during precipitation/runoff events and overland flow from groundwater seeps can carry suspended materials that contain actinides to surface waters In addition advective transport and sediment transport including resuspension and settling of particulate material in drainage channels and bed load transport may mobilize actinides bound to the suspended particles Geochemical processes influencing the fate and transport of actinides include adsorption/desorption dissolution/precipitation and oxidation/reduction

Contaminants in surface soils reach surface waters mainly through erosion The energy from falling raindrops can dislodge soil particles and contaminant particles attached to these soil particles Overland flow or runoff can then transport these particles to drainages Dissolved and colloidal contaminants may also be discharged from the groundwater system at seeps and then flow to nearby creeks For contaminants that are sorbed to suspended solids settling and re suspension from the sediments occurs as flow velocity conditions change

In surface waters sediment transport is the predominant transport mechanism for those constituents that are strongly associated with solids such as actinides Site specific studies (DOE 1995c) have shown that the actinides are concentrated in the fine (i e < 2 μm) sediment fraction which is much more mobile than the stream bedload

7 1 Surface-Water Monitoring

The previous surface water monitoring program at RFETS was time based rather than event based Currently through the use of some automated systems storm-event sampling is performed on the rising limb of the hydrograph for each monitoring station Sampling under low flow conditions has been de-emphasized under the current system of surface water sampling

The automated high flow sampling allows collection of high flow runoff samples which typically are very turbid with suspended solids which potentially have adsorbed plutonium

Water quality monitoring data for Water Years 1991 to 1995 at gaging stations upstream and downstream from the terminal ponds are summarized in Figure 7 1 These data indicate that the average plutonium and americium activities in stormwater at upstream locations generally are in excess of the proposed basic standard of 0 15 pCi/L but average activities in terminal pond effluents are substantially lower than the proposed basic standard This illustrates the effectiveness of the terminal ponds in removing radionuclide contaminants from the stormwater entering the ponds

7 2 Storm Event Monitoring

7 2 1 Storm Water Monitoring and Storm Water Detention Ponds

Storm water is monitored at RFETS by gaging stations equipped with continuously recording flow meters automatic water samplers and radiotelemetry systems for real time monitoring and datalogging (Figure 7 2) Storm water runoff from the RFETS Industrial Area is captured by the system of downstream detention ponds located within the Buffer Zone Each pond acting as an individual sediment-collection basin allows particulate matter suspended in the storm water to settle Water-quality data for the pond effluent compared to data for storm water inflows clearly indicate a significant improvement in quality after the storm water passes through the ponds

In the A and B-Series detention ponds located within the Walnut Creek drainage there have been few excursions above the current 0 05 pCi/L site specific water-quality standard for plutonium and americium Exceptions to this occur during extreme storm events (e g several inches in 24 hours) (Figures 7 3 through 7-6) Data for stream gaging stations in North Walnut Creek show higher radionuclide activities in 1994 and 1995 storm water than in previous years

However these data do not indicate increasing contamination in storm runoff Rather the data reflect a change in monitoring location and protocol that occurred in 1994

There are far more excursions above 0 05 pCi/L in Pond C 2 than in the other terminal ponds with 29 percent of the Pond C 2 data exceeding 0 05 pCi/L for Pu (Figure 7 8) The water quality of the Pond C 2 inflows is variable About half of the plutonium activities measured at monitoring station SW027 (above Pond C 2) exceeded 0 05 pCi/L The Industrial Area storm water runoff which is influent to Pond C 2 typically exceeds 0 05 pCi/L and Pond C 2 is less effective than Ponds A-4 and B 5 at radionuclide removal (compare Figures 7 7 and 7 8 to Figures 7 3 through 7-6) However water discharged from Pond C 2 is usually in attainment of the 0 05 pCi/L standard for plutonium and americium

7 2 2 Association of Radionuclides with Suspended Solids

Data from storm water collected at RFETS from 1991 through 1995 indicate that a relationship exists between radionuclides and total suspended solids (TSS) in storm water samples as indicated by the regression line fits shown in Figures 7 9 and 7 10 Note that the slope of each regression line for each of these plots is the mean specific activity of the material (e g soil or sediment) in units of pCi/g that is transported by the storm water For example the slope of the regression line for the correlation of TSS with plutonium 239+240 activity at gaging station GS10 is approximately 1 5 pCi/g (see Figure 7 9) This value agrees with the data for ditch sediments which contain plutonium 239+240 activities between 1 0 and 3 0 pCi/g (USDOE 1995)

7 2 3 Relationship Between Storm Water Flows and Radionuclide Activities

As the intensity of precipitation events increases storm water flow also increases The increased flows contribute to higher concentrations of TSS because of ditch and wetland scouring sheet flow on bare soils and raindrop impact Because the radionuclides are associated with

particulates (DOE 1995c) the total loading of radionuclides to streams will be related to the intensity and duration of storm events Figures 7 11 and 7 12 show association of the highest plutonium activity with the highest flow rate and the lowest plutonium activity with the lowest flow rate Some scatter occurs in the medium to low rates Note that plutonium activity is much higher and flow rates are much lower at GS 27 than in South Walnut Creek

7 2 4 A-Series Ponds / North Walnut Creek

Gaging stations SW092 SW093 and GS13 monitor inflows to the A Series ponds Stations SW092 and GS13 are co-located just above the A 1 Bypass on North Walnut Creek (see Figure 7 2) Station SW093 is located approximately 1 000 feet upstream from GS13 but there are no significant tributary inflows between SW093 and GS13 Relationships between flow rate and plutonium or americium activities showed no correlation based on the available data for these locations The absence of correlation may result from a large heterogeneous drainage basin which collects runoff from a wide variety of source areas with little surface soil plutonium contamination In addition the variability of areal precipitation distribution influences water quality at these monitoring locations For example precipitation for one storm may fall heavily on a more contaminated source area resulting in contaminated runoff Consequently a similarly sized precipitation event may fall heavily on a relatively clean source area resulting in cleaner runoff Conversely for the same observed flow rate the plutonium activity and TSS concentration may be quite different

Runoff hydrographs at gaging stations GS13 and SW093 commonly show two peaks This characteristic may indicate that runoff is originating from two or more distinct sub-basins with different response rates that converge near the gages The drainage basin for these gages includes the area inside the Protected Area which is characterized by numerous potential source areas for contaminants large impervious areas and flow paths through ditches and storm water conveyance structures In contrast the area north of the Protected Area is characterized by relatively uncontaminated source areas vegetated pervious slopes and a more indirect flow path

These drainage characteristics coupled with difficulty in automatically sampling multiple peak flows for every storm event (i e the magnitude and duration of runoff events is impossible to predict) may result in variable water quality in the runoff from events with similar magnitude The highest plutonium activity measured for all the A Series storm water inflow samples was 5 3 pCi/L measured at a flow of 1 08 cfs

7 2 5 B-Series Ponds / South Walnut Creek

Storm water data for the B Series Pond inflows are collected at gaging station GS10 (a k a SW023) (Figure 7 1) These stations are co-located just upstream of the B-1 Bypass on South Walnut Creek Data from 1991 to 1995 indicate no good statistical correlation between flow rate and plutonium activity However if selected data from 1995 are examined separately based on inspection of variation diagrams and for the reasons given in Table 7 1 an acceptable linear correlation coefficient (r^2 = 0 74) exists between flow and plutonium activity is obtained (Figure 7 12) As Figure 7 12 shows for flows of 0 23 cfs or less the plutonium activity is less than the 0 05 pCi/L standard Table 7 1 lists the data and reasons for their separate evaluation

Table 7 1 Stormwater Quality Data Flagged in B-Series Inflow Analysis

Sample Dates	Reason / Effect
prior to 4/1/93	Prior to 4/1/93 flow was being measured at a 90° V notch weir device considered unreliable for accurate flow measurement The weir was often overtopped in storm events and flow values had to be estimated In April 1993 a more reliable Parshall flume was installed These early data were excluded
5/17/93	This sample was a grab sample for the OU6 Synoptic Sampling Event. Since the other samples at this location are composites that are paced to sample the rising limb and peak of a runoff hydrograph this sample was considered incongruous This action is conservative since the Pu activity was relatively low (0 19 pCi/L) for a flow of 2 48 cfs
4/26/95	This sample was collected of snowmelt Since snowmelts are generally of low intensity and contain less TSS (no raindrop impact scouring) it was determined to be incongruous with precipitation event samples This action is conservative since the Pu activity was relatively low (0 27 pCi/L) for a flow of 5 45 cfs
5/17 6/28/95 4 samples	These samples were all collected during high flow rates and relatively low Pu activities a conservative action This phenomena is thought to be caused by the extremely large event on 5/16/95 to 5/17/95 We suspect that this large event effectively flushed transportable and potentially contaminated sediments from ditches and culverts Therefore during subsequent runoff events there was less contaminated sediment available for transport. Ditches and culverts might also have acted as sediment traps for the relatively lower intensity events that followed

Note that most of the flagged data in Figure 7 13 are from the spring of 1995 These samples were collected during and subsequent to extremely wet weather conditions at RFETS A best fit line shown for the correlation of the 1995 flow and plutonium data indicates only a weak to moderate relationship (r^2 = 0 49) between plutonium activity and flow rate (see Figure 7 13) However the slope of the regression line for the 1995 data is less steep than the slope of the best fit line for data from other years (see Figures 7 12 and 7 13) This change in slope might indicate that the extreme surface flows in 1995 may have scoured the drainage ditches and removed considerable quantities of the contaminated source material from the ditches An alternate hypothesis is that the plutonium in surface soil being transported to the creek was diluted by the massive flow rates It is likely that both mechanisms were operating during the extended period of high runoff and high flow rates during the spring of 1995

7 2 6 South Interceptor Ditch (SID) / Pond C 2 System

The time trend for plutonium activities in Pond C 2 indicates that plutonium activity fluctuates seasonally (Figure 7 14) These fluctuations may be related to individual storm events and quiescent periods between storms

Storm water data for the Pond C 2 inflow are collected at gaging station SW027 (see Figure 7 2) This station is located on the dual 60-inch culverts at the South Interceptor Ditch outfall to Pond C 2 Prior to April 1995 reliable flow data were not collected at this location The flow values in Figure 7 15 are considered inaccurate but are included and useable for their relative magnitude For water year 1995 inflow data to Pond C 2 (see Figure 7 16) clearly indicate that the most of the runoff to C 2 flowed during April May and June of that year This discharge record was measured as part of the surface-water monitoring program for the Industrial Area IM/IRA and is considered accurate

In order to estimate the total plutonium yield transported in the SID throughout May and June of 1995 a correlation between flow and plutonium activity was sought to provide an equation for conversion of flow to plutonium activity No statistical correlation was observed however the sample data for the May 17 May 27 and June 28 events at SW027 showed higher plutonium activities than all other samples collected from SW027 since 1992

The simultaneous occurrence of Pond C 2 inflow and corresponding increases in plutonium activity in Pond C 2 shown in Figure 7 15 lead to the conclusion that Pond C 2 water quality is linked to plutonium loading from the South Interceptor Ditch Evaluation of data in Figure 7 17 indicate that resuspension of plutonium and exceedance of the CWQCC goals might also occur due to changing redox conditions in the pond as indicated by simultaneous increases in dissolved manganese and plutonium activity in the water of Pond C 2 (Figure 7 17) Thus there are two plausible causes for increased plutonium activity in Pond C 2

During summer months Pond C 2 can stagnate leading to decreased dissolved oxygen and in turn altering the redox conditions in waters associated with bottom sediments These conditions favor formation of reduced manganese forms — relative to the more oxidized of MnO_2 — as the more soluble constituent If plutonium is adsorbed to a redox active ferrous-oxide (e g $Fe(OH)_3$ or MnO_2) in or on the sediments then liberation of the plutonium can occur when the redox potential (E_h) of the system decreases and the supporting oxides dissolve (Equation 7 1) Alternatively storm erosion of contaminated soils and storm surge scour of stream sediments could suspend large quantities of fine sediments containing both plutonium and manganese and produce the simultaneous time trends shown in Figure 7 17

8 0 CONCLUSIONS

8 1 Conclusions on Uranium Migration in Groundwater

Analytical data for uranium isotopes in samples of filtered (0 45 μm) and unfiltered groundwater show relatively high (>40 0 pCi/L for uranium 233+234 and uranium 238) maximum activities for both background and nonbackground areas Overall, the data suggest that RFETS uranium is migrating through the groundwater environment however groundwater in some nearby background areas contains significantly higher amounts of naturally occurring uranium (Moody and Morse 1992) than does the sitewide groundwater at RFETS Because the maximum activities of uranium isotopes measured in samples of RFETS groundwater are less than those measured for nearby background areas any cleanup of uranium in RFETS groundwater would effectively be cleanup to less than background levels Therefore the issue of remediating RFETS groundwater for possible contributions from RFETS uranium is a political/policy decision rather than a decision based on the need to eliminate an unacceptable public health risk Instead unless groundwater monitoring indicates any substantial increase in uranium activities any cleanup should focus on removing obvious uranium sources in the subsurface such as the East Trenches rather than on creating a treatment system for uranium in RFETS groundwater

8 2 Conclusions on Plutonium and Americium Migration in Groundwater

Analytical data for plutonium and americium in samples of filtered (0 45 μm) groundwater suggest that there are no plutonium/americium contaminant plumes in RFETS groundwater As discussed earlier a few wells showed activities of dissolved plutonium or americium greater than the 0 05 pCi/L standard all of the results were less than 2 0 pCi/L (see Table 6-1)

Some wells regularly yield samples of unfiltered groundwater that contain plutonium and americium activities significantly greater than the 0 05 pCi/L standard Well 09091 located within the 903 Pad area shows numerous samples with high activities of plutonium in unfiltered

groundwater samples (see Table 6-2) Most other wells showing high plutonium activities are located within or near the 903 Pad or within the Industrial Area of RFETS where surface soils are known to contain some plutonium contamination Of the 25 records for plutonium in unfiltered samples collected from aseptic wells (i e wells drilled in a manner to minimize cross contamination) only one result was higher than the 0 05 pCi/L standard (Well 10294 located in the extreme southeast corner of the buffer zone showed 0 129 pCi/L for first sample collected) Although not completely definitive the data at hand suggest that the plutonium detected in groundwater wells is the result of downhole cross-contamination of the well from plutonium contaminated surface soils

The main groundwater pathway for actinide transport at RFETS involves upward flow at seep areas through contaminated surficial soils resulting in the potential lateral migration of entrained contaminated soil particles via surface or subsurface flow This is expected to be a significant pathway only under conditions of high antecedent moisture conditions combined with continuing heavy rains which occurs every 25 to 50 years Data collected at the 903 Pad hillside soil study area during the spring and summer of 1995 indicate that soil bound plutonium may be remobilized as a result of groundwater flooding conditions at groundwater discharge areas Groundwater flooding of soils in surrounding recharge (non seepage) areas is not expected to result in the remobilization of soil plutonium based on geochemical and hydraulic considerations The transport distances of remobilized plutonium and americium transport flux and probability of offsite migration associated with the soil study area are however poorly defined at this time Based on the limited coincidence of actinide-contaminated soils and seeps in 903 Pad hillside and east buffer zone areas the effects of soil plutonium remobilization by groundwater flooding are expected to be highly localized and may be unique to the soil study area

The data supporting the proposed geochemically-driven movement of plutonium in shallow groundwater (Litaor et al Appendix C this report) have not been available for review and clarifications regarding specific issues have not yet been provided (see Appendix C)

8 3 Conclusions on Uranium Migration in Surface Water and Sediment

Uranium is more soluble than plutonium and americium in the RFETS chemical environment hence dissolved uranium may be transported by surface water and groundwater Uranium contaminated surface soils may also be transported overland to drainages where the particulates ultimately accumulate as sediment in the series of onsite detention ponds Isotopic studies of the pond water and pond sediment indicate that depleted uranium from RFETS has accumulated in the pond system at RFETS (Efurd et al 1993) The summary statistics for uranium isotopes in sitewide surface water (see Tables 3 3a and 3 3b) show activities significantly higher than those for background surface water (see Tables B 1 and B 2)

Overall the pond systems perform well in containing uranium such that surface water leaving the site generally meets the site specific standards for uranium

8 4 Conclusions on Plutonium and Americium Migration in Surface Water and Sediment

Although transport of plutonium and americium-contaminated particulates from surface soils to the creek beds by erosional processes occurs in the Woman Creek and Walnut Creek drainages sediment transport — hence actinide transport — within the drainage systems appears to be effectively inhibited by the pond systems established and maintained by DOE By careful management of the ponds and by controlling the timing of pond discharges plutonium and americium mobility can be controlled It is expected that the planned soil remediation activities for the 903 Pad Lip and surrounding actinide-contaminated soil areas together with watershed improvement projects currently in progress (i e application of road sealants revegetation of buffer zone roads installation of silt fences SID improvements etc) and demolition and decommissioning activities will serve to reduce actinide levels in pond influent and effluent waters

8 5 Conclusions on Uranium Migration in Surface and Subsurface Soils

In the RFCA document action levels for radionuclides in subsurface soils and sediments are the same as those for surface soils The action levels for uranium isotopes in surface and subsurface soils are not exceeded for background surface and subsurface soils at RFETS

In general wind transport does not appear to be a significant transport mechanism for uranium in surface soils (Litaor 1995) Other physical modes of transport as well as geochemical modes are the likely cause of uranium mobilization within the RFETS environment Although high activities of uranium isotopes are present in some RFETS soils (see Tables 3 2a and 3 2b) the uranium activities in RFETS groundwater are not elevated above those of background groundwater suggesting that surface and subsurface soil contamination by uranium has not adversely impacted groundwater Uranium-contaminated soils have been transported into some site drainages (Efurd et al 1993) but appear to be effectively controlled by the onsite detention pond system

The spotty occurrence of high levels of uranium at RFETS is also characteristic of naturally occurring uranium in Jefferson County including the RFETS area (DOE 1993a DOE 1995a Morse and Moody 1992 Bolivar et al 1978) Through the use of TIMS analysis to individually measure uranium 234 uranium 235 uranium 236 and uranium 238 one can approximate the relative proportions of natural and anthropogenic uranium at RFETS If total uranium activities lie within the range of activities for background uranium the expense of these TIMS analyses may not be justified

8 6 Conclusions on Plutonium and Americium Migration in Surface and Subsurface Soils

The distribution of RFETS plutonium and americium has been described for surface soils in areas downgradient of the 903 Pad Vertical profiles of plutonium and americium activities with

depth reflect transport by all applicable mechanisms over the past 30 years Aside from particle transport along macropores the vertical migration of plutonium and americium is quite limited (Litaor et al 1995 DOE 1995c) These data indicate that more than 90 percent of the plutonium and americium activity is contained within the upper 12 cm of the soil profile (Litaor et al 1995 DOE 1995c)

For surface and shallow subsurface soils there is recent evidence that plutonium and americium in RFETS soils at the soil study area may not be as geochemically immobile as previously believed (Litaor et al Appendix C this report) Results of rain simulations of 100-year precipitation events showed that under the experimental conditions there is a potential for translocation of actinides from the contaminated top horizon to deeper horizons of the soil and possibly to groundwater and that plutonium and americium stored in the surface soils at the soil study area may be subject to remobilization under certain groundwater flooding conditions (Litaor et al Appendix C this report) It is important to note that the soil and groundwater associations at the soil study area are however atypical of sitewide conditions and that remobilization of soil actinides by groundwater flooding is expected to be limited to groundwater discharge areas only

9 0 RECOMMENDATIONS

During the compilation and evaluation phase of this project various data gaps were identified that limit our understanding of actinide migration processes and potential in the various environmental media at RFETS These data gaps may have compromising effects on regulatory compliance and remediation strategies planned under RFCA that if left unattended may eventually lead to such adverse effects as exceedences of media specific actinide standards and initiation of unnecessary or inappropriate remedial actions Recommendations for further funding consideration include the following items

Groundwater

Empirically derived site specific K_d values and actinide speciation information would assist in modeling the fate and transport of plutonium americium and uranium at RFETS The installation of more aseptic wells twinned with wells that show consistently high detects for plutonium in unfiltered samples or the use of tracers when drilling new wells would provide additional evidence to dispel or confirm the concept of a plutonium-contaminant plume in RFETS groundwater Groundwater/surface water interactions are only poorly understood but have important implications with regard to actinide migration and compliance issues especially in Woman Creek above Pond C 2 where evidence of groundwater discharge to the stream flow has been shown to exist Further evaluation of groundwater and geochemical conditions at the 903 Pad hillside soil study area including the data and analyses of Litaor et al (currently unavailable) is warranted to verify the proposed hydrogeochemical transport mechanism and monitor for potential reductions in actinide levels during and after the soil removal activities planned for the 903 Pad Lip and surrounding buffer zone IM/IRA in FY 1998 This data would also be used to recommend a disposition action for the 903 Pad hillside soil study area i e possible dismantlement and restoration Additional well point installations and groundwater radiochemical analyses downgradient of the soil study area are recommended to assess the water

and plutonium fluxes calculated by Litaor et al should these fluxes remain an issue with stakeholders

Surface Water and Sediments

Currently available surface water data should be evaluated with emphasis on storm related loading of actinides to streams efficiency of the ponds to remove actinides from the water column and likely resuspension/mobilization of actinide-contaminated sediments on the pond bottom At the same time determination of K_d s and plutonium and americium speciation in pond waters and sediments during oxic and anoxic conditions should be undertaken to identify the release mechanisms that control the activity of these contaminants in solution This knowledge would be used to develop mitigation approaches that would serve to minimize resuspension/mobilization of actinides in pond waters and thereby lower the activity levels of pond releases Calculation of pond sediment actinide inventories should be made in order to estimate historic actinide transport rates Additional seep sampling and seep flow measurements downgradient of the 903 Pad is recommended to evaluate actinide mobility during the dry season and during periods of heavy rainfall and snowmelt and exceptionally high water table conditions This activity would address the issue of soil actinide transport by groundwater and surface flow at the seeps and would reduce questions regarding potential sediment/soil contamination of the water during sampling

Soils

Chemical speciation data combined with empirically-derived K_d values would be useful for determining the fate and transport of actinides in groundwater flooded soils

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TABLES

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Table 1 1 Current and Proposed Standards for Actinides at RFETS

SURFACE WATER ACTION LEVELS AND STANDARDS					
Analyte	Proposed RFCA Action Levels		Current Standards		Units
	Woman Creek	Walnut Creek	Woman Creek	Walnut Creek	
Americium-241 total	0 15	0 15	0 05	0 05	pCi/L
Plutonium 239+240 total	0 15	0 15	0 05	0 05	pCi/L
Uranium (all isotopes) total	11	10	5	10	pCi/L

GROUNDWATER ACTION LEVELS AND STANDARDS					
Analyte	Proposed RFCA Action Levels		Current Standards		Units
	Tier-2	Tier 1	Woman Creek	Walnut Creek	
Americium-241	0 145	14 5	0 05	0 05	pCi/L
Plutonium-239	0 151	15 1	0 05	0 05	pCi/L
Plutonium-240	0 151	15 1	0 05	0 05	pCi/L
Uranium-233+D	2.98	298			pCi/L
Uranium-234	1 07	107			pCi/L
Uranium-235+D	1 01	101			pCi/L
Uranium-238+D	0 768	76 8			pCi/L
Uranium (all isotopes)		*	5	10	pCi/L

SURFACE-SOIL, SUBSURFACE-SOIL AND SEDIMENT ACTION LEVELS FOR THE BUFFER ZONE (HYPOTHETICAL RESIDENT)					
Analyte	Proposed RFCA Action Levels		Current Standards		Units
	Tier 2	Tier 1			
Americium 241	38	215	N/A	N/A	pCi/g
Plutonium-239	252	1429	N/A	N/A	pCi/g
Plutonium-240	252	1429	N/A	N/A	pCi/g
Uranium-234	307	1738	N/A	N/A	pCi/g
Uranium-235+D	24	135	N/A	N/A	pCi/g
Uranium-238+D	103	586	N/A	N/A	pCi/g

SURFACE-SOIL, SUBSURFACE-SOIL AND SEDIMENT ACTION LEVELS FOR THE INDUSTRIAL AREA (OFFICE WORKER)					
Analyte	Proposed RFCA Action Levels		Current Standards		Units
	Tier-2	Tier 1			
Americium-241	38	209	N/A	N/A	pCi/g
Plutonium-239	252	1088	N/A	N/A	pCi/g
Plutonium-240	252	1088	N/A	N/A	pCi/g
Uranium-234	307	1627	N/A	N/A	pCi/g
Uranium-235+D	24	113	N/A	N/A	pCi/g
Uranium-238+D	103	506	N/A	N/A	pCi/g

89 5

Table 3 1 Mean U238/U235 Atom Ratios for Filtered Samples of Sitewide Groundwater

Location	U238/U235	No Samples	Location	U238/U235	No Samples
00193	120 1	2	06591	100 6	10
00291	49 7	11	06691	361 9	8
00293	22.2	6	0671	143 6	1
00391	127 9	12	06791	234 7	4
00393	7 4	5	0686	169 7	2
00491	148 8	10	0687	184 2	5
01291	253 8	1	07191	204	5
01391	176 1	9	07291	131 6	3
01491	89 2	11	07391	256 4	10
0160	68 8	1	0786	162.3	2
0171	175 8	6	07891	93 9	6
01791	115 2	13	07991	192.1	6
0182	170	1	0881	232.3	9
0186	136 8	11	08891	271 7	10
0187	288 4	4	09091	78 3	17
01891	124 4	10	09691	139 4	12
01991	86.8	12	0974	211 1	5 5
02091	131 1	11	0986	94 4	20
02291	159 6	11	0987	58 7	18
02491	140 8	10	10192	77 6	1
02591	118	11	10194	211 5	3
0260	144 7	7	10294	123	1
02691	124 8	15	10394	102	4
0286	361 8	5	10492	137 9	12
0290	10 4	11	10592	133 6	3
02991	110 9	10	10594	109 8	2
03091	54 2	14	10692	144 2	14
03191	109 9	3	10694	62.8	2
03391	102.6	18	1074	128 3	6
03591	183 5	6	1086	17 2	20
03691	161 2	13	10991	114 7	13
0374	81 3	6	10994	168 2	3
03791	102.2	16	11494	7	3
0386	164 9	19	11691	117 7	5
0390	223 3	11	11791	151 9	9
03991	95 5	12	1187	165 5	11
04591	206 1	15	11894	167 6	3
0460	70 6	7	11994	72 9	1
0486	230 6	11	12091	124 1	13
0487	171 5	16	12094	155	5
04991	138.2	3	12291	60 4	4
05091	182	12	12391	105 9	18
05093	113 2	9	12491	143 1	21
05191	219 8	13	12691	45 4	21
05193	68 7	10	1286	352.3	3
05293	73 4	2	1287	171 6	6
05391	110 8	12	13191	64 5	11
05393	115 8	1	13391	86 6	13
05691	105 7	13	13491	115	12
0581	542.2	1	1386	175 1	13
0587	146 1	14	1487	143 9	18
06091	160 6	15	1490	32.3	10
06291	402.3	2	1586	152	22
06491	133 2	8	1587	61 9	14

85 86

Table 3 1 (Continued) Mean U238/U235 Atom Ratios Sitewide Groundwater

Location	U238/U235	No Samples	Location	U238/U235	No Samples
1686	28 9	23	41491	167 3	4
1687	68 5	16	41591	171 4	15
1774	466 5	1	41691	179 3	27
1786	143 8	25	4286	136	21 5
1986	146 9	18	4287	98 3	6
2186	52.5	14	43392	48 3	9
2187	167 9	8	4386	128.8	4
22093	203 5	6	4387	195.8	9
22293	81 4	8	4486	210 5	11
22393	23 2	2	45091	29 5	7
2274	143 6	5	4587	65 1	19
2286	75 6	14	46192	37 8	13
2287	34 7	19	46292	13 5	19
23193	13 5	6	46392	34 7	11
2387	166 1	8	46692	67 1	11
24993	13 8	2	46792	98.6	10
2586	73 5	20	4686	144 5	20
2587	123 6	21	46892	50 5	9
2686	126 3	11	4786	84 1	26
2886	144 5	5	4887	96	2
2887	130 4	10	49192	83 9	13
2987	135 9	17 5	49292	59 2	13
308-P 1	91 8	3	4986	27 9	17
308-P 2	94 3	4	50092	76 1	6
3086	100 4	18	5086	31 9	28
31791	148 9	9	51193	22.9	13
3187	85 2	18	5186	24 5	22
31891	116 7	15	5187	100 3	1
3286	32.1	21	5286	10 2	12
3287	121 6	9	5287	126 2	18 5
3387	70 1	1	53094	69 9	5
34791	30 4	13	53194	128 4	6
3487	89 8	18	5386	76 4	1
35691	156 7	14	5387	89 9	2.5
3586	121 3	21	5687	138 4	7
36191	123 7	13	56994	74 5	2
36391	121 4	4	5786	88.9	13
36691	136	3	5887	22.2	21 5
3686	102.7	2	59393	167 5	6
3687	79 3	18	59593	26 1	8
37191	188 4	14	59793	80 3	2
37591	204 5	13	5986	212	7
37691	86 7	1	6186	131 5	12
37791	130 8	12	6187	15.3	20
3786	169 9	9	6286	125.4	20
3787	144 9	5	63093	49	1
37891	181 8	13	6386	440 9	2
37991	139 5	13	6486	126.2	4
38591	113 4	7	6487	51 8	16
3886	152 9	8 5	6586	141 7	19
38991	141 1	6	6587	16 6	17
39191	173 9	12	6686	115 5	12
3986	158 4	16	6687	18.9	19
4087	168 1	4	6786	138.9	3

86 87

Table 3 1 (Continued) Mean U238/U235 Atom Ratios Sitewide Groundwater

Location	U238/U235	No Samples	Location	U238/U235	No Samples
6886	79 2	15	B208789	124	4
6887	8 5	25	B210389	168 1	2
6986	166 4	7	B210489	147 5	25
70093	14 2	14	B217289	10 3	7
70193	34 7	12	B217589	49 6	2
70293	88 5	12	B302089	128 2	2
70493	50 9	13	B302889	144 3	10 5
70593	91 7	13	B302989	287 2	9
7086	74	19	B303089	145 8	2
7087	200 5	8	B304789	172.7	3
70893	71 2	7	B304889	152.1	6
71193	71 5	10	B304989	9 8	9
71493	137 4	8	B305389	177 8	9
7187	55 7	21	B402689	121 7	9 5
71893	22.5	13	B405289	211 9	2
72093	108 2	10	B405389	64 4	1
72293	39 7	10	B410789	64 3	19
72393	28 4	11	B411289	34 3	20
7287	85 5	14	B411389	20 6	22
75292	152 8	4	P114989	13 6	6
75992	155 3	1	P115089	9 4	7
B102389	49 6	12	P115489	22	11
B106089	76 1	5	P115589	63 3	8
B110989	27 3	24 5	P115689	103 8	7
B111189	34 6	19 5	P207389	113 7	21
B200589	19 3	11	P207689	139 6	23 5
B200689	39 3	11	P207889	136 5	15 5
B201089	165 7	1	P207989	137 2	7 5
B201189	126 3	9	P208989	142.4	19
B201289	151 1	6	P209089	192.2	2
B202589	61 7	15	P209189	186	14
B203489	120 5	5	P209489	145 8	22
B204089	154 8	3	P209789	106.7	21
B204189	56 6	10	P209889	137 8	17
B205589	160 8	10	P210089	160 7	15
B206189	137 3	10	P210189	99 3	20
B206289	66 4	15	P210289	170 2	3
B206389	134	7	P218089	50 1	2
B206489	133 4	7	P218289	43 5	7
B206589	159 4	17	P219089	99 5	1
B206689	195 6	7	P320089	75	28
B206789	108	11	P415889	17 6	6
B207089	82	21	P416289	163 2	3
B208089	143 9	5	P416389	11 8	8
B208189	134 8	10	P416989	108.5	7
B208589	134	6	UNCPURGE2	55.2	1

NOTE Each location listed has at least one result that is greater than the background mean for U-235 or U 238
All records with results less than or equal to zero and all nondetect records have been excluded

Activities in pCi/L were transformed into atom ratios using the following equation A = N/lamda, where
A = activity N = number of atoms of the isotope lamda = decay constant (i.e 0 693/half-life)
Lamda for U-238 = 9 84375E 10 Lamda for U-235 = 1 55103E 10
The atom ratio of U238/U235 = 137 8 in naturally occurring uranium (Efurd et al. 1993)

87 88

Table 3 2a Summary Statistics for Dissolved Uranium Isotopes (pCi/L) in Sitewide Groundwater (1990 96 data)

Analysis Variable RESULT

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
4284	0 5210000	491 6251280	7 5597913	20 8123863	492 1461280	275 3037142

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
4287	0 2700000	35 7247972	0 3030721	1 0299583	35 9947972	339 8393125

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
4271	0 1830000	324 6458330	5 2003025	13 5673892	324 8288330	260 8961551

Table 3 2b Summary Statistics for Total Uranium Isotopes (pCi/L) in Sitewide Groundwater (1990 96 data)

Analysis Variable RESULT

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
378	0 1600000	290 0000000	9 5779511	23 7992315	290 1600000	248 4793603

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
378	0 0880000	9 0000000	0 4138690	0 8768417	9 0880000	211 8645524

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
394	0 0230000	190 0000000	6 9618687	16 2523567	190 0230000	233 4481953

Table 3 3a Summary Statistics for Dissolved Uranium Isotopes (pCi/L) in Sitewide Surface Water (1990 96 data)

Analysis Variable RESULT

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
922	0 1150000	1050 00	8 2795113	56 3299702	1050 12	680 3538037

ANALYTE=URANIUM 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
191	0	780 0000000	15 6627958	85 2323618	780 0000000	544 1708031

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
1129	0 2520000	47 4900000	0 3652134	2 4070732	47 7420000	659 0867079

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
1110	0 2550000	1211 00	7 1879342	54 3415433	1211 26	756 0105852

Table 3 3b Summary Statistics for Total Uranium Isotopes (pCi/L) in Sitewide Surface Water (1990 96 data)

Analysis Variable RESULT

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
1509	0 1425000	845 6800000	9 5758507	55 2297818	845 8225000	576 7610981

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
1503	0 1800000	72 8700000	0 4274008	2 7336933	73 0500000	639 6087933

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
1510	0 1336000	375 1100000	5 8841705	26 1411014	375 2436000	444 2614524

Table 3 4 Summary Statistics for Uranium Isotopes (pCi/g) in Sitewide Subsurface Soils

Analysis Variable RESULT

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
2936	0 0600000	971 0000000	2 4930128	27 5820715	971 0600000	1106 38

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
2490	0 1700000	67 6102046	0 1638933	1 8787841	67 7802046	1146 35

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
2944	0 1200000	1160 00	3 9251795	46 6115972	1160 12	1187 50

Table 3 5 Summary Statistics for Uranium Isotopes (pCi/g) in Sitewide Surface Soils

Analysis Variable RESULT

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
1926	0 2000000	2800 00	3 8493774	65 3002526	2799 80	1696 38

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
1926	0 0200000	670 0000000	0 4943822	15 3230788	670 0200000	3099 44

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
1924	0 2500000	38000 00	23 4883915	867 9416807	37999 75	3695 19

4x 12

Table 3 6a Summary Statistics for Dissolved Plutonium and Americium (pCi/L) in Sitewide Groundwater

Analysis Variable RESULT

ANALYTE=AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
472	0 0590000	0 4706000	0 0062681	0 0308818	0 5296000	492 6863253

ANALYTE=PLUTONIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
24	0 0071000	0 0152400	0 000831875	0 0045015	0 0223400	541 1236230

ANALYTE=PLUTONIUM 239/240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
481	0 0220000	1 9990000	0 0129771	0 1219874	2 0210000	940 0226579

Table 3 6b Summary Statistics for Total Plutonium and Americium (pCi/L) in Sitewide Groundwater

Analysis Variable RESULT

ANALYTE=AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
3360	0 4610000	59 9100000	0 1544567	1 7875389	60 3710000	1157 31

ANALYTE=PLUTONIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
450	0 0392000	1 0220000	0 0046236	0 0486857	1 0612000	1052 98

ANALYTE=PLUTONIUM 239/240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
3512	0 0540000	218 4000000	0 7210264	7 9485372	218 4540000	1102 39

Table 3 7a Summary Statistics for Dissolved Plutonium and Americium (pCi/L) in Sitewide Surface Water (1990 96 data)

Analysis Variable RESULT

ANALYTE AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
464	0 1400000	20 0000000	0 1130261	1 0163228	20 1400000	899 1929789

ANALYTE PLUTONIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
1	0 000703000	0 000703000	0 000703000		0	

ANALYTE=PLUTONIUM 239/240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
476	0 1230000	76 0000000	0 3201973	3 5692995	76 1230000	1114 72

Table 3 7b Summary Statistics for Total Plutonium and Americium (pCi/L) in Sitewide Surface Water (1990 96 data)

Analysis Variable RESULT

ANALYTE AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
2263	1 8000000	48 0000000	0 2066956	1 7811561	49 8000000	861 7292766

ANALYTE PLUTONIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
233	0 0110000	1 7320000	0 0132722	0 1143856	1 7430000	861 8416375

ANALYTE=PLUTONIUM 239/240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
2448	0 0570000	250 0000000	0 6417974	7 1210928	250 0570000	1109 55

Table 3 8 Summary Statistics for Plutonium and Americium (pCi/g) in Sitewide Subsurface Soils

Analysis Variable RESULT

ANALYTE=AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
2607	0 6000000	208 7000000	0 2430073	4 6884897	209 3000000	1929 36

ANALYTE=PLUTONIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
266	0 0122000	26 6900000	0 2025775	1 8549977	26 7022000	915 6979760

ANALYTE=PLUTONIUM 239/240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
2941	0 1200000	1744 00	1 2450109	34 6531820	1744 12	2783 36

4445

Table 3 9 Summary Statistics for Plutonium and Americium (pCi/g) in Sitewide Surface Soils

Analysis Variable RESULT

ANALYTE AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
2083	0 1900000	4260 00	5 8577092	118 9489297	4260 19	2030 64

ANALYTE=PLUTONIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
157	0 0031500	24 5700000	0 4806045	2 2439731	24 5731500	466 9063866

ANALYTE=PLUTONIUM 239/240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
2489	0 1300000	17400 00	29 7746559	523 4664965	17400 13	1758 09

TABLE 4-1
SUMMARY STATISTICS OF THE ACTINIDES INVENTORIES IN THE 25 SOIL PITS

	Pu 239+240				Am 241			
Depth cm	mean $\mu Ci/m^2$	S D $\mu Ci/m^2$	Range $\mu Ci/m^2$		mean $\mu Ci/m^2$	S D $\mu Ci/m^2$	Range $\mu Ci/m^2$	
0 3	40 2	69 0	0 06	223	6 0	10 9	0 0003	45
3 6	32.5	57 0	0 01	191	4 3	7 2	0 0006	26
6 9	19 0	34 6	0 002	111	2 6	5 2	0 0002	19
9 12	10 8	26 6	0 002	121	2 1	5 2	0 0003	19
12 18	5 8	17 1	0 007	89	0 8	2 2	0.0001	10
18 24	1 8	4 6	0 004	21	0 2	0 6	0 0006	2
24 36	0 9	3 6	0 001	18	0 1	0 6	0 0001	3
36-48	0 1	0 4	0 002	2	0 03	0 06	0 0001	0 3
48 72	0 05	0 1	0 002	0 7	0 02	0 05	0 0001	0 2
72 96	0 06	0 21	0 002	1	0 02	0 03	0 0001	0 1

Table 6 1 Dissolved Plutonium and Americium Exceeding the 0 05 pCi/L Current Standard for Sitewide Groundwater (1990 96 data)

LOCATION	SDATE	ANALYTE	RESULT	UNITS	ERROR	QUAL	DETECT	VAL	HIT
0386	09/20/95	AMERICIUM 241	0 05391	PCI/L	0 0535	J	0 06620	Y	1
B208589	03/15/90	AMERICIUM 241	0 07300	PCI/L	0 0270		0 01400		1
07191	05/18/92	AMERICIUM 241	0 14750	PCI/L	0 0324		0 00000	A	1
08891	07/20/94	AMERICIUM 241	0 43470	PCI/L	0 0663		0 00972	V	1
1286	04/15/92	AMERICIUM 241	0 47060	PCI/L	0 0708		0 00000	A	1
3287	05/18/92	PLUTONIUM 239/240	0 05646	PCI/L	0 0177		0 00600	A	1
07191	05/18/92	PLUTONIUM 239/240	0 09292	PCI/L	0 0249		0 00600	A	1
51193	03/16/94	PLUTONIUM 239/240	0 09400	PCI/L	0 0220		0 00700	V	1
1286	04/15/92	PLUTONIUM 239/240	0 13560	PCI/L	0 0256		0 00400	A	1
09091	07/21/94	PLUTONIUM 239/240	0 14920	PCI/L	0 0352		0 00828	V	1
09091	07/21/94	PLUTONIUM 239/240	0 25550	PCI/L	0 0516		0 00497	V	1
09091	05/20/92	PLUTONIUM 239/240	0 68520	PCI/L	0 0899		0 00600	A	1
70393	07/19/94	PLUTONIUM 239/240	1 61600	PCI/L	0 1920		0 00781	V	1
08891	07/20/94	PLUTONIUM 239/240	1 99900	PCI/L	0 2300		0 00352	V	1

Where SDATE date of sample collection ERROR 95 percent upper confidence limit QUAL result qualifier VAL validation code and HIT detect (1) or nondetect (0)

Table 6 2 Total Plutonium Exceeding the 0 05 pCi/L Current Standard for Sitewide Groundwater (1990 96 data)

LOCATION	SDATE	ANALYTE	RESULT	UNITS	ERROR	QUAL	DETECT	VAL	HIT
00191	05/21/92	PLUTONIUM 239/240	0 051	PCI/L	0 0200		0 00300	V	1
05691	03/04/93	PLUTONIUM 239/240	0 051	PCI/L	0 0132		0 00736	A	1
4286	12/13/93	PLUTONIUM 239/240	0 052	PCI/L	0 0186		0 01185	Y	1
3086	07/21/95	PLUTONIUM 239/240	0 052	PCI/L	0 0203		0 00500	Y	1
5686	11/08/90	PLUTONIUM 239/240	0 052	PCI/L	0 0181		0 01000	A	1
4387	09/11/90	PLUTONIUM 239/240	0 052	PCI/L	0 0155		0 00000	A	1
0486	09/12/91	PLUTONIUM 239/240	0 053	PCI/L	0 0170		0 00000	V	1
6986	05/13/91	PLUTONIUM 239/240	0 053	PCI/L	0 0155		0 00500	V	1
0486	11/18/92	PLUTONIUM 239/240	0 053	PCI/L	0 0233		0 01630	A	1
0987	05/26/92	PLUTONIUM 239/240	0 053	PCI/L	0 0160		0 00500	A	1
05191	03/05/92	PLUTONIUM 239/240	0 054	PCI/L	0 0165		0 00500	A	1
B218789	08/21/92	PLUTONIUM 239/240	0 055	PCI/L	0 0301		0 00000	A	1
05193	07/15/94	PLUTONIUM 239/240	0 055	PCI/L	0 0520	U	0 06700	V	0
12991	05/17/93	PLUTONIUM 239/240	0 055	PCI/L	0 0158		0 00967	A	1
0486	06/20/91	PLUTONIUM 239/240	0 055	PCI/L	0 0164		0 00900	V	1
1787	11/06/90	PLUTONIUM 239/240	0 056	PCI/L	0 0189	X	0 01000	A	1
03091	06/19/95	PLUTONIUM 239/240	0 056	PCI/L	0 0150		0 00800	Y	1
11891	05/04/93	PLUTONIUM 239/240	0 056	PCI/L	0 0200		0 00200	V	1
P416589	08/18/94	PLUTONIUM 239/240	0 056	PCI/L	0 0219		0 00588	V	1
01891	07/29/92	PLUTONIUM 239/240	0 057	PCI/L	0 0500	B	0 05100	A	1
03091	12/08/93	PLUTONIUM 239/240	0 057	PCI/L	0 0320		0 03900	Y	1
41591	12/06/91	PLUTONIUM 239/240	0 058	PCI/L	0 0200		0 00000	A	1
3687	03/08/91	PLUTONIUM 239/240	0 058	PCI/L	0 0218		0 01000		1
03091	11/16/94	PLUTONIUM 239/240	0 058	PCI/L	0 0166		0 00326	Y	1
02995	04/28/95	PLUTONIUM 239/240	0 058	PCI/L	0 2070		0 38300	Y	1
05691	11/08/94	PLUTONIUM 239/240	0 058	PCI/L	0 0260		0 01700	Y	1
13191	06/19/95	PLUTONIUM 239/240	0 058	PCI/L	0 0180		0 00900	Y	1
P209189	03/02/90	PLUTONIUM 239/240	0 059	PCI/L	0 0198		0 00900		1
P210189	08/16/95	PLUTONIUM 239/240	0 059	PCI/L	0 0189		0 00737	Y	1
12991	03/11/93	PLUTONIUM 239/240	0 060	PCI/L	0 0136		0 00205	A	1
5670A	02/15/94	PLUTONIUM 239/240	0 060	PCI/L	0 0780		0 03700	V	1
3687	09/08/94	PLUTONIUM 239/240	0 060	PCI/L	0 0183		0 00380	A	1
00191	09/13/94	PLUTONIUM 239/240	0 061	PCI/L	0 0180		0 00800	Y	1
2387	08/13/90	PLUTONIUM 239/240	0 061	PCI/L	0 0260		0 01600	A	1
03391	09/12/94	PLUTONIUM 239/240	0 062	PCI/L	0 1100	U	0 19000	Y	0
46692	02/23/94	PLUTONIUM 239/240	0 062	PCI/L	0 0220		0 00500	V	1
P210189	05/10/95	PLUTONIUM 239/240	0 062	PCI/L	0 0250		0 01600	Y	1
B218789	03/08/91	PLUTONIUM 239/240	0 063	PCI/L	0 0206		0 01000		1
4286	03/14/95	PLUTONIUM 239/240	0 065	PCI/L	0 0420		0 04700	V	1
4586	11/05/90	PLUTONIUM 239/240	0 066	PCI/L	0 0189		0 01000	A	1
03391	06/02/92	PLUTONIUM 239/240	0 066	PCI/L	0 0360		0 00800	V	1
4286	05/06/93	PLUTONIUM 239/240	0 066	PCI/L	0 0240		0 01100	V	1
032T2	11/11/94	PLUTONIUM 239/240	0 067	PCI/L	0 0380		0 05000	Y	1
P210189	10/22/93	PLUTONIUM 239/240	0 067	PCI/L	0 0240		0 01500	V	1
60293	04/20/95	PLUTONIUM 239/240	0 067	PCI/L	0 0341		0 02020	Y	1
46692	09/24/92	PLUTONIUM 239/240	0 068	PCI/L	0 0274		0 00740	A	1
1687	04/16/91	PLUTONIUM 239/240	0 068	PCI/L	0 0192		0 01000		1
4286	03/09/94	PLUTONIUM 239/240	0 071	PCI/L	0 0360		0 01200	V	1
0460	01/20/92	PLUTONIUM 239/240	0 072	PCI/L	0 0191		0 00000	A	1
04591	08/31/92	PLUTONIUM 239/240	0 073	PCI/L	0 0341		0 00000	A	1
46892	02/24/94	PLUTONIUM 239/240	0 075	PCI/L	0 0180		0 00900	V	1
05191	08/23/94	PLUTONIUM 239/240	0 076	PCI/L	0 0196		0 00901	V	1
00291	11/14/94	PLUTONIUM 239/240	0 077	PCI/L	0 0230		0 01200	Y	1

72093	11/16/93	PLUTONIUM 239/240	0 078	PCI/L	0 0163		0 00590		1
00191	12/02/93	PLUTONIUM 239/240	0 080	PCI/L	0 0160		0 00600	Y	1
4286	12/04/91	PLUTONIUM 239/240	0 083	PCI/L	0 0208		0 00000	A	1
0560	03/17/92	PLUTONIUM 239/240	0 083	PCI/L	0 0210		0 00500	A	1
P209889	10/21/93	PLUTONIUM 239/240	0 083	PCI/L	0 1700	U	0 31000	Y	0
P209189	07/28/92	PLUTONIUM 239/240	0 083	PCI/L	0 0294		0 00000	A	1
06891	03/10/94	PLUTONIUM 239/240	0 084	PCI/L	0 0180	B	0 00600	JA	1
49192	06/15/93	PLUTONIUM 239/240	0 085	PCI/L	0 0400		0 02800	V	1
12991	09/14/94	PLUTONIUM 239/240	0 086	PCI/L	0 0420		0 03800	Y	1
02695	05/03/95	PLUTONIUM 239/240	0 089	PCI/L	0 1160		0 15200	Y	1
03091	09/02/93	PLUTONIUM 239/240	0 089	PCI/L	0 0500		0 01000	V	1
00391	08/11/94	PLUTONIUM 239/240	0 090	PCI/L	0 0400		0 03400	V	1
06891	11/29/93	PLUTONIUM 239/240	0 092	PCI/L	0 0220		0 01200	Y	1
01495	03/07/95	PLUTONIUM 239/240	0 093	PCI/L	0 0220		0 01000	Y	1
41691	02/16/94	PLUTONIUM 239/240	0 094	PCI/L	0 0300		0 01700	V	1
0171	11/21/91	PLUTONIUM 239/240	0 096	PCI/L	0 0207		0 00000	A	1
P210189	10/20/94	PLUTONIUM 239/240	0 097	PCI/L	0 0320		0 02000	Y	1
B218789	02/18/92	PLUTONIUM 239/240	0 097	PCI/L	0 0234		0 00500	A	1
00391	12/17/91	PLUTONIUM 239/240	0 098	PCI/L	0 0220		0 00000	A	1
13391	08/20/92	PLUTONIUM 239/240	0 098	PCI/L	0 0190		0 00600	V	1
3986	09/08/92	PLUTONIUM 239/240	0 099	PCI/L	0 0262		0 00700	A	1
03ZT2	11/09/94	PLUTONIUM 239/240	0 100	PCI/L	0 0860		0 10000	Y	1
06891	05/20/92	PLUTONIUM 239/240	0 100	PCI/L	0 0200		0 00400	V	1
1786	02/01/93	PLUTONIUM 239/240	0 100	PCI/L	0 0194		0 00229	A	1
1787	05/13/91	PLUTONIUM 239/240	0 102	PCI/L	0 0227		0 00500	V	1
P320089	03/03/93	PLUTONIUM 239/240	0 104	PCI/L	0 0266		0 00642	A	1
41691	03/17/95	PLUTONIUM 239/240	0 110	PCI/L	0 0199		0 00784	Y	1
00391	09/01/93	PLUTONIUM 239/240	0 110	PCI/L	0 0300		0 00900	A	1
05093	07/26/94	PLUTONIUM 239/240	0 110	PCI/L	0 0900		0 04900	V	1
09691	06/21/95	PLUTONIUM 239/240	0 110	PCI/L	0 0300		0 00500	Y	1
4286	09/23/93	PLUTONIUM 239/240	0 110	PCI/L	0 0360		0 00400	V	1
3687	03/03/93	PLUTONIUM 239/240	0 113	PCI/L	0 0364		0 00693	A	1
0160	02/06/92	PLUTONIUM 239/240	0 114	PCI/L	0 0317		0 00000	A	1
1787	03/09/91	PLUTONIUM 239/240	0 115	PCI/L	0 0265		0 00000	V	1
00291	05/16/94	PLUTONIUM 239/240	0 120	PCI/L	0 0280		0 01100	V	1
02291	07/31/92	PLUTONIUM 239/240	0 120	PCI/L	0 0540	B	0 02700	A	1
05193	06/16/93	PLUTONIUM 239/240	0 120	PCI/L	0 0480		0 02000	V	1
1687	03/10/93	PLUTONIUM 239/240	0 120	PCI/L	0 0199		0 00210	A	1
6387	07/30/92	PLUTONIUM 239/240	0 121	PCI/L	0 0299		0 00700	V	1
2286	07/27/90	PLUTONIUM 239/240	0 121	PCI/L	0 0206		0 01000	A	1
0987	03/07/91	PLUTONIUM 239/240	0 125	PCI/L	0 0315		0 01000		1
1687	08/22/94	PLUTONIUM 239/240	0 125	PCI/L	0 0628	Y	0 06734	A	1
60293	04/20/95	PLUTONIUM 239/240	0 127	PCI/L	0 0342		0 00507	Y	1
0260	04/30/91	PLUTONIUM 239/240	0 129	PCI/L	0 0321		0 00000	V	1
00193	03/23/95	PLUTONIUM 239/240	0 129	PCI/L	0 0543	Y	0 01589	Y	1
10294	08/25/94	PLUTONIUM 239/240	0 129	PCI/L	0 0392	Y	0 00815	Y	1
12091	02/27/92	PLUTONIUM 239/240	0 130	PCI/L	0 0283		0 00600	A	1
13491	09/08/94	PLUTONIUM 239/240	0 130	PCI/L	0 0269		0 00371	V	1
59493	06/24/93	PLUTONIUM 239/240	0 130	PCI/L	0 0360		0 00300	V	1
3687	12/10/93	PLUTONIUM 239/240	0 133	PCI/L	0 0214		0 00905	Y	1
01795	03/01/95	PLUTONIUM 239/240	0 134	PCI/L	0 0280		0 01300	Y	1
1687	09/18/90	PLUTONIUM 239/240	0 137	PCI/L	0 0340		0 00700	A	1
06891	05/14/93	PLUTONIUM 239/240	0 140	PCI/L	0 0200		0 01000	V	1
3687	02/23/94	PLUTONIUM 239/240	0 140	PCI/L	0 0380		0 00600	V	1
4286	05/29/92	PLUTONIUM 239/240	0 140	PCI/L	0 0240		0 00400	A	1
4286	08/17/92	PLUTONIUM 239/240	0 140	PCI/L	0 0200		0 00500	V	1
4286	05/24/94	PLUTONIUM 239/240	0 140	PCI/L	0 0400		0 02300	V	1
6387	04/29/91	PLUTONIUM 239/240	0 142	PCI/L	0 0272		0 00000	V	1
4286	05/17/91	PLUTONIUM 239/240	0 143	PCI/L	0 0280		0 00000	V	1
B217789	03/21/93	PLUTONIUM 239/240	0 144	PCI/L	0 0280		0 01000	A	1

B402689	11/07/90	PLUTONIUM 239/240	0	146	PCI/L	0	0324		0	01000	A	1
01695	03/02/95	PLUTONIUM 239/240	0	147	PCI/L	0	0300		0	01600	Y	1
1587	01/23/90	PLUTONIUM 239/240	0	147	PCI/L	0	0240		0	01000	A	1
00291	12/02/93	PLUTONIUM 239/240	0	150	PCI/L	0	0360		0	01200	Y	1
05193	04/21/94	PLUTONIUM 239/240	0	150	PCI/L	0	0660		0	06700	V	1
13491	11/16/94	PLUTONIUM 239/240	0	151	PCI/L	0	0252		0	00723	Y	1
P209189	07/26/91	PLUTONIUM 239/240	0	151	PCI/L	0	0306		0	01000		1
B102289	08/30/90	PLUTONIUM 239/240	0	158	PCI/L	0	0350		0	00000		1
P209189	01/24/95	PLUTONIUM 239/240	0	160	PCI/L	0	0250		0	00600	V	1
11891	02/28/92	PLUTONIUM 239/240	0	161	PCI/L	0	0416		0	00000	A	1
4286	11/17/94	PLUTONIUM 239/240	0	162	PCI/L	0	0252		0	00664	Y	1
P313489	10/16/95	PLUTONIUM 239/240	0	163	PCI/L	0	0319		0	00804	Y	1
3686	06/21/95	PLUTONIUM 239/240	0	166	PCI/L	0	0263		0	00712	Y	1
00291	03/02/94	PLUTONIUM 239/240	0	170	PCI/L	0	0400		0	01400	V	1
00391	05/13/93	PLUTONIUM 239/240	0	170	PCI/L	0	0300		0	01000	V	1
05191	12/17/91	PLUTONIUM 239/240	0	170	PCI/L	0	0420		0	00000	V	1
4286	09/13/94	PLUTONIUM 239/240	0	170	PCI/L	0	0620		0	04300	Y	1
4286	09/13/94	PLUTONIUM 239/240	0	170	PCI/L	0	0540		0	03300	Y	1
59493	08/11/93	PLUTONIUM 239/240	0	170	PCI/L	0	0580	B	0	00700	V	1
0171	02/25/92	PLUTONIUM 239/240	0	170	PCI/L	0	0356		0	00000	V	1
09691	03/18/92	PLUTONIUM 239/240	0	175	PCI/L	0	0315		0	00400	A	1
4286	11/17/94	PLUTONIUM 239/240	0	178	PCI/L	0	0267		0	00963	Y	1
07391	03/14/95	PLUTONIUM 239/240	0	179	PCI/L	0	0292		0	00817	Y	1
0486	11/14/91	PLUTONIUM 239/240	0	179	PCI/L	0	0319		0	00700	A	1
00291	05/18/93	PLUTONIUM 239/240	0	180	PCI/L	0	0279		0	00694	A	1
11891	10/16/92	PLUTONIUM 239/240	0	180	PCI/L	0	0372		0	00374	A	1
4286	05/24/94	PLUTONIUM 239/240	0	180	PCI/L	0	0500		0	03600	V	1
6387	03/04/91	PLUTONIUM 239/240	0	180	PCI/L	0	0307		0	01000		1
1490	03/21/93	PLUTONIUM 239/240	0	182	PCI/L	0	0400		0	01100	A	1
13491	03/02/93	PLUTONIUM 239/240	0	186	PCI/L	0	0436		0	00901	A	1
03391	09/12/94	PLUTONIUM 239/240	0	190	PCI/L	0	1300		0	05600	Y	1
4286	02/10/92	PLUTONIUM 239/240	0	191	PCI/L	0	0376		0	00000	A	1
6387	09/13/90	PLUTONIUM 239/240	0	196	PCI/L	0	0334		0	00000	A	1
00291	05/21/92	PLUTONIUM 239/240	0	196	PCI/L	0	0458		0	00000	A	1
0374	12/12/91	PLUTONIUM 239/240	0	199	PCI/L	0	0390		0	00000	V	1
03ZT2	11/11/94	PLUTONIUM 239/240	0	200	PCI/L	0	0620		0	06000	Y	1
05193	08/02/93	PLUTONIUM 239/240	0	200	PCI/L	0	0600		0	02500	V	1
09691	09/14/93	PLUTONIUM 239/240	0	200	PCI/L	0	0520		0	00300	V	1
25093	09/07/94	PLUTONIUM 239/240	0	200	PCI/L	0	1600		0	19000	Y	1
11891	12/19/91	PLUTONIUM 239/240	0	208	PCI/L	0	0490		0	00000	V	1
09691	11/17/92	PLUTONIUM 239/240	0	209	PCI/L	0	0438		0	00000	A	1
00191	03/08/94	PLUTONIUM 239/240	0	210	PCI/L	0	0360		0	00900	V	1
13491	09/01/93	PLUTONIUM 239/240	0	210	PCI/L	0	1300		0	02800	V	1
1786	04/16/93	PLUTONIUM-239/240	0	210	PCI/L	0	0900		0	01300	V	1
24993	09/07/94	PLUTONIUM 239/240	0	210	PCI/L	0	2300	U	0	36000	Y	0
70093	11/09/95	PLUTONIUM 239/240	0	215	PCI/L	0	0420		0	00378	Y	1
4286	11/16/90	PLUTONIUM 239/240	0	215	PCI/L	0	0730		0	01000		1
1687	11/29/93	PLUTONIUM 239/240	0	218	PCI/L	0	0253		0	00168	Y	1
B302989	12/05/90	PLUTONIUM 239/240	0	224	PCI/L	0	0381		0	01000		1
09691	06/02/94	PLUTONIUM 239/240	0	224	PCI/L	0	0330		0	01000	Y	1
6387	02/20/92	PLUTONIUM 239/240	0	229	PCI/L	0	0395		0	00500	A	1
P209189	03/25/91	PLUTONIUM 239/240	0	229	PCI/L	0	0378		0	00500	V	1
P313489	08/17/95	PLUTONIUM 239/240	0	229	PCI/L	0	0397		0	00294	Y	1
13491	02/22/94	PLUTONIUM 239/240	0	230	PCI/L	0	0620		0	03200	V	1
P209189	07/27/95	PLUTONIUM 239/240	0	230	PCI/L	0	0412		0	00320	Y	1
10991	02/06/92	PLUTONIUM 239/240	0	232	PCI/L	0	0676		0	00000	A	1
46192	08/18/94	PLUTONIUM 239/240	0	235	PCI/L	0	0710	Y	0	03837	A	1
P209189	05/04/95	PLUTONIUM 239/240	0	241	PCI/L	0	0352		0	01367	Y	1
6387	11/11/91	PLUTONIUM 239/240	0	243	PCI/L	0	0447		0	00600	A	1
00291	03/11/92	PLUTONIUM 239/240	0	248	PCI/L	0	0356		0	00000	A	1

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5086	02/11/92	PLUTONIUM 239/240	0 254	PCI/L	0 0641		0 00000	A	1
41691	12/09/93	PLUTONIUM 239/240	0 259	PCI/L	0 0321		0 00624	Y	1
2286	05/29/91	PLUTONIUM 239/240	0 260	PCI/L	0 0469		0 00000	V	1
72093	05/27/93	PLUTONIUM 239/240	0 262	PCI/L	0 0541		0 01051	V	1
00291	08/11/94	PLUTONIUM 239/240	0 262	PCI/L	0 0389		0 00361	V	1
09691	08/31/92	PLUTONIUM 239/240	0 265	PCI/L	0 0507		0 00800	A	1
4286	09/11/91	PLUTONIUM 239/240	0 269	PCI/L	0 0580		0 00000	V	1
13491	12/08/93	PLUTONIUM 239/240	0 270	PCI/L	0 0600		0 01700	Y	1
72393	07/26/93	PLUTONIUM 239/240	0 280	PCI/L	0 0287		0 00524	A	1
06891	08/26/92	PLUTONIUM 239/240	0 290	PCI/L	0 0380		0 00700	A	1
08891	11/17/92	PLUTONIUM 239/240	0 290	PCI/L	0 0526		0 01466	A	1
04295	05/15/95	PLUTONIUM 239/240	0 296	PCI/L	0 3430		0 26700	Y	1
03091	03/04/93	PLUTONIUM 239/240	0 300	PCI/L	0 0364		0 00630	A	1
07191	03/09/94	PLUTONIUM 239/240	0 300	PCI/L	0 0360	B	0 00200	V	1
08891	03/12/93	PLUTONIUM 239/240	0 300	PCI/L	0 0418		0 00304	A	1
02991	03/12/92	PLUTONIUM 239/240	0 305	PCI/L	0 0532		0 00000	A	1
13491	10/22/92	PLUTONIUM 239/240	0 306	PCI/L	0 0708		0 00000	A	1
01991	02/22/94	PLUTONIUM 239/240	0 310	PCI/L	0 0900		0 01500	V	1
08891	02/23/94	PLUTONIUM 239/240	0 310	PCI/L	0 0600		0 01800	V	1
09691	05/22/92	PLUTONIUM 239/240	0 320	PCI/L	0 0500		0 00500	V	1
1286	05/09/90	PLUTONIUM 239/240	0 327	PCI/L	0 0500		0 01000	A	1
6387	04/24/92	PLUTONIUM 239/240	0 329	PCI/L	0 0585		0 00000	A	1
09691	03/15/93	PLUTONIUM 239/240	0 330	PCI/L	0 0353		0 00190	A	1
P209189	11/10/94	PLUTONIUM 239/240	0 330	PCI/L	0 0370		0 00500	Y	1
41691	11/18/92	PLUTONIUM 239/240	0 340	PCI/L	0 0564		0 00533	A	1
72093	03/31/93	PLUTONIUM 239/240	0 346	PCI/L	0 0510		0 00700	A	1
5186	04/30/91	PLUTONIUM 239/240	0 347	PCI/L	0 0491		0 00000	V	1
03091	05/05/93	PLUTONIUM 239/240	0 350	PCI/L	0 1500		0 08800	V	1
P209189	10/14/92	PLUTONIUM 239/240	0 350	PCI/L	0 0735		0 00868	A	1
00391	12/07/93	PLUTONIUM 239/240	0 370	PCI/L	0 1100		0 05700	Y	1
41691	09/20/93	PLUTONIUM 239/240	0 370	PCI/L	0 0346		0 00164	V	1
2286	07/30/91	PLUTONIUM 239/240	0 379	PCI/L	0 0559		0 01000		1
6387	07/11/91	PLUTONIUM-239/240	0 386	PCI/L	0 0565		0 00000	A	1
0271	09/09/91	PLUTONIUM 239/240	0 388	PCI/L	0 0684		0 00900	V	1
07191	05/23/94	PLUTONIUM 239/240	0 390	PCI/L	0 0460		0 00200	V	1
1587	09/18/90	PLUTONIUM 239/240	0 392	PCI/L	0 0348		0 00000	A	1
2286	07/22/92	PLUTONIUM 239/240	0 404	PCI/L	0 0928		0 01800	V	1
P209189	03/03/92	PLUTONIUM 239/240	0 409	PCI/L	0 0589		0 00500	A	1
22193	04/17/95	PLUTONIUM 239/240	0 415	PCI/L	0 0550		0 01713	Y	1
00291	11/30/92	PLUTONIUM 239/240	0 420	PCI/L	0 0727		0 01818	A	1
13191	05/12/94	PLUTONIUM 239/240	0 420	PCI/L	0 0600		0 01200	V	1
1687	06/27/94	PLUTONIUM 239/240	0 420	PCI/L	0 0540		0 01200	V	1
P209189	04/10/92	PLUTONIUM 239/240	0 424	PCI/L	0 0622		0 00000	A	1
P209189	10/10/91	PLUTONIUM 239/240	0 442	PCI/L	0 0599		0 00400	A	1
6387	11/01/90	PLUTONIUM 239/240	0 447	PCI/L	0 0660		0 01000		1
13491	05/04/93	PLUTONIUM 239/240	0 470	PCI/L	0 0433		0 01000	V	1
46892	09/14/94	PLUTONIUM 239/240	0 480	PCI/L	0 0800		0 02100	Y	1
13191	09/01/93	PLUTONIUM 239/240	0 490	PCI/L	0 0760		0 00900	V	1
13191	09/12/94	PLUTONIUM 239/240	0 490	PCI/L	0 0540		0 00600	Y	1
72093	06/21/93	PLUTONIUM 239/240	0 490	PCI/L	0 0940		0 00500	V	1
0171	04/17/91	PLUTONIUM 239/240	0 494	PCI/L	0 0729		0 01000		1
1587	02/25/92	PLUTONIUM 239/240	0 510	PCI/L	0 0765		0 00700	V	1
P209189	02/19/93	PLUTONIUM 239/240	0 510	PCI/L	0 0413		0 00147	A	1
13191	11/22/94	PLUTONIUM 239/240	0 520	PCI/L	0 0580		0 00300	Y	1
46792	02/23/94	PLUTONIUM 239/240	0 530	PCI/L	0 0980		0 00800	V	1
41691	06/22/93	PLUTONIUM 239/240	0 560	PCI/L	0 0860		0 01200	V	1
04TS051	12/01/93	PLUTONIUM 239/240	0 563	PCI/L	0 1600		0 05050	Y	1
00391	03/09/93	PLUTONIUM 239/240	0 570	PCI/L	0 0511		0 00526	A	1
04591	05/14/93	PLUTONIUM 239/240	0 580	PCI/L	0 0600		0 01000	V	1
41691	02/18/94	PLUTONIUM 239/240	0 600	PCI/L	0 1600		0 02000	V	1

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00191	03/12/93	PLUTONIUM 239/240	0 620	PCI/L	0 0551		0 00205	A	1
03ZT2	11/09/94	PLUTONIUM 239/240	0 620	PCI/L	0 2300		0 20000	Y	1
13191	09/02/92	PLUTONIUM 239/240	0 666	PCI/L	0 1330		0 00000	A	1
41691	09/16/92	PLUTONIUM 239/240	0 677	PCI/L	0 1340		0 00000	A	1
1286	01/20/92	PLUTONIUM 239/240	0 699	PCI/L	0 0895		0 00000	A	1
03ZT2	11/09/94	PLUTONIUM 239/240	0 700	PCI/L	0 1200		0 07000	Y	1
P207689	07/27/95	PLUTONIUM 239/240	0 720	PCI/L	0 0973		0 00682	Y	1
06591	12/02/93	PLUTONIUM 239/240	0 778	PCI/L	0 0692		0 00643	Y	1
00291	03/15/93	PLUTONIUM 239/240	0 780	PCI/L	0 0667		0 00213	A	1
08891	06/19/95	PLUTONIUM 239/240	0 790	PCI/L	0 0930		0 01700	Y	1
72393	05/27/93	PLUTONIUM 239/240	0 799	PCI/L	0 1140		0 00783	V	1
02991	08/21/92	PLUTONIUM 239/240	0 800	PCI/L	0 0680		0 00600	V	1
08891	05/18/93	PLUTONIUM 239/240	0 800	PCI/L	0 0663		0 00232	A	1
13491	06/06/95	PLUTONIUM 239/240	0 808	PCI/L	0 0915		0 00589	Y	1
1587	11/29/93	PLUTONIUM 239/240	0 810	PCI/L	0 0595		0 00448	Y	1
06591	11/17/92	PLUTONIUM 239/240	0 810	PCI/L	0 1074		0 01697	A	1
1587	03/13/95	PLUTONIUM 239/240	0 810	PCI/L	0 1100		0 02800	V	1
06591	11/11/94	PLUTONIUM 239/240	0 850	PCI/L	0 0950		0 01600	Y	1
06691	05/20/93	PLUTONIUM 239/240	0 860	PCI/L	0 0680		0 00200	A	1
13491	08/21/92	PLUTONIUM 239/240	0 870	PCI/L	0 1410		0 00000	A	1
11791	02/06/92	PLUTONIUM 239/240	0 878	PCI/L	0 1110		0 00000	A	1
03ZT2	11/11/94	PLUTONIUM 239/240	0 880	PCI/L	0 1500		0 08000	Y	1
03TS101	12/01/93	PLUTONIUM 239/240	0 897	PCI/L	0 2700		0 09170	Y	1
0366	02/13/92	PLUTONIUM 239/240	0 900	PCI/L	0 1290		0 00000	A	1
02TS101	12/01/93	PLUTONIUM 239/240	0 904	PCI/L	0 2620		0 08550	Y	1
06591	09/01/94	PLUTONIUM 239/240	0 936	PCI/L	0 0720		0 00800	V	1
03ZT2	11/11/94	PLUTONIUM 239/240	0 940	PCI/L	0 1500		0 08000	Y	1
07191	11/30/93	PLUTONIUM 239/240	0 940	PCI/L	0 1200	B	0 00300	Y	1
46692	12/09/93	PLUTONIUM 239/240	0 970	PCI/L	0 0921		0 00424	Y	1
06591	05/14/93	PLUTONIUM 239/240	0 980	PCI/L	0 0800		0 01000	V	1
41691	02/16/94	PLUTONIUM 239/240	0 990	PCI/L	0 1800		0 04900	V	1
59493	11/09/93	PLUTONIUM 239/240	1 037	PCI/L	0 0767		0 00190	Y	1
1587	06/23/92	PLUTONIUM 239/240	1 093	PCI/L	0 1540		0 00000	V	1
02ZT22	03/14/95	PLUTONIUM 239/240	1 100	PCI/L	0 1400		0 05000	Y	1
09691	05/19/93	PLUTONIUM 239/240	1 100	PCI/L	0 0886		0 00984	A	1
13191	05/19/93	PLUTONIUM 239/240	1 100	PCI/L	0 0814		0 00791	A	1
1587	12/18/91	PLUTONIUM 239/240	1 119	PCI/L	1 1190		0 00000	V	1
06691	06/06/94	PLUTONIUM 239/240	1 184	PCI/L	0 1180		0 02900	Y	1
06591	05/12/94	PLUTONIUM 239/240	1 200	PCI/L	0 1300		0 01600	V	1
06991	05/20/93	PLUTONIUM 239/240	1 200	PCI/L	0 0901		0 00676	A	1
13191	03/10/94	PLUTONIUM 239/240	1 200	PCI/L	0 1100	B	0 01000	V	1
P313489	02/07/94	PLUTONIUM 239/240	1 200	PCI/L	0 1500		0 00300	V	1
0271	04/22/91	PLUTONIUM 239/240	1 261	PCI/L	0 1680		0 01000		1
00191	11/18/92	PLUTONIUM 239/240	1 300	PCI/L	0 1630		0 02035	A	1
13191	12/06/93	PLUTONIUM 239/240	1 300	PCI/L	0 1600		0 01400	Y	1
P313489	08/17/94	PLUTONIUM 239/240	1 343	PCI/L	0 1553	Y	0 04026	V	1
03ZT31	03/14/95	PLUTONIUM 239/240	1 400	PCI/L	0 1300		0 03000	Y	1
06691	11/30/93	PLUTONIUM 239/240	1 400	PCI/L	0 1700		0 01600	Y	1
1587	05/21/93	PLUTONIUM 239/240	1 400	PCI/L	0 1074		0 00691	A	1
06591	06/20/95	PLUTONIUM 239/240	1 444	PCI/L	0 1056		0 00290	Y	1
04ZT21	03/14/95	PLUTONIUM 239/240	1 500	PCI/L	0 1500		0 04000	Y	1
08891	12/06/93	PLUTONIUM 239/240	1 500	PCI/L	0 1700		0 00600	Y	1
06591	09/01/93	PLUTONIUM 239/240	1 600	PCI/L	0 2300		0 01600	V	1
P313489	11/16/93	PLUTONIUM 239/240	1 600	PCI/L	0 0983		0 00425		1
01395	03/06/95	PLUTONIUM 239/240	1 614	PCI/L	1 0300		0 01600	Y	1
08891	08/31/92	PLUTONIUM 239/240	1 685	PCI/L	0 2190		0 00000	A	1
13191	03/11/93	PLUTONIUM 239/240	1 700	PCI/L	0 1250		0 00617	A	1
01ZT12	04/03/95	PLUTONIUM 239/240	1 900	PCI/L	0 1600	B	0 02000	Y	1
01ZT11	03/14/95	PLUTONIUM 239/240	2 000	PCI/L	0 3100		0 20000	Y	1
13191	11/17/92	PLUTONIUM 239/240	2 000	PCI/L	0 1931		0 00522	A	1

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2286	04/21/94	PLUTONIUM 239/240	2 000	PCI/L	0 2000	B	0 01800	V	1
1587	09/04/91	PLUTONIUM 239/240	2 040	PCI/L	0 2360		0 00400	V	1
06591	05/19/92	PLUTONIUM 239/240	2 100	PCI/L	0 2700		0 00700	V	1
01095	03/09/95	PLUTONIUM 239/240	2 104	PCI/L	0 1020		0 01700	Y	1
B411389	07/13/95	PLUTONIUM 239/240	2 150	PCI/L	0 2500		0 00653	Y	1
41691	12/07/91	PLUTONIUM 239/240	2 204	PCI/L	0 3130		0 00000	A	1
01ZT1	12/01/93	PLUTONIUM 239/240	2 205	PCI/L	0 3190		0 01500	Y	1
06591	03/09/94	PLUTONIUM 239/240	2 300	PCI/L	0 2100	B	0 02000	V	1
06591	08/27/92	PLUTONIUM 239/240	2 315	PCI/L	0 2670		0 00000	A	1
03TS051	12/01/93	PLUTONIUM 239/240	2 348	PCI/L	0 3880		0 05130	Y	1
02895	04/03/95	PLUTONIUM 239/240	2 453	PCI/L	0 5620		0 02200	Y	1
06991	08/26/92	PLUTONIUM 239/240	2 500	PCI/L	0 2200		0 01000	A	1
06991	03/12/93	PLUTONIUM 239/240	2 500	PCI/L	0 1665		0 00714	A	1
06991	05/12/94	PLUTONIUM 239/240	2 500	PCI/L	0 2300		0 02000	V	1
11791	09/01/93	PLUTONIUM 239/240	2 500	PCI/L	0 2500		0 00400	A	1
0290	03/21/93	PLUTONIUM 239/240	2 510	PCI/L	0 1100		0 01300	A	1
04ZT3	11/23/93	PLUTONIUM 239/240	2 570	PCI/L	0 3900		0 04230	Y	1
06991	11/29/93	PLUTONIUM 239/240	2 600	PCI/L	0 3400		0 02900	Y	1
02ZT21	03/14/95	PLUTONIUM 239/240	2 700	PCI/L	0 3200		0 10000	Y	1
13191	05/19/92	PLUTONIUM 239/240	2 777	PCI/L	0 3160		0 00000	A	1
06591	03/10/93	PLUTONIUM 239/240	2 900	PCI/L	0 1874		0 00550	A	1
11791	05/20/92	PLUTONIUM 239/240	2 966	PCI/L	0 3250		0 00600	A	1
06991	11/18/92	PLUTONIUM 239/240	3 000	PCI/L	0 2874		0 00596	A	1
11791	12/08/94	PLUTONIUM 239/240	3 100	PCI/L	0 2600		0 01100	V	1
08891	05/12/94	PLUTONIUM 239/240	3 400	PCI/L	0 2600		0 00800	V	1
2286	04/11/95	PLUTONIUM 239/240	3 400	PCI/L	0 3000		0 01400	Y	1
P209189	11/08/90	PLUTONIUM 239/240	3 560	PCI/L	0 3960		0 01000	A	1
04ZT13	03/14/95	PLUTONIUM 239/240	3 600	PCI/L	0 5500		0 30000	Y	1
04ZT31	03/14/95	PLUTONIUM 239/240	3 600	PCI/L	0 3500		0 09000	Y	1
04ZT2	11/23/93	PLUTONIUM 239/240	3 656	PCI/L	0 4850		0 03060	Y	1
06991	07/20/94	PLUTONIUM 239/240	3 732	PCI/L	0 5380		0 02110	V	1
11791	11/11/92	PLUTONIUM 239/240	3 800	PCI/L	0 2912		0 01136	A	1
11791	05/13/93	PLUTONIUM 239/240	3 930	PCI/L	0 2400		0 01000	V	1
02TS051	12/01/93	PLUTONIUM 239/240	3 964	PCI/L	0 5460		0 06360	Y	1
03ZT2	11/09/94	PLUTONIUM 239/240	4 000	PCI/L	0 6900		0 30000	Y	1
03ZT2	11/11/94	PLUTONIUM 239/240	4 000	PCI/L	0 5400		0 10000	Y	1
02ZT23	04/03/95	PLUTONIUM 239/240	4 200	PCI/L	0 6400		0 20000	Y	1
1587	05/24/94	PLUTONIUM 239/240	4 300	PCI/L	0 3700		0 02800	V	1
05ZT2	11/23/93	PLUTONIUM 239/240	4 473	PCI/L	0 5500		0 03420	Y	1
06991	02/21/94	PLUTONIUM 239/240	4 700	PCI/L	0 6000		0 03700	V	1
2286	04/07/93	PLUTONIUM 239/240	4 820	PCI/L	0 6720		0 00996	A	1
02ZT23	03/14/95	PLUTONIUM-239/240	5 100	PCI/L	0 4700		0 20000	Y	1
02ZT12	03/14/95	PLUTONIUM 239/240	5 400	PCI/L	0 4700		0 08000	Y	1
11791	12/07/93	PLUTONIUM-239/240	5 600	PCI/L	0 5700		0 01000	Y	1
03ZT24	03/14/95	PLUTONIUM 239/240	5 800	PCI/L	1 1000		0 40000	Y	1
11791	06/27/94	PLUTONIUM 239/240	6 200	PCI/L	0 4700		0 00700	V	1
04ZT11	03/14/95	PLUTONIUM 239/240	6 600	PCI/L	0 7800		0 20000	Y	1
03ZT2	11/23/93	PLUTONIUM 239/240	6 953	PCI/L	0 8330		0 05320	Y	1
11791	03/09/93	PLUTONIUM 239/240	7 200	PCI/L	0 4372		0 00693	A	1
B204189	03/22/93	PLUTONIUM 239/240	10 320	PCI/L	0 1400		0 00800	A	1
02ZT11	03/14/95	PLUTONIUM 239/240	11 000	PCI/L	0 4700		0 04000	Y	1
04ZT23	03/14/95	PLUTONIUM 239/240	11 000	PCI/L	0 8400		0 20000	Y	1
05ZT12	03/14/95	PLUTONIUM 239/240	11 000	PCI/L	1 5000		0 50000	Y	1
03ZT2	03/14/95	PLUTONIUM 239/240	12 000	PCI/L	1 6000		0 50000	Y	1
05ZT12	03/14/95	PLUTONIUM 239/240	12 000	PCI/L	1 3000		0 30000	Y	1
09091	06/13/95	PLUTONIUM 239/240	12 000	PCI/L	0 7600		0 01000	Y	1
09091	06/13/95	PLUTONIUM 239/240	12 000	PCI/L	0 7800		0 00700	Y	1
03ZT1	11/23/93	PLUTONIUM 239/240	12 700	PCI/L	1 3700		0 01210	Y	1
11791	09/08/92	PLUTONIUM 239/240	13 360	PCI/L	1 5200		0 00000	A	1
04ZT1	11/23/93	PLUTONIUM 239/240	13 800	PCI/L	1 4200		0 01090	Y	1

03ZT14	03/14/95	PLUTONIUM 239/240	17 000	PCI/L	2 7000	0 70000	Y	1
09091	09/02/93	PLUTONIUM 239/240	17 000	PCI/L	2 5000	0 05500	JA	1
03ZT22	04/03/95	PLUTONIUM 239/240	19 000	PCI/L	2 7000	0 40000	Y	1
02ZT2	12/01/93	PLUTONIUM 239/240	19 130	PCI/L	2 0400	0 03500	Y	1
09091	06/07/94	PLUTONIUM 239/240	20 581	PCI/L	0 3520	0 01600	Y	1
03ZT14	03/14/95	PLUTONIUM 239/240	23 000	PCI/L	1 9000	0 40000	Y	1
09091	02/21/94	PLUTONIUM 239/240	24 000	PCI/L	3 6000	0 10000	V	1
09091	02/21/94	PLUTONIUM 239/240	27 000	PCI/L	5 0000	0 05500	V	1
09091	06/06/94	PLUTONIUM 239/240	28 180	PCI/L	0 3690	0 01700	Y	1
09091	12/05/94	PLUTONIUM 239/240	35 314	PCI/L	2 9104	0 36477	Y	1
03ZT11	04/03/95	PLUTONIUM 239/240	45 000	PCI/L	5 9000	0 30000	Y	1
09091	05/12/93	PLUTONIUM 239/240	48 110	PCI/L	2 9400	0 01000	V	1
09091	11/30/93	PLUTONIUM 239/240	49 000	PCI/L	8 7000	0 05800	Y	1
03ZT12	03/14/95	PLUTONIUM 239/240	54 000	PCI/L	9 6000	2 00000	Y	1
09091	12/05/94	PLUTONIUM 239/240	54 973	PCI/L	4 4241	0 60877	Y	1
05ZT1	02/03/95	PLUTONIUM 239/240	55 000	PCI/L	1 6000	0 05000	Y	1
03ZT11	04/03/95	PLUTONIUM 239/240	56 000	PCI/L	7 9000	0 40000	Y	1
04ZT14	03/14/95	PLUTONIUM 239/240	56 000	PCI/L	8 8000	1 00000	Y	1
04ZT15	03/14/95	PLUTONIUM 239/240	56 000	PCI/L	7 9000	1 00000	Y	1
05ZT13	03/14/95	PLUTONIUM 239/240	56 000	PCI/L	9 1000	1 00000	Y	1
02ZT35	03/14/95	PLUTONIUM 239/240	60 000	PCI/L	9 2000	2 00000	Y	1
02ZT15	03/14/95	PLUTONIUM 239/240	71 000	PCI/L	14 0000	4 00000	Y	1
05ZT1	11/22/93	PLUTONIUM 239/240	75 300	PCI/L	7 5500	0 01090	Y	1
05ZT1	02/03/95	PLUTONIUM 239/240	90 000	PCI/L	2 2000	0 07000	Y	1
03ZT13	03/14/95	PLUTONIUM 239/240	97 000	PCI/L	13 0000	2 00000	Y	1
04ZT15	04/03/95	PLUTONIUM 239/240	120 000	PCI/L	15 0000	0 90000	Y	1
09091	08/31/92	PLUTONIUM 239/240	139 100	PCI/L	16 7000	0 37300	A	1
01195	03/10/95	PLUTONIUM 239/240	140 000	PCI/L	8 7300	0 05700	Y	1
02ZT1	12/01/93	PLUTONIUM 239/240	148 800	PCI/L	14 5000	0 01440	Y	1
09091	11/18/92	PLUTONIUM 239/240	180 000	PCI/L	10 9657	0 16234	A	1
09091	03/19/93	PLUTONIUM 239/240	218 400	PCI/L	0 7200	0 04300	A	1

Where SDATE date of sample collection ERROR 95 percent upper confidence limit QUAL result qualifier
VAL validation code and HIT detect (1) or nondetect (0)

Table 6-3 Results of Groundwater Dissolved Oxygen Survey
Intrinsic Remediation Program

Well Name	Date	Time	Depth to Water (ft.)	Depth of Probe (ft.)	Submerged Depth (ft.)	Dissolved Oxygen (mg/L)	Temp (°C)	Comments
00191	15-Mar-95	1225	20.44	23.52	-3.08	5.8	11.9	
00291	17-Mar-95	910	31.01	50.40	19.39	0	12.8	
01991	13-Mar-95	1505	27.06	33.63	-6.57	4.2	12.5	
02091	14-Mar-95	1010	22.21	27.16	-4.95	5	10.9	
02491	14-Mar-95	1020	17.07	18.00	-0.93	6.8	10.9	
02591	13-Mar-95	1220	41.12	47.30	-6.18	3.6	12.3	
02991	13-Mar-95	1405	30.47	48.60	18.13	2.6	12.6	
03091	13-Mar-95	1350	37.99	44.65	-6.66	4.1	13	
03191	13-Mar-95	1335	dry					
03391	14-Mar-95	845	27.96	34.78	-6.82	5	11.7	
03591	13-Mar-95	1325	dry					
03691	14-Mar-95	955	34.43	38.17	-3.74	7.7	11.2	
03791	14-Mar-95	945	39.84	44.62	-4.78	3.8	11.4	
04091	13-Mar-95	1245	37.49	38.49	1.00	6.2	11.9	Below screen
05391	13-Mar-95	1310	36.46	37.46	1.00	3.5	12.3	
0590	10-Mar-95	950	19.61	24.30	-4.69	3.5	10.5	
06091	13-Mar-95	1230	37.41	39.81	2.40	6.6	11.9	
06191	13-Mar-95	1050	dry					
06391	13-Mar-95	1025	dry					
06691	15-Mar-95	1250	20.97	22.97	-2.00	0.8	14.9	
0690	10-Mar-95	1010	14.63	19.91	-5.28	1.3	9.9	
06991	15-Mar-95	1240	18.76	24.73	-5.97	5.4	12.4	
07691	13-Mar-95	1345	dry					
07991	17-Mar-95	935	28.41	29.50	1.09	7.5	11.7	
10991	13-Mar-95	1010	44.97	50.10	-5.13	5.3	11.4	
11691	14-Mar-95	935	35.31	36.00	-0.69	6.1	11.8	Below screen
11891	14-Mar-95	855	26.88	28.88	2.00	6.7	11.5	
12191	13-Mar-95	1415	30.04	32.37	2.33	5.8	12.4	
12391								Too deep
12491	15-Mar-95	1040	33.22	51.00	17.78	7.3	11.8	
12891	15-Mar-95	1025	37.46	51.00	13.54	4.6	12.3	
12991	17-Mar-95	925	25.82	30.91	-5.09	7.5	12.7	
13291	15-Mar-95	1300	dry					
13391	13-Mar-95	1205	38.75	39.75	1.00	7.4	12.9	
13491	13-Mar-95	1500	26.76	28.76	2.00	3.4	12.1	

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Table 6-3 Results of Groundwater Dissolved Oxygen Survey
Intrinsic Remediation Program

Well Name	Date	Time	Depth to Water (ft.)	Depth of Probe (ft.)	Submerged Depth (ft.)	Dissolved Oxygen (mg/L)	Temp (°C)	Comments
1787								Abandoned
2587	13-Mar-05	1400	30.22	37.61	7.39	4.2	13	
3687	15-Mar-05	1015	38.34	51.00	12.66	1	12.2	
37591	14-Mar-05	1045	10.58	12.59	-2.01	7.2	8.1	
39691	14-Mar-05	12	dry					
3986	13-Mar-05	1030	29.19	31.19	-2.00	7.3	12	
41591	13-Mar-05	940	13.25	14.25	1.00	8.4	9.9	
4286	13-Mar-05	1530	28.42	30.42	2.00	2.6	12.5	
4486	15-Mar-05	850	7.28	17.79	10.51	3.2	12.5	
50092	13-Mar-05	845	10.07	11.19	1.12	8.2	8.8	
5086	15-Mar-05	1435	52.99					Too deep
54793								
5486	10-Mar-05	915						Too deep
5586	10-Mar-05	900	24.10	31.30	7.20	6.1	11.7	
61593								
61693								
62593								Not a well
6586	13-Mar-05	900	4.31	6.96	-2.65	3.4	6.2	
6786	13-Mar-05	725	dry					
B218789	13-Mar-05	1515	27.62	29.62	-2.00	3.8	12.9	
B302089	10-Mar-05	1400	7.67	11.44	-3.77	7.9	7.5	
B401989	10-Mar-05	1305	3.15	15.85	12.70	1.8	8.7	
B402189	10-Mar-05	1340	9.91	20.20	10.29	4.4	8.6	
B405189	10-Mar-05	1430	20.70	22.70	-2.00	7.6	11.1	
B405289	10-Mar-05	1445	22.27	45.10	-22.83	0	11.3	
B405489	10-Mar-05	920	23.15	45.60	-22.45	8.5	11.9	
B405689	10-Mar-05	1320	10.68	42.75	-32.07	6.2	9.9	
B405989	10-Mar-05	1345	5.53	7.53	-2.00	4.8	4.3	
B410589	15-Mar-05	1430	55.11					Too deep
P114489	14-Mar-05	1420	17.22	48.60	-31.38	4.5	13	
P114889	14-Mar-05	1530	14.65	15.60	-0.95	8.6	10.1	
P114989	14-Mar-05	1510	15.22	37.80	22.58	8.6	13.6	
P115089	14-Mar-05	1435	18.66	40.50	-21.84	1.6	13.4	
P115489	15-Mar-05	830	11.22	26.00	14.78	5.9	13.1	
P218289	15-Mar-05	910	8.62	17.80	-9.18	1	10.8	

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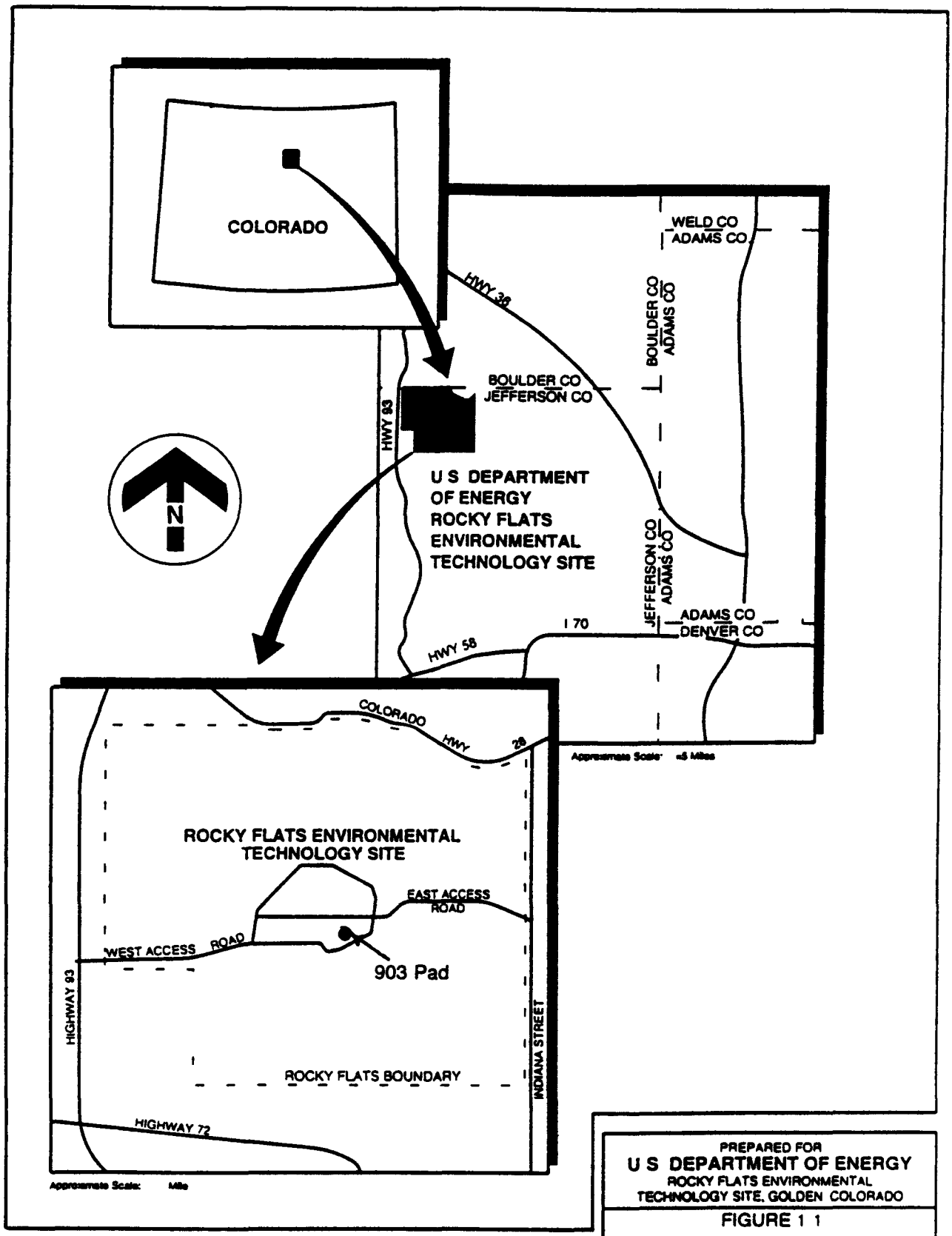
FIGURES

Best Available Copy



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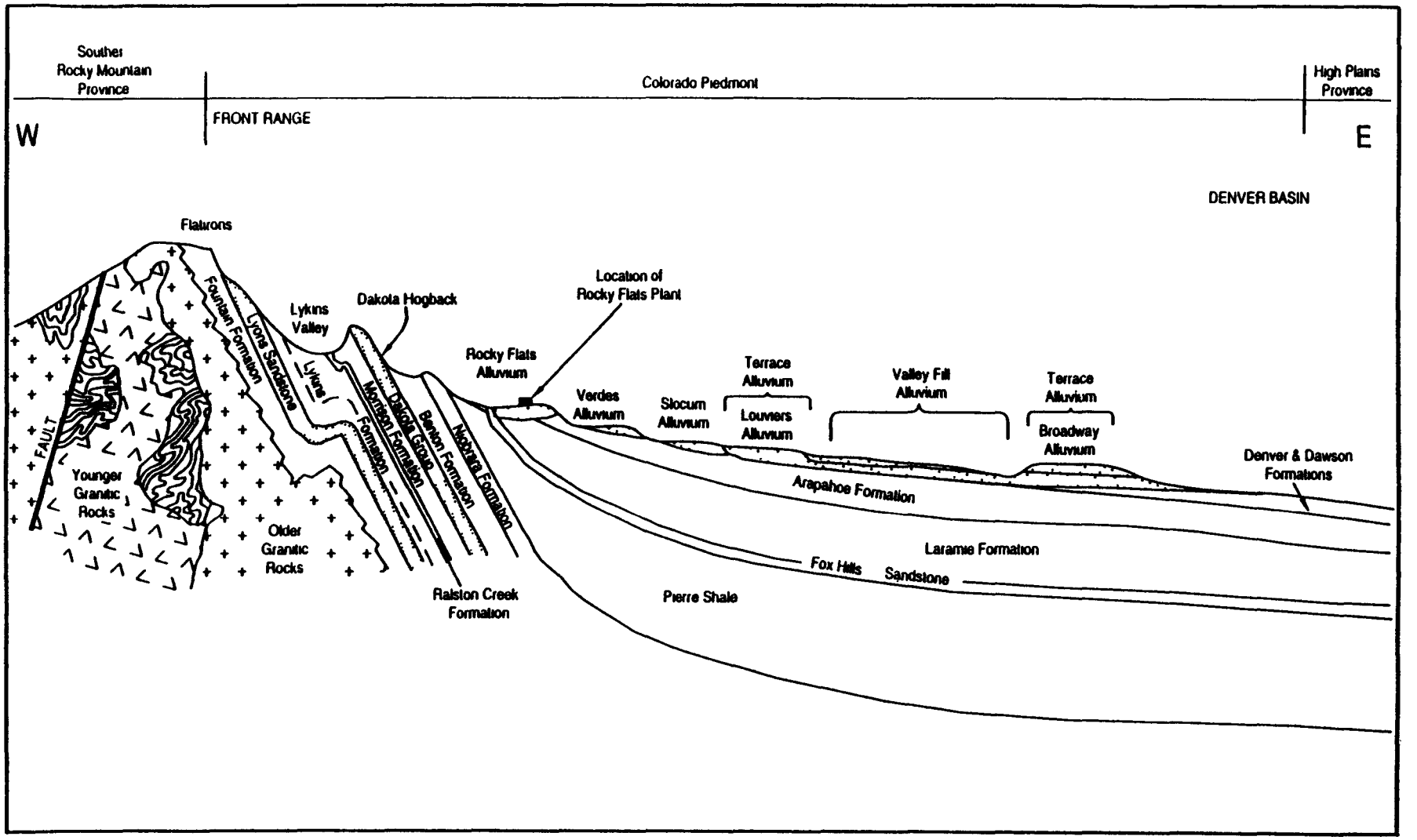
TECHNOLOGY SITE, GOLDEN COLORADO

FIGURE 1 1
GENERAL LOCATION OF
ROCKY FLATS ENVIRONMENTAL
TECHNOLOGY SITE



Not to Scale

Source Boulder County Planning Commission 1983 and Scott 1960

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GOLDEN COLORADO

FIGURE 2 1

GENERALIZED EAST WEST CROSS SECTION
FRONT RANGE TO DENVER BASIN

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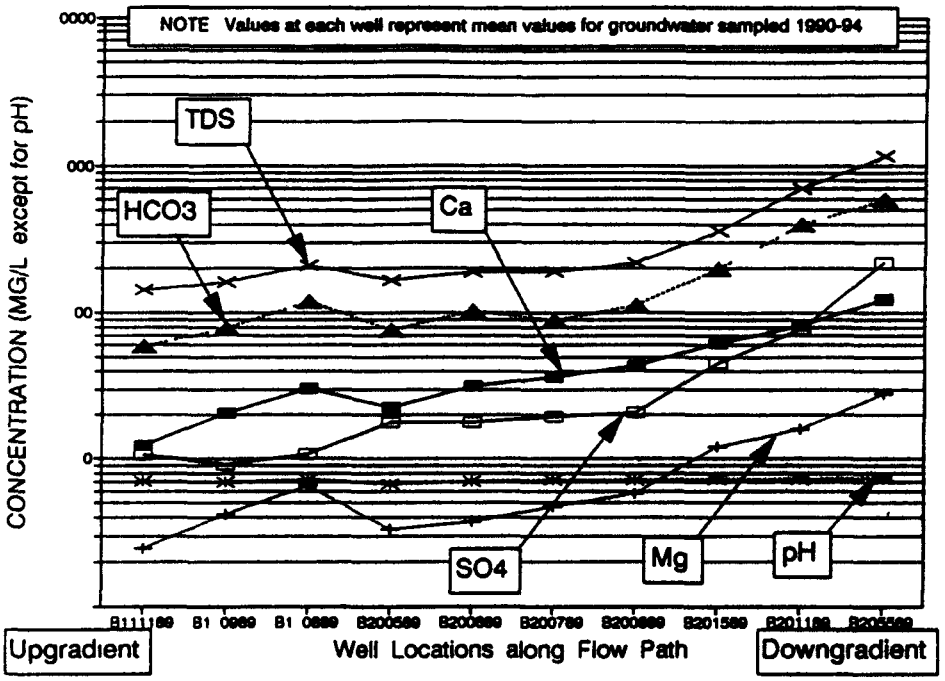


Figure 3 1a Concentrations of major ions along Rock Creek flow path

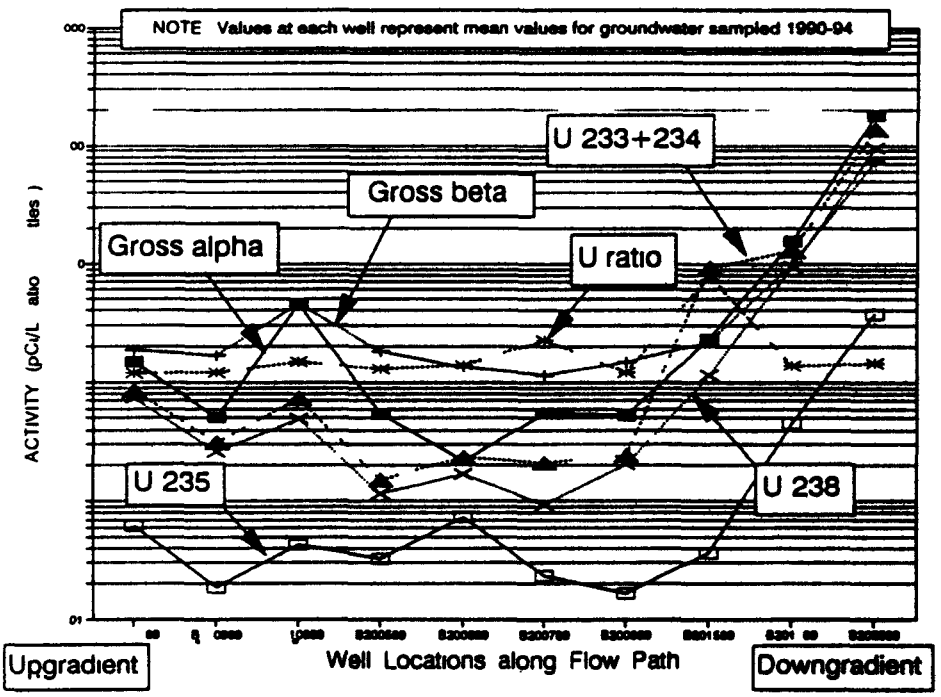
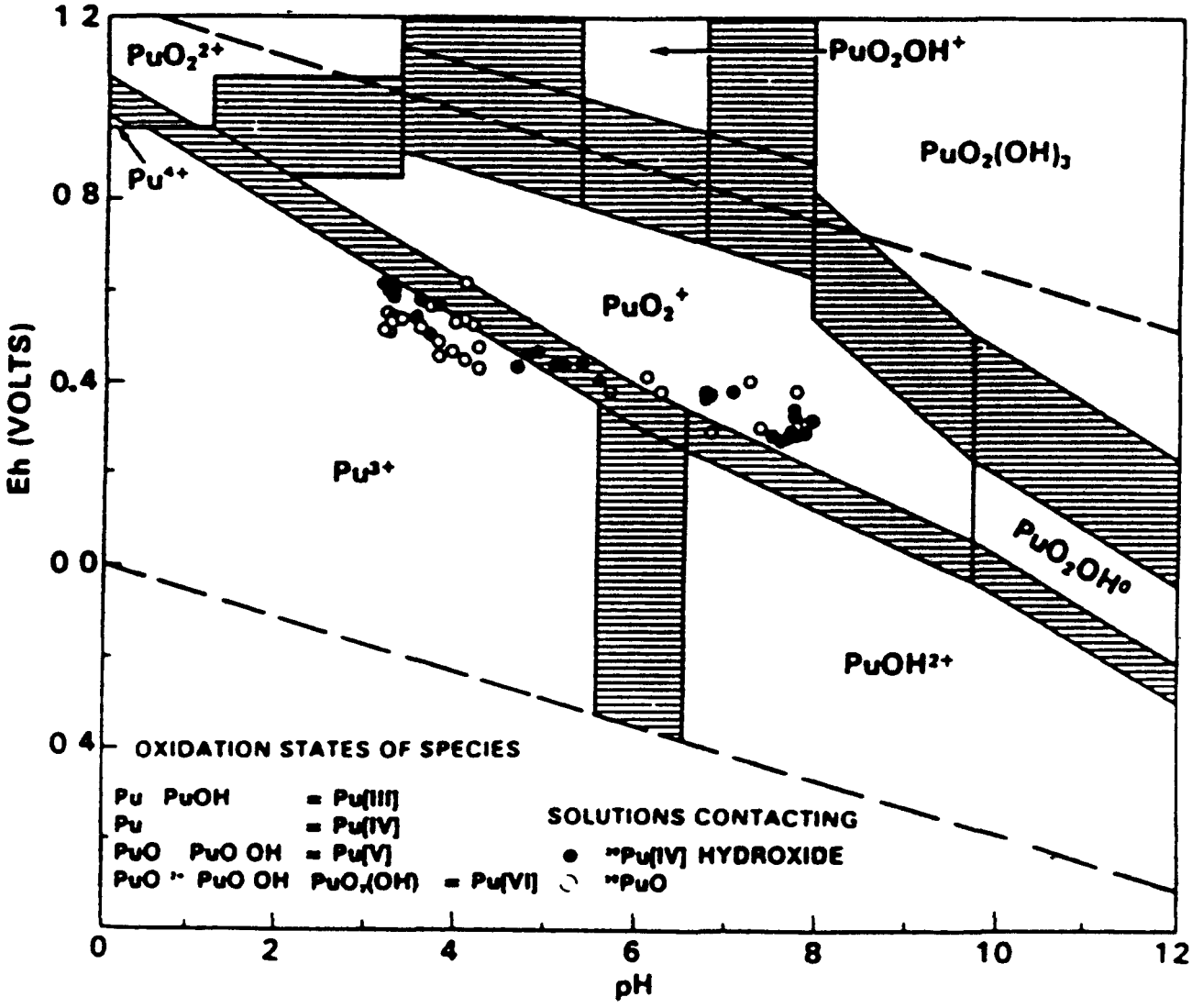


Figure 3 1b Activities of uranium isotopes along Rock Creek flow path



Equilibrium diagram of redox potential (Eh) versus pH at 25 C showing stability fields of different aqueous species of plutonium Dashed lines represent 1 atm O (upper stability limit of water) and 1 atm H_2 (lower stability limit of water) Shaded areas represent broad boundaries between stability fields due to uncertainty in the thermodynamic data Hydrolyzed species of Pu+4 may be important but because reliable formation constants are not available at environmental pH values (i e 4 to 9) their relative stability fields cannot be assessed (Figure and text from Rai et al 1980)

Figure 3 4 Equilibrium Diagram of Redox Potential Versus pH

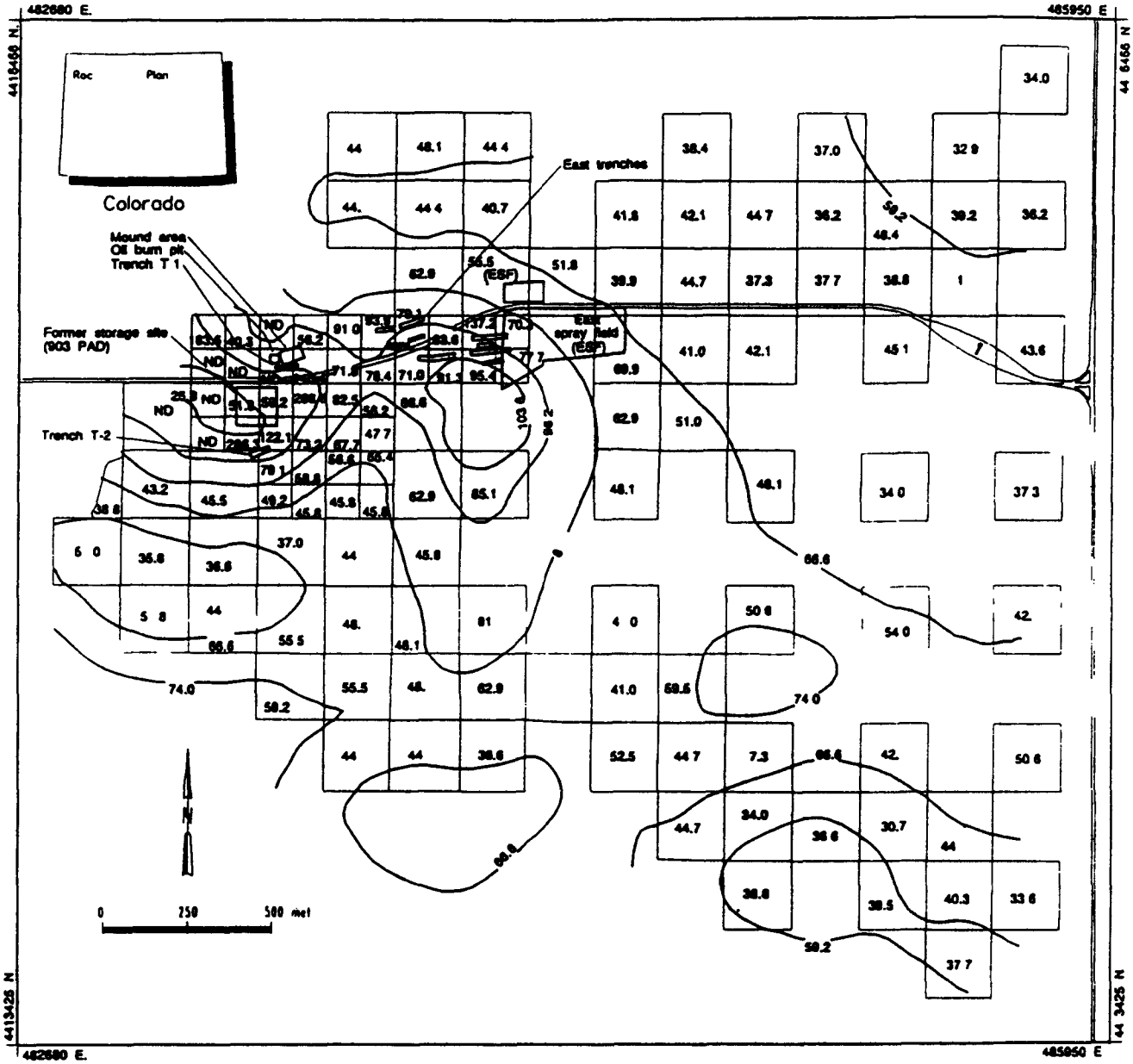


Fig 4 Isopleth map of U 238 i soils round RFP using ordinary k ging Units a e Bq kg The observed alues are plotted n the cent r of each 1 01 and 4 05-ha plot

Figure 4 1 Distribution of Uranium 235 in RFETS Surface Soils
Source Litaor 1995

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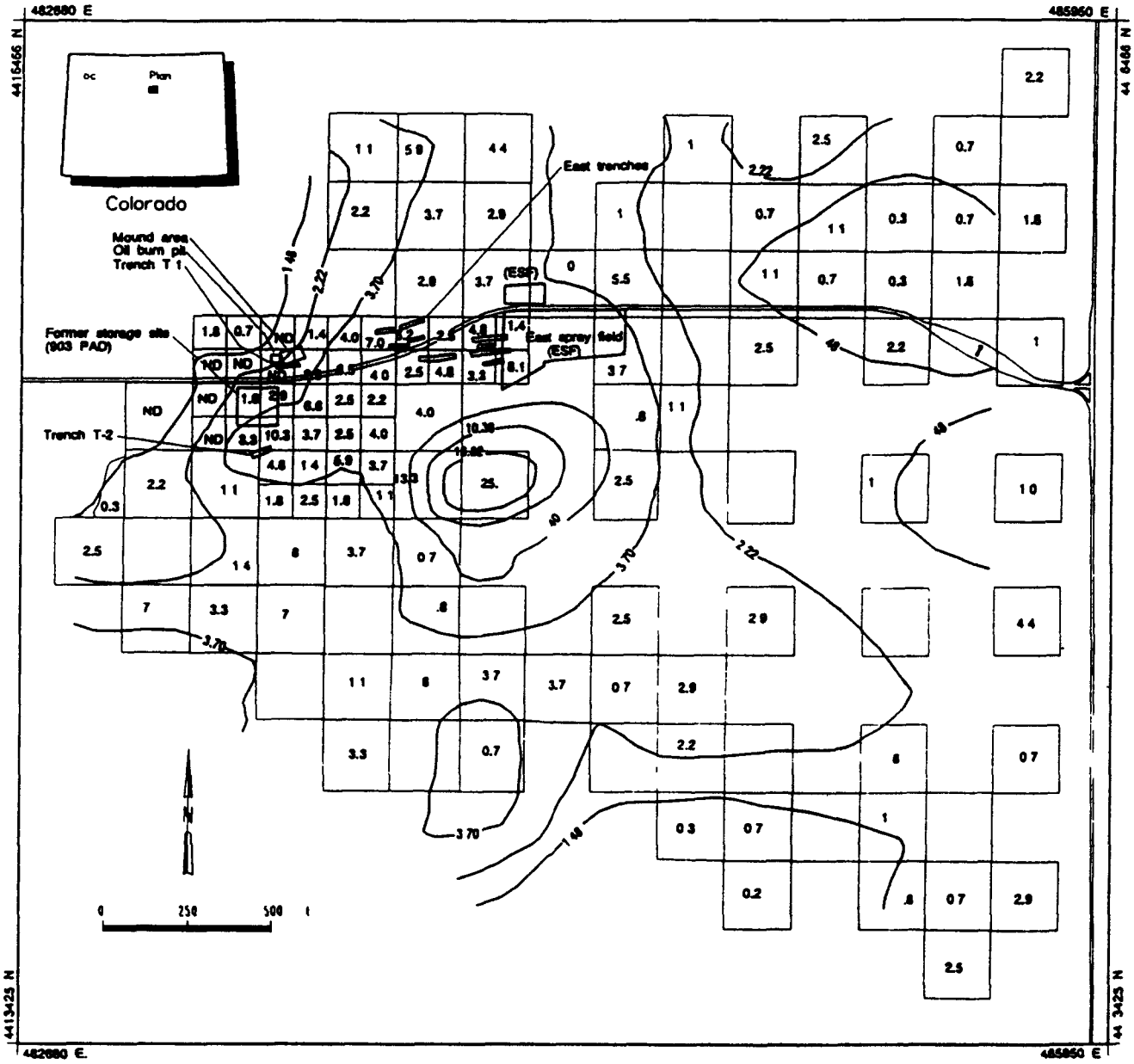
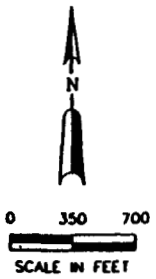
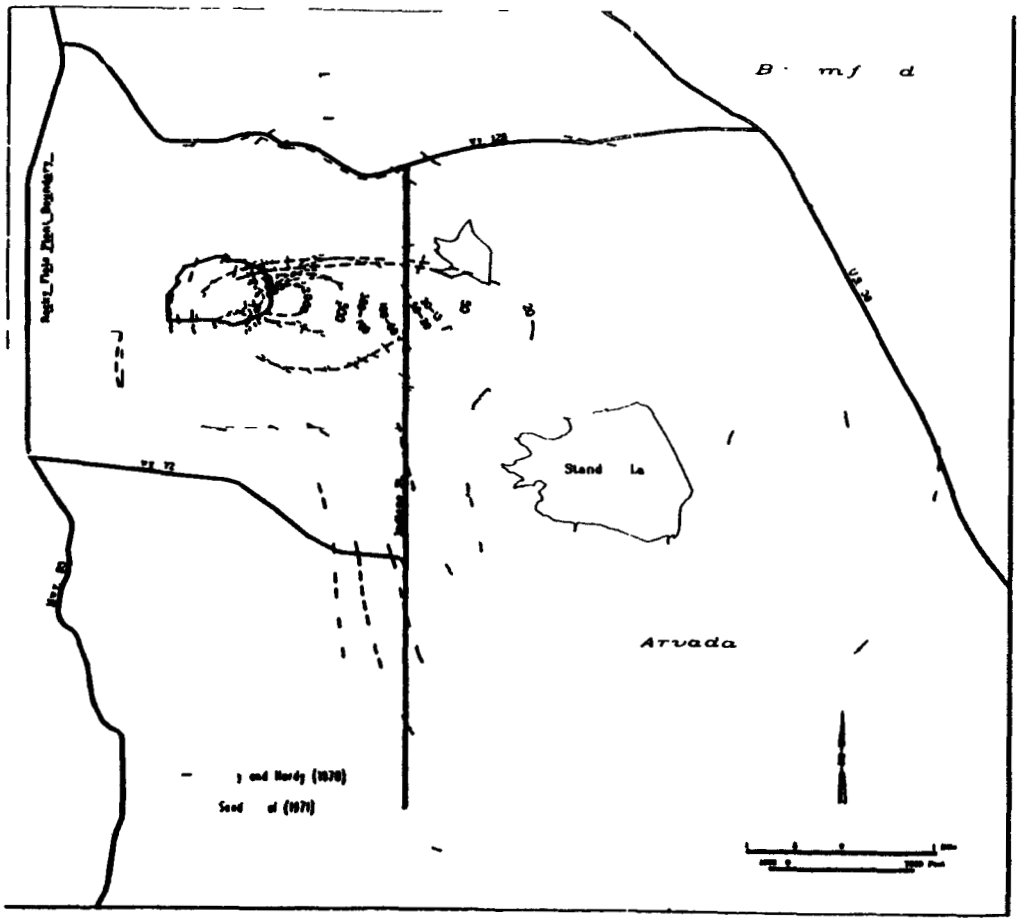


Fig 3 Isopleth map of U 235 in soils around RFP using ordinary kriging Units are n Bq kg The observed alues are plotted the t f each 1 01 nd 4 05-ha plot

Figure 4 2 Distribution of Uranium 238 in RFETS Surface Soils
Source Litaor 1995

1M





EXPLANATION

— — 50 — — P 239/240 (mC / m)
KREY & HARDY (1970)

20 3 P 239/240 (mC /km)
SEED ET AL (1971)

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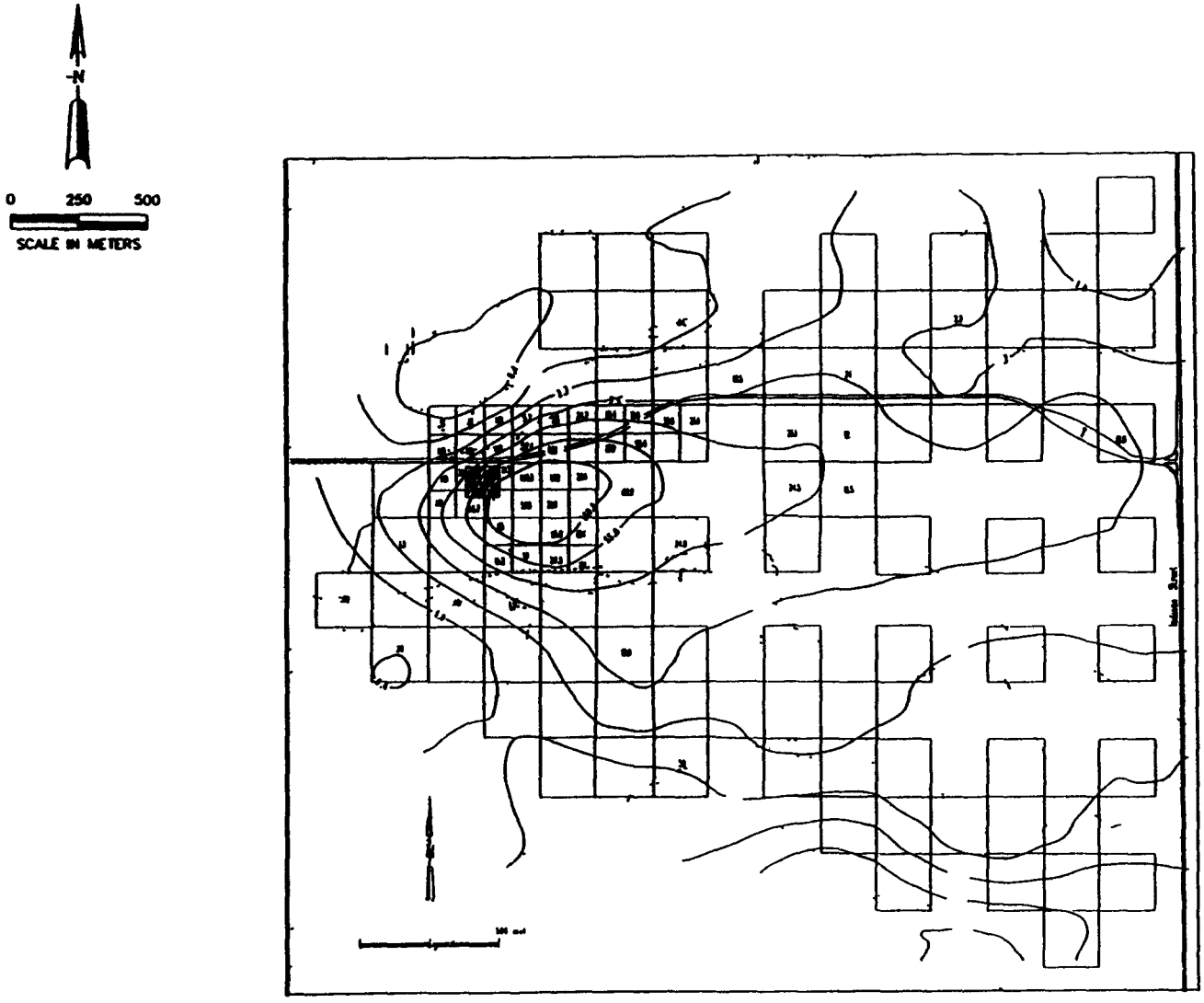
FIGURE 3

SP TI L DISTRIBUTION OF Pu 239/ ROUND RFETS AS PROPOSED BY PRE IOUS I ESTIG TIONS

Source Operable U 1 N 2 Phase II RFI/RI Oc 1993

12c



EXPLANATION

82 9	SAMPLING PLOT WITH OBSERVED VALUE (IN pC /g) IN THE CENTER
	W TER FEATURE
200	P 239/240 ISOPLETH USING ORDINARY KRIGING
	903 PAD

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GOLDEN COLORADO

FIGU E

SOPLETH MAP OF PL UTONIU M 24(N SC I S

S rc Ope b U 2 P se II I I/RI Oc 993

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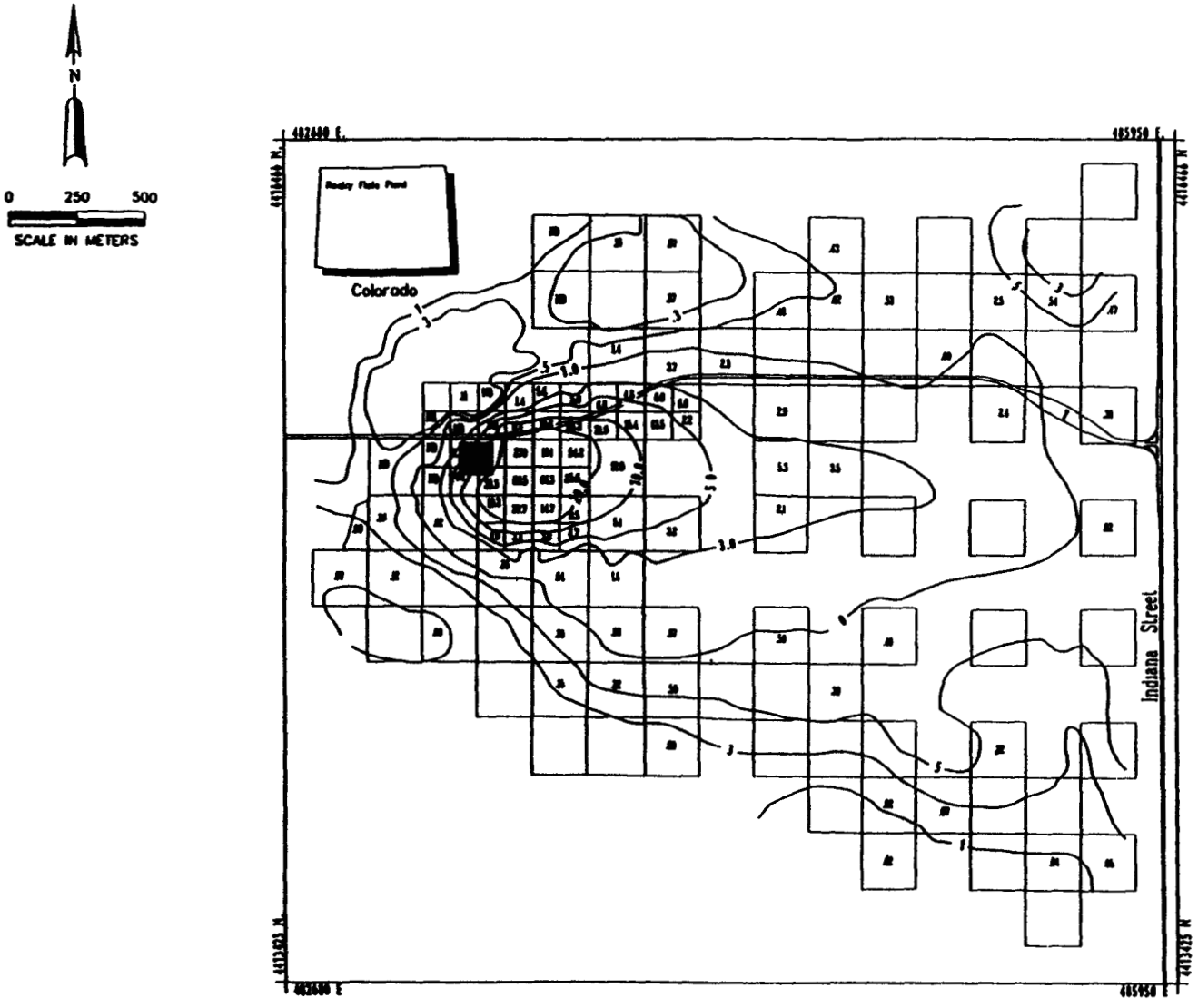

EXPLANATION

20 — SAMPLING PLOT WITH OBSERVED VALUE (IN pC/g) IN THE CENTER

50 — Am 241 ISOPLETH USING ORDINARY KRINGING

903 P D

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GOLDEN COLORADO

FIGURE 5

ISOPLETH MAP OF AMERICIUM 1 IN SOILS

Sourc Operable Unit No 2 Phase II RFI/RI Oc 1993

122

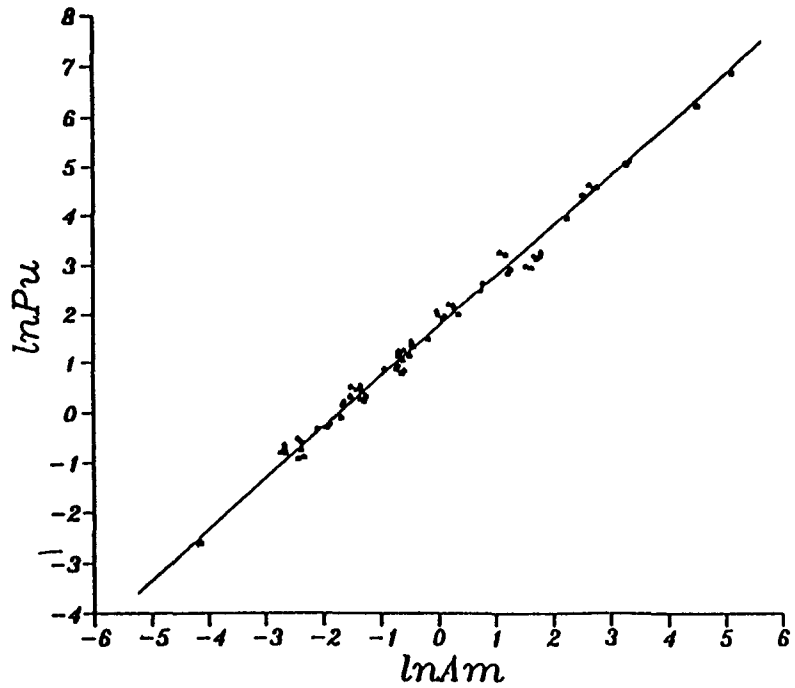

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FIGURE 4-6

RELATIONSHIPS BETWEEN Am AND Pu ACTIVITIES
IN SURFICIAL SOILS EAST OF RFETS

Source Operable Uni No 2 Phase II RFI/RI Oct 1993

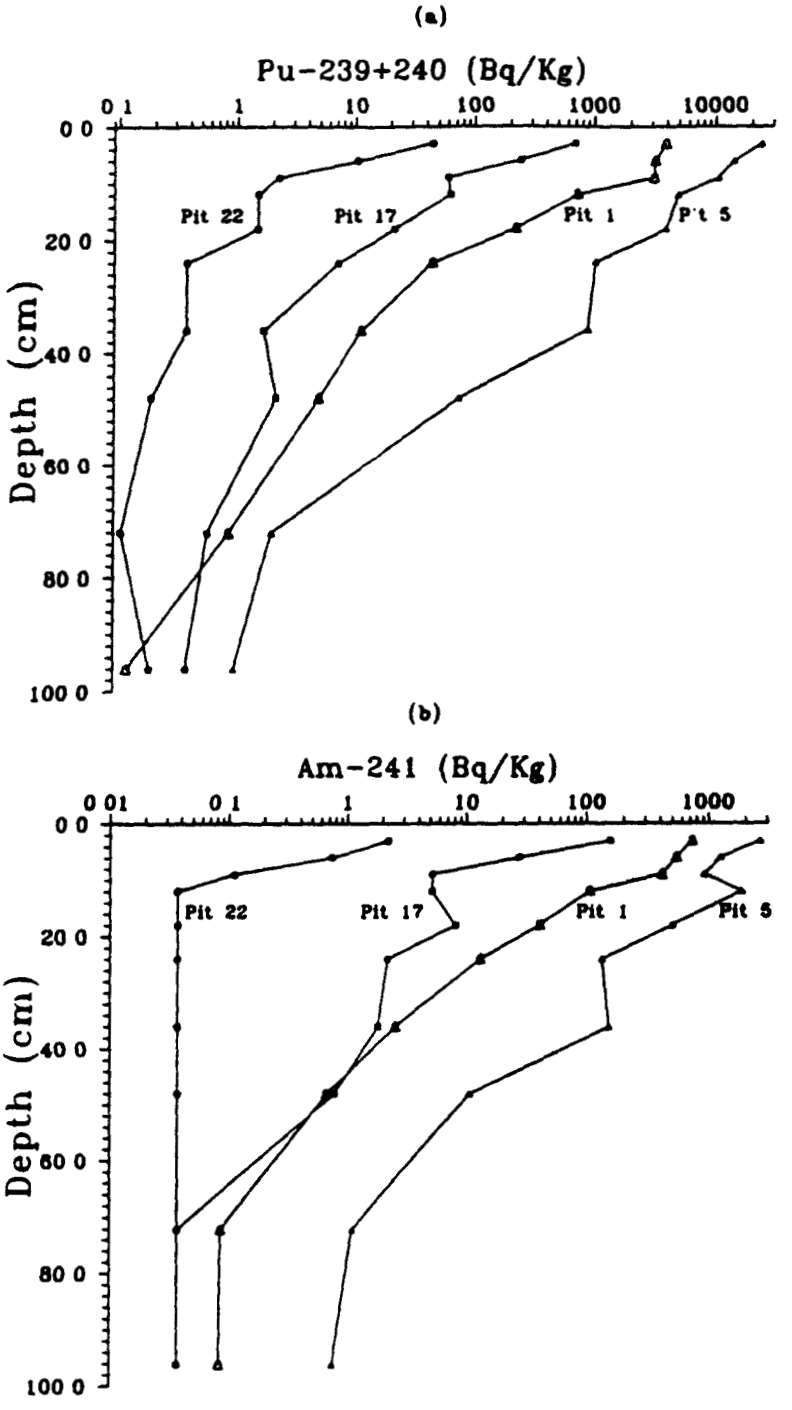


Fig 2 Typical vertical distribution of (*a*) Pu-239 + 240 and (*b*) Am-241 in four soil pits across a west–east transect.

Figure 4 7 Typical Vertical Distribution of a) Pu--239 and b) Am-241
Source Litaor 1995

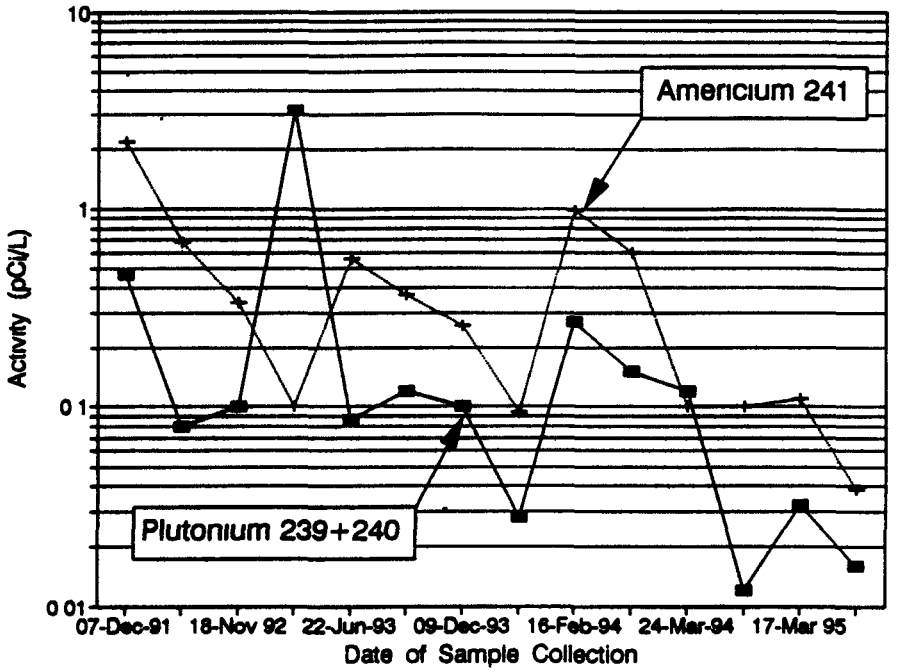


Figure 6-1a Plutonium and americium activities in samples of unfiltered groundwater from Well 41691

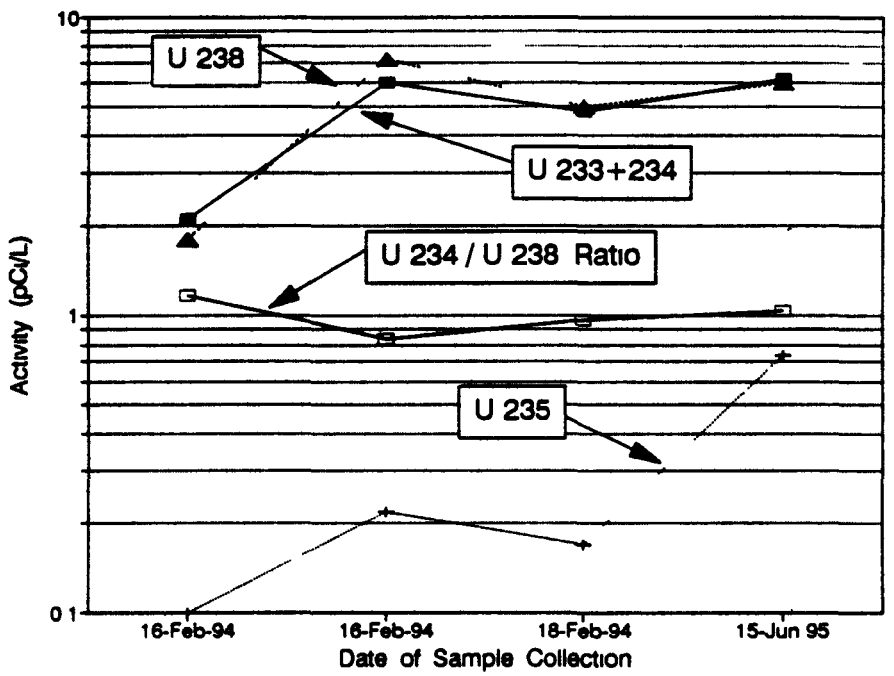
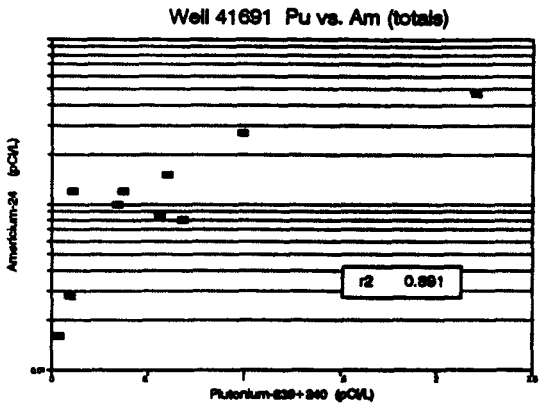
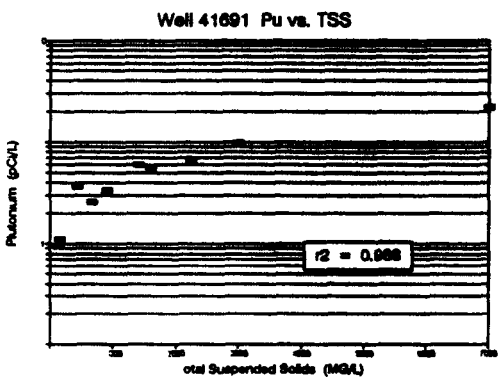


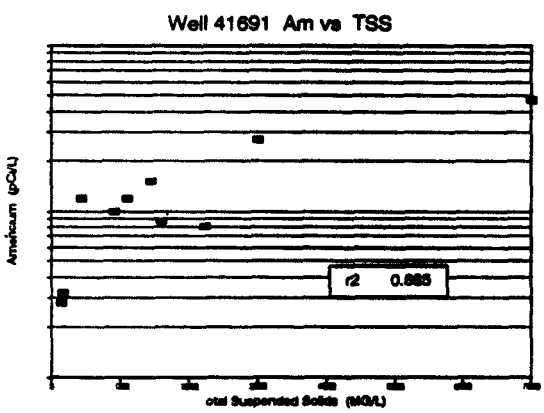
Figure 6 1b Uranium isotope activities in samples of unfiltered groundwater from Well 41691



Pu_Am 41691	Regression Output	
Constant		0 025131
Std Err of Y Est		0 046907
R Squared		0 891473
No of Observations		10
Degrees of Freedom		8
X Coefficient(s)	0 198639	
Std Err of Coef	0 024504	



Pu_TSS 41691	Regression Output	
Constant		294 651
Std Err of Y Est		239 4759
R Squared		0 988003
No of Observations		10
Degrees of Freedom		8
X Coefficient(s)	3303 727	
Std Err of Coef	128 71	



Am_TSS 41691	Regression Output	
Constant		0 035257
Std Err of Y Est		0 047688
R Squared		0 885064
No of Observations		10
Degrees of Freedom	38 2438	8
Std Err of Coef	701 0962	
X Coefficient(s)	6 12E 05	
Std Err of Coef	7 8E-06	

Figure 6 2 Correlations between plutonium americium and TSS in Well 41691

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Figure 7 1 Statistical Summary of Terminal Pond Influent and Effluent Water Quality with Respect to Plutonium and Americium Activity

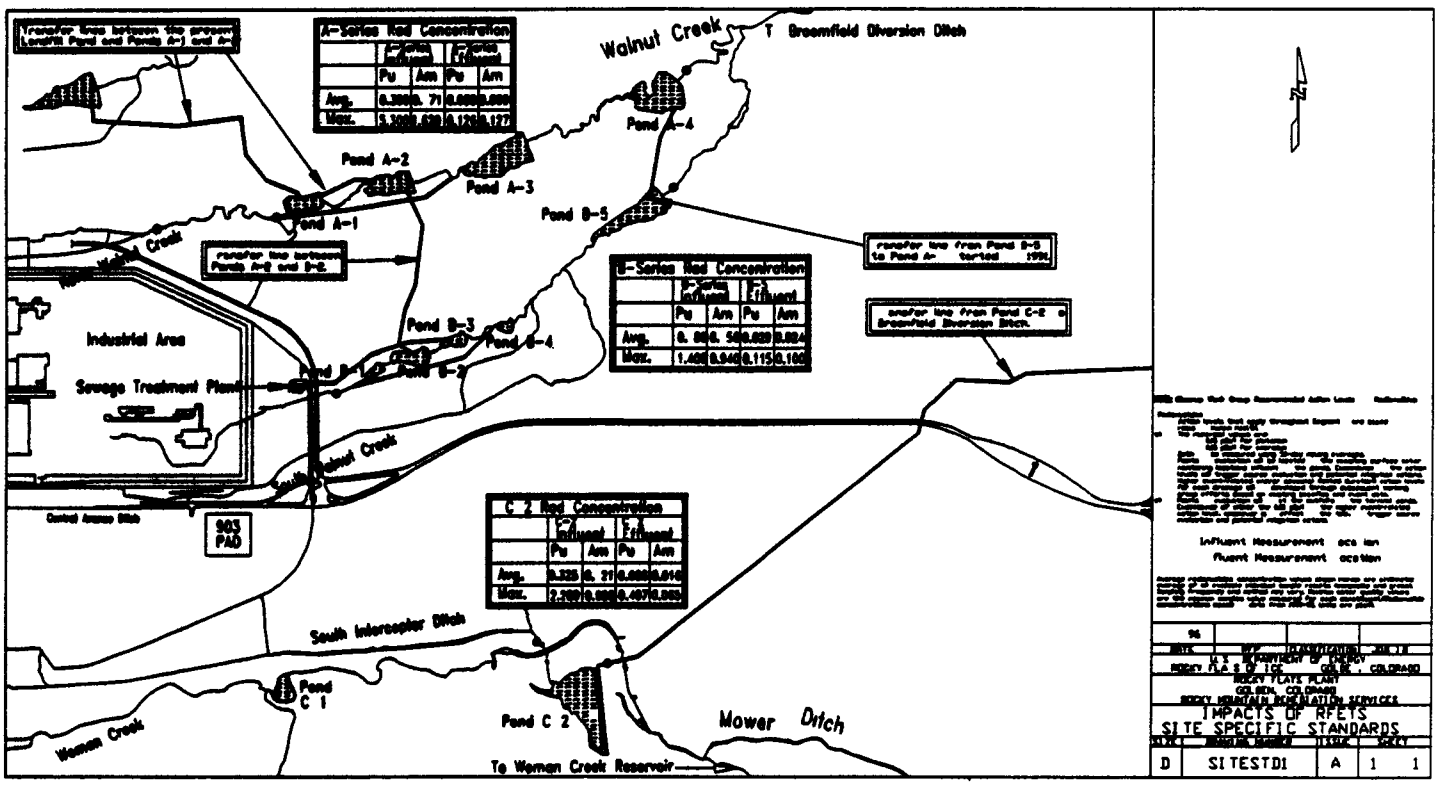
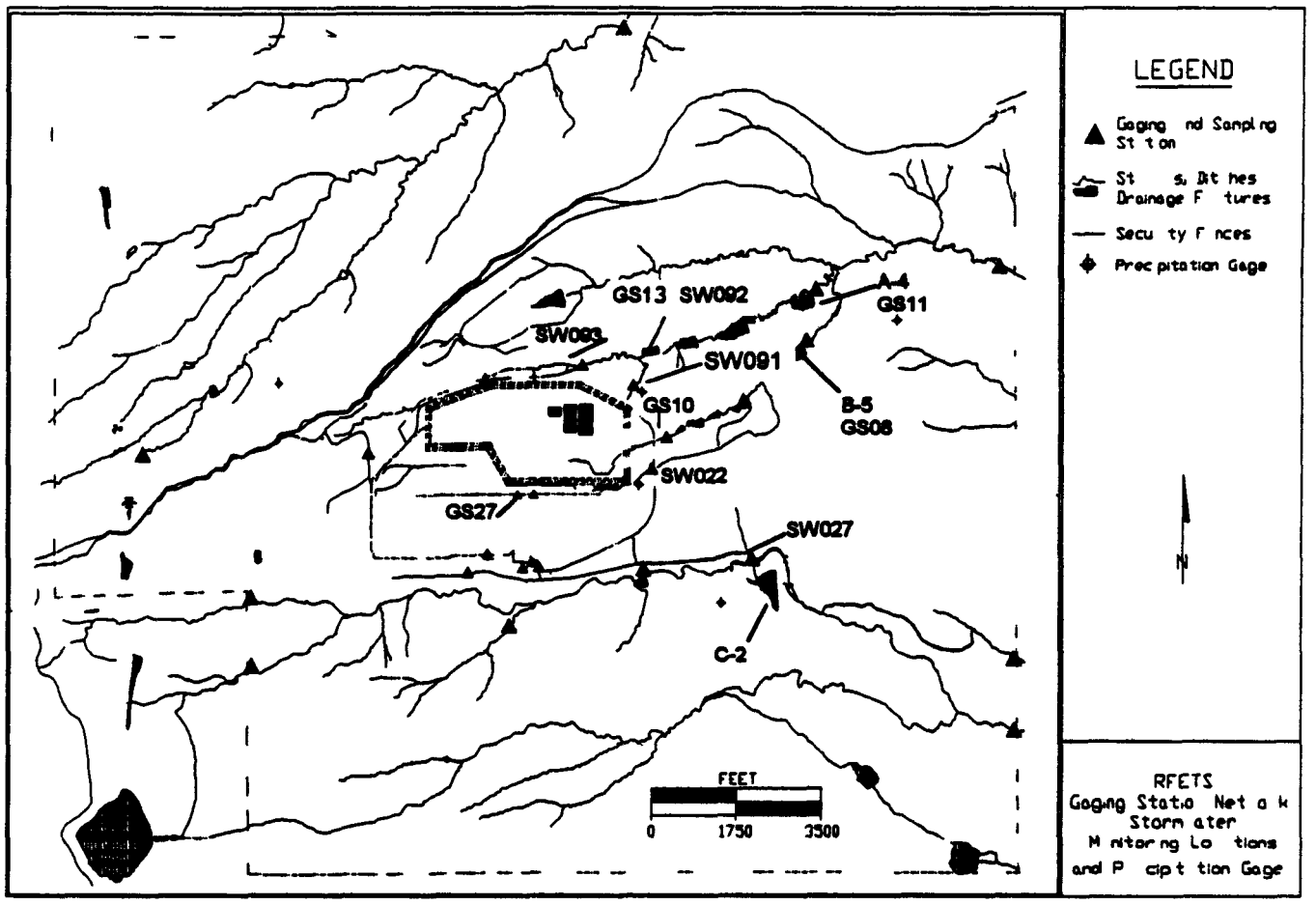


Figure7-2 Locations of Site stream gaging and stormwater sampling stations



128

for the North Walnut Creek Drainage

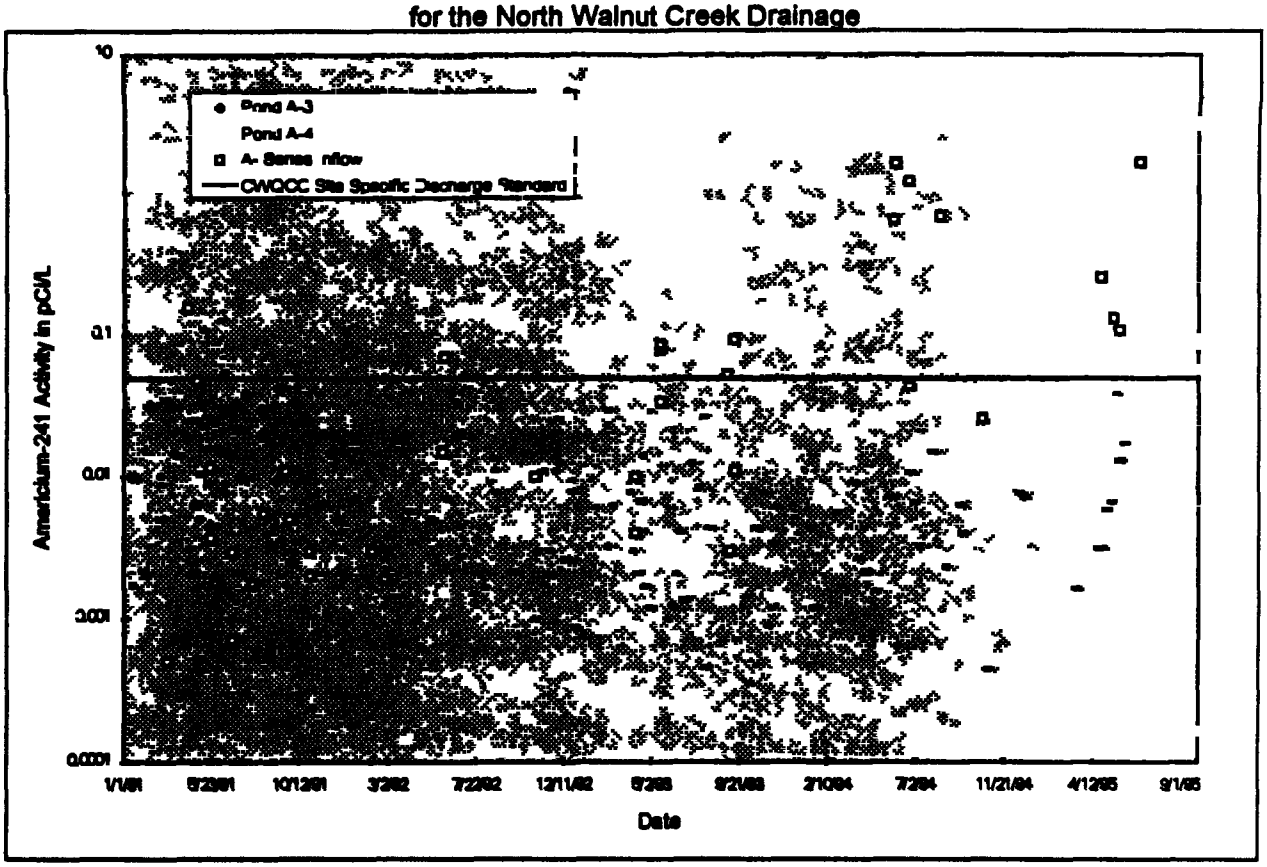


Figure 7-3 Variation of Americium Activity with Time for the North Walnut Creek Drainage

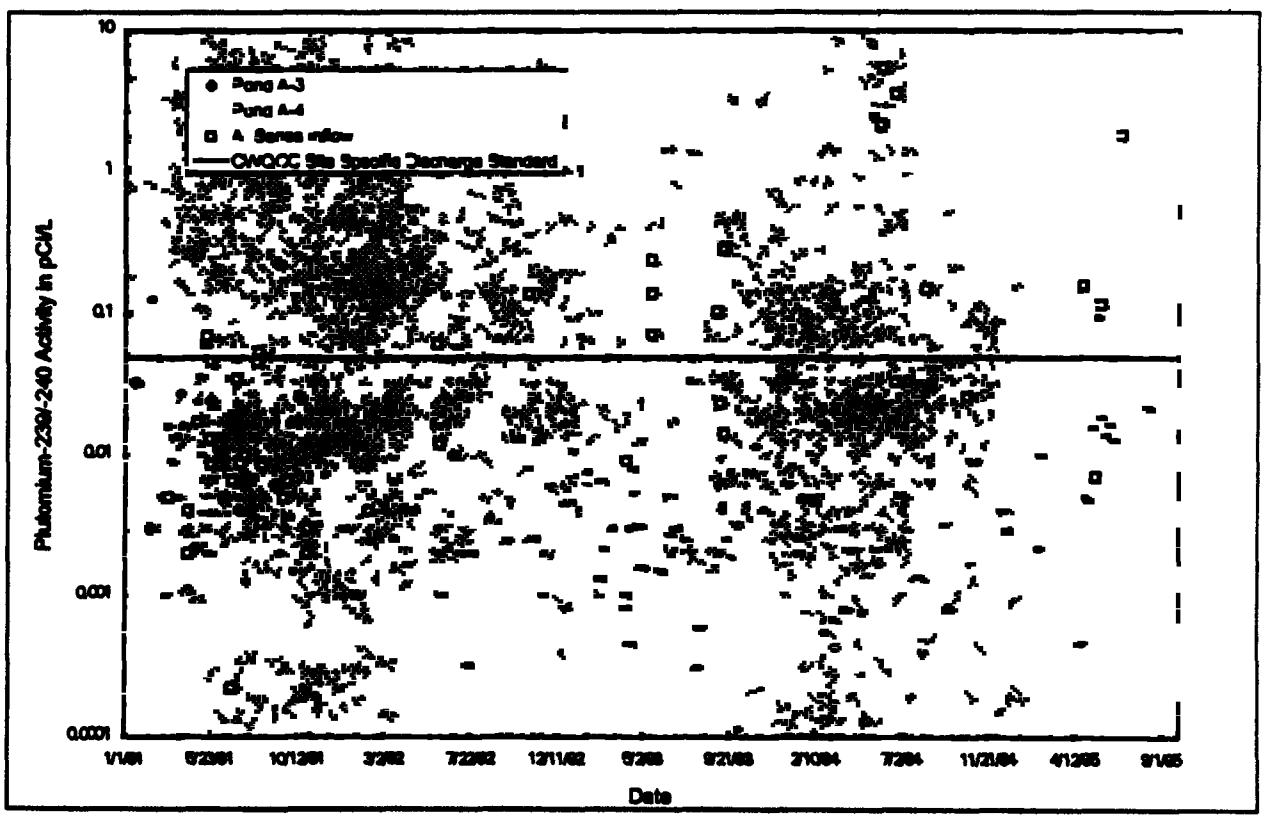


Figure 7-4. Variation of Plutonium Activity with Time for the North Walnut Creek Drainage

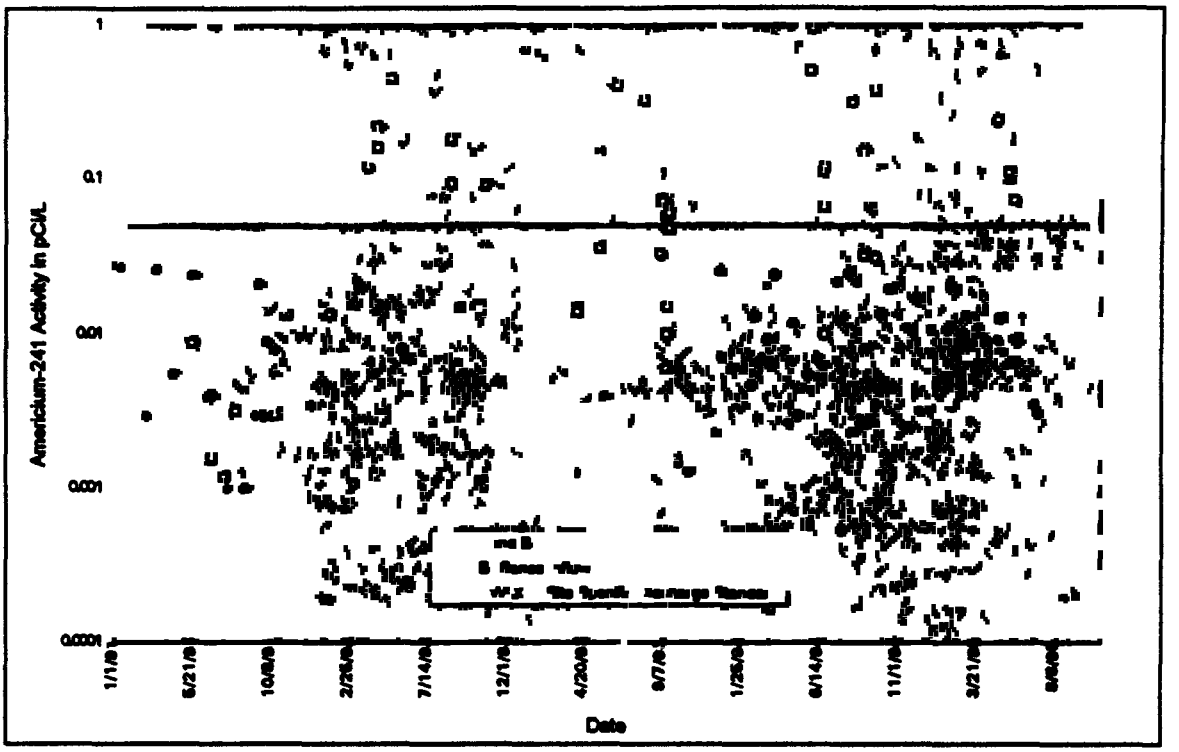


Figure 7-5 Variation of Americium Activity with Time for the South Walnut Creek Drainage

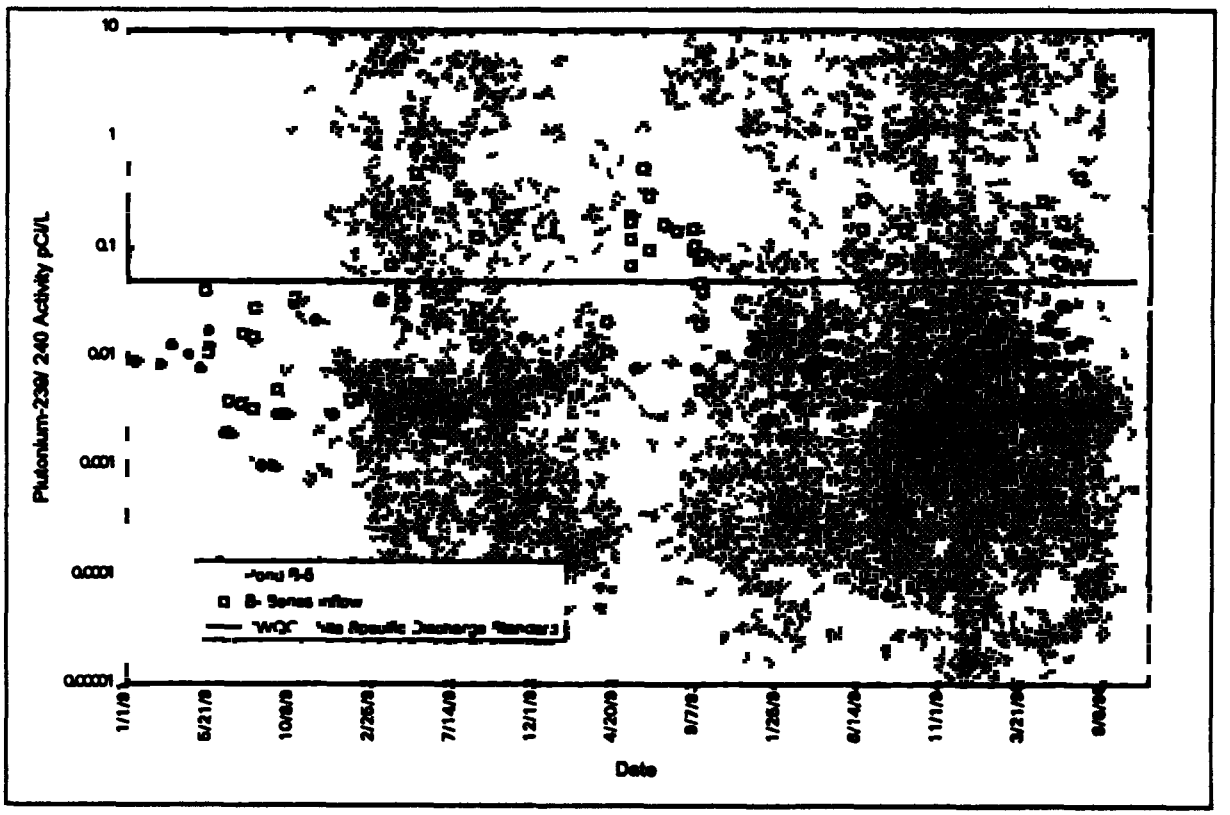


Figure 7-6 Variation of Plutonium Activity with Time for the South Walnut Creek Drainage

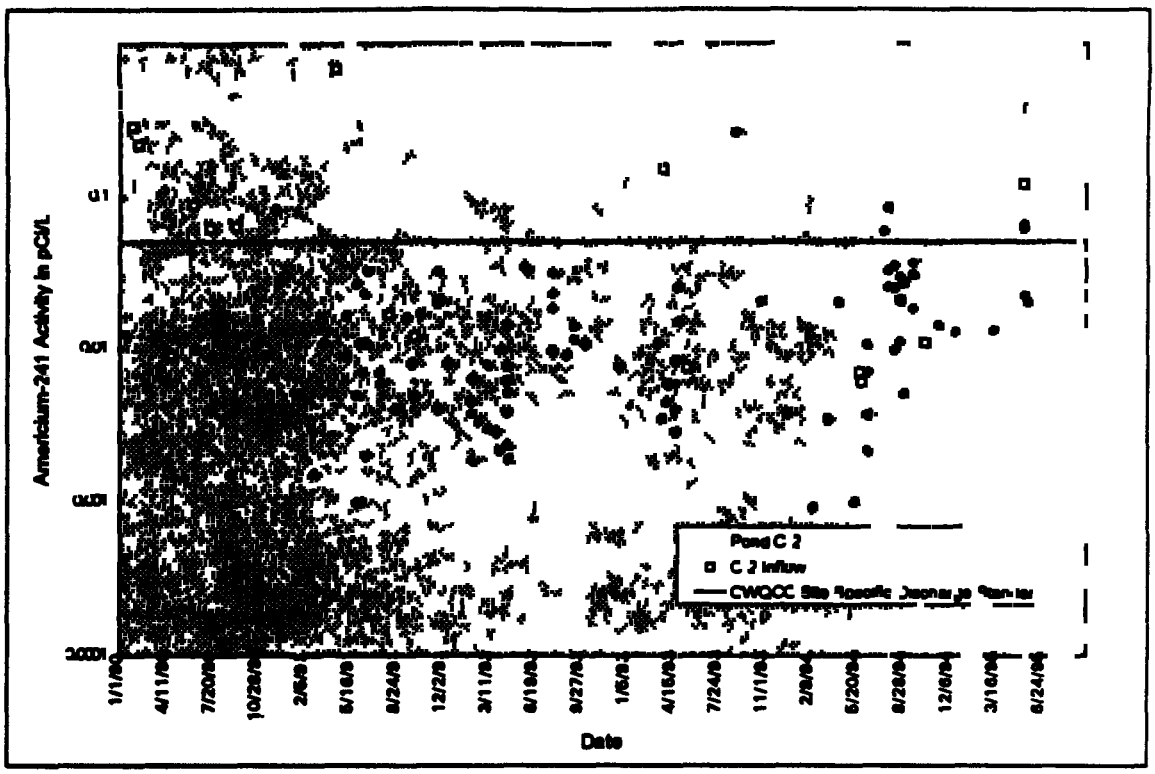


Figure 7 7 Variation of Americium Activity with Time for the SID / C-2 Drainage

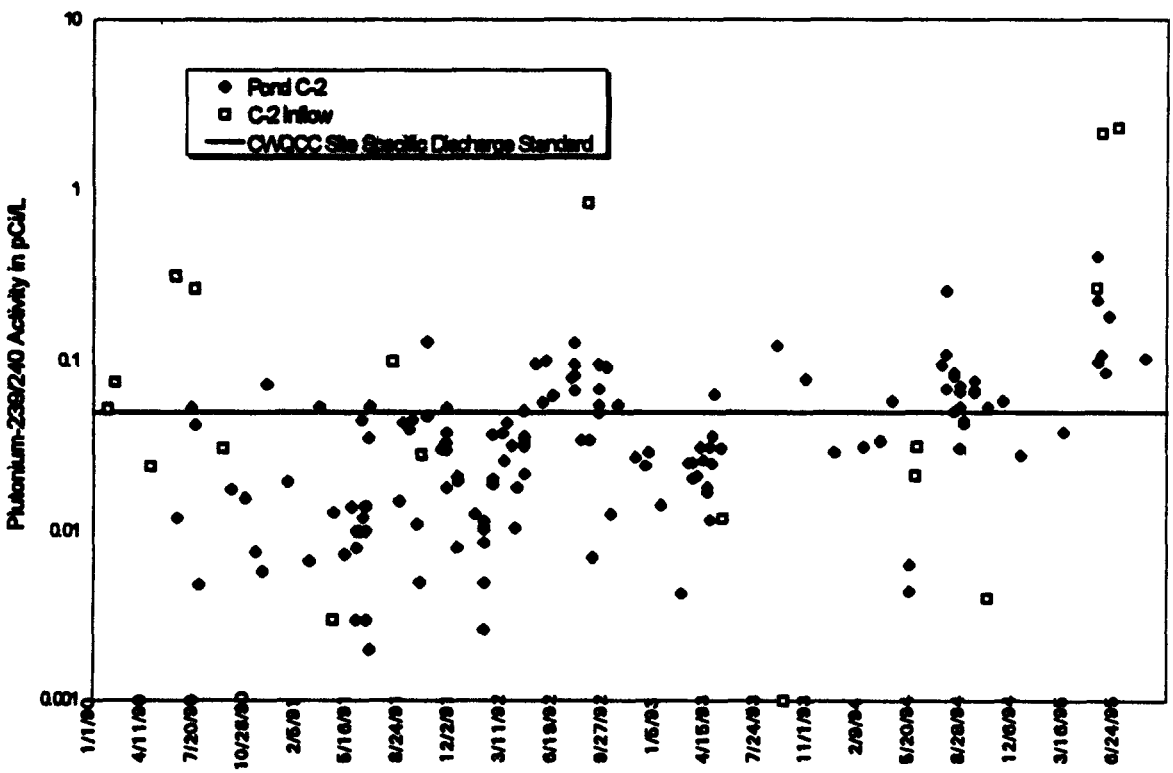


Figure 7-8. Variation of Plutonium Activity with Time for the SID / C-2 Drainage

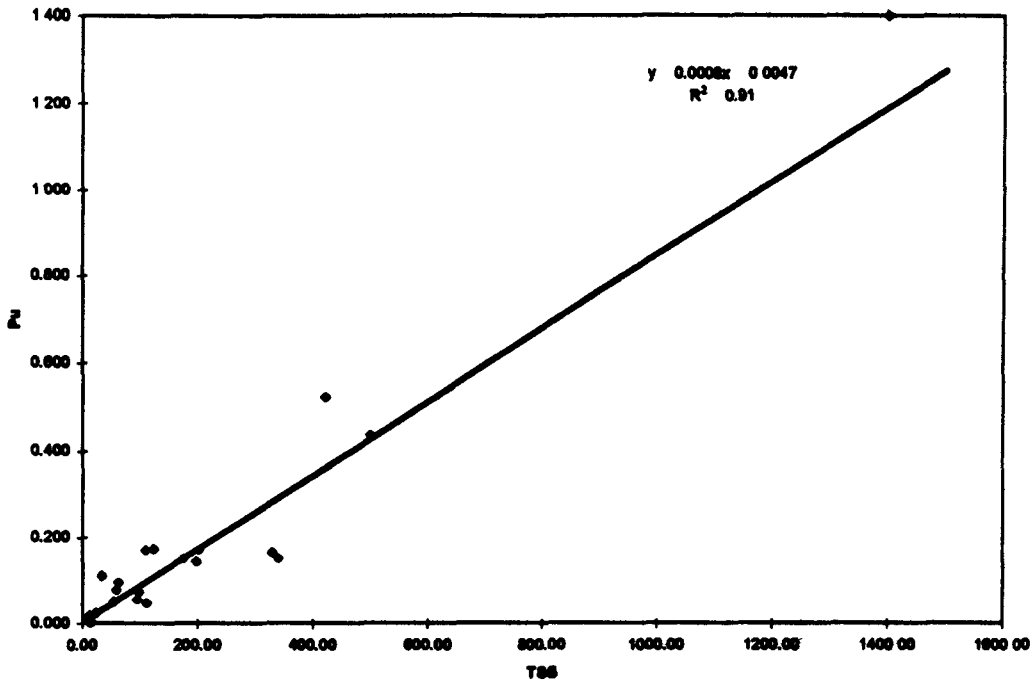


Figure 7 9 Variation of Plutonium Activity with Total Suspended Solids at Gaging Station GS10

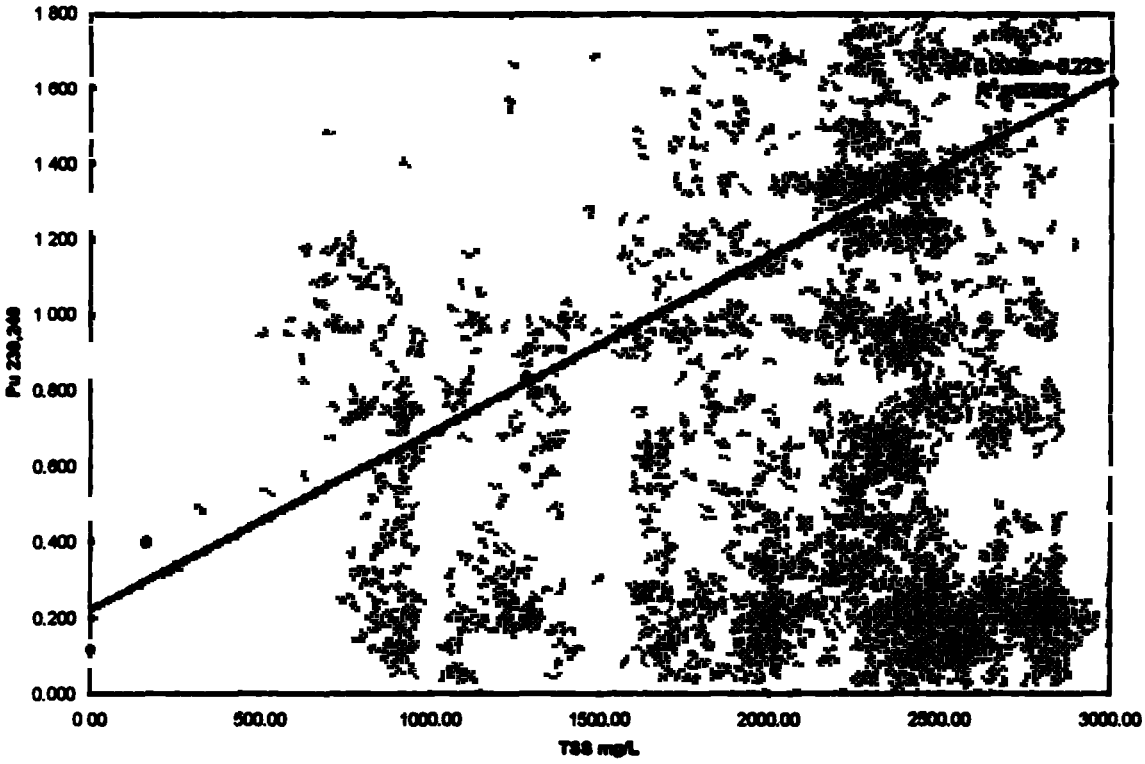


Figure 7 10 Variation of Plutonium Activity with Total Suspended Solids at Gaging Station SW091

Figure 7 11 Variation of Plutonium Activity with Flow at Gaging Station GS27

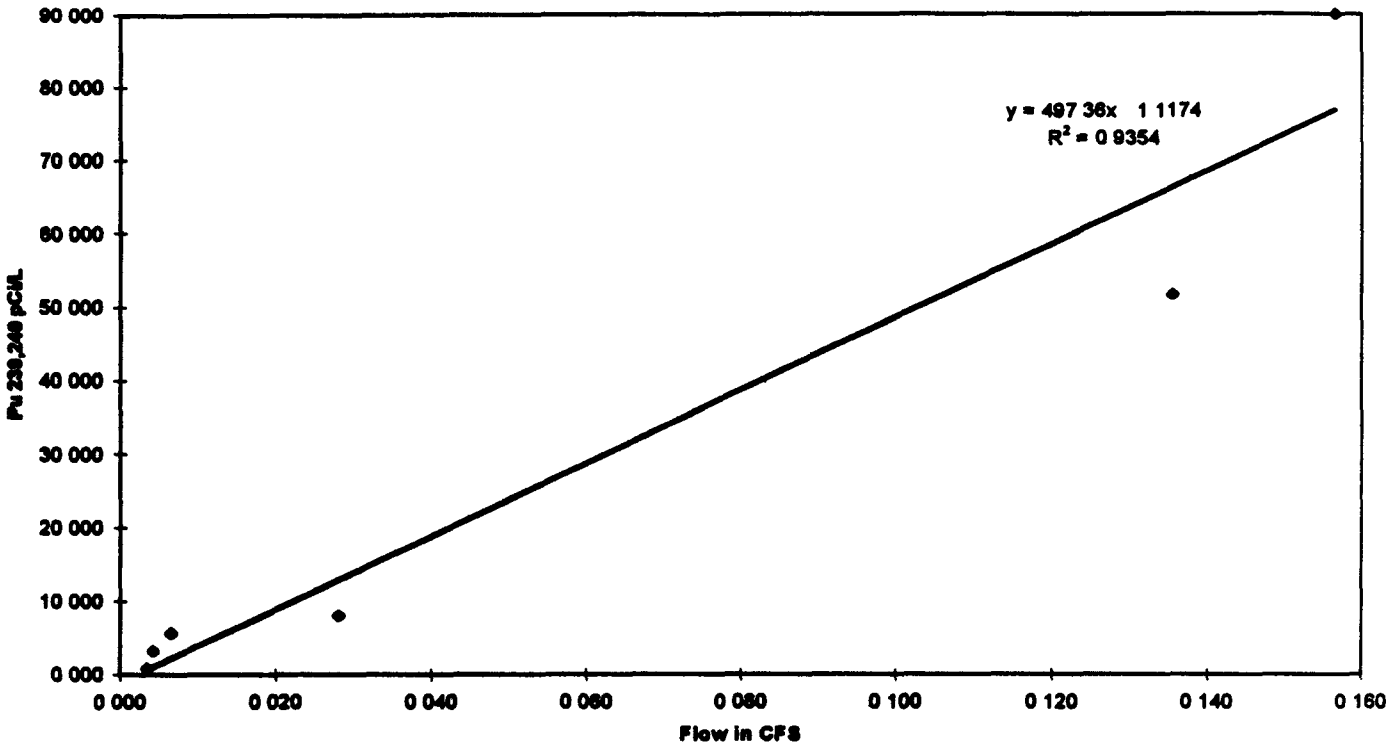
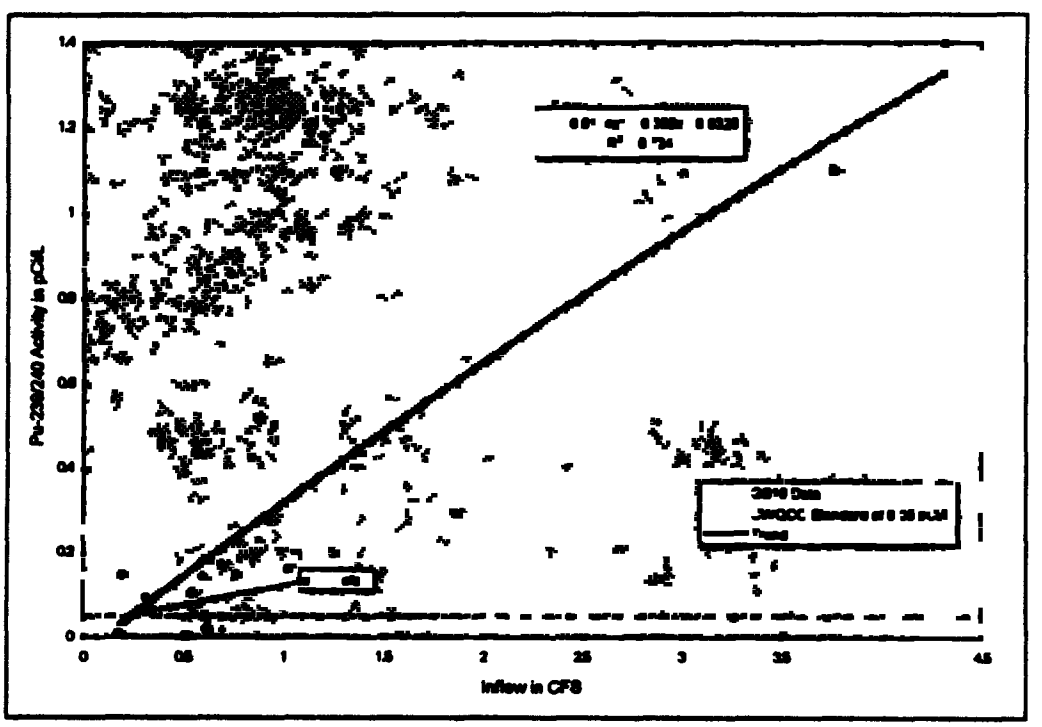
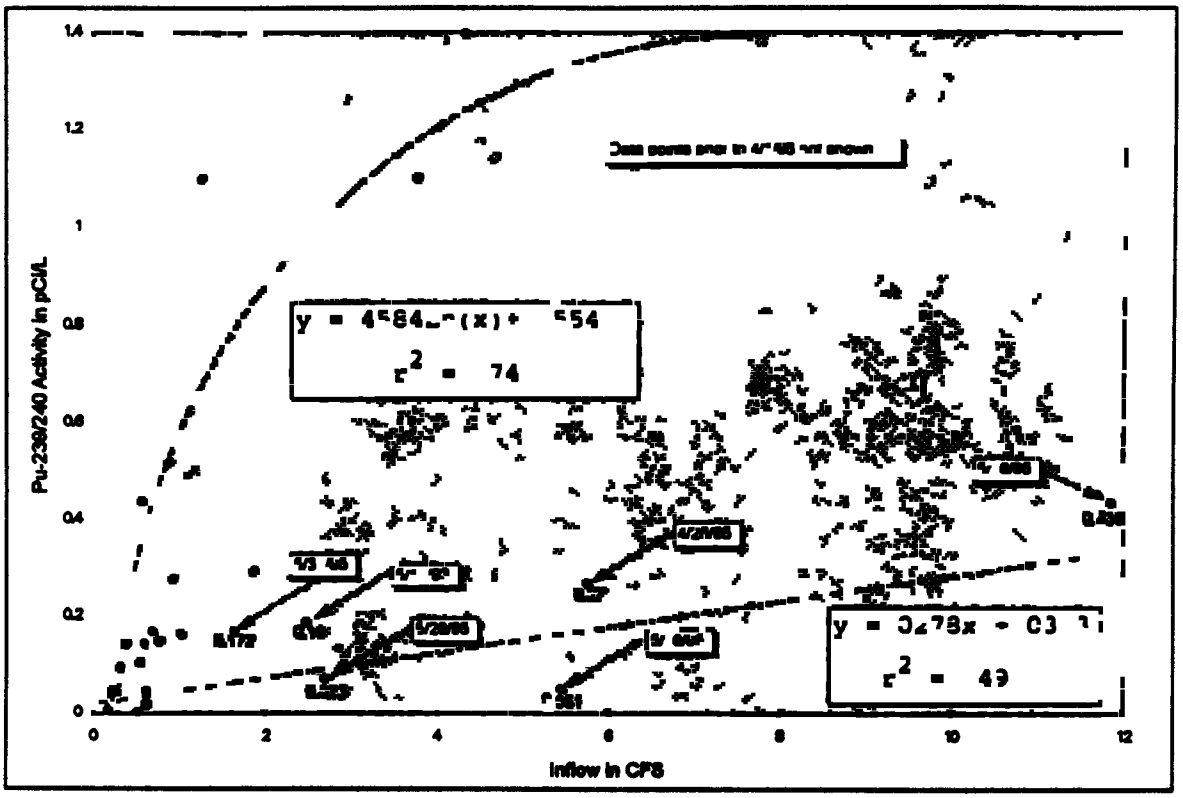


Figure 7 12. Variation of Plutonium Activity with Inflow for S Walnut Creek





7 13 Variation of Plutonium Activity with Inflow for South Walnut Creek Showing Excluded Data Points

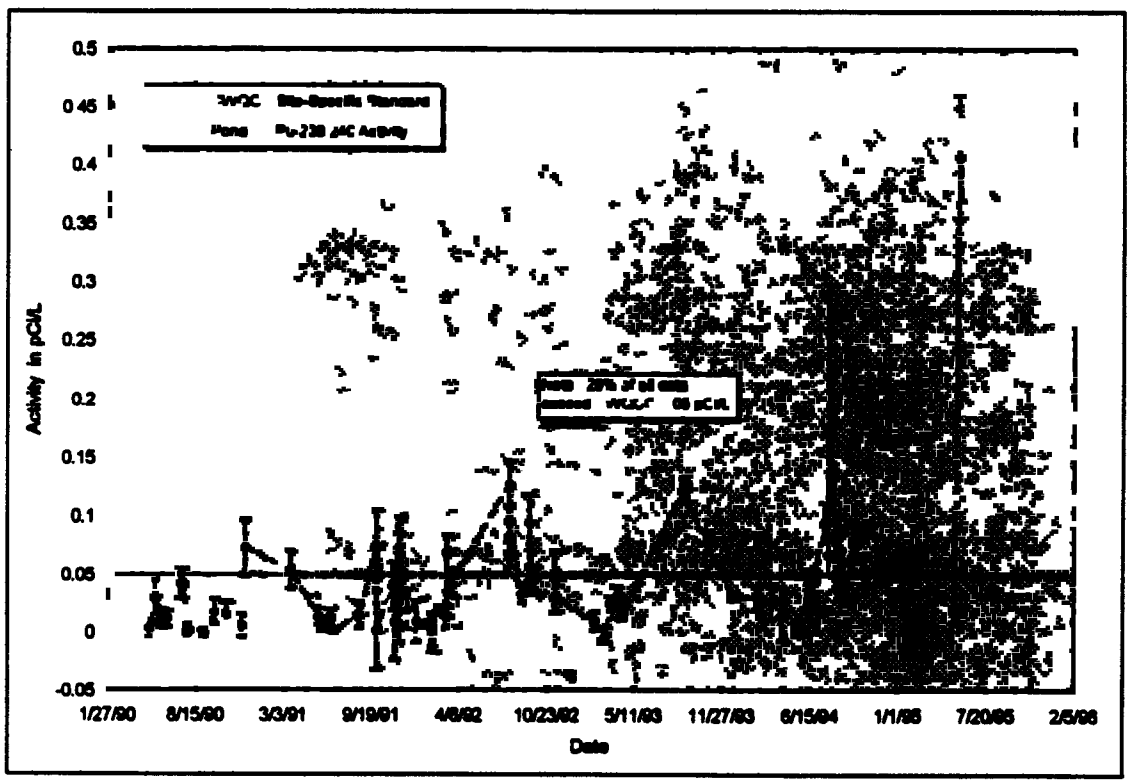
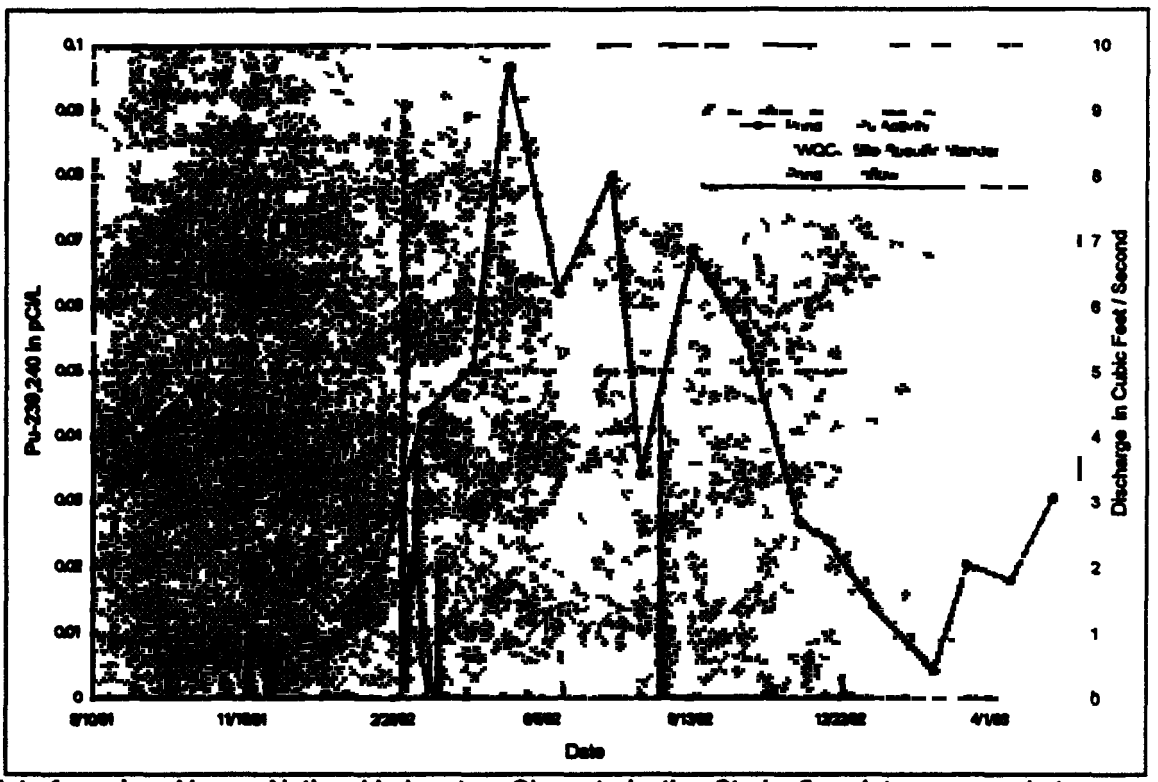


Figure 7 14 Variation of Pond C-2 Plutonium-239 240 Activity with Time

Figure 7 15 Relationship Between Plutonium-239 240 Activity and Stormwater Inflow for Pond C 2 by Date



Pu data from Los Alamos National Laboratory Characterization Study flow data measured at gaging station SW027

Figure 7 16. Mean Daily Inflow to Pond C 2 Measured at Gaging Station SW027 Water Year 1995

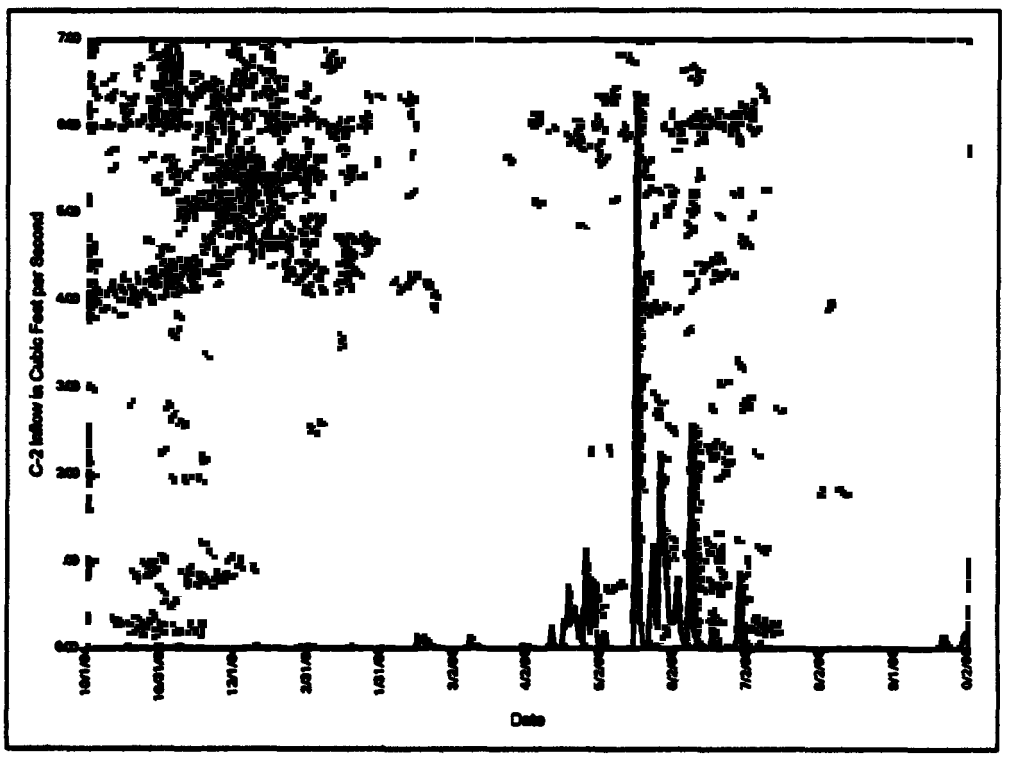
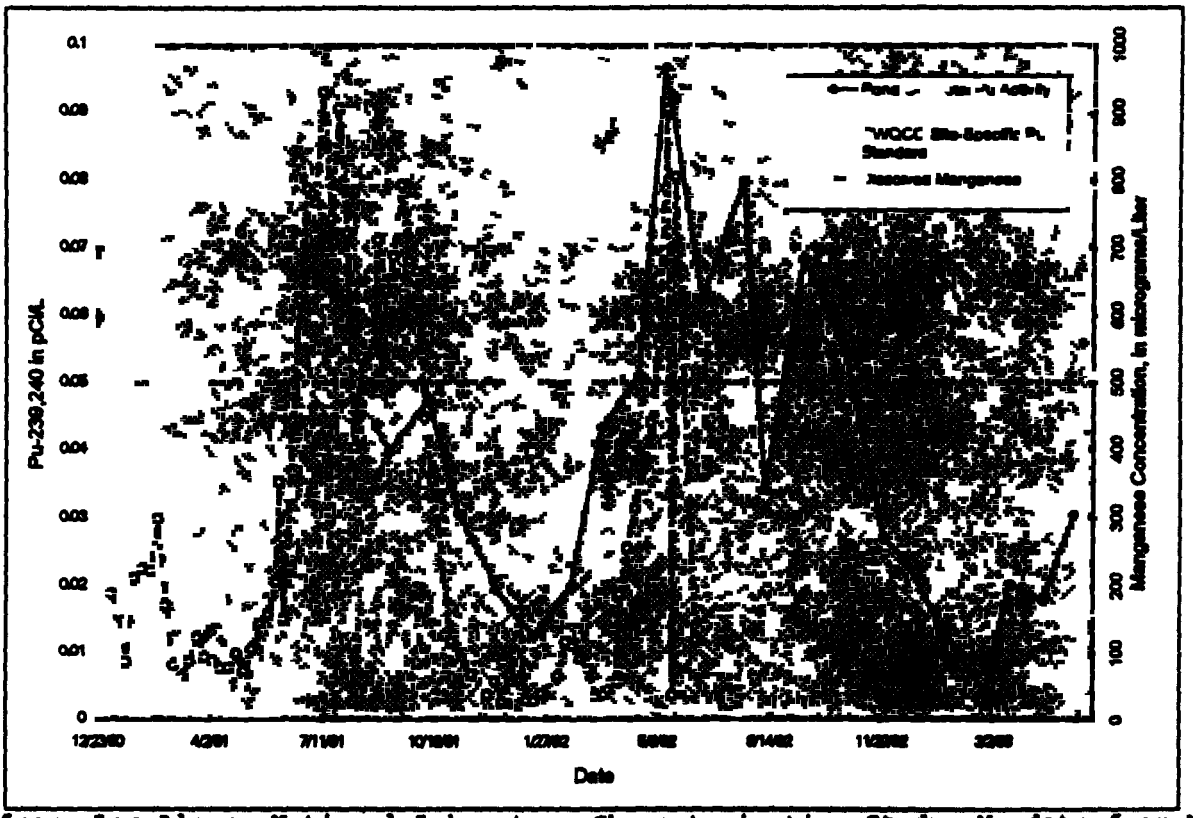


Figure 7 17 Variation of Plutonium-239 240 Activity and Dissolved Manganese Concentration with Time for Pond C 2



Pu data from: Los Alamos National Laboratory Characterization Study; Mn data from NPDES Compliance Monitoring

APPENDIX A

ASSESSMENT OF DATA QUALITY

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The quality of analytical data is commonly assessed by indicators of precision accuracy representativeness completeness and comparability (i e the PARCC parameters) (EPA 1992) Precision provides a measure of sampling and analytical variability results near the detection limit typically exhibit poor precision Accuracy is a measure of how close the result corresponds to the true concentration Representativeness is a qualitative measure of how well the samples represent the media or system sampled and how well the data meet project goals Completeness measures how much useable data were derived from the sampling and analysis program Comparability expresses the extent to which data collected over a period of time using different sampling and analytical methods can be considered equivalent Guidelines for sample analysis are outlined in the General Radiochemical and Routine Analytical Services Protocol (GRRASP) (EG&G 1991) and in task specific Standard Operating Procedures (SOPs)

The quality of data stored in RFEDS has been assessed in most reports prepared using these data Environmental samples are collected following RFETS or project specific protocols and procedures then sent to contract laboratories for analysis following published guidelines (QAPjP EG&G 1990) Analytical data are validated by an independent third party contractor then these data are uploaded into RFEDS which conducts additional data checks during uploading

Quality control (QC) samples are generally collected in the field as field blanks trip blanks duplicate samples and equipment-rinsate samples Blank and rinsate samples provide information on possible sample contamination whereas duplicate samples are used to assess sampling variability and reproducibility of the sample data Field measurements such as those for dissolved oxygen temperature specific conductivity and pH also provide data that can be used to assess quality of the analytical data Laboratory QC samples include lab blanks matrix spikes and replicate samples

Data that are validated as A (acceptable) or V (valid) indicate that all primary validation criteria have been met Rejected data (validation code = R) do not meet objective standards or primary validation criteria Not all data are required to be validated these records are coded Z and include a certain percentage of real sample data as well as all QC sample data However despite independent validation irregularities unrelated to laboratory procedures may still exist within RFEDS data

Irregularities found in RFEDS data include (1) missing data for duplicate sample analyses (2) different data qualifiers used for identical sample results entered for the same sample (3) apparent anomalous results that may represent transcription errors and (4) null result or blank form-generated records Other discrepancies include mixed units or incorrect units (e g MG/L for a pH record or MG/KG for a water sample) missing units or qualifier or detection limit and incorrect sample type In general the data for radionuclides exhibit following limitations

- Matrix spike recoveries which are used to assess analytical accuracy are not available from RFEDS Without an assessment of accuracy the possible bias that may be associated with specific data cannot be evaluated However one may assume that validation criteria for spike recoveries were met for all data that have A or V validation codes

- The precision of duplicate analyses exceeds 20 percent for most radionuclides and is frequently much higher

- Analytical results of zero or negative numbers are common in the data set for radionuclides making statistical analysis challenging when evaluating lognormally distributed data Zero values and negative numbers result from the sample count rate being less than the background count rate Therefore zero and negative result reflect a

random distribution around the detection limit and are essentially the result of the background noise

Data acquired since 1992 generally show fewer irregularities than data collected prior to 1992 Transcription errors are rare Any discrepancies and inconsistencies are generally corrected during data cleanup which precedes data analysis Additional information on RFEDS data is given in an Interoffice Correspondence (EG&G 1994)

Data extracted from RFEDS for use in this report were prepared following standard protocol (EG&G 1994) All QC and rejected data were excluded from the working data sets units and analyte names were standardized and null result records were deleted Due to the preponderance of negative and zero results in the database for the radionuclides statistical summaries were prepared assuming a normal distribution (Tables in Appendix B)

Data from Litaor et al (1994 and 1995) have not been reviewed or evaluated for data quality

A 1 Groundwater

Samples of groundwater are collected following standard operating procedure (SOP) GW 6 (EG&G 1992d) This SOP provides direction on the collection of both filtered and unfiltered samples Water samples are filtered through a 0 45 µm membrane filter in order to remove suspended particulates and to provide a measure of the constituents dissolved in the water Passage through a 0 45 µm filter is the standard operational definition of what constitutes the dissolved fraction In groundwater systems not dominated by flow through fractures flow through pores serves a filtering function therefore the chemistry of the filtered sample is probably more representative of contaminant migration potential than is that of an unfiltered sample Unfiltered samples contain particulates that accumulate in the well bore or sump and are resuspended by agitation during sampling of the well Typically the concentrations of major and trace constituents are higher in unfiltered samples than in filtered samples

Groundwater data in RFEDS have undergone much scrutiny with regard to data quality and data usability Reports in which these data were assessed include all *Annual RCRA Reports* (DOE 1989 1990 1991 1992 1993b 1994 and 1995b) the *Data Verification Report* (EG&G 1994a) the *Groundwater Geochemistry Report* (EG&G 1995a) the *Well Evaluation Report* (EG&G 1994b) and the *Background Geochemical Characterization Report* (DOE 1993a)

A 2 Surface Water and Sediments

Samples of stream water pond water and sediments are collected following site-specific SOPs SW 3 for standard surface-water sampling (EG&G 1992a) and SW 10 for event related surface water sampling (EG&G 1992b) Procedure SW 3 describes sampling methods to be used based on the site specific flow conditions (EG&G 1992a) This SOP describes sampling methods for flowing channelized streams pipes small ponds interceptor ditches sumps or standpipes low flow conditions and seep areas Data quality for surface-water and sediment samples was evaluated for the *Background Geochemical Characterization Report* (DOE 1993a)

A 3 Surface Soils

Sampling of surface soils using the Rocky Flats method follows operating procedure EMD OP GT 08 (EG&G 1993) This method employs a 10-cm by 10-cm stainless-steel jig driven 5 cm into the soil Soil samples are removed from the interior of the jig with a stainless-steel scoop and placed in a stainless steel pan Five samples are collected from each meter-square plot Samples are sieved through a 10-mesh metal sieve and mixed in a stainless-steel bowl Equipment is decontaminated prior to collecting each sample (EMD OP FO 13 Containerization Preserving Handling and Shipping of Soil and Water Samples EG&G 1992)

For surface soil samples collected during a background study (DOE 1995a) precision for actinide sampling and analysis ranged from 0 0 to 75 percent Data quality for surface soil samples was evaluated for the *Background Soils Characterization Report* (DOE 1995a) and the *Phase II RFI/RI Report for Operable Unit 2* (DOE 1995c)

A 4 Subsurface Soils

Samples of subsurface soils are collected during drilling operations Grab samples from drummed materials or samples from core are collected according to established protocol (EMD OP FO 13 EG&G 1992) Subsurface soil data compiled for a background study (DOE 1993a) indicate that overall precision is poor for radionuclides however these samples generally had concentrations near detection limits Data quality for subsurface soil samples was evaluated for the *Background Geochemical Characterization Report* (DOE 1993a)

APPENDIX B

Ordered Listings of Actinide Activities in Background Media at RFETS

Best Available Copy

Table B 1 Ordered Listing of Dissolved Uranium in Background Groundwater at RFETS

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL	GEOLOGY
1	B400289	GW01790IT	09/19/91	URANIUM 233 234	0 024	PCI/L	J	0 0204	0 60000		RFA
2	B400189	GW01750IT	09/17/91	URANIUM 233 234	0 022	PCI/L	J	0 0318	0 60000		RFA
3	B405789	GW03765IT	11/10/92	URANIUM 233 234	0 020	PCI/L	J	0 0205	0 60000		RFA
4	B400189	GW01341IT	06/17/91	URANIUM 233 234	0 018	PCI/L	J	0 0163	0 60000		RFA
5	B200589	GW01774IT	09/19/91	URANIUM 233 234	0 011	PCI/L	J	0 0222	0 60000		RFA
6	B405586	GW01775IT	09/13/91	URANIUM 233 234	0 007	PCI/L	J	0 0104	0 60000		RFA
7	B200589	GW01067IT	04/04/91	URANIUM 233 234	0 000	PCI/L	J	0 1410	0 00000	A	RFA
8	B400289	GW01334IT	05/23/91	URANIUM 233 234	0 021	PCI/L	J	0 1110	0 18900	V	RFA
9	B400189	GW02456IT	02/13/92	URANIUM 233 234	0 034	PCI/L	J	0 1140	0 16600	A	RFA
10	B200689	GW02042IT	11/18/91	URANIUM 233 234	0 039	PCI/L	J	0 0984	0 60000		RFA
11	B405586	GW03343IT	08/18/92	URANIUM-233 234	0 042	PCI/L	U	0 1700	0 40000		RFA
12	B400289	GW01047IT	03/28/91	URANIUM 233 234	0 044	PCI/L	J	0 0883	0 00000	V	RFA
13	B200589	GW03471IT	09/23/92	URANIUM 233 234	0 044	PCI/L	J	0 0989	0 60000		RFA
14	B405586	GW01048IT	03/28/91	URANIUM 233 234	0 044	PCI/L	J	0 0890	0 00000	V	RFA
15	B400289	GW03468IT	09/08/92	URANIUM 233 234	0 048	PCI/L	J	0 0106	0 60000		RFA
16	B200789	GW01059IT	04/04/91	URANIUM 233 234	0 056	PCI/L	J	0 1120	0 00000	A	RFA
17	B400189	GW01045IT	03/28/91	URANIUM 233 234	0 066	PCI/L	J	0 1380	0 17000	A	RFA
18	B400489	GW01058IT	04/03/91	URANIUM 233 234	0 068	PCI/L	J	0 1410	0 17400	A	RFA
19	B405586	GW02452IT	03/13/92	URANIUM 233 234	0 086	PCI/L	J	0 1640	0 04900	A	RFA
20	B200789	GW02981IT	06/02/92	URANIUM 233 234	0 088	PCI/L	J	0 1500	0 60000		RFA
21	B102389	GW01070IT	04/04/91	URANIUM 233 234	0 092	PCI/L	J	0 1300	0 00000	A	VFA
22	B200689	GW00285IT	08/23/90	URANIUM 233 234	0 092	PCI/L	J	0 0682	0 60000		RFA
23	B400289	GW02458IT	02/13/92	URANIUM 233 234	0 097	PCI/L	J	0 1650	0 17100	A	RFA
24	B400289	GW00397IT	09/14/90	URANIUM 233 234	0 100	PCI/L	J	0 1600	0 11600	V	RFA
25	B405586	GW01316IT	05/17/91	URANIUM 233 234	0 102	PCI/L	J	0 0640	0 00000	A	RFA
26	B400289	GW00762IT	11/29/90	URANIUM 233 234	0 108	PCI/L	J	0 1450	0 60000		RFA
27	B400189	GW03033IT	06/02/92	URANIUM 233 234	0 110	PCI/L	U	0 1900	0 18000	V	RFA
28	B200789	GW00271IT	08/20/90	URANIUM 233,234	0 116	PCI/L	J	0 0734	0 60000	V	RFA
29	B400489	GW00461IT	10/05/90	URANIUM 233 234	0 118	PCI/L	J	0 1740	0 18100	V	RFA
30	B102389	GW02485IT	02/13/92	URANIUM 233 234	0 123	PCI/L	J	0 1670	0 13900	A	VFA
31	B400489	GW01778IT	09/16/91	URANIUM 233 234	0 125	PCI/L	J	0 1500	0 60000		RFA
32	B200689	GW03274IT	08/10/92	URANIUM 233 234	0 130	PCI/L	U	0 1300	0 20000	A	RFA
33	B200789	GW01773IT	09/13/91	URANIUM 233 234	0 132	PCI/L	J	0 1530	0 60000		RFA
34	B200889	GW00494IT	10/11/90	URANIUM 233 234	0 135	PCI/L	J	0 1920	0 60000		RFA
35	B405789	GW00728IT	11/16/90	URANIUM 233 234	0 137	PCI/L	J	0 0846	0 60000		RFA
36	B200589	GW03790IT	11/05/92	URANIUM 233 234	0 143	PCI/L	U	0 0761	0 14283		RFA
37	B400189	GW00722IT	11/15/90	URANIUM 233 234	0 144	PCI/L	J	0 1670	0 60000	V	RFA
38	B400489	GW02443IT	02/10/92	URANIUM 233 234	0 144	PCI/L	J	0 1710	0 00000	A	RFA
39	B405789	GW02442IT	02/10/92	URANIUM 233 234	0 144	PCI/L	J	0 2130	0 00000	A	RFA
40	B405586	GW02993IT	06/11/92	URANIUM 233 234	0 144	PCI/L	J	0 2280	0 23200	V	RFA
41	B405789	GW03419IT	09/22/92	URANIUM-233 234	0 150	PCI/L	J	0 1230	0 60000		RFA
42	B405789	GW00161IT	08/16/90	URANIUM 233 234	0 155	PCI/L	J	0 1250	0 60000		RFA
43	B200689	GW01063IT	04/05/91	URANIUM 233 234	0 174	PCI/L	J	0 2480	0 00000	V	RFA
44	B200889	GW03027IT	06/04/92	URANIUM 233 234	0 188	PCI/L	J	0 2730	0 60000		RFA
45	B405586	GW00357IT	09/05/90	URANIUM 233 234	0 193	PCI/L	J	0 2240	0 00000	V	RFA
46	B200589	GW02322IT	01/28/92	URANIUM 233 234	0 199	PCI/L	J	0 2050	0 07150	A	RFA
47	B102289	GW01785IT	09/17/91	URANIUM 233 234	0 206	PCI/L	J	0 3280	0 60000		VFA
48	B400489	GW03482IT	09/15/92	URANIUM 233 234	0 209	PCI/L	J	0 2010	0 60000		RFA
49	B200889	GW01339IT	05/28/91	URANIUM 233 234	0 217	PCI/L	J	0 2130	0 60000		RFA
50	B200889	GW01018IT	03/22/91	URANIUM 233 234	0 223	PCI/L	J	0 2100	0 09700	A	RFA
51	B200889	GW01766IT	09/13/91	URANIUM 233 234	0 228	PCI/L	J	0 2020	0 60000		RFA
52	B102289	GW02482IT	02/28/92	URANIUM 233 234	0 230	PCI/L	J	0 2210	0 00000	A	VFA
53	B400189	GW03397IT	08/20/92	URANIUM 233 234	0 255	PCI/L	J	0 2300	0 20000		RFA

54	B200689	GW02497IT	02/20/92	URANIUM 233 234	0 259	PCI/L	J	0 2420	0 11100	A	RFA
55	B200589	GW03030IT	06/26/92	URANIUM 233 234	0 285	PCI/L	J	0 2100	0 06800	V	RFA
56	B102289	GW01331IT	05/23/91	URANIUM 233 234	0 287	PCI/L	J	0 2370	0 09600	V	VFA
57	B200889	GW03273IT	08/17/92	URANIUM 233 234	0 290	PCI/L	J	0 1600	0 20000		RFA
58	B200889	GW00248IT	08/16/90	URANIUM 233 234	0 292	PCI/L	J	0 1320	0 60000		RFA
59	B200689	GW00465IT	10/08/90	URANIUM 233 234	0 295	PCI/L	J	0 2400	0 13200	V	RFA
60	B200689	GW01780IT	09/17/91	URANIUM 233 234	0 306	PCI/L	J	0 2830	0 60000		RFA
61	B405789	GW01338IT	05/28/91	URANIUM 233 234	0 307	PCI/L	J	0 2440	0 60000		RFA
62	B200889	GW02351IT	02/03/92	URANIUM 233 234	0 311	PCI/L	J	0 3060	0 19900	A	RFA
63	B400189	GW03034IT	06/05/92	URANIUM 233 234	0 320	PCI/L	BJ	0 3000	0 21000	V	RFA
64	B200689	GW02980IT	05/29/92	URANIUM 233 234	0 330	PCI/L	BJ	0 2500	0 04000	V	RFA
65	B200589	GW00570IT	10/22/90	URANIUM 233 234	0 338	PCI/L	J	0 2490	0 09000	V	RFA
66	B200789	GW02554IT	03/03/92	URANIUM 233 234	0 341	PCI/L	J	0 2550	0 13100	A	RFA
67	B400389	GW01789IT	09/18/91	URANIUM 233 234	0 343	PCI/L	J	0 2590	0 60000		RFA
68	B405789	GW01784IT	09/17/91	URANIUM 233 234	0 350	PCI/L	J	0 2790	0 60000		RFA
69	B102389	GW02947IT	05/26/92	URANIUM 233 234	0 350	PCI/L	BJ	0 2400	0 08800	A	VFA
70	B102389	GW03224IT	08/11/92	URANIUM 233 234	0 350	PCI/L	U	0 3500	0 40000		VFA
71	B200789	GW03269IT	08/18/92	URANIUM 233 234	0 350	PCI/L	U	0 2700	0 40000		RFA
72	B400389	GW01057IT	04/03/91	URANIUM 233 234	0 374	PCI/L	J	0 2690	0 00000	A	RFA
73	B102289	GW02944IT	05/26/92	URANIUM 233 234	0 380	PCI/L	BJ	0 3400	0 09700	A	VFA
74	B102389	GW00106IT	07/27/90	URANIUM 233 234	0 417	PCI/L	J	0 2820	0 60000	V	VFA
75	B202589	GW02544IT	03/26/92	URANIUM 233 234	0 417	PCI/L	J	0 2900	0 09900	V	VFA
76	B405689	GW03418IT	08/18/92	URANIUM 233 234	0 420	PCI/L	J	0 3400	0 40000		RFA
77	B400389	GW02444IT	02/07/92	URANIUM 233 234	0 431	PCI/L	J	0 3030	0 14600	A	RFA
78	B202489	GW03773IT	10/19/92	URANIUM 233 234	0 440	PCI/L		0 4112	0 23291		VFA
79	B202489	GW00610IT	11/12/90	URANIUM 233 234	0 446	PCI/L	J	0 1370	0 60000	A	VFA
80	B202589	GW02967IT	05/29/92	URANIUM 233 234	0 465	PCI/L	BJ	0 4000	0 16000	V	VFA
81	B102389	GW00571IT	10/24/90	URANIUM 233 234	0 481	PCI/L	J	0 3290	0 00000	V	VFA
82	B200789	GW00466IT	10/08/90	URANIUM 233 234	0 494	PCI/L	J	0 3160	0 13700	V	RFA
83	B405689	GW02457IT	02/13/92	URANIUM 233 234	0 499	PCI/L	J	0 3330	0 15300	A	RFA
84	B405689	GW01329IT	05/29/91	URANIUM 233 234	0 527	PCI/L	J	0 3410	0 60000		RFA
85	B202489	GW01072IT	04/08/91	URANIUM 233 234	0 537	PCI/L	J	0 3290	0 13700	V	VFA
86	B102289	GW01055IT	03/28/91	URANIUM 233 234	0 539	PCI/L		0 3470	0 00000	A	VFA
87	B405689	GW03764IT	11/09/92	URANIUM 233 234	0 541	PCI/L	J	0 3490	0 60000		RFA
88	B405689	GW03036IT	06/29/92	URANIUM 233 234	0 558	PCI/L	J	0 3710	0 22800	V	RFA
89	B102289	GW00561IT	10/24/90	URANIUM 233 234	0 580	PCI/L		0 4400	0 00000	V	VFA
90	B405689	GW00036IT	07/19/90	URANIUM 233 234	0 639	PCI/L		0 1960	0 60000	V	RFA
91	B102289	GW03218IT	07/28/92	URANIUM 233 234	0 695	PCI/L	B	0 3700	0 03550		VFA
92	B202489	GW02535IT	02/27/92	URANIUM 233 234	0 736	PCI/L		0 3970	0 10400	A	VFA
93	B405689	GW00793IT	12/11/90	URANIUM 233 234	0 741	PCI/L		0 3750	0 60000	A	RFA
94	B202489	GW02119IT	12/11/91	URANIUM 233 234	0 763	PCI/L		0 4420	0 60000		VFA
95	B400389	GW03479IT	09/23/92	URANIUM 233 234	0 775	PCI/L		0 5328	0 28393		RFA
96	B405689	GW01783IT	09/17/91	URANIUM 233 234	0 780	PCI/L		0 3940	0 60000		RFA
97	B400389	GW00462IT	10/05/90	URANIUM 233 234	0 800	PCI/L		0 4180	0 10600	V	RFA
98	B202489	GW03272IT	07/27/92	URANIUM 233 234	0 829	PCI/L		0 4490	0 11700	A	VFA
99	B405586	55 86 08 01 89	08/01/89	URANIUM 233 234	0 880	PCI/L		0 6700	0 00000		RFA
100	B102389	GW03798IT	10/16/92	URANIUM 233 234	0 890	PCI/L		0 6416	0 25202		VFA
101	B302889	GW03400IT	08/13/92	URANIUM 233 234	0 940	PCI/L		0 3200	0 20000		VFA
102	B202589	GW01014IT	03/28/91	URANIUM 233 234	1 008	PCI/L		0 4680	0 07750	A	VFA
103	B401989	GW03066IT	06/24/92	URANIUM 233 234	1 095	PCI/L		0 4690	0 16200	A	COL
104	B401989	GW03339IT	08/06/92	URANIUM 233 234	1 100	PCI/L		0 3600	0 20000	A	COL
105	B302789	GW03759IT	10/22/92	URANIUM 233 234	1 106	PCI/L		0 6080	0 60000		VFA
106	B405489	GW02996IT	06/26/92	URANIUM 233 234	1 114	PCI/L		0 4890	0 10200	A	WCS
107	B202589	GW02099IT	12/09/91	URANIUM 233 234	1 162	PCI/L		0 5470	0 60000		VFA
108	B202489	G 2089 0614 02 0901	06/14/90	URANIUM 233 234	1 190	PCI/L		0 5300	0 60000		VFA
109	B302789	GW03052IT	06/09/92	URANIUM 233 234	1 200	PCI/L	B	0 4900	0 06800	V	VFA
110	B401989	GW00544IT	10/12/90	URANIUM 233 234	1 221	PCI/L		0 5030	0 00000	V	COL
111	B202589	GW01368IT	05/31/91	URANIUM 233 234	1 232	PCI/L		0 5250	0 14800	A	VFA
112	B302789	GW03466IT	09/17/92	URANIUM 233 234	1 233	PCI/L		0 6440	0 60000		VFA
113	B401989	GW02583IT	03/13/92	URANIUM 233 234	1 257	PCI/L		0 5320	0 10600	A	COL

114	B201589	GW03775IT	10/20/92	URANIUM 233 234	1 286	PCI/L		0 5220	0 60000			COL
115	B405489	GW03346IT	08/19/92	URANIUM 233 234	1 300	PCI/L		0 5200	0 30000			WCS
116	B401989	GW03748IT	10/21/92	URANIUM 233 234	1 305	PCI/L		0 5620	0 60000			COL
117	B203489	GW01061IT	04/05/91	URANIUM 233 234	1 324	PCI/L		0 6700	0 00000		V	WCS
118	B302789	GW00754IT	11/19/90	URANIUM 233 234	1 346	PCI/L		0 5600	0 60000			VFA
119	B401989	GW00028IT	07/24/90	URANIUM 233 234	1 346	PCI/L		0 5300	0 60000		A	COL
120	B202489	GW02970IT	06/03/92	URANIUM 233 234	1 400	PCI/L	B	0 5700	0 07400			VFA
121	B405489	GW01719IT	08/28/91	URANIUM 233 234	1 463	PCI/L		0 6260	0 60000			WCS
122	B201589	GW00495IT	10/24/90	URANIUM 233 234	1 490	PCI/L		0 5670	0 00000		A	COL
123	B201589	GW02534IT	02/28/92	URANIUM 233 234	1 624	PCI/L		0 6140	0 10600		A	COL
124	B405489	GW00777IT	12/07/90	URANIUM 233 234	1 626	PCI/L		0 6010	0 60000			WCS
125	B405489	GW01322IT	05/22/91	URANIUM 233 234	1 632	PCI/L		0 5980	0 17100		A	WCS
126	B405489	GW02451IT	02/10/92	URANIUM 233 234	1 665	PCI/L		0 5660	0 08700		A	WCS
127	B402689	GW00658IT	11/07/90	URANIUM 233 234	1 669	PCI/L		0 5960	0 60000		A	VFA
128	B401989	GW01745IT	09/06/91	URANIUM 233 234	1 694	PCI/L		0 6500	0 60000			COL
129	B202489	GW00376IT	09/12/90	URANIUM 233 234	1 758	PCI/L		0 6270	0 60000			VFA
130	B202589	GW00595IT	11/01/90	URANIUM 233 234	1 869	PCI/L		0 6380	0 60000			VFA
131	B302889	GW03749IT	11/06/92	URANIUM 233 234	1 900	PCI/L		0 5588	0 18229			VFA
132	B202589	GW03325IT	08/13/92	URANIUM 233 234	2 000	PCI/L		0 4200	0 20000			VFA
133	B202589	GW00230IT	08/20/90	URANIUM 233 234	2 013	PCI/L		0 3540	0 60000		V	VFA
134	B302889	GW03040IT	06/04/92	URANIUM 233 234	2 100	PCI/L	B	0 8600	0 17000			VFA
135	B202589	GW01753IT	09/10/91	URANIUM 233 234	2 133	PCI/L		0 6880	0 60000			VFA
136	B402689	GW02475IT	02/13/92	URANIUM 233 234	2 190	PCI/L		0 6720	0 09000		A	VFA
137	B302789	GW02587IT	03/16/92	URANIUM 233 234	2 193	PCI/L		0 6810	0 00000		A	VFA
138	B203189	GW00560IT	10/23/90	URANIUM 233 234	2 268	PCI/L		0 6810	0 00000		V	WCS
139	B203189	GW01781IT	09/18/91	URANIUM 233 234	2 319	PCI/L		0 7500	0 60000			WCS
140	B201589	GW02973IT	06/05/92	URANIUM 233 234	2 354	PCI/L		0 7260	0 13700		V	COL
141	B302889	GW01330IT	05/22/91	URANIUM 233 234	2 364	PCI/L		0 7200	0 09500		V	VFA
142	B402689	GW01716IT	08/27/91	URANIUM 233 234	2 377	PCI/L		0 8970	0 60000			VFA
143	B202589	GW03766IT	10/21/92	URANIUM 233 234	2 382	PCI/L		0 6640	0 60000			VFA
144	B205589	GW03776IT	10/20/92	URANIUM 233 234	2 453	PCI/L		0 7400	0 60000			COL
145	B305389	GW00776IT	12/05/90	URANIUM 233 234	2 471	PCI/L		0 7490	0 60000			WCS
146	B203289	GW01064IT	04/09/91	URANIUM 233 234	2 493	PCI/L		0 7780	0 14800		A	WCS
147	B402689	GW02948IT	05/28/92	URANIUM 233 234	2 500	PCI/L	B	0 9100	0 12000		V	VFA
148	B203189	GW00272IT	08/22/90	URANIUM 233 234	2 710	PCI/L		0 4100	0 60000			WCS
149	B302889	GW01022IT	03/22/91	URANIUM 233 234	2 745	PCI/L		0 7680	0 00000		A	VFA
150	B305389	GW03405IT	08/18/92	URANIUM 233 234	2 800	PCI/L		0 7000	0 50000			WCS
151	B203189	GW03793IT	11/04/92	URANIUM 233 234	2 900	PCI/L		0 6477	0 12273			WCS
152	B203289	GW00111IT	08/03/90	URANIUM 233 234	3 122	PCI/L		0 9790	0 60000		V	WCS
153	B302889	GW02503IT	02/22/92	URANIUM 233 234	3 196	PCI/L		0 9530	0 00000		A	VFA
154	B402689	GW00035IT	07/19/90	URANIUM 233 234	3 235	PCI/L	X	0 4620	0 60000		V	VFA
155	B302889	GW01736IT	08/30/91	URANIUM 233 234	3 353	PCI/L		0 9360	0 60000			VFA
156	B302989	GW03401IT	08/13/92	URANIUM 233 234	3 400	PCI/L		0 6500	0 20000			VFA
157	B302989	GW00778IT	12/05/90	URANIUM 233 234	3 442	PCI/L		0 8640	0 60000			VFA
158	B203489	GW00511IT	10/16/90	URANIUM 233 234	3 474	PCI/L		0 9920	0 60000		V	WCS
159	B203289	GW03270IT	08/11/92	URANIUM 233 234	3 500	PCI/L		0 7400	0 30000			WCS
160	B305389	GW01739IT	09/19/91	URANIUM 233 234	3 588	PCI/L		0 9210	0 60000			WCS
161	B203489	GW01772IT	09/13/91	URANIUM 233 234	3 699	PCI/L		1 0700	0 60000			WCS
162	B203289	GW03784IT	11/04/92	URANIUM 233 234	3 700	PCI/L		0 7509	0 13592			WCS
163	B203189	GW01068IT	04/05/91	URANIUM 233 234	3 776	PCI/L		1 2900	0 26200		A	WCS
164	B305389	GW03054IT	06/10/92	URANIUM 233 234	3 800	PCI/L	B	0 7500	0 07000		V	WCS
165	B203289	GW01782IT	09/17/91	URANIUM-233 234	3 813	PCI/L		0 9460	0 60000			WCS
166	B302989	GW01019IT	03/22/91	URANIUM 233 234	3 843	PCI/L		0 9580	0 13200		A	VFA
167	B203289	GW00528IT	10/16/90	URANIUM 233 234	3 887	PCI/L		1 0800	0 60000		A	WCS
168	B302789	GW01732IT	08/29/91	URANIUM 233 234	3 891	PCI/L		1 1200	0 60000			VFA
169	B305389	GW01308IT	05/22/91	URANIUM 233 234	3 957	PCI/L		1 0000	0 10000		A	WCS
170	B302989	GW03051IT	06/04/92	URANIUM 233 234	4 100	PCI/L	B	1 4000	0 36000			VFA
171	B305389	GW02595IT	03/16/92	URANIUM 233 234	4 131	PCI/L		0 9970	0 13100		A	WCS
172	B203489	GW00307IT	08/28/90	URANIUM 233 234	4 366	PCI/L		1 0600	0 60000		V	WCS
173	B302989	GW02492IT	02/21/92	URANIUM 233 234	4 458	PCI/L		1 1700	0 11900		A	VFA

174	B302989	GW03752IT	11/06/92	URANIUM 233 234	4 600	PCI/L		0 8294	0 09442		VFA
175	B203289	GW02498IT	02/21/92	URANIUM 233 234	4 692	PCI/L		1 1400	0 10400	A	WCS
176	B203489	GW02109IT	12/10/91	URANIUM 233 234	5 238	PCI/L		1 3000	0 60000		WCS
177	B302989	GW01672IT	08/29/91	URANIUM 233 234	5 326	PCI/L		1 2600	0 60000		VFA
178	B302989	GW00126IT	08/06/90	URANIUM 233 234	5 829	PCI/L		1 5900	0 60000	V	VFA
179	B304789	GW00096IT	08/02/90	URANIUM 233 234	7 961	PCI/L		1 5800	0 60000		WCS
180	B201189	GW01073IT	04/05/91	URANIUM 233 234	8 992	PCI/L		1 7500	0 17800	V	COL
181	B304789	GW00992IT	03/19/91	URANIUM 233 234	9 153	PCI/L		1 9800	0 00000	A	WCS
182	B201289	GW02486IT	02/25/92	URANIUM 233 234	9 166	PCI/L		1 8900	0 00000	A	COL
183	B201289	GW01758IT	09/11/91	URANIUM 233 234	10 320	PCI/L		2 2900	0 60000		COL
184	B304789	GW00773IT	12/04/90	URANIUM 233 234	10 520	PCI/L		1 9500	0 60000		WCS
185	B201189	GW02972IT	06/05/92	URANIUM 233 234	11 090	PCI/L		1 8900	0 08400	V	COL
186	B304889	GW01725IT	08/27/91	URANIUM 233 234	12 110	PCI/L		2 7800	0 60000		WCS
187	B304789	GW01731IT	08/29/91	URANIUM 233 234	12 340	PCI/L		2 5000	0 60000		WCS
188	B201189	GW01747IT	08/30/91	URANIUM 233 234	13 580	PCI/L		3 0000	0 60000		COL
189	B201289	GW01071IT	05/29/91	URANIUM 233 234	13 600	PCI/L		2 5300	0 21100	A	COL
190	B201189	GW00497IT	10/19/90	URANIUM 233 234	13 610	PCI/L		3 5100	0 26300	V	COL
191	B201289	G 1189 0614 02 1124	06/15/90	URANIUM 233 234	13 660	PCI/L		2 9100	0 60000		COL
192	B201189	GW02103IT	12/11/91	URANIUM 233 234	14 290	PCI/L		2 4600	0 60000		COL
193	B201189	GW03774IT	10/20/92	URANIUM 233 234	14 460	PCI/L		2 6600	0 60000		COL
194	B201289	GW00375IT	09/12/90	URANIUM 233 234	14 680	PCI/L		2 4400	0 60000		COL
195	B304889	GW00774IT	12/04/90	URANIUM 233 234	14 890	PCI/L		2 3700	0 60000		WCS
196	B201189	GW02522IT	02/27/92	URANIUM 233 234	15 220	PCI/L		2 7500	0 12200	A	COL
197	B304889	GW01321IT	05/21/91	URANIUM 233 234	15 590	PCI/L		2 6800	0 28600	V	WCS
198	B304889	GW03041IT	06/05/92	URANIUM 233 234	16 000	PCI/L	B	4 3000	0 52000		WCS
199	B304889	GW03403IT	08/19/92	URANIUM 233 234	16 000	PCI/L		2 4000	0 60000		WCS
200	B302089	GW00048IT	07/25/90	URANIUM 233 234	19 090	PCI/L	X	2 0200	0 60000		COL
201	B102389	GW01759IT	09/12/91	URANIUM 233 234	20 260	PCI/L		4 2100	0 60000		VFA
02	B205589	GW02974IT	06/05/92	URANIUM 233 234	127 900	PCI/L		16 4000	0 09300	V	COL
203	B205589	GW02523IT	02/27/92	URANIUM 233 234	128 800	PCI/L		17 4000	0 19600	A	COL
04	B305389	GW03761IT	10/23/92	URANIUM 233 234	133 800	PCI/L		19 4000	0 60000		WCS
05	B205589	GW01746IT	09/10/91	URANIUM 233 234	150 100	PCI/L		21 7000	0 60000		COL
06	B205589	GW01076IT	04/05/91	URANIUM 233 234	158 400	PCI/L		20 1000	0 16100	A	COL
07	B205589	GW00496IT	10/19/90	URANIUM 233 234	199 500	PCI/L		28 1000	0 18900	V	COL
08	B400189	GW03033IT	06/02/92	URANIUM 235	0 037	PCI/L	U	0 0400	0 20000	V	RFA
09	B102289	GW01331IT	05/23/91	URANIUM 235	0 030	PCI/L	J	0 0109	0 17400	V	VFA
10	B200889	GW00494IT	10/11/90	URANIUM 235	0 027	PCI/L	J	0 0385	0 60000		RFA
11	B302789	GW03759IT	10/22/92	URANIUM 235	0 024	PCI/L	J	0 0245	0 60000		VFA
12	B405689	GW03036IT	06/29/92	URANIUM 235	0 022	PCI/L	J	0 0198	0 16100	V	RFA
13	B400289	GW01334IT	05/23/91	URANIUM 235	0 021	PCI/L	J	0 0298	0 15500	V	RFA
14	B405789	GW03765IT	11/10/92	URANIUM 235	0 020	PCI/L	J	0 0205	0 60000		RFA
15	B400189	GW01045IT	03/28/91	URANIUM 235	0 019	PCI/L	J	0 0268	0 13900	A	RFA
16	B302789	GW03466IT	09/17/92	URANIUM 235	0 018	PCI/L	J	0 0209	0 60000		VFA
17	B401989	GW03066IT	06/24/92	URANIUM 235	0 018	PCI/L	J	0 0255	0 13200	A	COL
18	B405586	GW02993IT	06/11/92	URANIUM 235	0 018	PCI/L	J	0 0182	0 17400	V	RFA
19	B200689	GW01063IT	04/05/91	URANIUM 235	0 017	PCI/L	J	0 0349	0 18200	V	RFA
20	B200689	GW02497IT	02/20/92	URANIUM 235	0 017	PCI/L	J	0 0172	0 15800	A	RFA
21	B200889	GW01339IT	05/28/91	URANIUM-235	0 015	PCI/L	J	0 0152	0 60000		RFA
22	B302989	GW02492IT	02/21/92	URANIUM 235	0 014	PCI/L	J	0 0160	0 11900	A	VFA
23	B400489	GW02443IT	02/10/92	URANIUM 235	0 012	PCI/L	J	0 0137	0 10200	A	RFA
24	B400189	GW01750IT	09/17/91	URANIUM 235	0 011	PCI/L	J	0 0225	0 60000		RFA
25	B405586	GW01775IT	09/13/91	URANIUM 235	0 011	PCI/L	J	0 0128	0 60000		RFA
26	B305389	GW01739IT	09/19/91	URANIUM 235	0 011	PCI/L	J	0 0126	0 60000		WCS
27	B203189	GW01781IT	09/18/91	URANIUM 235	0 010	PCI/L	J	0 0204	0 60000		WCS
28	B400489	GW00461IT	10/05/90	URANIUM 235	0 010	PCI/L	J	0 0197	0 10400	V	RFA
29	B405489	GW00777IT	12/07/90	URANIUM 235	0 010	PCI/L	J	0 0194	0 60000		WCS
30	B405689	GW01329IT	05/29/91	URANIUM 235	0 010	PCI/L	J	0 1070	0 60000		RFA
31	B200589	GW01067IT	04/04/91	URANIUM 235	0 009	PCI/L	J	0 0188	0 09800	A	RFA
32	B102289	GW02482IT	02/28/92	URANIUM 235	0 009	PCI/L	J	0 0111	0 09750	A	VFA

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233	B400189	GW02456IT	02/13/92	URANIUM 235	0 009	PCI/L	J	0 0128	0 11700	A	RFA
234	B200789	GW01773IT	09/13/91	URANIUM 235	0 009	PCI/L	J	0 0177	0 60000		RFA
235	B400289	GW01047IT	03/28/91	URANIUM 235	0 009	PCI/L	J	0 0177	0 09200	V	RFA
236	B200589	GW00570IT	10/22/90	URANIUM 235	0 009	PCI/L	J	0 0174	0 09000	V	RFA
237	B200789	GW02981IT	06/02/92	URANIUM 235	0 008	PCI/L	J	0 0119	0 60000		RFA
238	B202489	GW00376IT	09/12/90	URANIUM 235	0 008	PCI/L	J	0 0111	0 60000		VFA
239	B405689	GW01783IT	09/17/91	URANIUM 235	0 007	PCI/L	J	0 0105	0 60000		RFA
240	B405586	GW02452IT	03/13/92	URANIUM 235	0 007	PCI/L	J	0 0107	0 09300	A	RFA
241	B202489	GW02970IT	06/03/92	URANIUM 235	0 007	PCI/L	U	0 0010	0 07400		VFA
242	B405789	GW02442IT	02/10/92	URANIUM 235	0 006	PCI/L	J	0 0120	0 00000	A	RFA
243	B200589	GW02322IT	01/28/92	URANIUM 235	0 006	PCI/L	J	0 0073	0 05050	A	RFA
244	B400289	GW01790IT	09/19/91	URANIUM 235	0 005	PCI/L	J	0 0204	0 60000		RFA
245	B102289	GW01055IT	03/28/91	URANIUM 235	0 005	PCI/L	J	0 0188	0 04900	A	VFA
246	B400389	GW02444IT	02/07/92	URANIUM 235	0 004	PCI/L	J	0 0080	0 00000	A	RFA
247	B102389	GW00106IT	07/27/90	URANIUM 235	0 000	PCI/L	J	0 1390	0 60000	V	VFA
248	B102389	GW00571IT	10/24/90	URANIUM 235	0 000	PCI/L	J	0 1620	0 00000	V	VFA
249	B102389	GW01070IT	04/04/91	URANIUM 235	0 000	PCI/L	J	0 1370	0 00000	A	VFA
250	B102389	GW02485IT	02/13/92	URANIUM 235	0 000	PCI/L	J	0 1420	0 00000	A	VFA
251	B102389	GW02947IT	05/26/92	URANIUM 235	0 000	PCI/L	U	0 2800	0 03400	A	VFA
252	B200589	GW01774IT	09/19/91	URANIUM 235	0 000	PCI/L	J	0 1660	0 60000		RFA
253	B200689	GW02042IT	11/18/91	URANIUM 235	0 000	PCI/L	J	0 1450	0 60000		RFA
254	B200689	GW03274IT	08/10/92	URANIUM 235	0 000	PCI/L	U	0 0510	0 20000	A	RFA
255	B200789	GW03269IT	08/18/92	URANIUM 235	0 000	PCI/L	U	0 1100	0 40000		RFA
256	B201589	GW00495IT	10/24/90	URANIUM 235	0 000	PCI/L	J	0 1440	0 00000	A	COL
257	B202489	GW01072IT	04/08/91	URANIUM 235	0 000	PCI/L	J	0 1390	0 00000	V	VFA
258	B202589	GW02544IT	03/26/92	URANIUM 235	0 000	PCI/L	J	0 1420	0 00000	V	VFA
259	B203289	GW00528IT	10/16/90	URANIUM 235	0 000	PCI/L	J	0 1730	0 60000	A	WCS
260	B203289	GW01782IT	09/17/91	URANIUM 235	0 000	PCI/L	J	0 1330	0 60000		WCS
261	B304789	GW00992IT	03/19/91	URANIUM 235	0 000	PCI/L	J	0 1930	0 00000	A	WCS
262	B305389	GW03405IT	08/18/92	URANIUM 235	0 000	PCI/L	U	0 2100	0 50000		WCS
263	B400189	GW00722IT	11/15/90	URANIUM 235	0 000	PCI/L	J	0 1440	0 60000	V	RFA
264	B400189	GW01341IT	06/17/91	URANIUM 235	0 000	PCI/L	J	0 1350	0 60000		RFA
265	B400289	GW00397IT	09/14/90	URANIUM 235	0 000	PCI/L	J	0 1670	0 00000	V	RFA
266	B400389	GW00462IT	10/05/90	URANIUM 235	0 000	PCI/L	J	0 1520	0 00000	V	RFA
267	B402689	GW01716IT	08/27/91	URANIUM 235	0 000	PCI/L	J	0 2170	0 60000		VFA
268	B405489	GW02451IT	02/10/92	URANIUM 235	0 000	PCI/L	J	0 1250	0 00000	A	WCS
269	B405489	GW02996IT	06/26/92	URANIUM 235	0 000	PCI/L	J	0 1460	0 00000	A	WCS
270	B405586	GW01048IT	03/28/91	URANIUM 235	0 000	PCI/L	J	0 1330	0 00000	V	RFA
271	B405689	GW03764IT	11/09/92	URANIUM 235	0 000	PCI/L	J	0 1620	0 60000		RFA
272	B405789	GW00728IT	11/16/90	URANIUM 235	0 000	PCI/L	J	0 0274	0 60000		RFA
273	B405789	GW01338IT	05/28/91	URANIUM-235	0 000	PCI/L	J	0 1360	0 60000		RFA
274	B405789	GW03419IT	09/22/92	URANIUM 235	0 000	PCI/L	J	0 0748	0 60000		RFA
275	B200689	GW00285IT	08/23/90	URANIUM 235	0 005	PCI/L	J	0 0212	0 60000		RFA
276	B405586	GW01316IT	05/17/91	URANIUM 235	0 007	PCI/L	J	0 0196	0 00000	A	RFA
277	B200589	GW03030IT	06/26/92	URANIUM 235	0 008	PCI/L	J	0 0946	0 12300	V	RFA
278	B102289	GW01785IT	09/17/91	URANIUM 235	0 012	PCI/L	J	0 1720	0 60000		VFA
279	B400189	GW03034IT	06/05/92	URANIUM-235	0 012	PCI/L	U	0 1200	0 21000	V	RFA
280	B302789	GW01732IT	08/29/91	URANIUM 235	0 012	PCI/L	J	0 1410	0 60000		VFA
281	B405689	GW00036IT	07/19/90	URANIUM 235	0 013	PCI/L	J	0 0261	0 60000	V	RFA
282	B200889	GW03027IT	06/04/92	URANIUM 235	0 014	PCI/L	J	0 0108	0 60000		RFA
283	B200589	GW03471IT	09/23/92	URANIUM 235	0 018	PCI/L	J	0 0986	0 60000		RFA
284	B102289	GW02944IT	05/26/92	URANIUM 235	0 020	PCI/L	U	0 1800	0 05600	A	VFA
285	B200889	GW03273IT	08/17/92	URANIUM 235	0 020	PCI/L	U	0 0780	0 10000		RFA
286	B400289	GW00762IT	11/29/90	URANIUM 235	0 020	PCI/L	J	0 1000	0 60000		RFA
287	B202589	GW01753IT	09/10/91	URANIUM 235	0 021	PCI/L	J	0 1210	0 60000		VFA
288	B102289	GW00561IT	10/24/90	URANIUM 235	0 022	PCI/L	J	0 1710	0 05450	V	VFA
289	B400189	GW03397IT	08/20/92	URANIUM 235	0 023	PCI/L	U	0 0910	0 25000		RFA
290	B202589	GW03325IT	08/13/92	URANIUM 235	0 024	PCI/L	U	0 0950	0 20000		VFA
291	B202589	GW00595IT	11/01/90	URANIUM 235	0 024	PCI/L	J	0 1350	0 60000		VFA
292	B200889	GW00248IT	08/16/90	URANIUM 235	0 024	PCI/L	J	0 0597	0 60000		RFA

'93	B200689	GW00465IT	10/08/90	URANIUM 235	0 027	PCI/L	J	0 0928	0 13200	V	RFA
'94	B201589	GW03775IT	10/20/92	URANIUM 235	0 028	PCI/L	J	0 0953	0 60000		COL
'95	B202489	GW00610IT	11/12/90	URANIUM 235	0 028	PCI/L	J	0 0330	0 60000	A	VFA
'96	B305389	GW03054IT	06/10/92	URANIUM 235	0 032	PCI/L	J	0 0640	0 02600	V	WCS
'97	B205589	GW03776IT	10/20/92	URANIUM 235	0 035	PCI/L	J	0 0928	0 60000		COL
98	B400489	GW03482IT	09/15/92	URANIUM 235	0 037	PCI/L	J	0 1170	0 60000		RFA
99	B200789	GW00466IT	10/08/90	URANIUM 235	0 037	PCI/L	J	0 0951	0 09700	V	RFA
00	B200789	GW02554IT	03/03/92	URANIUM 235	0 037	PCI/L	J	0 0894	0 09300	A	RFA
01	B400389	GW01057IT	04/03/91	URANIUM 235	0 037	PCI/L	J	0 0956	0 09800	A	RFA
02	B200789	GW00271IT	08/20/90	URANIUM 235	0 039	PCI/L	J	0 0390	0 60000	V	RFA
03	B405789	GW01784IT	09/17/91	URANIUM 235	0 039	PCI/L	J	0 1070	0 60000		RFA
04	B202489	G 2089 0614 02 0901	06/14/90	URANIUM 235	0 040	PCI/L		0 1000	0 60000		VFA
05	B302789	GW02587IT	03/16/92	URANIUM 235	0 041	PCI/L	J	0 0899	0 00000	A	VFA
06	B302889	GW02503IT	02/22/92	URANIUM 235	0 043	PCI/L	J	0 1160	0 11900	A	VFA
07	B405689	GW00793IT	12/11/90	URANIUM 235	0 044	PCI/L	J	0 0884	0 60000	A	RFA
08	B200789	GW01059IT	04/04/91	URANIUM 235	0 045	PCI/L	J	0 1140	0 11600	A	RFA
09	B302989	GW01019IT	03/22/91	URANIUM 235	0 045	PCI/L	J	0 0900	0 00000	A	VFA
10	B302889	GW01330IT	05/22/91	URANIUM 235	0 046	PCI/L	J	0 0915	0 00000	V	VFA
11	B203289	GW02498IT	02/21/92	URANIUM 235	0 046	PCI/L	J	0 1000	0 00000	A	WCS
12	B200889	GW01018IT	03/22/91	URANIUM 235	0 046	PCI/L	J	0 0931	0 00000	A	RFA
13	B201589	GW02973IT	06/05/92	URANIUM 235	0 047	PCI/L	J	0 0932	0 00000	V	COL
14	B402689	GW00658IT	11/07/90	URANIUM 235	0 047	PCI/L	J	0 0933	0 60000	A	VFA
15	B401989	GW00028IT	07/24/90	URANIUM 235	0 047	PCI/L	J	0 0935	0 60000	A	COL
16	B401989	GW00544IT	10/12/90	URANIUM 235	0 047	PCI/L	J	0 0941	0 00000	V	COL
17	B405489	GW01322IT	05/22/91	URANIUM 235	0 047	PCI/L	J	0 0950	0 00000	A	WCS
18	B203489	GW00307IT	08/28/90	URANIUM 235	0 048	PCI/L	J	0 0953	0 60000	V	WCS
19	B202489	GW02119IT	12/11/91	URANIUM 235	0 048	PCI/L	J	0 1220	0 60000		VFA
'0	B302789	GW03052IT	06/09/92	URANIUM 235	0 048	PCI/L	J	0 0960	0 04000	V	VFA
1	B202489	GW02535IT	02/27/92	URANIUM 235	0 050	PCI/L	J	0 0997	0 00000	A	VFA
2	B405489	GW03346IT	08/19/92	URANIUM 235	0 050	PCI/L	U	0 1000	0 40000		WCS
.3	B302889	GW03400IT	08/13/92	URANIUM 235	0 051	PCI/L	U	0 0510	0 20000		VFA
4	B400289	GW03468IT	09/08/92	URANIUM 235	0 052	PCI/L	J	0 0934	0 60000		RFA
.5	B202589	GW01014IT	03/28/91	URANIUM 235	0 053	PCI/L	J	0 1530	0 10900	A	VFA
6	B203189	GW01068IT	04/05/91	URANIUM 235	0 053	PCI/L	J	0 1840	0 26200	A	WCS
7	B203189	GW00272IT	08/22/90	URANIUM 235	0 054	PCI/L	J	0 0467	0 60000		WCS
8	B401989	GW03748IT	10/21/92	URANIUM 235	0 055	PCI/L	J	0 1100	0 60000		COL
'9	B102289	GW03218IT	07/28/92	URANIUM 235	0 057	PCI/L	BJ	0 1100	0 02500		VFA
0	B200889	GW02351IT	02/03/92	URANIUM 235	0 057	PCI/L	J	0 1360	0 14100	A	RFA
1	B405789	GW00161IT	08/16/90	URANIUM 235	0 062	PCI/L	J	0 0622	0 60000		RFA
2	B203289	GW00111IT	08/03/90	URANIUM 235	0 063	PCI/L	J	0 1250	0 60000	V	WCS
3	B405586	GW00357IT	09/05/90	URANIUM 235	0 064	PCI/L	J	0 1290	0 00000	V	RFA
4	B102389	GW03224IT	08/11/92	URANIUM 235	0 070	PCI/L	U	0 1400	0 50000		VFA
	B200889	GW01766IT	09/13/91	URANIUM 235	0 073	PCI/L	J	0 1160	0 60000		RFA
	B302989	GW00126IT	08/06/90	URANIUM 235	0 078	PCI/L	J	0 1560	0 60000	V	VFA
	B203489	GW01061IT	04/05/91	URANIUM 235	0 078	PCI/L	J	0 1560	0 00000	V	WCS
3	B400389	GW01789IT	09/18/91	URANIUM 235	0 079	PCI/L	J	0 1290	0 60000		RFA
)	B401989	GW02583IT	03/13/92	URANIUM 235	0 081	PCI/L	J	0 1470	0 14900	A	COL
)	B305389	GW02595IT	03/16/92	URANIUM 235	0 082	PCI/L	J	0 1270	0 09300	A	WCS
1	B305389	GW00776IT	12/05/90	URANIUM 235	0 084	PCI/L	J	0 1330	0 60000		WCS
2	B202589	GW00230IT	08/20/90	URANIUM 235	0 084	PCI/L	J	0 0602	0 60000	V	VFA
3	B203189	GW00560IT	10/23/90	URANIUM 235	0 086	PCI/L	J	0 1210	0 00000	V	WCS
4	B400489	GW01778IT	09/16/91	URANIUM 235	0 086	PCI/L	J	0 1220	0 60000		RFA
5	B402689	GW02475IT	02/13/92	URANIUM 235	0 086	PCI/L	J	0 1220	0 00000	A	VFA
6	B401989	GW03339IT	08/06/92	URANIUM 235	0 087	PCI/L	U	0 1200	0 20000	A	COL
7	B302889	GW01022IT	03/22/91	URANIUM 235	0 087	PCI/L	J	0 1240	0 00000	A	VFA
8	B200689	GW02980IT	05/29/92	URANIUM 235	0 089	PCI/L	J	0 1300	0 06700	V	RFA
9	B201589	GW02534IT	02/28/92	URANIUM 235	0 092	PCI/L	J	0 1460	0 10600	A	COL
0	B405689	GW02457IT	02/13/92	URANIUM 235	0 099	PCI/L	J	0 1470	0 00000	A	RFA
1	B405586	GW03343IT	08/18/92	URANIUM 235	0 100	PCI/L	U	0 1000	0 40000		RFA
2	B202589	GW01368IT	05/31/91	URANIUM 235	0 100	PCI/L	J	0 1750	0 00000	A	VFA

353	B203289	GW01064IT	04/09/91	URANIUM 235	0 101	PCI/L	J	0 1430	0 00000	A	WCS
354	B401989	GW01745IT	09/06/91	URANIUM 235	0 101	PCI/L	J	0 1560	0 60000		COL
355	B302889	GW01736IT	08/30/91	URANIUM 235	0 103	PCI/L	J	0 1470	0 60000		VFA
356	B202489	GW03272IT	07/27/92	URANIUM 235	0 108	PCI/L	J	0 1600	0 00000	A	VFA
357	B302989	GW03401IT	08/13/92	URANIUM 235	0 110	PCI/L	U	0 0870	0 20000		VFA
358	B402689	GW02948IT	05/28/92	URANIUM 235	0 110	PCI/L	J	0 1500	0 04400	V	VFA
359	B400289	GW02458IT	02/13/92	URANIUM 235	0 111	PCI/L	J	0 1650	0 00000	A	RFA
360	B302889	GW03749IT	11/06/92	URANIUM 235	0 111	PCI/L	U	0 1139	0 11119		VFA
361	B202589	GW02099IT	12/09/91	URANIUM 235	0 117	PCI/L	J	0 1670	0 60000		VFA
362	B202589	GW02967IT	05/29/92	URANIUM 235	0 118	PCI/L	U	0 1800	0 12500	V	VFA
363	B203289	GW03270IT	08/11/92	URANIUM 235	0 120	PCI/L	U	0 1700	0 30000		WCS
364	B203289	GW03784IT	11/04/92	URANIUM 235	0 124	PCI/L	U	0 0000	0 12446		WCS
365	B400489	GW01058IT	04/03/91	URANIUM 235	0 126	PCI/L	J	0 1700	0 14200	A	RFA
366	B200589	GW03790IT	11/05/92	URANIUM 235	0 127	PCI/L	U	0 0771	0 12734		RFA
367	B304789	GW01731IT	08/29/91	URANIUM 235	0 135	PCI/L	J	0 1910	0 60000		WCS
368	B402689	GW00035IT	07/19/90	URANIUM 235	0 138	PCI/L	J	0 0850	0 60000	V	VFA
369	B203189	GW03793IT	11/04/92	URANIUM 235	0 140	PCI/L		0 1383	0 09543		WCS
370	B302889	GW03040IT	06/04/92	URANIUM 235	0 150	PCI/L	J	0 2300	0 11000		VFA
371	B302789	GW00754IT	11/19/90	URANIUM 235	0 157	PCI/L	J	0 1820	0 60000		VFA
372	B202589	GW03766IT	10/21/92	URANIUM 235	0 158	PCI/L	J	0 1010	0 60000		VFA
373	B200689	GW01780IT	09/17/91	URANIUM 235	0 159	PCI/L	J	0 2650	0 60000		RFA
374	B302989	GW01672IT	08/29/91	URANIUM 235	0 161	PCI/L	J	0 2910	0 60000		VFA
375	B405489	GW01719IT	08/28/91	URANIUM 235	0 167	PCI/L	J	0 2090	0 60000		WCS
376	B304789	GW00096IT	08/02/90	URANIUM 235	0 171	PCI/L	J	0 1930	0 60000		WCS
377	B203489	GW01772IT	09/13/91	URANIUM 235	0 178	PCI/L	J	0 2120	0 60000		WCS
378	B302989	GW03051IT	06/04/92	URANIUM 235	0 180	PCI/L	U	0 3300	0 39000		VFA
379	B304889	GW03041IT	06/05/92	URANIUM 235	0 180	PCI/L	U	0 4100	0 29000		WCS
380	B304889	GW01725IT	08/27/91	URANIUM 235	0 194	PCI/L	J	0 3230	0 60000		WCS
381	B302989	GW03752IT	11/06/92	URANIUM 235	0 200	PCI/L		0 1681	0 12142		VFA
382	B405689	GW03418IT	08/18/92	URANIUM 235	0 200	PCI/L	U	0 2100	0 40000		RFA
383	B203489	GW00511IT	10/16/90	URANIUM 235	0 202	PCI/L	J	0 2280	0 60000	V	WCS
384	B202489	GW03773IT	10/19/92	URANIUM 235	0 204	PCI/L	U	0 1477	0 20377		VFA
385	B201289	GW01758IT	09/11/91	URANIUM 235	0 212	PCI/L	J	0 2600	0 60000		COL
386	B102389	GW03798IT	10/16/92	URANIUM 235	0 220	PCI/L	U	0 0000	0 22049		VFA
387	B203489	GW02109IT	12/10/91	URANIUM 235	0 224	PCI/L	J	0 2360	0 60000		WCS
388	B305389	GW01308IT	05/22/91	URANIUM 235	0 239	PCI/L	J	0 2160	0 00000	A	WCS
389	B400389	GW03479IT	09/23/92	URANIUM 235	0 255	PCI/L	U	0 2807	0 25465		RFA
390	B201289	GW02486IT	02/25/92	URANIUM 235	0 284	PCI/L	J	0 2610	0 00000	A	COL
391	B304889	GW00774IT	12/04/90	URANIUM 235	0 285	PCI/L	J	0 2180	0 60000		WCS
392	B302989	GW00778IT	12/05/90	URANIUM 235	0 291	PCI/L	J	0 2230	0 60000		VFA
393	B304789	GW00773IT	12/04/90	URANIUM 235	0 332	PCI/L	J	0 2620	0 60000		WCS
394	B201289	GW00375IT	09/12/90	URANIUM 235	0 366	PCI/L	J	0 2630	0 60000		COL
395	B405586	55 86 08 01 89	08/01/89	URANIUM 235	0 380	PCI/L		0 4400	0 00000		RFA
396	B304889	GW01321IT	05/21/91	URANIUM 235	0 405	PCI/L	J	0 2990	0 10800	V	WCS
397	B201189	GW02103IT	12/11/91	URANIUM 235	0 417	PCI/L	J	0 3040	0 60000		COL
398	B201189	GW03774IT	10/20/92	URANIUM 235	0 453	PCI/L	J	0 3390	0 60000		COL
399	B201189	GW01073IT	04/05/91	URANIUM 235	0 454	PCI/L	J	0 3190	0 20500	V	COL
400	B201189	GW02522IT	02/27/92	URANIUM 235	0 504	PCI/L	J	0 3590	0 17300	A	COL
401	B201189	GW00497IT	10/19/90	URANIUM 235	0 505	PCI/L	J	0 5120	0 00000	V	COL
02	B201289	G 1189 0614 02 1124	06/15/90	URANIUM 235	0 510	PCI/L		0 3100	0 60000		COL
03	B201189	GW02972IT	06/05/92	URANIUM 235	0 524	PCI/L	J	0 2980	0 00000	V	COL
404	B201189	GW01747IT	08/30/91	URANIUM 235	0 526	PCI/L	J	0 4430	0 60000		COL
05	B302089	GW00048IT	07/25/90	URANIUM 235	0 657	PCI/L	X	0 1760	0 60000		COL
06	B304889	GW03403IT	08/19/92	URANIUM 235	0 710	PCI/L		0 4200	0 40000		WCS
07	B201289	GW01071IT	05/29/91	URANIUM 235	0 815	PCI/L		0 4510	0 00000	A	COL
408	B102389	GW01759IT	09/12/91	URANIUM 235	0 854	PCI/L		0 5950	0 60000		VFA
09	B205589	GW01746IT	09/10/91	URANIUM 235	2 841	PCI/L		0 9640	0 60000		COL
10	B205589	GW02523IT	02/27/92	URANIUM 235	3 124	PCI/L		0 9190	0 16000	A	COL
411	B305389	GW03761IT	10/23/92	URANIUM 235	3 208	PCI/L		1 0300	0 60000		WCS
412	B205589	GW02974IT	06/05/92	URANIUM 235	3 338	PCI/L		0 8740	0 00000	V	COL

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413	B205589	GW01076IT	04/05/91	URANIUM 235	4 729	PCI/L		1 0900	0 00000	A	COL
414	B205589	GW00496IT	10/19/90	URANIUM 235	4 803	PCI/L		1 2900	0 00000	V	COL
415	B200889	GW02351IT	02/03/92	URANIUM 238	0 038	PCI/L	J	0 0291	0 24400	A	RFA
416	B400189	GW02456IT	02/13/92	URANIUM 238	0 032	PCI/L	J	0 0242	0 20300	A	RFA
417	B405586	GW01775IT	09/13/91	URANIUM 238	0 022	PCI/L	J	0 0182	0 60000		RFA
418	B400289	GW01790IT	09/19/91	URANIUM 238	0 020	PCI/L	J	0 0354	0 60000		RFA
419	B400289	GW02458IT	02/13/92	URANIUM 238	0 019	PCI/L	J	0 0187	0 17100	A	RFA
420	B400289	GW01334IT	05/23/91	URANIUM 238	0 011	PCI/L	J	0 0210	0 10900	V	RFA
421	B400289	GW00762IT	11/29/90	URANIUM 238	0 005	PCI/L	J	0 0404	0 60000		RFA
422	B102389	GW01070IT	04/04/91	URANIUM 238	0 000	PCI/L	J	0 1370	0 00000	A	VFA
423	B200589	GW01067IT	04/04/91	URANIUM 238	0 000	PCI/L	J	0 1410	0 00000	A	RFA
424	B200789	GW03269IT	08/18/92	URANIUM 238	0 000	PCI/L	U	0 0890	0 30000		RFA
425	B400289	GW00397IT	09/14/90	URANIUM 238	0 000	PCI/L	J	0 1670	0 00000	V	RFA
426	B400189	GW01750IT	09/17/91	URANIUM 238	0 022	PCI/L	J	0 1190	0 60000		RFA
427	B405789	GW01338IT	05/28/91	URANIUM 238	0 024	PCI/L	J	0 0927	0 60000		RFA
428	B400289	GW01047IT	03/28/91	URANIUM 238	0 026	PCI/L	J	0 0917	0 13000	V	RFA
429	B400489	GW01058IT	04/03/91	URANIUM 238	0 029	PCI/L	J	0 1010	0 14200	A	RFA
430	B200789	GW01059IT	04/04/91	URANIUM 238	0 033	PCI/L	J	0 1160	0 16400	A	RFA
431	B200689	GW02042IT	11/18/91	URANIUM 238	0 039	PCI/L	J	0 0984	0 60000		RFA
432	B405689	GW03418IT	08/18/92	URANIUM 238	0 042	PCI/L	U	0 1700	0 30000		RFA
433	B200789	GW02981IT	06/02/92	URANIUM 238	0 044	PCI/L	J	0 1060	0 60000		RFA
434	B200789	GW01773IT	09/13/91	URANIUM 238	0 044	PCI/L	J	0 0883	0 60000		RFA
435	B400189	GW03397IT	08/20/92	URANIUM 238	0 047	PCI/L	U	0 1500	0 20000		RFA
436	B102389	GW02485IT	02/13/92	URANIUM 238	0 047	PCI/L	J	0 0947	0 00000	A	VFA
437	B202489	GW02119IT	12/11/91	URANIUM 238	0 048	PCI/L	J	0 1220	0 60000		VFA
438	B400189	GW00722IT	11/15/90	URANIUM 238	0 048	PCI/L	J	0 0959	0 60000	V	RFA
39	B400489	GW02443IT	02/10/92	URANIUM 238	0 049	PCI/L	J	0 0985	0 00000	A	RFA
440	B405586	GW01316IT	05/17/91	URANIUM 238	0 050	PCI/L	J	0 0476	0 04400	A	RFA
441	B200889	GW03027IT	06/04/92	URANIUM 238	0 052	PCI/L	J	0 1360	0 60000		RFA
442	B200589	GW01774IT	09/19/91	URANIUM 238	0 055	PCI/L	J	0 1110	0 60000		RFA
443	B405586	GW00357IT	09/05/90	URANIUM 238	0 064	PCI/L	J	0 1290	0 00000	V	RFA
444	B200789	GW00271IT	08/20/90	URANIUM 238	0 068	PCI/L	J	0 0646	0 60000	V	RFA
445	B400389	GW01789IT	09/18/91	URANIUM 238	0 076	PCI/L	J	0 1290	0 60000		RFA
446	B200689	GW00465IT	10/08/90	URANIUM 238	0 080	PCI/L	J	0 1280	0 09300	V	RFA
447	B405789	GW00728IT	11/16/90	URANIUM 238	0 082	PCI/L	J	0 0553	0 60000		RFA
448	B405586	GW03343IT	08/18/92	URANIUM 238	0 084	PCI/L	U	0 0850	0 30000		RFA
449	B200689	GW00285IT	08/23/90	URANIUM 238	0 085	PCI/L	J	0 0609	0 60000		RFA
50	B405586	GW01048IT	03/28/91	URANIUM 238	0 089	PCI/L	J	0 1260	0 00000	V	RFA
51	B405586	GW02452IT	03/13/92	URANIUM 238	0 096	PCI/L	J	0 1650	0 08500	A	RFA
52	B200889	GW03273IT	08/17/92	URANIUM 238	0 097	PCI/L	U	0 0660	0 10000		RFA
53	B200689	GW02497IT	02/20/92	URANIUM 238	0 107	PCI/L	J	0 1520	0 00000	A	RFA
54	B405586	GW02993IT	06/11/92	URANIUM 238	0 118	PCI/L	J	0 2270	0 10000	V	RFA
55	B400189	GW01045IT	03/28/91	URANIUM 238	0 123	PCI/L	J	0 1660	0 13900	A	RFA
56	B400189	GW01341IT	06/17/91	URANIUM 238	0 128	PCI/L	J	0 1570	0 60000		RFA
57	B200789	GW02554IT	03/03/92	URANIUM 238	0 130	PCI/L	J	0 1550	0 00000	A	RFA
8	B200889	GW01018IT	03/22/91	URANIUM 238	0 130	PCI/L	J	0 1630	0 09700	A	RFA
59	B400389	GW02444IT	02/07/92	URANIUM 238	0 133	PCI/L	J	0 1740	0 14600	A	RFA
60	B102289	GW01331IT	05/23/91	URANIUM 238	0 138	PCI/L	J	0 1360	0 12850	V	VFA
61	B102389	GW00106IT	07/27/90	URANIUM 238	0 139	PCI/L	J	0 1610	0 60000	V	VFA
62	B400189	GW03033IT	06/02/92	URANIUM 238	0 140	PCI/L	J	0 1900	0 05700	V	RFA
63	B400389	GW01057IT	04/03/91	URANIUM 238	0 140	PCI/L	J	0 1630	0 00000	A	RFA
64	B405789	GW02442IT	02/10/92	URANIUM 238	0 144	PCI/L	J	0 2130	0 00000	A	RFA
65	B400489	GW00461IT	10/05/90	URANIUM 238	0 148	PCI/L	J	0 1710	0 00000	V	RFA
66	B405789	GW00161IT	08/16/90	URANIUM 238	0 155	PCI/L	J	0 0991	0 60000		RFA
67	B200789	GW00466IT	10/08/90	URANIUM 238	0 158	PCI/L	J	0 1900	0 16800	V	RFA
68	B102289	GW00561IT	10/24/90	URANIUM 238	0 159	PCI/L	J	0 1140	0 00000	V	VFA
69	B405789	GW01784IT	09/17/91	URANIUM 238	0 168	PCI/L	J	0 2130	0 60000		RFA
70	B200589	GW02322IT	01/28/92	URANIUM 238	0 173	PCI/L	J	0 1830	0 08800	A	RFA
71	B200689	GW01063IT	04/05/91	URANIUM 238	0 174	PCI/L	J	0 2480	0 00000	V	RFA

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472	B405689	GW03036IT	06/29/92	URANIUM 238	0 197	PCI/L	J	0 2210	0 16100	V	RFA
473	B102289	GW01785IT	09/17/91	URANIUM 238	0 201	PCI/L	J	0 3680	0 60000		VFA
474	B102289	GW01055IT	03/28/91	URANIUM 238	0 211	PCI/L	J	0 1630	0 00000	A	VFA
475	B400489	GW01778IT	09/16/91	URANIUM 238	0 215	PCI/L	J	0 1940	0 60000		RFA
476	B200589	GW03030IT	06/26/92	URANIUM 238	0 226	PCI/L	J	0 2310	0 12100	V	RFA
477	B200689	GW02980IT	05/29/92	URANIUM 238	0 230	PCI/L	J	0 2100	0 06700	V	RFA
478	B200889	GW00248IT	08/16/90	URANIUM 238	0 231	PCI/L	J	0 1080	0 60000		RFA
479	B400189	GW03034IT	06/05/92	URANIUM 238	0 250	PCI/L	J	0 2700	0 21000	V	RFA
480	B102289	GW02944IT	05/26/92	URANIUM 238	0 265	PCI/L	BJ	0 2900	0 04300	A	VFA
481	B200889	GW01339IT	05/28/91	URANIUM 238	0 268	PCI/L	J	0 2340	0 60000		RFA
482	B405689	GW01783IT	09/17/91	URANIUM 238	0 274	PCI/L	J	0 2300	0 60000		RFA
483	B405689	GW00793IT	12/11/90	URANIUM 238	0 291	PCI/L	J	0 2370	0 60000	A	RFA
484	B102389	GW00571IT	10/24/90	URANIUM 238	0 315	PCI/L	J	0 2670	0 11200	V	VFA
485	B200889	GW01766IT	09/13/91	URANIUM 238	0 317	PCI/L	J	0 2330	0 60000		RFA
486	B102289	GW02482IT	02/28/92	URANIUM 238	0 318	PCI/L	J	0 1970	0 04650	A	VFA
487	B202489	GW00610IT	11/12/90	URANIUM 238	0 323	PCI/L	J	0 1240	0 60000	A	VFA
488	B200889	GW00494IT	10/11/90	URANIUM 238	0 325	PCI/L	J	0 3070	0 60000		RFA
489	B200589	GW00570IT	10/22/90	URANIUM 238	0 329	PCI/L	J	0 2500	0 12800	V	RFA
490	B102389	GW03224IT	08/11/92	URANIUM 238	0 350	PCI/L	U	0 2400	0 40000		VFA
491	B200689	GW01780IT	09/17/91	URANIUM 238	0 352	PCI/L	J	0 3310	0 60000		RFA
492	B405689	GW00036IT	07/19/90	URANIUM 238	0 352	PCI/L	J	0 1400	0 60000	V	RFA
493	B203489	GW01061IT	04/05/91	URANIUM 238	0 389	PCI/L	J	0 3530	0 00000	V	WCS
494	B405689	GW02457IT	02/13/92	URANIUM 238	0 396	PCI/L	J	0 2960	0 15300	A	RFA
495	B405586	55 86 08 01 89	08/01/89	URANIUM 238	0 500	PCI/L		0 5000	0 00000		RFA
496	B400389	GW00462IT	10/05/90	URANIUM 238	0 507	PCI/L	J	0 3270	0 00000	V	RFA
497	B102289	GW03218IT	07/28/92	URANIUM 238	0 510	PCI/L	B	0 3500	0 06500		VFA
498	B401989	GW00544IT	10/12/90	URANIUM 238	0 517	PCI/L	J	0 3180	0 00000	V	COL
499	B202589	GW02544IT	03/26/92	URANIUM 238	0 560	PCI/L	J	0 3360	0 09900	V	VFA
500	B405489	GW02996IT	06/26/92	URANIUM 238	0 570	PCI/L	J	0 3460	0 14400	A	WCS
501	B401989	GW03066IT	06/24/92	URANIUM 238	0 619	PCI/L		0 3450	0 09400	A	COL
502	B405489	GW00777IT	12/07/90	URANIUM 238	0 619	PCI/L		0 3580	0 60000		WCS
503	B401989	GW01745IT	09/06/91	URANIUM 238	0 633	PCI/L		0 3900	0 60000		COL
504	B405489	GW03346IT	08/19/92	URANIUM 238	0 660	PCI/L		0 3400	0 30000		WCS
505	B405689	GW01329IT	05/29/91	URANIUM 238	0 671	PCI/L		0 3830	0 60000		RFA
506	B401989	GW00028IT	07/24/90	URANIUM 238	0 693	PCI/L		0 3720	0 60000	A	COL
507	B202489	GW02535IT	02/27/92	URANIUM 238	0 766	PCI/L		0 4110	0 18000	A	VFA
508	B202589	GW02099IT	12/09/91	URANIUM-238	0 822	PCI/L		0 4520	0 60000		VFA
509	B405489	GW01322IT	05/22/91	URANIUM 238	0 863	PCI/L		0 4290	0 19800	A	WCS
510	B201589	GW00495IT	10/24/90	URANIUM 238	0 865	PCI/L		0 4220	0 00000	A	COL
511	B202589	GW02967IT	05/29/92	URANIUM 238	0 870	PCI/L		0 6500	0 16000	V	VFA
512	B405489	GW02451IT	02/10/92	URANIUM 238	0 912	PCI/L		0 4080	0 08700	A	WCS
513	B202589	GW01368IT	05/31/91	URANIUM 238	0 920	PCI/L		0 4270	0 00000	A	VFA
14	B302789	GW00754IT	11/19/90	URANIUM 238	0 929	PCI/L		0 4590	0 60000		VFA
15	B401989	GW02583IT	03/13/92	URANIUM 238	0 943	PCI/L		0 4590	0 14900	A	COL
16	B203189	GW01068IT	04/05/91	URANIUM 238	0 993	PCI/L		0 6360	0 37100	A	WCS
17	B202589	GW01014IT	03/28/91	URANIUM 238	1 056	PCI/L		0 4960	0 06350	A	VFA
18	B302889	GW03400IT	08/13/92	URANIUM 238	1 100	PCI/L		0 3300	0 20000		VFA
19	B202489	GW00376IT	09/12/90	URANIUM 238	1 122	PCI/L		0 4900	0 60000		VFA
20	B202489	GW01072IT	04/08/91	URANIUM 238	1 148	PCI/L		0 4850	0 09700	V	VFA
21	B201589	GW02534IT	02/28/92	URANIUM 238	1 226	PCI/L		0 5240	0 00000	A	COL
22	B405489	GW01719IT	08/28/91	URANIUM 238	1 237	PCI/L		0 5700	0 60000		WCS
23	B201589	GW02973IT	06/05/92	URANIUM 238	1 252	PCI/L		0 5080	0 00000	V	COL
24	B302789	GW02587IT	03/16/92	URANIUM 238	1 287	PCI/L		0 5070	0 09300	A	VFA
25	B202489	GW02970IT	06/03/92	URANIUM 238	1 300	PCI/L	B	0 5400	0 07400		VFA
26	B203189	GW01781IT	09/18/91	URANIUM 238	1 302	PCI/L		0 5450	0 60000		WCS
27	B202589	GW00595IT	11/01/90	URANIUM 238	1 366	PCI/L		0 5020	0 60000		VFA
28	B402689	GW01716IT	08/27/91	URANIUM 238	1 377	PCI/L		0 6610	0 60000		VFA
29	B302889	GW01330IT	05/22/91	URANIUM 238	1 412	PCI/L		0 5380	0 00000	V	VFA
30	B202589	GW00230IT	08/20/90	URANIUM 238	1 433	PCI/L		0 2810	0 60000	V	VFA
31	B302889	GW03040IT	06/04/92	URANIUM 238	1 500	PCI/L	B	0 7100	0 06600		VFA

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532	B203189	GW00272IT	08/22/90	URANIUM 238	1 524	PCI/L		0 2800	0 60000		WCS
533	B402689	GW00658IT	11/07/90	URANIUM 238	1 576	PCI/L		0 5770	0 60000	A	VFA
534	B202589	GW03325IT	08/13/92	URANIUM 238	1 600	PCI/L		0 3900	0 15000		VFA
535	B302889	GW01022IT	03/22/91	URANIUM 238	1 612	PCI/L		0 5650	0 00000	A	VFA
536	B202589	GW01753IT	09/10/91	URANIUM 238	1 666	PCI/L		0 6610	0 60000		VFA
537	B203489	GW00511IT	10/16/90	URANIUM 238	1 782	PCI/L		0 6760	0 60000	V	WCS
538	B402689	GW02948IT	05/28/92	URANIUM 238	1 800	PCI/L	B	0 7200	0 12000	V	VFA
539	B402689	GW02475IT	02/13/92	URANIUM 238	1 837	PCI/L		0 6090	0 12700	A	VFA
540	B203189	GW00560IT	10/23/90	URANIUM 238	1 925	PCI/L		0 6200	0 00000	V	WCS
541	B203289	GW00111IT	08/03/90	URANIUM 238	1 939	PCI/L		0 7440	0 60000	V	WCS
542	B302789	GW01732IT	08/29/91	URANIUM 238	1 983	PCI/L		0 7590	0 60000		VFA
543	B203289	GW03270IT	08/11/92	URANIUM 238	2 000	PCI/L		0 5700	0 30000		WCS
544	B203289	GW02498IT	02/21/92	URANIUM 238	2 042	PCI/L		0 6900	0 10400	A	WCS
545	B305389	GW03405IT	08/18/92	URANIUM 238	2 100	PCI/L		0 5600	0 30000		WCS
546	B302889	GW02503IT	02/22/92	URANIUM 238	2 115	PCI/L		0 7490	0 00000	A	VFA
547	B305389	GW01739IT	09/19/91	URANIUM 238	2 163	PCI/L		0 6800	0 60000		WCS
548	B203289	GW01782IT	09/17/91	URANIUM 238	2 289	PCI/L		0 6990	0 60000		WCS
549	B203489	GW01772IT	09/13/91	URANIUM 238	2 422	PCI/L		0 8340	0 60000		WCS
550	B305389	GW01308IT	05/22/91	URANIUM 238	2 427	PCI/L		0 7470	0 10000	A	WCS
551	B305389	GW00776IT	12/05/90	URANIUM 238	2 498	PCI/L		0 7500	0 60000		WCS
552	B402689	GW00035IT	07/19/90	URANIUM 238	2 511	PCI/L	X	0 3860	0 60000	V	VFA
553	B203289	GW00528IT	10/16/90	URANIUM 238	2 530	PCI/L		0 8320	0 60000	A	WCS
554	B302889	GW01736IT	08/30/91	URANIUM 238	2 577	PCI/L		0 8010	0 60000		VFA
555	B302989	GW03401IT	08/13/92	URANIUM 238	2 600	PCI/L		0 5300	0 20000		VFA
556	B203489	GW02109IT	12/10/91	URANIUM 238	2 612	PCI/L		0 8550	0 60000		WCS
557	B203489	GW00307IT	08/28/90	URANIUM 238	2 654	PCI/L		0 7860	0 60000	V	WCS
558	B305389	GW02595IT	03/16/92	URANIUM 238	2 842	PCI/L		0 7930	0 09300	A	WCS
559	B302989	GW00778IT	12/05/90	URANIUM 238	3 184	PCI/L		0 8250	0 60000		VFA
560	B302989	GW03051IT	06/04/92	URANIUM 238	3 300	PCI/L	B	1 2000	0 21000		VFA
561	B302989	GW01019IT	03/22/91	URANIUM 238	3 323	PCI/L		0 8740	0 00000	A	VFA
562	B302989	GW02492IT	02/21/92	URANIUM 238	3 599	PCI/L		1 0200	0 11900	A	VFA
563	B302989	GW01672IT	08/29/91	URANIUM 238	4 158	PCI/L		1 0700	0 60000		VFA
564	B302989	GW00126IT	08/06/90	URANIUM 238	4 197	PCI/L		1 2900	0 60000	V	VFA
565	B203289	GW01064IT	04/09/91	URANIUM 238	4 774	PCI/L		1 1600	0 23400	A	WCS
566	B304789	GW00992IT	03/19/91	URANIUM 238	4 899	PCI/L		1 3100	0 00000	A	WCS
567	B304789	GW00096IT	08/02/90	URANIUM 238	5 795	PCI/L		1 2700	0 60000		WCS
568	B201289	GW02486IT	02/25/92	URANIUM 238	5 924	PCI/L		1 4100	0 12000	A	COL
569	B304789	GW00773IT	12/04/90	URANIUM 238	6 811	PCI/L		1 4400	0 60000		WCS
570	B201289	GW01758IT	09/11/91	URANIUM 238	8 354	PCI/L		1 9800	0 60000		COL
571	B201189	GW02522IT	02/27/92	URANIUM 238	8 415	PCI/L		1 7900	0 17300	A	COL
572	B304889	GW01725IT	08/27/91	URANIUM 238	8 760	PCI/L		2 2200	0 60000		WCS
573	B201189	GW01747IT	08/30/91	URANIUM 238	9 051	PCI/L		2 2500	0 60000		COL
574	B201189	GW02972IT	06/05/92	URANIUM 238	9 066	PCI/L		1 6300	0 08400	V	COL
575	B304789	GW01731IT	08/29/91	URANIUM 238	9 173	PCI/L		2 0200	0 60000		WCS
576	B201289	GW01071IT	05/29/91	URANIUM 238	9 238	PCI/L		1 9100	0 12200	A	COL
577	B201189	GW02103IT	12/11/91	URANIUM 238	9 370	PCI/L		1 8000	0 60000		COL
578	B201189	GW00497IT	10/19/90	URANIUM 238	9 466	PCI/L		2 7200	0 00000	V	COL
579	B304889	GW00774IT	12/04/90	URANIUM 238	9 640	PCI/L		1 7100	0 60000		WCS
580	B304889	GW03403IT	08/19/92	URANIUM 238	9 700	PCI/L		1 6000	0 50000		WCS
581	B304889	GW01321IT	05/21/91	URANIUM 238	9 936	PCI/L		1 9200	0 15300	V	WCS
582	B201289	GW00375IT	09/12/90	URANIUM 238	10 980	PCI/L		1 9600	0 60000		COL
583	B304889	GW03041IT	06/05/92	URANIUM 238	11 000	PCI/L	B	3 4000	0 29000		WCS
584	B302089	GW00048IT	07/25/90	URANIUM 238	13 240	PCI/L	X	1 4600	0 60000		COL
585	B201189	GW01073IT	04/05/91	URANIUM 238	13 720	PCI/L		2 3900	0 20500	V	COL
586	B102389	GW01759IT	09/12/91	URANIUM 238	15 500	PCI/L		3 4300	0 60000		VFA
587	B205589	GW02974IT	06/05/92	URANIUM 238	92 520	PCI/L		12 1000	0 13100	V	COL
588	B205589	GW02523IT	02/27/92	URANIUM 238	93 870	PCI/L		12 9000	0 11300	A	COL
589	B205589	GW01746IT	09/10/91	URANIUM 238	99 640	PCI/L		14 7000	0 60000		COL
590	B205589	GW01076IT	04/05/91	URANIUM 238	105 600	PCI/L		13 6000	0 09300	A	COL
591	B205589	GW00496IT	10/19/90	URANIUM 238	135 600	PCI/L		19 4000	0 00000	V	COL

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hese data are available on diskette in the 1993 Background Geochemical Characterization Report (DOE 1993a) The ERROR variable s the 95 percent upper confidence limit (UCL) The RL variable is the reporting (i e detection) limit reported for the analyses The GEOLOGY variable indicates the geologic unit in which the monitoring well is screened (RFA = Rocky Flats Alluvium COL olluvium VFA valley fill alluvium and WCS weathered claystone bedrock)

SUMMARY STATISTICS FOR URANIUM ISOTOPES IN SAMPLES OF FILTERED BACKGROUND GROUNDWATER

Isotope	N	Min	Max	Mean	SD	Mean+2SD	99/99 UTL	Units
Uranium-233+234	207	0 024	199 5	6 914	25 439	57 8	74 9	pCi/L
Uranium 235	207	0 037	4 8	0 195	0 635	1 46	1 9	pCi/L
Uranium-238	177	0 038	135 6	4 832	17 673	40 2	52 6	pCi/L

Table B 2 Ordered Listing of Total Uranium in Unfiltered Samples of Background Groundwater at RFETS

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL	GEOLOGY
1	B200589	G 0589 0607 02 1310	06/07/90	URANIUM 233 234	0 000	PCI/L		0 1323	0 320	A	RFA
2	B405586	G 5586 0607 02 1331	06/07/90	URANIUM 233 234	0 064	PCI/L		0 1253	0 300	A	RFA
3	B102289	G 1889 0514 02 1209	05/14/90	URANIUM 233 234	0 100	PCI/L		0 2100	0 600		VFA
4	B400489	G 0489 0608 02 0920	06/08/90	URANIUM 233 234	0 108	PCI/L		0 2123	0 500	A	RFA
5	B405789	G 4889 0530 02 1510	05/30/90	URANIUM 233 234	0 130	PCI/L		0 1700	0 600		RFA
6	B200689	G 0689 0608 02 1320	06/08/90	URANIUM 233 234	0 181	PCI/L		0 1806	0 420	A	RFA
7	B200889	G 0889 0606 02 0915	06/06/90	URANIUM 233 234	0 353	PCI/L		0 2368	0 270	A	RFA
8	B200589	GW00270IT	08/21/90	URANIUM 233 234	0 368	PCI/L		0 2080	0 000		RFA
9	B400489	GW00247IT	08/15/90	URANIUM 233 234	0 455	PCI/L		0 2550	0 000		RFA
10	B200789	G 0789 0607 02 0940	06/07/90	URANIUM 233 234	0 608	PCI/L		0 4083	0 320	A	RFA
11	B102289	GW00332IT	08/30/90	URANIUM 233 234	0 678	PCI/L		0 2640	0 000		VFA
12	B400389	G 0389 0611 02 1025	06/11/90	URANIUM 233 234	0 872	PCI/L		0 5429	0 310	A	RFA
13	B202589	G 2189 0601 02 1220	06/01/90	URANIUM 233 234	1 100	PCI/L		0 4600	0 600		VFA
14	B400189	G 0189 0606 02 1115	06/06/90	URANIUM 233 234	1 246	PCI/L		0 5613	0 250	A	RFA
15	B400389	GW00273IT	08/21/90	URANIUM 233 234	1 330	PCI/L		0 4100	0 000		RFA
16	B302889	G 2489 0522 02 1025	05/22/90	URANIUM 233 234	1 540	PCI/L		0 6100	0 600		VFA
17	B405489	G 4589 0521 02 1445	05/22/90	URANIUM 233 234	1 830	PCI/L		0 6100	0 600		WCS
18	B405489	GW00118IT	08/15/90	URANIUM 233 234	1 930	PCI/L		0 4400	0 000		WCS
19	B201589	G 1389 0604 02 1500	06/05/90	URANIUM 233 234	2 405	PCI/L		1 1250	0 590	A	COL
20	B302989	G 2589 0523 02 1125	05/23/90	URANIUM 233 234	2 470	PCI/L		0 7500	0 600		VFA
21	B402689	G 2289 0507 02 0903	05/08/90	URANIUM 233 234	2 510	PCI/L		0 8100	0 600		VFA
22	B302889	GW00125IT	08/10/90	URANIUM 233 234	2 650	PCI/L		0 7200	0 000		VFA
23	B305389	G 4489 0521 02 1123	05/25/90	URANIUM 233 234	4 440	PCI/L		1 1400	0 600		WCS
24	B305389	GW00137IT	08/09/90	URANIUM 233 234	5 020	PCI/L		0 9900	0 000		WCS
25	B203289	G 2889 0612 02 0917	06/13/90	URANIUM 233 234	5 120	PCI/L		1 1900	0 600		WCS
26	B203589	G 3089 0612 02 1133	06/13/90	URANIUM 233 234	6 930	PCI/L		1 5300	0 600		WCS
27	B201089	G 0989 0605 02 1510	06/06/90	URANIUM 233 234	12 490	PCI/L		2 5715	0 390	A	COL
28	B201189	GW00249IT	08/17/90	URANIUM 233 234	13 400	PCI/L		1 8000	0 000		COL
29	B201189	G 1089 0604 02 1000	06/05/90	URANIUM 233 234	13 960	PCI/L		2 0000	0 600		COL
30	B201189	GW03275IT	07/30/92	URANIUM 233 234	14 000	PCI/L	B	1 9000	0 056		COL
31	B304889	G 4089 0523 02 1445	05/24/90	URANIUM 233 234	17 170	PCI/L		3 0000	0 600		WCS
32	B304889	GW00132IT	08/09/90	URANIUM 233 234	17 500	PCI/L		2 2000	0 000		WCS
33	B205589	GW03280IT	07/30/92	URANIUM 233 234	120 000	PCI/L	BX	12 0000	0 110		COL
34	B205589	G 4689 0604 02 1205	06/05/90	URANIUM 233 234	129 670	PCI/L		13 2900	0 600		COL
35	B205589	GW00250IT	08/17/90	URANIUM 233 234	164 000	PCI/L		22 0000	0 000		COL
36	B203289	G 2889 0612 02 0917	06/13/90	URANIUM 235	0 020	PCI/L		0 0200	0 600		WCS
37	B302889	G 2489 0522 02 1025	05/22/90	URANIUM 235	0 010	PCI/L		0 0100	0 600		VFA
38	B405489	G 4589 0521 02 1445	05/22/90	URANIUM 235	0 010	PCI/L		0 0100	0 600		WCS
39	B102289	G 1889 0514 02 1209	05/14/90	URANIUM 235	0 000	PCI/L		0 2900	0 600		VFA
40	B200589	G 0589 0607 02 1310	06/07/90	URANIUM 235	0 000	PCI/L		0 1602	0 380	A	RFA
41	B200689	G 0689 0608 02 1320	06/08/90	URANIUM 235	0 000	PCI/L		0 2144	0 510	A	RFA
42	B200789	G 0789 0607 02 0940	06/07/90	URANIUM 235	0 000	PCI/L		0 1602	0 380	A	RFA
43	B400389	G 0389 0611 02 1025	06/11/90	URANIUM 235	0 000	PCI/L		0 1591	0 380	A	RFA
44	B400489	G 0489 0608 02 0920	06/08/90	URANIUM 235	0 000	PCI/L		0 2556	0 610	A	RFA
45	B202589	G 2189 0601 02 1220	06/01/90	URANIUM 235	0 040	PCI/L		0 0900	0 600		VFA
46	B405789	G 4889 0530 02 1510	05/30/90	URANIUM 235	0 040	PCI/L		0 1000	0 600		RFA
47	B400189	G 0189 0606 02 1115	06/06/90	URANIUM 235	0 066	PCI/L		0 1289	0 310	A	RFA
48	B200889	G 0889 0606 02 0915	06/06/90	URANIUM 235	0 071	PCI/L		0 1401	0 330	A	RFA
49	B405586	G 5586 0607 02 1331	06/07/90	URANIUM 235	0 077	PCI/L		0 1516	0 360	A	RFA
50	B302989	G 2589 0523 02 1125	05/23/90	URANIUM 235	0 080	PCI/L		0 1200	0 600		VFA
51	B405489	GW00118IT	08/15/90	URANIUM 235	0 174	PCI/L		0 1290	0 000		WCS
52	B402689	G 2289 0507 02 0903	05/08/90	URANIUM 235	0 180	PCI/L		0 2000	0 600		VFA
53	B203589	G 3089 0612 02 1133	06/13/90	URANIUM 235	0 190	PCI/L		0 2300	0 600		WCS

54	B102289	GW00332IT	08/30/90	URANIUM 235	0 208	PCI/L		0 1900	0 000		VFA
55	B302889	GW00125IT	08/10/90	URANIUM 235	0 227	PCI/L		0 2160	0 000		VFA
56	B200589	GW00270IT	08/21/90	URANIUM 235	0 255	PCI/L		0 1720	0 000		RFA
57	B304889	G 4089 0523 02 1445	05/24/90	URANIUM 235	0 290	PCI/L		0 3000	0 600		WCS
58	B400389	GW00273IT	08/21/90	URANIUM 235	0 310	PCI/L		0 2210	0 000		RFA
59	B201189	G 1089 0604 02 1000	06/05/90	URANIUM 235	0 370	PCI/L		0 2500	0 600		COL
60	B305389	G 4489 0521 02 1123	05/25/90	URANIUM 235	0 370	PCI/L		0 3000	0 600		WCS
61	B201089	G 0989 0605 02 1510	06/06/90	URANIUM 235	0 401	PCI/L		0 3963	0 470	A	COL
62	B201189	GW03275IT	07/30/92	URANIUM 235	0 440	PCI/L	BJ	0 2700	0 056		COL
63	B304889	GW00132IT	08/09/90	URANIUM 235	0 524	PCI/L		0 2120	0 000		WCS
64	B201589	G 1389 0604 02 1500	06/05/90	URANIUM 235	0 613	PCI/L		0 6156	0 710	A	COL
65	B400489	GW00247IT	08/15/90	URANIUM 235	0 667	PCI/L		0 3060	0 000		RFA
66	B201189	GW00249IT	08/17/90	URANIUM 235	0 668	PCI/L		0 2760	0 000		COL
67	B305389	GW00137IT	08/09/90	URANIUM 235	0 751	PCI/L		0 3310	0 000		WCS
68	B205589	G 4689 0604 02 1205	06/05/90	URANIUM 235	3 420	PCI/L		0 8700	0 600		COL
69	B205589	GW03280IT	07/30/92	URANIUM 235	4 900	PCI/L	BX	1 1000	0 002		COL
70	B205589	GW00250IT	08/17/90	URANIUM 235	6 290	PCI/L		1 7100	0 000		COL
71	B200589	G 0589 0607 02 1310	06/07/90	URANIUM 238	0 000	PCI/L		0 1323	0 320	A	RFA
72	B200689	G 0689 0608 02 1320	06/08/90	URANIUM 238	0 000	PCI/L		0 1772	0 420	A	RFA
73	B405586	G 5586 0607 02 1331	06/07/90	URANIUM 238	0 000	PCI/L		0 1249	0 300	A	RFA
74	B200889	G 0889 0606 02 0915	06/06/90	URANIUM 238	0 059	PCI/L		0 1157	0 270	A	RFA
75	B400489	G 0489 0608 02 0920	06/08/90	URANIUM 238	0 108	PCI/L		0 2123	0 500	A	RFA
76	B200589	GW00270IT	08/21/90	URANIUM 238	0 170	PCI/L		0 1400	0 000		RFA
77	B400489	GW00247IT	08/15/90	URANIUM 238	0 334	PCI/L		0 2220	0 000		RFA
78	B400389	G 0389 0611 02 1025	06/11/90	URANIUM 238	0 335	PCI/L		0 2679	0 310	A	RFA
79	B102289	GW00332IT	08/30/90	URANIUM 238	0 389	PCI/L		0 1970	0 000		VFA
80	B405489	GW00118IT	08/15/90	URANIUM 238	0 947	PCI/L		0 2930	0 000		WCS
81	B400189	G 0189 0606 02 1115	06/06/90	URANIUM 238	0 975	PCI/L		0 4481	0 250	A	RFA
82	B400389	GW00273IT	08/21/90	URANIUM 238	1 040	PCI/L		0 3700	0 000		RFA
83	B200789	G 0789 0607 02 0940	06/07/90	URANIUM 238	1 418	PCI/L		0 6982	0 320	A	RFA
84	B201589	G 1389 0604 02 1500	06/05/90	URANIUM 238	1 772	PCI/L		1 0664	0 590	A	COL
85	B302889	GW00125IT	08/10/90	URANIUM 238	2 080	PCI/L		0 6300	0 000		VFA
86	B305389	GW00137IT	08/09/90	URANIUM 238	3 790	PCI/L		0 8400	0 000		WCS
87	B201089	G 0989 0605 02 1510	06/06/90	URANIUM 238	6 951	PCI/L		1 7334	0 390	A	COL
88	B201189	GW00249IT	08/17/90	URANIUM 238	8 220	PCI/L		1 2600	0 000		COL
89	B201189	GW03275IT	07/30/92	URANIUM 238	9 300	PCI/L	B	1 5000	0 034		COL
90	B304889	GW00132IT	08/09/90	URANIUM 238	10 600	PCI/L		1 4000	0 000		WCS
91	B205589	GW03280IT	07/30/92	URANIUM 238	82 000	PCI/L	BX	8 6000	0 002		COL
92	B205589	GW00250IT	08/17/90	URANIUM 238	108 000	PCI/L		15 0000	0 000		COL

ese data are available on diskette in the 1993 Background Geochemical Characterization Report (DOE 1993a) The ERROR variable the 95 percent upper confidence limit (UCL) The RL variable is the reporting (i e detection) limit reported for the alyses The GEOLOGY variable indicates the geologic unit in which the monitoring well is screened (RFA = Rocky Flats Alluvium) L colluvium VFA valley fill alluvium and WCS = weathered claystone bedrock)

SUMMARY STATISTICS FOR URANIUM ISOTOPES IN SAMPLES OF UNFILTERED BACKGROUND GROUNDWATER

Isotope	N	Min	Max	Mean	SD	Mean+2SD	99/99-UTL	Units
Uranium-233+234	35	0 00	164 0	15 62	38 75	93 12	144 83	pCi/L
Uranium 235	35	0 02	6 29	0 62	1 38	3 38	5 23	pCi/L
Uranium 238	22	0 00	108 0	10 84	27 23	66 30	114 17	pCi/L

Table B 3 Ordered Listing of Total Uranium Isotopes IN BACKGROUND Boreholes (Data from 1993 BGCR)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
943	B400289	BH02893036	04/14/89	URANIUM TOTAL	0 500	PCI/G				
944	B400489	BH04894046	05/01/89	URANIUM TOTAL	0 600	PCI/G				
945	B200889	BH08891420	03/06/89	URANIUM TOTAL	0 700	PCI/G				N
946	B200889	BH08890608	03/06/89	URANIUM TOTAL	0 700	PCI/G				N
947	B200889	BH08892022	03/06/89	URANIUM TOTAL	0 700	PCI/G				N
948	B400489	BH04890309	04/28/89	URANIUM TOTAL	0 700	PCI/G				
949	B200689	BH06890410	02/28/89	URANIUM TOTAL	0 800	PCI/G				N
950	B200689	BH06890003	03/09/89	URANIUM TOTAL	0 800	PCI/G				
951	B200789	BH07890612	03/01/89	URANIUM TOTAL	0 800	PCI/G				N
952	B200789	BH07891218	03/01/89	URANIUM TOTAL	0 800	PCI/G				N
953	B200889	BH08890106	03/06/89	URANIUM TOTAL	0 800	PCI/G				N
954	B200989	BH09890104	03/02/89	URANIUM TOTAL	0 800	PCI/G				
955	B200789	BH07892426	03/01/89	URANIUM TOTAL	0 900	PCI/G				N
956	B201089	BH10890003	03/09/89	URANIUM TOTAL	0 900	PCI/G				
957	B400289	BH02890003	04/12/89	URANIUM TOTAL	0 900	PCI/G				
958	B400389	BH03892127	04/25/89	URANIUM TOTAL	0 900	PCI/G				
959	B200889	BH08890814	03/06/89	URANIUM TOTAL	1 000	PCI/G				N
960	B400289	BH02890915	04/12/89	URANIUM TOTAL	1 000	PCI/G				
961	B400389	BH03890003	04/25/89	URANIUM TOTAL	1 000	PCI/G				
962	B400489	BH04890003	04/28/89	URANIUM TOTAL	1 000	PCI/G				
963	B400489	BH04891521	04/28/89	URANIUM TOTAL	1 000	PCI/G				
964	B400489	BH04892127	04/28/89	URANIUM TOTAL	1 000	PCI/G				
965	B400489	BH04892733	05/01/89	URANIUM TOTAL	1 000	PCI/G				
966	B400489	BH04893840	05/01/89	URANIUM TOTAL	1 000	PCI/G				
967	B400489	BH04894652	05/01/89	URANIUM TOTAL	1 000	PCI/G				
968	B405189	BH01891521	03/09/89	URANIUM TOTAL	1 000	PCI/G				N
969	B200589	BH05891723	02/22/89	URANIUM TOTAL	1 050	PCI/G				N
970	B200589	BH05890003	02/22/89	URANIUM TOTAL	1 100	PCI/G				
971	B200689	BH06891016	02/28/89	URANIUM TOTAL	1 100	PCI/G				N
972	B200789	BH07890306	03/01/89	URANIUM TOTAL	1 100	PCI/G				N
973	B200989	BH09891016	03/02/89	URANIUM TOTAL	1 100	PCI/G				
974	B201589	BH14891417	03/16/89	URANIUM TOTAL	1 100	PCI/G				
975	B400289	BH02893642	04/14/89	URANIUM TOTAL	1 100	PCI/G				
976	B400389	BH03892733	04/05/89	URANIUM TOTAL	1 100	PCI/G				
977	B400489	BH04890915	04/28/89	URANIUM TOTAL	1 100	PCI/G				
978	B405189	BH01890309	03/09/89	URANIUM TOTAL	1 100	PCI/G				N
979	B400389	BH03891521	04/25/89	URANIUM TOTAL	1 150	PCI/G				
980	B200789	BH07890103	03/01/89	URANIUM TOTAL	1 200	PCI/G				N
981	B200789	BH07891824	03/01/89	URANIUM TOTAL	1 200	PCI/G				N
982	B201089	BH10890106	03/02/89	URANIUM TOTAL	1 200	PCI/G				
983	B201489	BH13890709	03/10/89	URANIUM TOTAL	1 200	PCI/G				
984	B201489	BH13891519	03/10/89	URANIUM TOTAL	1 200	PCI/G				
985	B201589	BH14890003	03/15/89	URANIUM TOTAL	1 200	PCI/G				
986	B301889	BH15892834	03/07/89	URANIUM TOTAL	1 200	PCI/G				
987	B405189	BH01893638	03/10/89	URANIUM TOTAL	1 200	PCI/G				N
988	B200589	BH05892530	02/23/89	URANIUM TOTAL	1 300	PCI/G				N
989	B200689	BH06892430	02/28/89	URANIUM TOTAL	1 300	PCI/G				N
990	B200889	BH08890003	03/08/89	URANIUM TOTAL	1 300	PCI/G				N
991	B201189	BH11890915	03/17/89	URANIUM TOTAL	1 300	PCI/G				
992	B201589	BH14890814	03/16/89	URANIUM TOTAL	1 300	PCI/G				
993	B201589	BH14891720	03/16/89	URANIUM TOTAL	1 300	PCI/G				
994	B400289	BH02890309	04/12/89	URANIUM TOTAL	1 300	PCI/G				
995	B400389	BH03890915	04/25/89	URANIUM TOTAL	1 300	PCI/G				
996	B400389	BH03893339	04/25/89	URANIUM TOTAL	1 300	PCI/G				

997	B400389	BH03893945	04/26/89	URANIUM	TOTAL	1 300	PCI/G	
998	B402189	BH18890003	03/29/89	URANIUM	TOTAL	1 300	PCI/G	N
999	B402189	BH18891319	03/29/89	URANIUM	TOTAL	1 300	PCI/G	N
1000	B200589	BH05892325	02/22/89	URANIUM	TOTAL	1 400	PCI/G	N
1001	B200789	BH07890003	03/08/89	URANIUM	TOTAL	1 400	PCI/G	N
1002	B200989	BH09891620	03/02/89	URANIUM	TOTAL	1 400	PCI/G	
1003	B400289	BH02894248	04/17/89	URANIUM	TOTAL	1 400	PCI/G	
1004	B400489	BH04893538	05/01/89	URANIUM	TOTAL	1 400	PCI/G	
1005	B405189	BH01890003	03/09/89	URANIUM	TOTAL	1 400	PCI/G	N
1006	B405189	BH01892127	03/09/89	URANIUM	TOTAL	1 400	PCI/G	N
1007	B405189	BH01894448	03/10/89	URANIUM	TOTAL	1 400	PCI/G	N
1008	B201189	BH11890309	03/17/89	URANIUM	TOTAL	1 450	PCI/G	
1009	B200589	BH05890308	02/22/89	URANIUM	TOTAL	1 500	PCI/G	N
1010	B200589	BH05890913	02/22/89	URANIUM	TOTAL	1 500	PCI/G	N
1011	B200689	BH06890104	02/28/89	URANIUM	TOTAL	1 500	PCI/G	N
1012	B200689	BH06891824	02/28/89	URANIUM	TOTAL	1 500	PCI/G	N
1013	B201189	BH11891521	03/17/89	URANIUM	TOTAL	1 500	PCI/G	
1014	B201289	BH12890307	03/22/89	URANIUM	TOTAL	1 500	PCI/G	
1015	B405189	BH01893844	03/10/89	URANIUM	TOTAL	1 500	PCI/G	N
1016	B200589	BH05890003R	03/08/89	URANIUM	TOTAL	1 600	PCI/G	
1017	B200689	BH06891618	02/28/89	URANIUM	TOTAL	1 600	PCI/G	N
1018	B201289	BH12890003	03/22/89	URANIUM	TOTAL	1 600	PCI/G	
1019	B201489	BH13890003	03/10/89	URANIUM	TOTAL	1 600	PCI/G	
1020	B201589	BH14890307	03/15/89	URANIUM	TOTAL	1 600	PCI/G	
1021	B301889	BH15891521	03/07/89	URANIUM	TOTAL	1 600	PCI/G	
1022	B400289	BH02892130	04/13/89	URANIUM	TOTAL	1 600	PCI/G	
1023	B400289	BH02891521	04/13/89	URANIUM	TOTAL	1 600	PCI/G	
1024	B400489	BH04893335	05/01/89	URANIUM	TOTAL	1 600	PCI/G	
1025	B400489	BH04895254	05/01/89	URANIUM	TOTAL	1 600	PCI/G	
1026	B405189	BH01890915	03/09/89	URANIUM	TOTAL	1 600	PCI/G	N
1027	B405189	BH01893036	03/10/89	URANIUM	TOTAL	1 600	PCI/G	N
1028	B200589	BH05891317	02/22/89	URANIUM	TOTAL	1 700	PCI/G	N
1029	B201189	BH11890003	03/17/89	URANIUM	TOTAL	1 700	PCI/G	
1030	B301889	BH15890915	03/07/89	URANIUM	TOTAL	1 700	PCI/G	
1031	B401989	BH16890915	04/05/89	URANIUM	TOTAL	1 700	PCI/G	
1032	B201289	BH12892930	03/23/89	URANIUM	TOTAL	1 800	PCI/G	
1033	B201289	BH12893032	03/23/89	URANIUM	TOTAL	1 800	PCI/G	
1034	B201489	BH13890307	03/10/89	URANIUM	TOTAL	1 800	PCI/G	
1035	B301889	BH15892228	03/07/89	URANIUM	TOTAL	1 800	PCI/G	
1036	B401989	BH16891519	04/05/89	URANIUM	TOTAL	1 800	PCI/G	
1037	B201289	BH12890915	03/23/89	URANIUM	TOTAL	1 850	PCI/G	
1038	B201489	BH13891015	03/10/89	URANIUM	TOTAL	1 900	PCI/G	
1039	B400389	BH03890309	04/25/89	URANIUM	TOTAL	1 900	PCI/G	
1040	B401989	BH16890309	04/05/89	URANIUM	TOTAL	1 900	PCI/G	
1041	B402189	BH18890307	03/29/89	URANIUM	TOTAL	1 900	PCI/G	N
1042	B401989	BH16890003	04/05/89	URANIUM	TOTAL	2 000	PCI/G	
1043	B402189	BH18890713	03/29/89	URANIUM	TOTAL	2 000	PCI/G	N
1044	B301889	BH15890309	03/07/89	URANIUM	TOTAL	2 100	PCI/G	
1045	B302089	BH17891925	03/28/89	URANIUM	TOTAL	2 100	PCI/G	
1046	B400389	BH03894548	04/26/89	URANIUM	TOTAL	2 200	PCI/G	
1047	B401989	BH16892127	04/05/89	URANIUM	TOTAL	2 200	PCI/G	
1048	B302089	BH17890306	03/28/89	URANIUM	TOTAL	2 250	PCI/G	
1049	B201189	BH11892127	03/17/89	URANIUM	TOTAL	2 300	PCI/G	
1050	B301889	BH15890003	03/07/89	URANIUM	TOTAL	2 300	PCI/G	
1051	B201089	BH10890713	03/02/89	URANIUM	TOTAL	2 400	PCI/G	
1052	B201289	BH12891521	03/23/89	URANIUM	TOTAL	2 400	PCI/G	
1053	B201189	BH11892733	03/17/89	URANIUM	TOTAL	2 500	PCI/G	
1054	B201289	BH12892329	03/23/89	URANIUM	TOTAL	2 500	PCI/G	
1055	B302089	BH17891319	03/28/89	URANIUM	TOTAL	2 600	PCI/G	
1056	B201089	BH10891319	03/02/89	URANIUM	TOTAL	2 700	PCI/G	

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1057	B401989	BH16892733	04/05/89	URANIUM	TOTAL	2 700	PCI/G			
1058	B201189	BH11893541	03/23/89	URANIUM	TOTAL	3 000	PCI/G			
1059	B200989	BH09890003	03/08/89	URANIUM	TOTAL	3 100	PCI/G			N
1060	B201189	BH11894146	03/23/89	URANIUM	TOTAL	3 100	PCI/G			
1061	B302089	BH17890003	03/28/89	URANIUM	TOTAL	5 000	PCI/G			
1062	B200989	BH09890410	03/02/89	URANIUM	TOTAL	6 700	PCI/G			
1063	B400289	BH02893036	04/14/89	URANIUM	233 234	0 200	PCI/G	0 20	0 10	
1064	B200689	BH06890003	03/09/89	URANIUM	233 234	0 300	PCI/G	0 10		
1065	B200889	BH08891420	03/06/89	URANIUM	233 234	0 300	PCI/G	0 10		N
1066	B200889	BH08892022	03/06/89	URANIUM	233 234	0 300	PCI/G	0 10		N
1067	B400489	BH04890309	04/28/89	URANIUM	233 234	0 300	PCI/G	0 10		
1068	B200889	BH08890608	03/06/89	URANIUM	233 234	0 350	PCI/G	0 10		N
1069	B200789	BH07890612	03/01/89	URANIUM	233 234	0 400	PCI/G	0 10		N
1070	B200789	BH07892426	03/01/89	URANIUM	233 234	0 400	PCI/G	0 10		N
1071	B200889	BH08890106	03/06/89	URANIUM	233 234	0 400	PCI/G	0 10		N
1072	B200989	BH09890104	03/02/89	URANIUM	233 234	0 400	PCI/G	0 10	0 10	
1073	B201589	BH14890003	03/15/89	URANIUM	233 234	0 400	PCI/G	0 10	0 10	
1074	B201589	BH14891417	03/16/89	URANIUM	233 234	0 400	PCI/G	0 20		
1075	B400289	BH02890003	04/12/89	URANIUM	233 234	0 400	PCI/G	0 20	0 10	
1076	B400389	BH03892127	04/25/89	URANIUM	233 234	0 400	PCI/G	0 20		
1077	B400489	BH04892127	04/28/89	URANIUM	233 234	0 400	PCI/G	0 20	0 10	
1078	B400489	BH04892733	05/01/89	URANIUM	233 234	0 400	PCI/G	0 20		
1079	B400489	BH04894046	05/01/89	URANIUM	233 234	0 400	PCI/G	0 20		
1080	B400489	BH04894652	05/01/89	URANIUM	233 234	0 400	PCI/G	0 10		
1081	B405189	BH01891521	03/09/89	URANIUM	233 234	0 400	PCI/G	0 10		N
1082	B200589	BH05891723	02/22/89	URANIUM	233 234	0 500	PCI/G	0 10		N
1083	B200689	BH06890410	02/28/89	URANIUM	233 234	0 500	PCI/G	0 10		N
1084	B200689	BH06891016	02/28/89	URANIUM	233 234	0 500	PCI/G	0 10		N
1085	B200789	BH07890306	03/01/89	URANIUM	233 234	0 500	PCI/G	0 10		N
1086	B200789	BH07891218	03/01/89	URANIUM	233 234	0 500	PCI/G	0 10		N
1087	B200789	BH07891824	03/01/89	URANIUM	233 234	0 500	PCI/G	0 10		N
1088	B200889	BH08890814	03/06/89	URANIUM	233 234	0 500	PCI/G	0 10		N
1089	B200989	BH09891016	03/02/89	URANIUM	233 234	0 500	PCI/G	0 10	0 10	
1090	B201089	BH10890003	03/09/89	URANIUM	233 234	0 500	PCI/G	0 20		
1091	B201189	BH11890915	03/17/89	URANIUM	233 234	0 500	PCI/G	0 10		
1092	B201289	BH12890307	03/22/89	URANIUM	233 234	0 500	PCI/G	0 20	0 10	
1093	B201489	BH13890003	03/10/89	URANIUM	233 234	0 500	PCI/G	0 10	0 10	
1094	B201489	BH13890709	03/10/89	URANIUM	233 234	0 500	PCI/G	0 10	0 10	
1095	B201589	BH14891720	03/16/89	URANIUM	233 234	0 500	PCI/G	0 10		
1096	B301889	BH15892834	03/07/89	URANIUM	233 234	0 500	PCI/G	0 10		
1097	B400289	BH02890915	04/12/89	URANIUM	233 234	0 500	PCI/G	0 20	0 10	
1098	B400389	BH03891521	04/25/89	URANIUM	233 234	0 500	PCI/G	0 10		
1099	B400389	BH03890003	04/25/89	URANIUM	233 234	0 500	PCI/G	0 20		
1100	B400489	BH04890003	04/28/89	URANIUM	233 234	0 500	PCI/G	0 20	0 10	
1101	B400489	BH04890915	04/28/89	URANIUM	233 234	0 500	PCI/G	0 20	0 10	
1102	B400489	BH04893840	05/01/89	URANIUM	233 234	0 500	PCI/G	0 20		
1103	B402189	BH18890003	03/29/89	URANIUM	233 234	0 500	PCI/G	0 20		N
1104	B405189	BH01890309	03/09/89	URANIUM	233 234	0 500	PCI/G	0 10		N
1105	B405189	BH01893638	03/10/89	URANIUM	233 234	0 500	PCI/G	0 20		N
1106	B200589	BH05890003	02/22/89	URANIUM	233 234	0 550	PCI/G	0 10		
1107	B201089	BH10890106	03/02/89	URANIUM	233 234	0 550	PCI/G	0 10	0 10	
1108	B200689	BH06892430	02/28/89	URANIUM	233 234	0 600	PCI/G	0 20		N
1109	B200789	BH07890103	03/01/89	URANIUM	233 234	0 600	PCI/G	0 10		N
1110	B201189	BH11890309	03/17/89	URANIUM	233 234	0 600	PCI/G	0 10		
1111	B201189	BH11891521	03/17/89	URANIUM	233 234	0 600	PCI/G	0 10		
1112	B400289	BH02890309	04/12/89	URANIUM	233 234	0 600	PCI/G	0 20	0 10	
1113	B400389	BH03892733	04/05/89	URANIUM	233 234	0 600	PCI/G	0 20		
1114	B400389	BH03890915	04/25/89	URANIUM	233 234	0 600	PCI/G	0 20		
1115	B400389	BH03893945	04/26/89	URANIUM	233 234	0 600	PCI/G	0 20		

1116	B400489	BH04891521	04/28/89	URANIUM 233 234	0 600	PCI/G	0 20	0 10	
1117	B400489	BH04893335	05/01/89	URANIUM 233 234	0 600	PCI/G	0 20		
1118	B402189	BH18891319	03/29/89	URANIUM 233 234	0 600	PCI/G	0 30		N
1119	B405189	BH01892127	03/09/89	URANIUM 233 234	0 600	PCI/G	0 20		N
1120	B405189	BH01893036	03/10/89	URANIUM 233 234	0 600	PCI/G	0 20		N
1121	B405189	BH01893844	03/10/89	URANIUM 233 234	0 600	PCI/G	0 10		N
1122	B201489	BH13891519	03/10/89	URANIUM 233 234	0 600	PCI/G	0 10	0 10	
1123	B200589	BH05890308	02/22/89	URANIUM 233 234	0 700	PCI/G	0 10		N
1124	B200589	BH05890913	02/22/89	URANIUM 233 234	0 700	PCI/G	0 10		N
1125	B200589	BH05892530	02/23/89	URANIUM 233 234	0 700	PCI/G	0 20		N
1126	B200589	BH05890003R	03/08/89	URANIUM 233 234	0 700	PCI/G	0 20		
1127	B200689	BH06890104	02/28/89	URANIUM 233 234	0 700	PCI/G	0 20		N
1128	B200689	BH06891618	02/28/89	URANIUM 233 234	0 700	PCI/G	0 20		N
1129	B200889	BH08890003	03/08/89	URANIUM 233 234	0 700	PCI/G	0 20		N
1130	B200989	BH09891620	03/02/89	URANIUM 233 234	0 700	PCI/G	0 10	0 10	
1131	B201289	BH12890003	03/22/89	URANIUM 233 234	0 700	PCI/G	0 20	0 10	
1132	B201589	BH14890307	03/15/89	URANIUM 233 234	0 700	PCI/G	0 20	0 10	
1133	B400289	BH02892130	04/13/89	URANIUM 233 234	0 700	PCI/G	0 20	0 10	
1134	B400289	BH02893642	04/14/89	URANIUM 233 234	0 700	PCI/G	0 20	0 10	
1135	B400289	BH02894248	04/17/89	URANIUM 233 234	0 700	PCI/G	0 20	0 10	
1136	B400389	BH03893339	04/25/89	URANIUM 233 234	0 700	PCI/G	0 20		
1137	B400489	BH04893538	05/01/89	URANIUM 233 234	0 700	PCI/G	0 20		
1138	B400489	BH04895254	05/01/89	URANIUM 233 234	0 700	PCI/G	0 20		
1139	B402189	BH18890307	03/29/89	URANIUM 233 234	0 700	PCI/G	0 30		N
1140	B405189	BH01890915	03/09/89	URANIUM 233 234	0 700	PCI/G	0 20		N
1141	B405189	BH01894448	03/10/89	URANIUM 233 234	0 700	PCI/G	0 20		N
1142	B201289	BH12890915	03/23/89	URANIUM 233 234	0 750	PCI/G	0 20	0 10	
1143	B200589	BH05891317	02/22/89	URANIUM 233 234	0 800	PCI/G	0 10		N
1144	B200589	BH05892325	02/22/89	URANIUM 233 234	0 800	PCI/G	0 20		N
1145	B200689	BH06891824	02/28/89	URANIUM 233 234	0 800	PCI/G	0 20		N
1146	B200789	BH07890003	03/08/89	URANIUM-233 234	0 800	PCI/G	0 20		N
1147	B201189	BH11890003	03/17/89	URANIUM 233 234	0 800	PCI/G	0 20		
1148	B201289	BH12893032	03/23/89	URANIUM 233 234	0 800	PCI/G	0 30	0 10	
1149	B201489	BH13891015	03/10/89	URANIUM 233 234	0 800	PCI/G	0 20	0 10	
1150	B201589	BH14890814	03/16/89	URANIUM 233 234	0 800	PCI/G	0 20		
1151	B400289	BH02891521	04/13/89	URANIUM 233 234	0 800	PCI/G	0 20	0 10	
1152	B401989	BH16890915	04/05/89	URANIUM 233 234	0 800	PCI/G	0 20		
1153	B405189	BH01890003	03/09/89	URANIUM 233 234	0 800	PCI/G	0 20		N
1154	B201289	BH12892930	03/23/89	URANIUM 233 234	0 900	PCI/G	0 30	0 10	
1155	B201489	BH13890307	03/10/89	URANIUM 233 234	0 900	PCI/G	0 20	0 10	
1156	B301889	BH15890309	03/07/89	URANIUM 233 234	0 900	PCI/G	0 20		
1157	B301889	BH15892228	03/07/89	URANIUM 233 234	0 900	PCI/G	0 20		
1158	B401989	BH16890003	04/05/89	URANIUM 233 234	0 900	PCI/G	0 30		
1159	B401989	BH16891519	04/05/89	URANIUM 233 234	0 900	PCI/G	0 30		
1160	B201089	BH10890713	03/02/89	URANIUM 233 234	1 000	PCI/G	0 20	0 10	
1161	B201189	BH11892127	03/17/89	URANIUM 233 234	1 000	PCI/G	0 20		
1162	B301889	BH15891521	03/07/89	URANIUM 233 234	1 000	PCI/G	0 20		
1163	B400389	BH03894548	04/26/89	URANIUM 233 234	1 000	PCI/G	0 30		
1164	B401989	BH16892127	04/05/89	URANIUM 233 234	1 000	PCI/G	0 30		
1165	B402189	BH18890713	03/29/89	URANIUM 233 234	1 000	PCI/G	0 30		N
1166	B301889	BH15890003	03/07/89	URANIUM 233 234	1 100	PCI/G	0 20		
1167	B302089	BH17890306	03/28/89	URANIUM 233 234	1 100	PCI/G	0 30		
1168	B302089	BH17891925	03/28/89	URANIUM 233 234	1 100	PCI/G	0 30		
1169	B400389	BH03890309	04/25/89	URANIUM 233 234	1 100	PCI/G	0 30		
1170	B401989	BH16890309	04/05/89	URANIUM 233 234	1 100	PCI/G	0 30		
1171	B201189	BH11892733	03/17/89	URANIUM 233 234	1 200	PCI/G	0 20		
1172	B201289	BH12891521	03/23/89	URANIUM 233 234	1 200	PCI/G	0 20	0 10	
1173	B201089	BH10891319	03/02/89	URANIUM 233 234	1 300	PCI/G	0 20	0 10	
1174	B201289	BH12892329	03/23/89	URANIUM 233 234	1 300	PCI/G	0 30	0 10	
1175	B201189	BH11893541	03/23/89	URANIUM 233 234	1 500	PCI/G	0 30	0 10	

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1176	B302089	BH17891319	03/28/89	URANIUM 233 234	1 500	PCI/G	0 40		
1177	B401989	BH16892733	04/05/89	URANIUM 233 234	1 500	PCI/G	0 30		
1178	B201189	BH11894146	03/23/89	URANIUM 233 234	1 700	PCI/G	0 40	0 10	
1179	B200989	BH09890003	03/08/89	URANIUM 233 234	2 400	PCI/G	0 30		N
1180	B302089	BH17890003	03/28/89	URANIUM 233 234	2 600	PCI/G	0 50		
1181	B200989	BH09890410	03/02/89	URANIUM 233 234	3 400	PCI/G	0 20	0 10	
1182	B301889	BH15890915	03/07/89	URANIUM 233 234	8 900	PCI/G	0 30		
1183	B200589	BH05890003	02/22/89	URANIUM 235	0 000	PCI/G	0 10		
1184	B200589	BH05890308	02/22/89	URANIUM 235	0 000	PCI/G	0 10		N
1185	B200589	BH05890913	02/22/89	URANIUM 235	0 000	PCI/G	0 10		N
1186	B200589	BH05891317	02/22/89	URANIUM 235	0 000	PCI/G	0 10		N
1187	B200589	BH05891723	02/22/89	URANIUM 235	0 000	PCI/G	0 10		N
1188	B200589	BH05892325	02/22/89	URANIUM 235	0 000	PCI/G	0 10		N
1189	B200589	BH05892530	02/23/89	URANIUM 235	0 000	PCI/G	0 10		N
1190	B200589	BH05890003R	03/08/89	URANIUM 235	0 000	PCI/G	0 10		
1191	B200689	BH06890104	02/28/89	URANIUM 235	0 000	PCI/G	0 10		N
1192	B200689	BH06890410	02/28/89	URANIUM 235	0 000	PCI/G	0 10		N
1193	B200689	BH06891016	02/28/89	URANIUM 235	0 000	PCI/G	0 10		N
1194	B200689	BH06891618	02/28/89	URANIUM 235	0 000	PCI/G	0 10		N
1195	B200689	BH06891824	02/28/89	URANIUM 235	0 000	PCI/G	0 10		N
1196	B200689	BH06892430	02/28/89	URANIUM 235	0 000	PCI/G	0 10		N
1197	B200689	BH06890003	03/09/89	URANIUM 235	0 000	PCI/G	0 10		
1198	B200789	BH07890103	03/01/89	URANIUM 235	0 000	PCI/G	0 10		N
1199	B200789	BH07890306	03/01/89	URANIUM 235	0 000	PCI/G	0 10		N
1200	B200789	BH07890612	03/01/89	URANIUM 235	0 000	PCI/G	0 10		N
1201	B200789	BH07891218	03/01/89	URANIUM 235	0 000	PCI/G	0 10		N
1202	B200789	BH07891824	03/01/89	URANIUM 235	0 000	PCI/G	0 10		N
1203	B200789	BH07890003	03/08/89	URANIUM 235	0 000	PCI/G	0 10		N
1204	B200889	BH08890106	03/06/89	URANIUM 235	0 000	PCI/G	0 10		N
1205	B200889	BH08890608	03/06/89	URANIUM 235	0 000	PCI/G	0 10		N
1206	B200889	BH08890814	03/06/89	URANIUM 235	0 000	PCI/G	0 10		N
1207	B200889	BH08891420	03/06/89	URANIUM 235	0 000	PCI/G	0 10		N
1208	B200889	BH08892022	03/06/89	URANIUM 235	0 000	PCI/G	0 10		N
1209	B200889	BH08890003	03/08/89	URANIUM 235	0 000	PCI/G	0 10		N
1210	B200989	BH09890104	03/02/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1211	B200989	BH09890003	03/08/89	URANIUM 235	0 000	PCI/G	0 10		N
1212	B201089	BH10891319	03/02/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1213	B201089	BH10890003	03/09/89	URANIUM 235	0 000	PCI/G	0 10		
1214	B201189	BH11890309	03/17/89	URANIUM 235	0 000	PCI/G	0 10		
1215	B201189	BH11891521	03/17/89	URANIUM 235	0 000	PCI/G	0 10		
1216	B201189	BH11892733	03/17/89	URANIUM 235	0 000	PCI/G	0 10		
1217	B201189	BH11894146	03/23/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1218	B201289	BH12890003	03/22/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1219	B201289	BH12890307	03/22/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1220	B201289	BH12890915	03/23/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1221	B201289	BH12891521	03/23/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1222	B201289	BH12892329	03/23/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1223	B201289	BH12892930	03/23/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1224	B201289	BH12893032	03/23/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1225	B201489	BH13890003	03/10/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1226	B201589	BH14890307	03/15/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1227	B201589	BH14890814	03/16/89	URANIUM 235	0 000	PCI/G	0 10		
1228	B201589	BH14891417	03/16/89	URANIUM 235	0 000	PCI/G	0 10		
1229	B201589	BH14891720	03/16/89	URANIUM 235	0 000	PCI/G	0 10		
1230	B301889	BH15890915	03/07/89	URANIUM 235	0 000	PCI/G	0 10		
1231	B301889	BH15892228	03/07/89	URANIUM 235	0 000	PCI/G	0 10		
1232	B301889	BH15892834	03/07/89	URANIUM 235	0 000	PCI/G	0 10		
1233	B302089	BH17890306	03/28/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1234	B302089	BH17891319	03/28/89	URANIUM 235	0 000	PCI/G	0 10	0 10	

1235	B400289	BH02890003	04/12/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1236	B400289	BH02890309	04/12/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1237	B400289	BH02890915	04/12/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1238	B400289	BH02891521	04/13/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1239	B400289	BH02893036	04/14/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1240	B400289	BH02893642	04/14/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1241	B400289	BH02894248	04/17/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1242	B400389	BH03892733	04/05/89	URANIUM 235	0 000	PCI/G	0 10		
1243	B400389	BH03890003	04/25/89	URANIUM 235	0 000	PCI/G	0 10		
1244	B400389	BH03890915	04/25/89	URANIUM 235	0 000	PCI/G	0 10		
1245	B400389	BH03891521	04/25/89	URANIUM 235	0 000	PCI/G	0 10		
1246	B400389	BH03892127	04/25/89	URANIUM 235	0 000	PCI/G	0 10		
1247	B400389	BH03893339	04/25/89	URANIUM 235	0 000	PCI/G	0 10		
1248	B400389	BH03893945	04/26/89	URANIUM 235	0 000	PCI/G	0 10		
1249	B400489	BH04890003	04/28/89	URANIUM 235	0 000	PCI/G	0 10		
1250	B400489	BH04890309	04/28/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1251	B400489	BH04890915	04/28/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1252	B400489	BH04891521	04/28/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1253	B400489	BH04892127	04/28/89	URANIUM 235	0 000	PCI/G	0 10	0 10	
1254	B400489	BH04892733	05/01/89	URANIUM 235	0 000	PCI/G	0 10		
1255	B400489	BH04893335	05/01/89	URANIUM 235	0 000	PCI/G	0 10		
1256	B400489	BH04893538	05/01/89	URANIUM 235	0 000	PCI/G	0 10		
1257	B400489	BH04893840	05/01/89	URANIUM 235	0 000	PCI/G	0 10		
1258	B400489	BH04894046	05/01/89	URANIUM 235	0 000	PCI/G	0 10		
1259	B400489	BH04894652	05/01/89	URANIUM 235	0 000	PCI/G	0 10		
1260	B400489	BH04895254	05/01/89	URANIUM 235	0 000	PCI/G	0 10		
1261	B401989	BH16890003	04/05/89	URANIUM 235	0 000	PCI/G	0 10		
1262	B401989	BH16890309	04/05/89	URANIUM 235	0 000	PCI/G	0 10		
1263	B401989	BH16890915	04/05/89	URANIUM 235	0 000	PCI/G	0 10		
1264	B401989	BH16891519	04/05/89	URANIUM 235	0 000	PCI/G	0 10		
1265	B401989	BH16892127	04/05/89	URANIUM 235	0 000	PCI/G	0 10		
1266	B401989	BH16892733	04/05/89	URANIUM 235	0 000	PCI/G	0 10		
1267	B402189	BH18890713	03/29/89	URANIUM 235	0 000	PCI/G	0 10		N
1268	B402189	BH18891319	03/29/89	URANIUM 235	0 000	PCI/G	0 10		N
1269	B405189	BH01890003	03/09/89	URANIUM 235	0 000	PCI/G	0 10		N
1270	B405189	BH01890309	03/09/89	URANIUM 235	0 000	PCI/G	0 10		N
1271	B405189	BH01890915	03/09/89	URANIUM 235	0 000	PCI/G	0 10		N
1272	B405189	BH01891521	03/09/89	URANIUM 235	0 000	PCI/G	0 10		N
1273	B405189	BH01892127	03/09/89	URANIUM 235	0 000	PCI/G	0 10		N
1274	B405189	BH01893638	03/10/89	URANIUM 235	0 000	PCI/G	0 10		N
1275	B405189	BH01893844	03/10/89	URANIUM 235	0 000	PCI/G	0 10		N
1276	B405189	BH01894448	03/10/89	URANIUM 235	0 000	PCI/G	0 10		N
1277	B201089	BH10890106	03/02/89	URANIUM 235	0 050	PCI/G	0 10	0 10	
278	B200789	BH07892426	03/01/89	URANIUM 235	0 100	PCI/G	0 10		N
279	B200989	BH09890410	03/02/89	URANIUM 235	0 100	PCI/G	0 10	0 10	
280	B200989	BH09891016	03/02/89	URANIUM 235	0 100	PCI/G	0 10	0 10	
281	B200989	BH09891620	03/02/89	URANIUM 235	0 100	PCI/G	0 10	0 10	
282	B201189	BH11890003	03/17/89	URANIUM 235	0 100	PCI/G	0 10		
283	B201189	BH11890915	03/17/89	URANIUM 235	0 100	PCI/G	0 10		
1284	B201189	BH11892127	03/17/89	URANIUM 235	0 100	PCI/G	0 10		
1285	B201489	BH13890307	03/10/89	URANIUM 235	0 100	PCI/G	0 10	0 10	
1286	B201489	BH13890709	03/10/89	URANIUM 235	0 100	PCI/G	0 10	0 10	
1287	B201489	BH13891015	03/10/89	URANIUM 235	0 100	PCI/G	0 10	0 10	
1288	B201489	BH13891519	03/10/89	URANIUM 235	0 100	PCI/G	0 10	0 10	
1289	B201589	BH14890003	03/15/89	URANIUM 235	0 100	PCI/G	0 10	0 10	
1290	B301889	BH15890003	03/07/89	URANIUM 235	0 100	PCI/G	0 10		
1291	B301889	BH15891521	03/07/89	URANIUM 235	0 100	PCI/G	0 10		
1292	B302089	BH17890003	03/28/89	URANIUM 235	0 100	PCI/G	0 10	0 10	
1293	B302089	BH17891925	03/28/89	URANIUM 235	0 100	PCI/G	0 10	0 10	
1294	B400289	BH02892130	04/13/89	URANIUM 235	0 100	PCI/G	0 10	0 10	

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1295	B400389	BH03890309	04/25/89	URANIUM 235	0 100	PCI/G	0 10		
1296	B400389	BH03894548	04/26/89	URANIUM 235	0 100	PCI/G	0 10		
1297	B402189	BH18890003	03/29/89	URANIUM 235	0 100	PCI/G	0 10		N
1298	B402189	BH18890307	03/29/89	URANIUM 235	0 100	PCI/G	0 10		N
1299	B201189	BH11893541	03/23/89	URANIUM 235	0 200	PCI/G	0 10	0 10	
1300	B301889	BH15890309	03/07/89	URANIUM 235	0 200	PCI/G	0 10		
1301	B405189	BH01893036	03/10/89	URANIUM 235	0 200	PCI/G	0 10		N
1302	B201089	BH10890713	03/02/89	URANIUM 235	0 300	PCI/G	0 10	0 10	
1303	B400489	BH04894046	05/01/89	URANIUM 238	0 200	PCI/G	0 10		
1304	B200689	BH06890410	02/28/89	URANIUM 238	0 300	PCI/G	0 10		N
1305	B200789	BH07891218	03/01/89	URANIUM 238	0 300	PCI/G	0 10		N
1306	B400289	BH02893036	04/14/89	URANIUM 238	0 300	PCI/G	0 10	0 10	
1307	B200889	BH08891420	03/06/89	URANIUM 238	0 350	PCI/G	0 10		N
1308	B200789	BH07890612	03/01/89	URANIUM 238	0 400	PCI/G	0 10		N
1309	B200789	BH07892426	03/01/89	URANIUM 238	0 400	PCI/G	0 10		N
1310	B200889	BH08890106	03/06/89	URANIUM 238	0 400	PCI/G	0 10		N
1311	B200889	BH08890608	03/06/89	URANIUM 238	0 400	PCI/G	0 10		N
1312	B200889	BH08892022	03/06/89	URANIUM 238	0 400	PCI/G	0 10		N
1313	B200989	BH09890104	03/02/89	URANIUM 238	0 400	PCI/G	0 10	0 10	
1314	B201089	BH10890003	03/09/89	URANIUM 238	0 400	PCI/G	0 20		
1315	B400289	BH02893642	04/14/89	URANIUM 238	0 400	PCI/G	0 10	0 10	
1316	B400489	BH04890309	04/28/89	URANIUM 238	0 400	PCI/G	0 10		
1317	B400489	BH04891521	04/28/89	URANIUM 238	0 400	PCI/G	0 10	0 10	
1318	B200589	BH05891723	02/22/89	URANIUM 238	0 500	PCI/G	0 10		N
1319	B200689	BH06890003	03/09/89	URANIUM 238	0 500	PCI/G	0 20		
1320	B200889	BH08890814	03/06/89	URANIUM 238	0 500	PCI/G	0 10		N
1321	B200989	BH09891016	03/02/89	URANIUM 238	0 500	PCI/G	0 10	0 10	
1322	B201589	BH14890814	03/16/89	URANIUM 238	0 500	PCI/G	0 20		
1323	B301889	BH15891521	03/07/89	URANIUM 238	0 500	PCI/G	0 10		
1324	B400289	BH02890003	04/12/89	URANIUM 238	0 500	PCI/G	0 20	0 10	
1325	B400289	BH02890915	04/12/89	URANIUM 238	0 500	PCI/G	0 20	0 10	
1326	B400389	BH03892733	04/05/89	URANIUM 238	0 500	PCI/G	0 20		
1327	B400389	BH03891521	04/25/89	URANIUM 238	0 500	PCI/G	0 10		
1328	B400389	BH03892127	04/25/89	URANIUM 238	0 500	PCI/G	0 20		
1329	B400489	BH04890003	04/28/89	URANIUM 238	0 500	PCI/G	0 10	0 10	
1330	B400489	BH04893840	05/01/89	URANIUM 238	0 500	PCI/G	0 20		
1331	B200589	BH05890003	02/22/89	URANIUM 238	0 600	PCI/G	0 10		
1332	B200589	BH05892325	02/22/89	URANIUM 238	0 600	PCI/G	0 20		N
1333	B200589	BH05892530	02/23/89	URANIUM 238	0 600	PCI/G	0 20		N
1334	B200689	BH06891016	02/28/89	URANIUM 238	0 600	PCI/G	0 10		N
1335	B200789	BH07890103	03/01/89	URANIUM 238	0 600	PCI/G	0 10		N
1336	B200789	BH07890306	03/01/89	URANIUM 238	0 600	PCI/G	0 10		N
1337	B200789	BH07890003	03/08/89	URANIUM 238	0 600	PCI/G	0 20		N
1338	B200889	BH08890003	03/08/89	URANIUM 238	0 600	PCI/G	0 20		N
1339	B200989	BH09891620	03/02/89	URANIUM 238	0 600	PCI/G	0 10	0 10	
1340	B201089	BH10890106	03/02/89	URANIUM 238	0 600	PCI/G	0 10	0 10	
1341	B400389	BH03893339	04/25/89	URANIUM 238	0 600	PCI/G	0 20		
1342	B400489	BH04890915	04/28/89	URANIUM 238	0 600	PCI/G	0 20	0 10	
1343	B400489	BH04892127	04/28/89	URANIUM 238	0 600	PCI/G	0 20	0 10	
1344	B400489	BH04892733	05/01/89	URANIUM 238	0 600	PCI/G	0 20		
1345	B400489	BH04894652	05/01/89	URANIUM-238	0 600	PCI/G	0 20		
1346	B405189	BH01890003	03/09/89	URANIUM 238	0 600	PCI/G	0 20		N
1347	B405189	BH01890309	03/09/89	URANIUM 238	0 600	PCI/G	0 10		N
1348	B405189	BH01891521	03/09/89	URANIUM 238	0 600	PCI/G	0 10		N
1349	B400389	BH03890003	04/25/89	URANIUM 238	0 650	PCI/G	0 20		
1350	B200689	BH06891824	02/28/89	URANIUM 238	0 700	PCI/G	0 20		N
1351	B200689	BH06892430	02/28/89	URANIUM 238	0 700	PCI/G	0 20		N
1352	B200789	BH07891824	03/01/89	URANIUM 238	0 700	PCI/G	0 10		N
1353	B200989	BH09890003	03/08/89	URANIUM 238	0 700	PCI/G	0 20		N

354	B201189	BH11890915	03/17/89	URANIUM 238	0 700	PCI/G	0 20			
355	B201489	BH13890003	03/10/89	URANIUM 238	0 700	PCI/G	0 20	0 10		
356	B201489	BH13891519	03/10/89	URANIUM 238	0 700	PCI/G	0 10	0 10		
357	B201589	BH14890003	03/15/89	URANIUM 238	0 700	PCI/G	0 20	0 10		
358	B201589	BH14891417	03/16/89	URANIUM 238	0 700	PCI/G	0 30			
359	B301889	BH15892834	03/07/89	URANIUM 238	0 700	PCI/G	0 20			
360	B400289	BH02890309	04/12/89	URANIUM 238	0 700	PCI/G	0 20	0 10		
361	B400289	BH02894248	04/17/89	URANIUM 238	0 700	PCI/G	0 20	0 10		
362	B400389	BH03890309	04/25/89	URANIUM 238	0 700	PCI/G	0 20			
363	B400389	BH03890915	04/25/89	URANIUM 238	0 700	PCI/G	0 20			
364	B400389	BH03893945	04/26/89	URANIUM 238	0 700	PCI/G	0 20			
365	B400489	BH04893538	05/01/89	URANIUM 238	0 700	PCI/G	0 20			
366	B402189	BH18890003	03/29/89	URANIUM 238	0 700	PCI/G	0 20		N	
367	B402189	BH18891319	03/29/89	URANIUM 238	0 700	PCI/G	0 20		N	
368	B405189	BH01893638	03/10/89	URANIUM 238	0 700	PCI/G	0 20		N	
369	B405189	BH01894448	03/10/89	URANIUM 238	0 700	PCI/G	0 20		N	
370	B200589	BH05890308	02/22/89	URANIUM 238	0 800	PCI/G	0 10		N	
371	B200589	BH05890913	02/22/89	URANIUM 238	0 800	PCI/G	0 10		N	
372	B200689	BH06890104	02/28/89	URANIUM 238	0 800	PCI/G	0 20		N	
373	B201189	BH11890003	03/17/89	URANIUM-238	0 800	PCI/G	0 20			
374	B201489	BH13890307	03/10/89	URANIUM 238	0 800	PCI/G	0 20	0 10		
375	B201589	BH14891720	03/16/89	URANIUM 238	0 800	PCI/G	0 20			
376	B301889	BH15890915	03/07/89	URANIUM 238	0 800	PCI/G	0 30			
77	B400289	BH02891521	04/13/89	URANIUM 238	0 800	PCI/G	0 20	0 10		
78	B401989	BH16890309	04/05/89	URANIUM 238	0 800	PCI/G	0 20			
79	B405189	BH01892127	03/09/89	URANIUM 238	0 800	PCI/G	0 20		N	
80	B405189	BH01893036	03/10/89	URANIUM 238	0 800	PCI/G	0 20		N	
81	B400289	BH02892130	04/13/89	URANIUM 238	0 850	PCI/G	0 20	0 10		
82	B201489	BH13890709	03/10/89	URANIUM 238	0 900	PCI/G	0 20	0 10		
83	B200589	BH05891317	02/22/89	URANIUM 238	0 900	PCI/G	0 10		N	
84	B200589	BH05890003R	03/08/89	URANIUM 238	0 900	PCI/G	0 20			
85	B200689	BH06891618	02/28/89	URANIUM 238	0 900	PCI/G	0 20		N	
86	B201189	BH11890309	03/17/89	URANIUM 238	0 900	PCI/G	0 20			
87	B201189	BH11891521	03/17/89	URANIUM 238	0 900	PCI/G	0 20			
88	B201289	BH12890003	03/22/89	URANIUM 238	0 900	PCI/G	0 20	0 10		
89	B201289	BH12892930	03/23/89	URANIUM 238	0 900	PCI/G	0 20	0 10		
90	B201589	BH14890307	03/15/89	URANIUM 238	0 900	PCI/G	0 20	0 10		
91	B301889	BH15892228	03/07/89	URANIUM 238	0 900	PCI/G	0 20			
92	B302089	BH17891925	03/28/89	URANIUM 238	0 900	PCI/G	0 20	0 10		
93	B400489	BH04895254	05/01/89	URANIUM 238	0 900	PCI/G	0 20			
94	B401989	BH16890915	04/05/89	URANIUM 238	0 900	PCI/G	0 20			
95	B401989	BH16891519	04/05/89	URANIUM 238	0 900	PCI/G	0 30			
6	B405189	BH01890915	03/09/89	URANIUM 238	0 900	PCI/G	0 20		N	
7	B405189	BH01893844	03/10/89	URANIUM 238	0 900	PCI/G	0 20		N	
8	B201289	BH12890307	03/22/89	URANIUM 238	1 000	PCI/G	0 30	0 10		
9	B201289	BH12893032	03/23/89	URANIUM 238	1 000	PCI/G	0 20	0 10		
0	B201489	BH13891015	03/10/89	URANIUM 238	1 000	PCI/G	0 20	0 10		
1	B301889	BH15890309	03/07/89	URANIUM 238	1 000	PCI/G	0 20			
2	B400489	BH04893335	05/01/89	URANIUM 238	1 000	PCI/G	0 20			
13	B402189	BH18890713	03/29/89	URANIUM 238	1 000	PCI/G	0 20		N	
14	B201089	BH10890713	03/02/89	URANIUM 238	1 100	PCI/G	0 20	0 10		
15	B201289	BH12890915	03/23/89	URANIUM 238	1 100	PCI/G	0 20	0 10		
16	B301889	BH15890003	03/07/89	URANIUM 238	1 100	PCI/G	0 20			
17	B302089	BH17891319	03/28/89	URANIUM 238	1 100	PCI/G	0 30	0 10		
18	B400389	BH03894548	04/26/89	URANIUM 238	1 100	PCI/G	0 30			
19	B401989	BH16890003	04/05/89	URANIUM 238	1 100	PCI/G	0 30			
0	B402189	BH18890307	03/29/89	URANIUM 238	1 100	PCI/G	0 30		N	
1	B302089	BH17890306	03/28/89	URANIUM 238	1 150	PCI/G	0 30	0 10		
2	B201189	BH11892127	03/17/89	URANIUM 238	1 200	PCI/G	0 30			
3	B201289	BH12891521	03/23/89	URANIUM 238	1 200	PCI/G	0 20	0 10		

1414	B201289	BH12892329	03/23/89	URANIUM 238	1 200	PCI/G	0 30	0 10
1415	B401989	BH16892127	04/05/89	URANIUM 238	1 200	PCI/G	0 30	
1416	B401989	BH16892733	04/05/89	URANIUM 238	1 200	PCI/G	0 30	
1417	B201189	BH11892733	03/17/89	URANIUM 238	1 300	PCI/G	0 20	
1418	B201189	BH11893541	03/23/89	URANIUM 238	1 300	PCI/G	0 30	0 10
1419	B201089	BH10891319	03/02/89	URANIUM 238	1 400	PCI/G	0 20	0 10
1420	B201189	BH11894146	03/23/89	URANIUM 238	1 400	PCI/G	0 30	0 10
1421	B302089	BH17890003	03/28/89	URANIUM 238	2 300	PCI/G	0 40	0 10
1422	B200989	BH09890410	03/02/89	URANIUM 238	3 200	PCI/G	0 20	0 10

Summary Statistics for Total Uranium Isotopes in Background Subsurface Soils (Boreholes) (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=URANIUM TOTAL

N	Minimum	Maximum	Mean	Std Dev	Range	CV
120	0 5000000	6 7000000	1 5445833	0 7883819	6 2000000	51 0417209

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
120	0 2000000	8 9000000	0 8108333	0 8634790	8 7000000	106 4927820

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
120	0	0 3000000	0 0254167	0 0538422	0 3000000	211 8382404

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
120	0 2000000	3 2000000	0 7766667	0 3683334	3 0000000	47 4248968

Table B 4 Ordered Listing of Uranium Isotopes in Background Surface Soils (BSCP DOE 1995a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	DETECT	VAL
1	SS106194	SS00113EG	06/08/94	URANIUM 233 234	0 660	PCI/G		0 038	0 007	V
2	SS105794	SS00109EG	06/07/94	URANIUM 233 234	0 730	PCI/G		0 045	0 010	V
3	SS106994	SS00121EG	06/08/94	URANIUM 233 234	0 780	PCI/G		0 055	0 010	V
4	SS105594	SS00107EG	06/07/94	URANIUM 233 234	0 790	PCI/G		0 051	0 010	V
5	SS106794	SS00119EG	06/07/94	URANIUM 233 234	0 810	PCI/G		0 058	0 010	V
6	SS107294	SS00103EG	06/08/94	URANIUM 233 234	0 810	PCI/G		0 044	0 007	V
7	SS107294	SS00125EG	06/08/94	URANIUM 233 234	0 810	PCI/G		0 059	0 010	V
8	SS107194	SS00123EG	06/08/94	URANIUM 233 234	0 850	PCI/G		0 059	0 010	V
9	SS105994	SS00111EG	06/08/94	URANIUM 233 234	0 910	PCI/G		0 048	0 008	V
10	SS105694	SS00108EG	06/07/94	URANIUM 233 234	0 940	PCI/G		0 050	0 009	V
11	SS106694	SS00118EG	06/07/94	URANIUM 233 234	0 940	PCI/G		0 051	0 009	V
12	SS107094	SS00122EG	06/08/94	URANIUM 233 234	0 950	PCI/G		0 063	0 010	V
13	SS105894	SS00110EG	06/07/94	URANIUM 233 234	0 960	PCI/G		0 051	0 009	V
14	SS106094	SS00112EG	06/08/94	URANIUM 233 234	1 000	PCI/G		0 049	0 007	V
15	SS106894	SS00120EG	06/07/94	URANIUM 233 234	1 000	PCI/G		0 068	0 010	V
16	SS106294	SS00114EG	06/08/94	URANIUM 233 234	1 100	PCI/G		0 054	0 009	V
17	SS106394	SS00115EG	06/07/94	URANIUM 233 234	1 100	PCI/G		0 056	0 009	V
18	SS106494	SS00116EG	06/07/94	URANIUM 233 234	1 100	PCI/G		0 077	0 010	V
19	SS106594	SS00117EG	06/07/94	URANIUM 233 234	1 100	PCI/G		0 056	0 010	V
20	SS105494	SS00106EG	06/07/94	URANIUM 233 234	2 300	PCI/G		0 120	0 010	V
21	SS107294	SS00125EG	06/08/94	URANIUM 235	0 033	PCI/G	J	0 012	0 009	V
22	SS106194	SS00113EG	06/08/94	URANIUM 235	0 034	PCI/G	J	0 008	0 003	V
23	SS107294	SS00103EG	06/08/94	URANIUM 235	0 035	PCI/G	J	0 008	0 005	V
24	SS106794	SS00119EG	06/07/94	URANIUM 235	0 038	PCI/G	J	0 011	0 008	V
25	SS105594	SS00107EG	06/07/94	URANIUM 235	0 040	PCI/G	J	0 010	0 005	V
26	SS105994	SS00111EG	06/08/94	URANIUM 235	0 041	PCI/G	J	0 009	0 004	V
27	SS107094	SS00122EG	06/08/94	URANIUM 235	0 042	PCI/G	J	0 012	0 008	V
28	SS107194	SS00123EG	06/08/94	URANIUM 235	0 042	PCI/G	J	0 011	0 006	V
29	SS106994	SS00121EG	06/08/94	URANIUM 235	0 043	PCI/G	J	0 013	0 007	V
30	SS105794	SS00109EG	06/07/94	URANIUM 235	0 044	PCI/G	J	0 010	0 004	V
31	SS105894	SS00110EG	06/07/94	URANIUM 235	0 046	PCI/G	J	0 010	0 004	V
32	SS106094	SS00112EG	06/08/94	URANIUM 235	0 049	PCI/G	J	0 010	0 003	V
33	SS106494	SS00116EG	06/07/94	URANIUM 235	0 052	PCI/G	J	0 016	0 009	V
34	SS106894	SS00120EG	06/07/94	URANIUM 235	0 052	PCI/G	J	0 014	0 007	V
35	SS106394	SS00115EG	06/07/94	URANIUM 235	0 055	PCI/G	J	0 011	0 004	V
36	SS106694	SS00118EG	06/07/94	URANIUM 235	0 056	PCI/G	J	0 011	0 004	V
37	SS105694	SS00108EG	06/07/94	URANIUM 235	0 058	PCI/G	J	0 011	0 004	V
38	SS106294	SS00114EG	06/08/94	URANIUM 235	0 064	PCI/G	J	0 011	0 004	V
39	SS106594	SS00117EG	06/07/94	URANIUM 235	0 077	PCI/G	J	0 013	0 004	V
40	SS105494	SS00106EG	06/07/94	URANIUM 235	0 100	PCI/G	J	0 017	0 007	V
41	SS106194	SS00113EG	06/08/94	URANIUM 238	0 740	PCI/G		0 041	0 006	V
42	SS105594	SS00107EG	06/07/94	URANIUM 238	0 800	PCI/G		0 051	0 008	V
43	SS105794	SS00109EG	06/07/94	URANIUM 238	0 810	PCI/G		0 049	0 008	V
44	SS106994	SS00121EG	06/08/94	URANIUM 238	0 830	PCI/G		0 057	0 010	V
45	SS107294	SS00125EG	06/08/94	URANIUM 238	0 830	PCI/G		0 060	0 010	V
46	SS107294	SS00103EG	06/08/94	URANIUM 238	0 840	PCI/G		0 045	0 007	V
47	SS105694	SS00108EG	06/07/94	URANIUM 238	0 870	PCI/G		0 047	0 008	V
48	SS106794	SS00119EG	06/07/94	URANIUM 238	0 890	PCI/G		0 061	0 009	V
49	SS105994	SS00111EG	06/08/94	URANIUM 238	0 900	PCI/G		0 048	0 007	V
50	SS107094	SS00122EG	06/08/94	URANIUM 238	0 920	PCI/G		0 061	0 009	V
51	SS107194	SS00123EG	06/08/94	URANIUM 238	0 920	PCI/G		0 062	0 009	V
52	SS106094	SS00112EG	06/08/94	URANIUM 238	0 980	PCI/G		0 049	0 007	V
53	SS105894	SS00110EG	06/07/94	URANIUM 238	1 000	PCI/G		0 052	0 007	V

54	SS106694	SS00118EG	06/07/94	URANIUM 238	1 000	PCI/G	0 053	0 008	V
55	SS106294	SS00114EG	06/08/94	URANIUM 238	1 100	PCI/G	0 053	0 008	V
56	SS106394	SS00115EG	06/07/94	URANIUM 238	1 100	PCI/G	0 057	0 008	V
57	SS106494	SS00116EG	06/07/94	URANIUM 238	1 100	PCI/G	0 080	0 010	V
58	SS106894	SS00120EG	06/07/94	URANIUM 238	1 100	PCI/G	0 068	0 010	V
59	SS106594	SS00117EG	06/07/94	URANIUM 238	1 200	PCI/G	0 059	0 009	V
60	SS105494	SS00106EG	06/07/94	URANIUM 238	2 100	PCI/G	0 110	0 010	V

Summary Statistics for Uranium Isotopes in Background Surface Soils (BSCP DOE 1995a)

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
20	0 6600000	2 3000000	0 9820000	0 3367585	1 6400000	34 2931306

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
20	0 0330000	0 1000000	0 0500500	0 0160311	0 0670000	32 0302447

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
20	0 7400000	2 1000000	1 0015000	0 2873889	1 3600000	28 6958442

Table B 5 Ordered Listing of Dissolved Uranium Isotopes in Background Stream Water (1993 BGCR Data DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
386	SW041	SW41001	03/01/89	URANIUM TOTAL	0 10	PCI/L				
387	SW107	SW107001	02/28/89	URANIUM TOTAL	0 30	PCI/L				N
388	SW007	SW07001	02/27/89	URANIUM TOTAL	0 70	PCI/L				N
389	SW006	SW06001	02/24/89	URANIUM TOTAL	0 75	PCI/L				
390	SW005	SW05001	02/28/89	URANIUM TOTAL	1 10	PCI/L				N
391	SW004	SW004001	03/02/89	URANIUM TOTAL	1 40	PCI/L				N
392	SW130	SW01401WC	08/01/91	URANIUM 233 234	0 02	PCI/L	J	0 02	0 60	
393	SW130	SW01192WC	06/03/91	URANIUM 233 234	0 01	PCI/L	J	0 02	0 60	
394	SW006	SW01855WC	03/23/92	URANIUM 233 234	0 00	PCI/L		0 00	0 60	
395	SW134	SW01851WC	03/23/92	URANIUM 233 234	0 00	PCI/L		0 00	0 60	
396	SW135	SW01852WC	03/23/92	URANIUM 233 234	0 00	PCI/L		0 00	0 60	
397	SW131	SW01403WC	08/05/91	URANIUM 233 234	0 09	PCI/L	J	0 15	0 60	
398	SW131	SW00675WC	01/03/91	URANIUM 233 234	0 10	PCI/L	U		0 60	
399	SW041	SW01397WC	08/05/91	URANIUM 233 234	0 10	PCI/L	J	0 14	0 60	
400	SW107	SW50224WC	11/04/92	URANIUM 233 234	0 11	PCI/L	J	0 20	0 60	
401	SW006	SW01292WC	07/01/91	URANIUM 233 234	0 13	PCI/L	J	0 15	0 09	A
402	SW041	SW01188WC	06/04/91	URANIUM 233 234	0 13	PCI/L	J	0 15	0 60	
403	SW006	SW01398WC	08/01/91	URANIUM 233 234	0 14	PCI/L	J	0 17	0 60	
404	SW005	SW00669WC	01/02/91	URANIUM 233 234	0 15	PCI/L		0 14	0 60	
405	SW107	SW01289WC	07/01/91	URANIUM 233 234	0 16	PCI/L	J	0 19	0 17	V
406	SW131	SW01297WC	07/08/91	URANIUM 233 234	0 17	PCI/L	J	0 20	0 60	
407	SW006	SW01189WC	06/05/91	URANIUM 233 234	0 18	PCI/L	J	0 20	0 60	
408	SW041	SW00207WC	08/06/90	URANIUM 233 234	0 20	PCI/L	J	0 23	0 60	A
409	SW005	SW00463WC	11/08/90	URANIUM 233 234	0 20	PCI/L	U		0 60	
410	SW005	SW00875WC	03/06/91	URANIUM 233 234	0 20	PCI/L	U		0 60	
411	SW007	SW00872WC	03/06/91	URANIUM 233 234	0 20	PCI/L	U		0 60	
412	SW107	SW107001	02/28/89	URANIUM 233 234	0 20	PCI/L		0 10		N
413	SW107	SW00462WC	11/01/90	URANIUM 233 234	0 20	PCI/L	U		0 60	
414	SW131	SW00984WC	04/01/91	URANIUM 233 234	0 20	PCI/L	U		0 60	
415	SW004	SW01848WC	03/30/92	URANIUM 233 234	0 20	PCI/L	J	0 01	0 60	
416	SW107	SW00205WC	08/01/90	URANIUM 233 234	0 21	PCI/L	J	0 10	0 60	V
417	SW041	SW01291WC	07/08/91	URANIUM 233 234	0 22	PCI/L	J	0 26	0 60	
418	SW131	SW01194WC	06/04/91	URANIUM 233 234	0 23	PCI/L	J	0 21	0 60	
419	SW005	SW01396WC	08/01/91	URANIUM 233 234	0 23	PCI/L	J	0 23	0 60	
420	SW005	SW01290WC	07/01/91	URANIUM 233 234	0 24	PCI/L	J	0 21	0 09	A
421	SW006	SW01086WC	05/30/91	URANIUM 233 234	0 26	PCI/L	J	0 24	0 17	V
422	SW005	SW00206WC	08/01/90	URANIUM 233 234	0 27	PCI/L	J	0 10	0 60	V
423	SW006	SW00671WC	01/15/91	URANIUM 233 234	0 29	PCI/L		0 25	0 60	
424	SW107	SW00874WC	03/06/91	URANIUM 233 234	0 29	PCI/L		0 20	0 60	
425	SW107	SW00566WC	12/03/90	URANIUM 233 234	0 30	PCI/L	U		0 60	
426	SW127	SW00467WC	11/01/90	URANIUM 233 234	0 30	PCI/L	U		0 60	
427	SW127	SW01400WC	08/01/91	URANIUM 233 234	0 31	PCI/L	J	0 29	0 60	
428	SW005	SW00978WC	04/02/91	URANIUM 233 234	0 37	PCI/L		0 20	0 60	
429	SW007	SW01184WC	06/03/91	URANIUM 233 234	0 40	PCI/L	J	0 28	0 60	
430	SW006	SW00980WC	04/02/91	URANIUM-233 234	0 41	PCI/L		0 19	0 60	
431	SW107	SW01186WC	06/03/91	URANIUM 233 234	0 45	PCI/L	J	0 30	0 60	
432	SW006	SW06001	02/24/89	URANIUM 233 234	0 50	PCI/L		0 10		
433	SW007	SW07001	02/27/89	URANIUM 233 234	0 50	PCI/L		1 30		N
434	SW131	SW00469WC	11/01/90	URANIUM 233 234	0 50	PCI/L	U		0 60	
435	SW131	SW00881WC	03/13/91	URANIUM 233 234	0 50	PCI/L	U		0 60	
436	SW006	SW00569WC	12/03/90	URANIUM 233 234	0 53	PCI/L		0 50	0 60	
437	SW004	SW01183WC	06/05/91	URANIUM 233 234	0 55	PCI/L	J	0 34	0 60	
438	SW006	SW00465WC	11/13/90	URANIUM 233 234	0 60	PCI/L	U		0 60	

439	SW006	SW00877WC	03/06/91	URANIUM 233 234	0 60	PCI/L	U		0 60	
440	SW041	SW00568WC	12/04/90	URANIUM 233 234	0 70	PCI/L	U		0 60	
441	SW107	SW00977WC	04/02/91	URANIUM-233 234	0 71	PCI/L		0 30	0 60	
442	SW004	SW004001	03/02/89	URANIUM 233 234	0 80	PCI/L		0 20		N
443	SW005	SW05001	02/28/89	URANIUM 233 234	0 80	PCI/L		0 30		N
444	SW004	SW00871WC	03/06/91	URANIUM 233 234	1 10	PCI/L		0 40	0 60	
445	SW005	SW00575WC	12/03/90	URANIUM 233 234	1 80	PCI/L		1 10	0 60	
446	SW041	SW00522WC	11/05/90	URANIUM 233 234	1 80	PCI/L		0 60	0 60	
447	SW005	SW00108WC	07/02/90	URANIUM 233 234	31 75	PCI/L	X	4 64	0 60	
448	SW005	SW00206WC	08/01/90	URANIUM 235	0 02	PCI/L	J	0 04	0 60	V
449	SW107	SW50224WC	11/04/92	URANIUM 235	0 02	PCI/L	J	0 02	0 60	
450	SW041	SW01291WC	07/08/91	URANIUM 235	0 01	PCI/L	J	0 02	0 60	
451	SW127	SW01400WC	08/01/91	URANIUM 235	0 01	PCI/L	J	0 01	0 60	
452	SW006	SW01189WC	06/05/91	URANIUM 235	0 01	PCI/L	J	0 01	0 60	
453	SW107	SW01289WC	07/01/91	URANIUM 235	0 01	PCI/L	J	0 01	0 10	V
454	SW041	SW01188WC	06/04/91	URANIUM 235	0 01	PCI/L	J	0 01	0 60	
455	SW130	SW01401WC	08/01/91	URANIUM 235	0 01	PCI/L	J	0 01	0 60	
456	SW006	SW01086WC	05/30/91	URANIUM 235	0 00	PCI/L	J	0 01	0 00	V
457	SW004	SW004001	03/02/89	URANIUM 235	0 00	PCI/L		0 10		N
458	SW005	SW05001	02/28/89	URANIUM 235	0 00	PCI/L		0 10		N
459	SW005	SW01396WC	08/01/91	URANIUM 235	0 00	PCI/L	J	0 15	0 60	
460	SW006	SW06001	02/24/89	URANIUM 235	0 00	PCI/L		0 10		
461	SW041	SW01397WC	08/05/91	URANIUM 235	0 00	PCI/L	J	0 15	0 60	
462	SW107	SW107001	02/28/89	URANIUM 235	0 00	PCI/L		0 10		N
463	SW107	SW00205WC	08/01/90	URANIUM 235	0 00	PCI/L	J	0 03	0 60	V
464	SW131	SW01403WC	08/05/91	URANIUM 235	0 00	PCI/L	J	0 16	0 60	
465	SW004	SW01848WC	03/30/92	URANIUM 235	0 02	PCI/L	J	0 93	0 60	
466	SW134	SW01851WC	03/23/92	URANIUM 235	0 03	PCI/L		0 46	0 60	
467	SW005	SW01290WC	07/01/91	URANIUM 235	0 03	PCI/L	J	0 08	0 12	A
468	SW006	SW01855WC	03/23/92	URANIUM 235	0 03	PCI/L		0 48	0 60	
469	SW006	SW01292WC	07/01/91	URANIUM 235	0 04	PCI/L	J	0 09	0 09	A
470	SW007	SW01184WC	06/03/91	URANIUM 235	0 05	PCI/L	J	0 09	0 60	
471	SW107	SW01186WC	06/03/91	URANIUM 235	0 05	PCI/L	J	0 09	0 60	
472	SW131	SW01194WC	06/04/91	URANIUM 235	0 05	PCI/L	J	0 09	0 60	
473	SW130	SW01192WC	06/03/91	URANIUM 235	0 05	PCI/L	J	0 12	0 60	
474	SW006	SW01398WC	08/01/91	URANIUM 235	0 05	PCI/L	J	0 10	0 60	
475	SW131	SW01297WC	07/08/91	URANIUM 235	0 05	PCI/L	J	0 12	0 60	
476	SW131	SW00984WC	04/01/91	URANIUM 235	0 08	PCI/L	U		0 60	
477	SW041	SW00207WC	08/06/90	URANIUM 235	0 08	PCI/L	J	0 13	0 60	A
478	SW005	SW00978WC	04/02/91	URANIUM 235	0 09	PCI/L	U		0 60	
479	SW006	SW00980WC	04/02/91	URANIUM 235	0 09	PCI/L	U		0 60	
480	SW005	SW00669WC	01/02/91	URANIUM 235	0 10	PCI/L	U		0 60	
481	SW005	SW00875WC	03/06/91	URANIUM 235	0 10	PCI/L	U		0 60	
482	SW007	SW07001	02/27/89	URANIUM 235	0 10	PCI/L		0 20		N
483	SW107	SW00874WC	03/06/91	URANIUM 235	0 10	PCI/L	U		0 60	
484	SW107	SW00977WC	04/02/91	URANIUM 235	0 10	PCI/L	U		0 60	
485	SW131	SW00675WC	01/03/91	URANIUM 235	0 10	PCI/L	U		0 60	
486	SW004	SW01183WC	06/05/91	URANIUM 235	0 13	PCI/L	J	0 17	0 60	
487	SW135	SW01852WC	03/23/92	URANIUM 235	0 13	PCI/L		0 09	0 60	
488	SW004	SW00871WC	03/06/91	URANIUM 235	0 20	PCI/L	U		0 60	
489	SW005	SW00463WC	11/08/90	URANIUM 235	0 20	PCI/L	U		0 60	
490	SW006	SW00671WC	01/15/91	URANIUM 235	0 20	PCI/L	U		0 60	
491	SW007	SW00872WC	03/06/91	URANIUM 235	0 20	PCI/L	U		0 60	
492	SW041	SW00522WC	11/05/90	URANIUM 235	0 20	PCI/L	U		0 60	
493	SW107	SW00462WC	11/01/90	URANIUM 235	0 20	PCI/L	U		0 60	
494	SW107	SW00566WC	12/03/90	URANIUM 235	0 30	PCI/L	U		0 60	
495	SW127	SW00467WC	11/01/90	URANIUM 235	0 30	PCI/L	U		0 60	
496	SW131	SW00881WC	03/13/91	URANIUM 235	0 30	PCI/L	U		0 60	
497	SW006	SW00569WC	12/03/90	URANIUM 235	0 40	PCI/L	U		0 60	

498	SW006	SW00877WC	03/06/91	URANIUM 235	0 40	PCI/L	U		0 60	
499	SW131	SW00469WC	11/01/90	URANIUM 235	0 50	PCI/L	U		0 60	
500	SW006	SW00465WC	11/13/90	URANIUM 235	0 60	PCI/L	U		0 60	
501	SW005	SW00575WC	12/03/90	URANIUM 235	0 70	PCI/L	U		0 60	
502	SW041	SW00568WC	12/04/90	URANIUM 235	0 70	PCI/L	U		0 60	
503	SW005	SW00108WC	07/02/90	URANIUM 235	0 90	PCI/L	X	0 43	0 60	
504	SW041	SW41001	03/01/89	URANIUM 238	0 00	PCI/L		0 10		
505	SW131	SW01403WC	08/05/91	URANIUM 238	0 00	PCI/L	J	0 16	0 60	
506	SW006	SW01855WC	03/23/92	URANIUM 238	0 04	PCI/L		0 38	0 60	
507	SW107	SW01289WC	07/01/91	URANIUM 238	0 04	PCI/L	J	0 09	0 10	V
508	SW041	SW01397WC	08/05/91	URANIUM 238	0 05	PCI/L	J	0 10	0 60	
509	SW127	SW01400WC	08/01/91	URANIUM 238	0 05	PCI/L	J	0 13	0 60	
510	SW135	SW01852WC	03/23/92	URANIUM 238	0 06	PCI/L		0 22	0 60	
511	SW005	SW01290WC	07/01/91	URANIUM 238	0 07	PCI/L	J	0 12	0 12	A
512	SW006	SW01086WC	05/30/91	URANIUM 238	0 09	PCI/L	J	0 14	0 10	V
513	SW007	SW07001	02/27/89	URANIUM 238	0 10	PCI/L		1 20		N
514	SW107	SW107001	02/28/89	URANIUM 238	0 10	PCI/L		0 10		N
515	SW107	SW00874WC	03/06/91	URANIUM 238	0 10	PCI/L	U		0 60	
516	SW130	SW01192WC	06/03/91	URANIUM 238	0 11	PCI/L	J	0 17	0 60	
517	SW134	SW01851WC	03/23/92	URANIUM 238	0 11	PCI/L		0 10	0 60	
518	SW041	SW01188WC	06/04/91	URANIUM 238	0 12	PCI/L	J	0 15	0 60	
519	SW130	SW01401WC	08/01/91	URANIUM 238	0 13	PCI/L	J	0 19	0 60	
520	SW004	SW01848WC	03/30/92	URANIUM 238	0 14	PCI/L	J	0 11	0 60	
521	SW131	SW00675WC	01/03/91	URANIUM 238	0 14	PCI/L		0 13	0 60	
522	SW041	SW01291WC	07/08/91	URANIUM 238	0 14	PCI/L	J	0 21	0 60	
523	SW041	SW00207WC	08/06/90	URANIUM 238	0 16	PCI/L	J	0 19	0 60	A
524	SW006	SW01292WC	07/01/91	URANIUM 238	0 17	PCI/L	J	0 18	0 00	A
525	SW005	SW00875WC	03/06/91	URANIUM 238	0 19	PCI/L		0 18	0 60	
526	SW107	SW00205WC	08/01/90	URANIUM 238	0 19	PCI/L	J	0 09	0 60	V
527	SW006	SW01398WC	08/01/91	URANIUM 238	0 19	PCI/L	J	0 20	0 60	
528	SW005	SW01396WC	08/01/91	URANIUM 238	0 19	PCI/L	J	0 21	0 60	
529	SW005	SW00206WC	08/01/90	URANIUM 238	0 20	PCI/L	J	0 09	0 60	V
530	SW005	SW00463WC	11/08/90	URANIUM 238	0 20	PCI/L	U		0 60	
531	SW107	SW00462WC	11/01/90	URANIUM 238	0 20	PCI/L	U		0 60	
532	SW131	SW00984WC	04/01/91	URANIUM 238	0 20	PCI/L	U		0 60	
533	SW005	SW00978WC	04/02/91	URANIUM 238	0 22	PCI/L		0 16	0.60	
534	SW004	SW01183WC	06/05/91	URANIUM 238	0 22	PCI/L	J	0 22	0 60	
535	SW131	SW01194WC	06/04/91	URANIUM 238	0 23	PCI/L	J	0 21	0 60	
536	SW131	SW01297WC	07/08/91	URANIUM 238	0 23	PCI/L	J	0 24	0 60	
537	SW006	SW01189WC	06/05/91	URANIUM 238	0 24	PCI/L	J	0 22	0 60	
538	SW006	SW06001	02/24/89	URANIUM 238	0 25	PCI/L		0 20		
539	SW005	SW05001	02/28/89	URANIUM 238	0 30	PCI/L		0 20		N
540	SW006	SW00671WC	01/15/91	URANIUM 238	0 30	PCI/L	U		0 60	
541	SW107	SW00566WC	12/03/90	URANIUM 238	0 30	PCI/L	U		0 60	
542	SW127	SW00467WC	11/01/90	URANIUM 238	0 30	PCI/L	U		0 60	
543	SW131	SW00881WC	03/13/91	URANIUM 238	0 30	PCI/L	U		0 60	
544	SW005	SW00669WC	01/02/91	URANIUM 238	0 31	PCI/L		0 19	0 60	
545	SW107	SW00977WC	04/02/91	URANIUM 238	0 37	PCI/L		0 24	0 60	
546	SW006	SW00980WC	04/02/91	URANIUM 238	0 40	PCI/L		0 18	0 60	
547	SW007	SW01184WC	06/03/91	URANIUM-238	0 40	PCI/L	J	0 28	0 60	
548	SW006	SW00569WC	12/03/90	URANIUM 238	0 40	PCI/L	U		0 60	
549	SW006	SW00877WC	03/06/91	URANIUM 238	0 40	PCI/L	U		0 60	
550	SW007	SW00872WC	03/06/91	URANIUM 238	0 40	PCI/L	U		0 60	
551	SW131	SW00469WC	11/01/90	URANIUM 238	0 50	PCI/L	U		0 60	
552	SW107	SW01186WC	06/03/91	URANIUM 238	0 55	PCI/L	J	0 33	0 60	
553	SW004	SW004001	03/02/89	URANIUM 238	0 60	PCI/L		0 20		N
554	SW006	SW00465WC	11/13/90	URANIUM 238	0 60	PCI/L	U		0 60	
555	SW005	SW00575WC	12/03/90	URANIUM 238	0 70	PCI/L	U		0 60	
556	SW041	SW00568WC	12/04/90	URANIUM 238	0 70	PCI/L	U		0 60	

557	SW004	SW00871WC	03/06/91	URANIUM 238	0 82	PCI/L			0 34	0 60
558	SW041	SW00522WC	11/05/90	URANIUM 238	1 70	PCI/L			0 60	0 60
559	SW005	SW00108WC	07/02/90	URANIUM 238	24 45	PCI/L		X	3 72	0 60

Summary Statistics for Dissolved Uranium Isotopes in Background Stream Water (DOE 1993a)

Analysis Variable RESULT

ANALYTE=URANIUM TOTAL

N	Minimum	Maximum	Mean	Std Dev	Range	CV
6	0 1000000	1 4000000	0 7250000	0 4834770	1 3000000	66 6864814

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
56	0 0157000	31 7500000	0 9199834	4 2102724	31 7657000	457 6465654

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
56	0 0178000	0 8951000	0 1399177	0 2030022	0 9129000	145 0868948

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
56	0	24 4500000	0 7082350	3 2413667	24 4500000	457 6682417

Ordered Listing of Dissolved Uranium Isotopes in Background Seep Water (Data from 1993 BGCR DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
88	SW080	SW080001	03/01/89	URANIUM TOTAL	0 10	PCI/L				
89	SW108	SW108001	03/02/89	URANIUM TOTAL	1 20	PCI/L				N
90	SW104	SW104001	03/02/89	URANIUM TOTAL	4 60	PCI/L				N
91	SW080	SW080001	03/01/89	URANIUM 233 234	0 00	PCI/L		0 100		
92	SW104	SW01193WC	06/26/91	URANIUM 233 234	0 06	PCI/L	J	0 168	0 600	
93	SW080	SW00466WC	11/01/90	URANIUM 233 234	0 20	PCI/L	U		0 600	
94	SW080	SW00209WC	08/02/90	URANIUM 233 234	0 59	PCI/L	J	0 162	0 600	V
95	SW108	SW01185WC	06/05/91	URANIUM 233 234	0 60	PCI/L	J	0 347	0 600	
96	SW108	SW108001	03/02/89	URANIUM 233 234	0 70	PCI/L		0 200		N
97	SW108	SW00461WC	11/12/90	URANIUM 233 234	0 70	PCI/L		0 380	0 600	
98	SW108	SW01288WC	07/01/91	URANIUM 233 234	0 73	PCI/L		0 372	0 129	A
99	SW108	SW00873WC	03/05/91	URANIUM 233 234	1 10	PCI/L		0 500	0 600	
100	SW108	SW00565WC	12/03/90	URANIUM 233 234	1 20	PCI/L		0 500	0 600	
101	SW104	SW00203WC	08/07/90	URANIUM 233 234	1 61	PCI/L		0 591	0 600	V
102	SW108	SW00976WC	04/02/91	URANIUM 233 234	1 70	PCI/L		0 400	0 600	
103	SW104	SW104001	03/02/89	URANIUM 233 234	2 60	PCI/L		0 500		N

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104	SW104	SW01193WC	06/26/91	URANIUM 235	0 02	PCI/L	J	0 026	0 600	
105	SW108	SW108001	03/02/89	URANIUM 235	0 00	PCI/L		0 100		N
106	SW108	SW01288WC	07/01/91	URANIUM 235	0 00	PCI/L	J	0 131	0 000	A
107	SW080	SW00209WC	08/02/90	URANIUM 235	0 02	PCI/L	J	0 046	0 600	V
108	SW108	SW01185WC	06/05/91	URANIUM 235	0 05	PCI/L	J	0 094	0 600	
109	SW104	SW00203WC	08/07/90	URANIUM 235	0 05	PCI/L	J	0 096	0 600	V
110	SW108	SW00976WC	04/02/91	URANIUM 235	0 09	PCI/L	U		0 600	
111	SW080	SW00466WC	11/01/90	URANIUM 235	0 20	PCI/L	U		0 600	
112	SW108	SW00461WC	11/12/90	URANIUM 235	0 20	PCI/L	U		0 600	
113	SW104	SW104001	03/02/89	URANIUM 235	0 30	PCI/L		0 100		N
114	SW108	SW00565WC	12/03/90	URANIUM 235	0 30	PCI/L	U		0 600	
115	SW108	SW00873WC	03/05/91	URANIUM 235	0 30	PCI/L	U		0 600	
116	SW080	SW080001	03/01/89	URANIUM 238	0 10	PCI/L		0 100		
117	SW104	SW01193WC	06/26/91	URANIUM 238	0 03	PCI/L	J	0 095	0 600	
118	SW080	SW00466WC	11/01/90	URANIUM 238	0 20	PCI/L	U		0 600	
119	SW080	SW00209WC	08/02/90	URANIUM 238	0 29	PCI/L	J	0 107	0 600	V
120	SW108	SW01288WC	07/01/91	URANIUM 238	0 30	PCI/L	J	0 235	0 091	A
121	SW108	SW00461WC	11/12/90	URANIUM 238	0 47	PCI/L		0 320	0 600	
122	SW108	SW108001	03/02/89	URANIUM 238	0 50	PCI/L		0 200		N
123	SW108	SW01185WC	06/05/91	URANIUM 238	0 51	PCI/L	J	0 318	0 600	
124	SW108	SW00565WC	12/03/90	URANIUM 238	0 70	PCI/L		0 410	0 600	
125	SW104	SW00203WC	08/07/90	URANIUM 238	0 80	PCI/L		0 406	0 600	V
126	SW108	SW00873WC	03/05/91	URANIUM 238	0 87	PCI/L		0 480	0 600	
127	SW108	SW00976WC	04/02/91	URANIUM 238	1 60	PCI/L		0 400	0 600	
128	SW104	SW104001	03/02/89	URANIUM 238	1 70	PCI/L		0 400		N

Summary Statistics for Dissolved Uranium Isotopes in Background Seep Water (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=URANIUM TOTAL

N	Minimum	Maximum	Mean	Std Dev	Range	CV
3	0 1000000	4 6000000	1 9000000	2 4269322	4 7000000	127 7332747

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
13	0	2 6000000	0 9064931	0 7346919	2 6000000	81 0477081

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
12	0 0183000	0 3000000	0 1237492	0 1277411	0 3183000	103 2258129

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
13	0 1000000	1 7000000	0 6048154	0 5426485	1 8000000	89 7213421

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Table B 6 Ordered Listing of Total Uranium Isotopes in Background Stream Water (Data from 1993 BGCR DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
661	SW107	SW107001	02/28/89	URANIUM TOTAL	0 100	PCI/L				N
662	SW107	SW107003	06/16/89	URANIUM TOTAL	0 100	PCI/L				
663	SW005	SW05001	02/28/89	URANIUM TOTAL	0 200	PCI/L				N
664	SW005	SW005003	06/09/89	URANIUM TOTAL	0 200	PCI/L				
665	SW007	SW007002	05/31/89	URANIUM TOTAL	0 200	PCI/L				
666	SW041	SW41001	03/01/89	URANIUM TOTAL	0 200	PCI/L				N
667	SW005	SW005006	09/05/89	URANIUM TOTAL	0 300	PCI/L				V
668	SW005	SW005002	05/30/89	URANIUM TOTAL	0 400	PCI/L				
669	SW041	SW041003	06/16/89	URANIUM TOTAL	0 500	PCI/L				
670	SW006	SW006006	09/05/89	URANIUM TOTAL	0 575	PCI/L				V
671	SW006	SW06001	02/24/89	URANIUM TOTAL	0 650	PCI/L				
672	SW006	SW006002	05/31/89	URANIUM TOTAL	0 700	PCI/L				
673	SW007	SW07001	02/27/89	URANIUM TOTAL	0 800	PCI/L				N
674	SW107	SW107002	05/26/89	URANIUM TOTAL	0 800	PCI/L				
675	SW107	SW107006	09/20/89	URANIUM TOTAL	1 000	PCI/L				V
676	SW041	SW041002	05/26/89	URANIUM TOTAL	1 100	PCI/L				
677	SW004	SW004003	06/15/89	URANIUM TOTAL	2 200	PCI/L				
678	SW007	SW02029WC	12/03/92	URANIUM 233 234	0 007	PCI/L	J	0 009	0 600	
679	SW107	SW50224WC	11/04/92	URANIUM 233 234	0 029	PCI/L	J	0 137	0 600	
680	SW127	SW00366WC	10/04/90	URANIUM 233 234	0 056	PCI/L		0 110	0 260	A
681	SW130	SW01882WC	04/15/92	URANIUM 233 234	0 076	PCI/L	J	0 079	0 600	
682	SW006	SW02028WC	12/02/92	URANIUM 233 234	0 096	PCI/L	J	0 172	0 600	
683	SW005	SW005004	07/13/89	URANIUM 233 234	0 100	PCI/L		0 100	0 100	
684	SW006	SW006003	06/08/89	URANIUM 233 234	0 100	PCI/L		0 200	0 100	
685	SW006	SW006004	07/13/89	URANIUM 233 234	0 100	PCI/L		0 100	0 100	
686	SW007	SW007002	05/31/89	URANIUM 233 234	0 100	PCI/L		0 100		
687	SW041	SW41001	03/01/89	URANIUM 233 234	0 100	PCI/L		0 100		N
688	SW107	SW107001	02/28/89	URANIUM 233 234	0 100	PCI/L		0 100		N
689	SW107	SW107003	06/16/89	URANIUM 233 234	0 100	PCI/L		0 200		
690	SW107	SW107009	12/04/89	URANIUM 233 234	0 100	PCI/L		0 200	0 128	A
691	SW131	SW00368WC	10/02/90	URANIUM 233 234	0 125	PCI/L		0 124	0 292	A
692	SW107	SW10790002	02/05/90	URANIUM 233 234	0 140	PCI/L		0 220	0 240	A
693	SW127	SW02032WC	12/08/92	URANIUM 233 234	0 159	PCI/L	J	0 185	0 600	
694	SW007	SW007W060190A	06/01/90	URANIUM 233 234	0 170	PCI/L		0 170	0 600	
695	SW107	SW10790001	01/09/90	URANIUM 233 234	0 170	PCI/L		0 330	0 390	A
696	SW127	SW02009WC	08/19/92	URANIUM 233 234	0 176	PCI/L	J	0 193	0 141	A
697	SW127	SW01883WC	04/15/92	URANIUM 233 234	0 196	PCI/L	J	0 083	0 600	
698	SW005	SW05001	02/28/89	URANIUM 233 234	0 200	PCI/L		0 200		N
699	SW005	SW005003	06/09/89	URANIUM 233 234	0 200	PCI/L		0 200		
700	SW005	SW005005	08/01/89	URANIUM 233 234	0 200	PCI/L		0 200	0 100	
701	SW005	SW005006	09/05/89	URANIUM 233 234	0 200	PCI/L	U	0 200	0 600	V
702	SW007	SW007005	08/01/89	URANIUM 233 234	0 200	PCI/L		0 100	0 100	
703	SW107	SW00283WC	09/05/90	URANIUM 233 234	0 209	PCI/L		0 166	0 195	V
704	SW007	SW00790003	03/05/90	URANIUM 233 234	0 225	PCI/L		0 150	0 068	
705	SW006	SW006009	12/04/89	URANIUM 233 234	0 225	PCI/L		0 200	0 046	A
706	SW005	SW005009	12/04/89	URANIUM 233 234	0 240	PCI/L		0 180	0 000	A
707	SW006	SW006005	08/01/89	URANIUM 233 234	0 250	PCI/L		0 100	0 100	
708	SW007	SW01841WC	03/05/92	URANIUM 233 234	0 280	PCI/L	J	0 138	0 600	
709	SW041	SW00363WC	10/02/90	URANIUM 233 234	0 287	PCI/L		0 171	0 134	
710	SW107	SW02010WC	08/19/92	URANIUM 233 234	0 287	PCI/L	J	0 251	0 149	A
711	SW005	SW005W060190A	06/01/90	URANIUM 233 234	0 290	PCI/L		0 250	0 600	
712	SW006	SW01937WC	06/30/92	URANIUM 233 234	0 295	PCI/L	J	0 180	0 200	A
713	SW007	SW02016WC	08/26/92	URANIUM 233 234	0 297	PCI/L	J	0 129	0 600	

714	SW006	SW006002	05/31/89	URANIUM 233 234	0 300	PCI/L		0 200			
715	SW006	SW006006	09/05/89	URANIUM 233 234	0 300	PCI/L		0 200	0 600	V	
716	SW007	SW007003	06/08/89	URANIUM 233 234	0 300	PCI/L		0 100	0 100		
717	SW041	SW041003	06/16/89	URANIUM 233 234	0 300	PCI/L		0 200			
718	SW041	SW041W050290A	05/02/90	URANIUM 233 234	0 300	PCI/L		0 350	0 600		
719	SW041	SW04190003	03/21/90	URANIUM 233 234	0 311	PCI/L		0 310	0 362		
720	SW130	SW02008WC	08/19/92	URANIUM 233 234	0 330	PCI/L	J	0 255	0 000	A	
721	SW007	SW00790001	01/09/90	URANIUM 233 234	0 350	PCI/L		0 430	0 410	A	
722	SW005	SW02027WC	12/08/92	URANIUM 233 234	0 353	PCI/L	J	0 264	0 600		
723	SW041	SW00285WC	09/05/90	URANIUM 233 234	0 356	PCI/L		0 303	0 237	V	
724	SW041	SW01503WC	09/05/91	URANIUM 233 234	0 360	PCI/L	BJ	0 230	0 047		
725	SW005	SW00590003	03/22/90	URANIUM 233 234	0 366	PCI/L		0 363	0 284		
726	SW006	SW00286WC	09/05/90	URANIUM 233 234	0 376	PCI/L		0 251	0 195	V	
727	SW107	SW107W050190A	05/01/90	URANIUM 233 234	0 390	PCI/L		0 460	0 600		
728	SW005	SW005002	05/30/89	URANIUM 233 234	0 400	PCI/L		0 200			
729	SW006	SW06001	02/24/89	URANIUM 233 234	0 400	PCI/L		0 200			
730	SW107	SW107002	05/26/89	URANIUM 233 234	0 400	PCI/L		0 200			
731	SW005	SW00590001	01/04/90	URANIUM 233 234	0 410	PCI/L		0 360	0 445	A	
732	SW006	SW00690003	03/05/90	URANIUM 233 234	0 427	PCI/L		0 241	0 092		
733	SW107	SW00111WC	07/02/90	URANIUM 233 234	0 433	PCI/L		0 292	0 336		
734	SW005	SW00590002	02/05/90	URANIUM 233 234	0 470	PCI/L		0 320	0 030	A	
735	SW041	SW00112WC	07/05/90	URANIUM 233 234	0 479	PCI/L		0 321	0 248		
736	SW006	SW00690001	01/09/90	URANIUM 233 234	0 490	PCI/L		0 450	0 385	A	
737	SW107	SW107006	09/20/89	URANIUM 233 234	0 500	PCI/L		0 460	0 600	V	
738	SW107	SW107W06190A	06/01/90	URANIUM 233 234	0 510	PCI/L		0 330	0 600		
739	SW005	SW00108WC	07/02/90	URANIUM 233 234	0 568	PCI/L		0 344	0 265		
740	SW004	SW02026WC	12/02/92	URANIUM 233 234	0 612	PCI/L		0 378	0 600		
741	SW107	SW01802WC	01/20/92	URANIUM 233 234	0 640	PCI/L	B	0 310	0 048	A	
742	SW041	SW041002	05/26/89	URANIUM 233 234	0 700	PCI/L		0 200			
743	SW004	SW004W060190A	06/01/90	URANIUM 233 234	0 750	PCI/L		0 420	0 600		
744	SW005	SW02018WC	08/27/92	URANIUM 233 234	0 820	PCI/L		0 334	0 600		
745	SW005	SW00284WC	09/04/90	URANIUM 233 234	0 823	PCI/L		0 417	0 192	V	
746	SW004	SW004001	03/02/89	URANIUM 233 234	0 900	PCI/L		0 300		N	
747	SW004	SW004003	06/15/89	URANIUM 233 234	1 100	PCI/L		0 300			
748	SW107	SW107004	07/14/89	URANIUM 233 234	1 100	PCI/L		0 300	0 010		
749	SW006	SW02022WC	08/28/92	URANIUM 233 234	1 333	PCI/L		0 015	0 600		
750	SW041	SW04190001	01/04/90	URANIUM 233 234	1 370	PCI/L		0 730	0 400	A	
751	SW041	SW041008	11/20/89	URANIUM 233 234	1 410	PCI/L		1 010	0 000		
752	SW041	SW04190002	02/06/90	URANIUM 233 234	1 435	PCI/L		0 610	0 340	A	
753	SW107	SW10790003	03/13/90	URANIUM 233 234	1 530	PCI/L		0 620	0 180	A	
754	SW007	SW01923WC	06/08/92	URANIUM 233 234	1 836	PCI/L		0 244	0 600		
755	SW006	SW00690002	02/06/90	URANIUM 233 234	2 590	PCI/L		0 860	0 300	A	
756	SW107	SW01884WC	04/14/92	URANIUM 233 234	3 213	PCI/L	J	0 106	0 600		
757	SW107	SW107W050190A	05/01/90	URANIUM 235	0 030	PCI/L		0 180	0 600		
758	SW107	SW50224WC	11/04/92	URANIUM 235	0 021	PCI/L	J	0 022	0 600		
759	SW041	SW041W050290A	05/02/90	URANIUM 235	0 020	PCI/L		0 140	0 600		
760	SW005	SW00590002	02/05/90	URANIUM 235	0 010	PCI/L		0 010	0 030	A	
761	SW004	SW004003	06/15/89	URANIUM 235	0 000	PCI/L		0 100			
762	SW005	SW005002	05/30/89	URANIUM 235	0 000	PCI/L		0 100			
763	SW005	SW005003	06/09/89	URANIUM 235	0 000	PCI/L		0 100			
764	SW005	SW005004	07/13/89	URANIUM 235	0 000	PCI/L		0 100	0 100		
765	SW005	SW005005	08/01/89	URANIUM 235	0 000	PCI/L		0 100	0 100		
766	SW005	SW005006	09/05/89	URANIUM 235	0 000	PCI/L	U	0 100	0 600	V	
767	SW005	SW00590003	03/22/90	URANIUM 235	0 000	PCI/L		0 145	0 344		
768	SW005	SW00284WC	09/04/90	URANIUM 235	0 000	PCI/L		0 098	0 232	V	
769	SW006	SW006002	05/31/89	URANIUM 235	0 000	PCI/L		0 100			
770	SW006	SW006003	06/08/89	URANIUM 235	0 000	PCI/L		0 100	0 100		
771	SW006	SW006004	07/13/89	URANIUM 235	0 000	PCI/L		0 100	0 100		
772	SW006	SW006005	08/01/89	URANIUM 235	0 000	PCI/L		0 100	0 100		

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773	SW007	SW007002	05/31/89	URANIUM 235	0 000	PCI/L		0 100		
774	SW007	SW007003	06/08/89	URANIUM 235	0 000	PCI/L		0 100	0 100	
775	SW007	SW007005	08/01/89	URANIUM 235	0 000	PCI/L		0 100	0 100	
776	SW007	SW00790003	03/05/90	URANIUM 235	0 000	PCI/L		0 089	0 058	
777	SW007	SW02029WC	12/03/92	URANIUM 235	0 000	PCI/L	J	0 123	0 600	
778	SW041	SW41001	03/01/89	URANIUM 235	0 000	PCI/L		0 100		N
779	SW041	SW041002	05/26/89	URANIUM 235	0 000	PCI/L		0 100		
780	SW041	SW041003	06/16/89	URANIUM 235	0 000	PCI/L		0 100		
781	SW041	SW00112WC	07/05/90	URANIUM 235	0 000	PCI/L		0 126	0 301	
782	SW041	SW00363WC	10/02/90	URANIUM 235	0 000	PCI/L		0 068	0 162	
783	SW041	SW01503WC	09/05/91	URANIUM 235	0 000	PCI/L	U	0 000	0 028	
784	SW107	SW107002	05/26/89	URANIUM 235	0 000	PCI/L		0 100		
785	SW107	SW107003	06/16/89	URANIUM 235	0 000	PCI/L		0 100		
786	SW107	SW107004	07/14/89	URANIUM 235	0 000	PCI/L		0 100	0 100	
787	SW107	SW107009	12/04/89	URANIUM 235	0 000	PCI/L		0 200	0 091	A
788	SW107	SW00111WC	07/02/90	URANIUM 235	0 000	PCI/L		0 171	0 407	
789	SW127	SW00366WC	10/04/90	URANIUM 235	0 000	PCI/L		0 132	0 314	A
790	SW127	SW02032WC	12/08/92	URANIUM 235	0 000	PCI/L	J	0 159	0 600	
791	SW130	SW01882WC	04/15/92	URANIUM 235	0 000	PCI/L	U	0 000	0 600	
792	SW007	SW01841WC	03/05/92	URANIUM 235	0 001	PCI/L	J	6 633	0 600	
793	SW006	SW02028WC	12/02/92	URANIUM 235	0 015	PCI/L	J	0 014	0 600	
794	SW107	SW10790002	02/05/90	URANIUM 235	0 020	PCI/L		0 120	0 160	A
795	SW006	SW01937WC	06/30/92	URANIUM 235	0 029	PCI/L	U	0 110	0 200	A
796	SW107	SW01802WC	01/20/92	URANIUM 235	0 030	PCI/L	U	0 068	0 048	A
797	SW007	SW02016WC	08/26/92	URANIUM 235	0 031	PCI/L	J	0 061	0 600	
798	SW005	SW02027WC	12/08/92	URANIUM 235	0 031	PCI/L	J	0 093	0 600	
799	SW005	SW005009	12/04/89	URANIUM 235	0 040	PCI/L		0 070	0 000	A
800	SW107	SW107W06190A	06/01/90	URANIUM 235	0 040	PCI/L		0 100	0 600	
801	SW127	SW02009WC	08/19/92	URANIUM 235	0 044	PCI/L	J	0 096	0 000	A
802	SW006	SW00690001	01/09/90	URANIUM 235	0 045	PCI/L		0 350	0 545	A
803	SW130	SW02008WC	08/19/92	URANIUM 235	0 048	PCI/L	J	0 095	0 000	A
804	SW004	SW004W060190A	06/01/90	URANIUM 235	0 050	PCI/L		0 110	0 600	
805	SW041	SW04190002	02/06/90	URANIUM 235	0 050	PCI/L		0 200	0 360	A
806	SW006	SW00286WC	09/05/90	URANIUM 235	0 051	PCI/L		0 099	0 236	V
807	SW107	SW00283WC	09/05/90	URANIUM 235	0 051	PCI/L		0 099	0 236	V
808	SW041	SW00285WC	09/05/90	URANIUM 235	0 062	PCI/L		0 121	0 287	V
809	SW005	SW00108WC	07/02/90	URANIUM 235	0 069	PCI/L		0 135	0 321	
810	SW005	SW02018WC	08/27/92	URANIUM 235	0 074	PCI/L	J	0 103	0 600	
811	SW006	SW006006	09/05/89	URANIUM 235	0 075	PCI/L		0 090	0 600	V
812	SW006	SW006009	12/04/89	URANIUM 235	0 075	PCI/L		0 120	0 023	A
813	SW131	SW00368WC	10/02/90	URANIUM 235	0 076	PCI/L		0 149	0 353	A
814	SW007	SW007W060190A	06/01/90	URANIUM 235	0 080	PCI/L		0 120	0 600	
815	SW107	SW10790001	01/09/90	URANIUM 235	0 080	PCI/L		0 170	0 000	A
816	SW006	SW00690003	03/05/90	URANIUM 235	0 088	PCI/L		0 115	0 054	
817	SW041	SW04190003	03/21/90	URANIUM 235	0 094	PCI/L		0 185	0 438	
818	SW005	SW00590001	01/04/90	URANIUM 235	0 095	PCI/L		0 130	0 305	A
819	SW005	SW005W060190A	06/01/90	URANIUM 235	0 100	PCI/L		0 140	0 600	
820	SW107	SW107006	09/20/89	URANIUM 235	0 100	PCI/L		0 150	0 600	V
821	SW006	SW00690002	02/06/90	URANIUM 235	0 110	PCI/L		0 240	0 290	A
822	SW107	SW10790003	03/13/90	URANIUM 235	0 110	PCI/L		0 160	0 000	A
823	SW107	SW02010WC	08/19/92	URANIUM 235	0 144	PCI/L	J	0 176	0 105	A
824	SW006	SW02022WC	08/28/92	URANIUM 235	0 145	PCI/L	J	0 097	0 600	
825	SW004	SW02026WC	12/02/92	URANIUM 235	0 167	PCI/L	J	0 194	0 600	
826	SW041	SW041008	11/20/89	URANIUM 235	0 170	PCI/L		0 580	0 780	A
827	SW041	SW04190001	01/04/90	URANIUM 235	0 190	PCI/L		0 380	0 400	A
828	SW007	SW00790001	01/09/90	URANIUM 235	0 200	PCI/L		0 400	0 410	A
829	SW007	SW01923WC	06/08/92	URANIUM 235	0 213	PCI/L	J	0 082	0 600	
830	SW127	SW01883WC	04/15/92	URANIUM 235	0 305	PCI/L	J	0 120	0 600	
831	SW107	SW01884WC	04/14/92	URANIUM 235	0 376	PCI/L	U	0 000	0 600	

832	SW005	SW05001	02/28/89	URANIUM 238	0 000	PCI/L		0 100			N
833	SW005	SW005002	05/30/89	URANIUM 238	0 000	PCI/L		0 100			
834	SW005	SW005003	06/09/89	URANIUM 238	0 000	PCI/L		0 100			
835	SW005	SW00590003	03/22/90	URANIUM 238	0 000	PCI/L		0 120	0 284		
836	SW107	SW107001	02/28/89	URANIUM 238	0 000	PCI/L		0 100			N
837	SW107	SW107003	06/16/89	URANIUM 238	0 000	PCI/L		0 200			
838	SW107	SW10790002	02/05/90	URANIUM 238	0 000	PCI/L		0 120	0 160		A
839	SW131	SW00368WC	10/02/90	URANIUM 238	0 063	PCI/L		0 123	0 292		A
840	SW107	SW107009	12/04/89	URANIUM 238	0 080	PCI/L		0 160	0 091		A
841	SW005	SW005004	07/13/89	URANIUM 238	0 100	PCI/L		0 100	0 100		
842	SW005	SW005006	09/05/89	URANIUM 238	0 100	PCI/L		0 100	0 600		V
843	SW006	SW006004	07/13/89	URANIUM 238	0 100	PCI/L		0 100	0 100		
844	SW007	SW007002	05/31/89	URANIUM 238	0 100	PCI/L		0 100			
845	SW007	SW007003	06/08/89	URANIUM 238	0 100	PCI/L		0 100	0 100		
846	SW007	SW007005	08/01/89	URANIUM 238	0 100	PCI/L		0 100	0 100		
847	SW041	SW41001	03/01/89	URANIUM 238	0 100	PCI/L		0 100			N
848	SW127	SW00366WC	10/04/90	URANIUM 238	0 112	PCI/L		0 111	0 260		A
849	SW007	SW00790003	03/05/90	URANIUM 238	0 113	PCI/L		0 148	0 096		
850	SW006	SW006009	12/04/89	URANIUM 238	0 125	PCI/L		0 100	0 023		A
851	SW107	SW00283WC	09/05/90	URANIUM 238	0 126	PCI/L		0 165	0 195		V
852	SW005	SW00590002	02/05/90	URANIUM 238	0 130	PCI/L		0 170	0 030		A
853	SW041	SW00112WC	07/05/90	URANIUM 238	0 160	PCI/L		0 210	0 248		
854	SW041	SW01503WC	09/05/91	URANIUM 238	0 160	PCI/L	BJ	0 150	0 047		
855	SW041	SW00363WC	10/02/90	URANIUM 238	0 172	PCI/L		0 114	0 134		
856	SW007	SW00790001	01/09/90	URANIUM 238	0 180	PCI/L		0 500	0 710		A
857	SW005	SW005005	08/01/89	URANIUM 238	0 200	PCI/L		0 100	0 100		
858	SW006	SW006005	08/01/89	URANIUM 238	0 200	PCI/L		0 100	0 100		
859	SW006	SW006006	09/05/89	URANIUM 238	0 200	PCI/L		0 200	0 600		V
860	SW007	SW07001	02/27/89	URANIUM 238	0 200	PCI/L		1 200			N
861	SW041	SW041003	06/16/89	URANIUM 238	0 200	PCI/L		0 200			
862	SW041	SW00285WC	09/05/90	URANIUM 238	0 203	PCI/L		0 201	0 237		V
863	SW107	SW00111WC	07/02/90	URANIUM 238	0 289	PCI/L		0 287	0 336		
864	SW006	SW006003	06/08/89	URANIUM 238	0 300	PCI/L		0 200	0 100		
865	SW107	SW10790001	01/09/90	URANIUM 238	0 330	PCI/L		0 410	0 390		A
866	SW041	SW041008	11/20/89	URANIUM 238	0 340	PCI/L		0 670	0 780		A
867	SW006	SW00690003	03/05/90	URANIUM 238	0 367	PCI/L		0 192	0 059		
868	SW006	SW00286WC	09/05/90	URANIUM 238	0 376	PCI/L		0 251	0 195		V
869	SW005	SW00108WC	07/02/90	URANIUM 238	0 398	PCI/L		0 339	0 265		
870	SW006	SW006002	05/31/89	URANIUM 238	0 400	PCI/L		0 200			
871	SW041	SW041002	05/26/89	URANIUM 238	0 400	PCI/L		0 200			
872	SW107	SW107002	05/26/89	URANIUM 238	0 400	PCI/L		0 200			
873	SW107	SW107006	09/20/89	URANIUM 238	0 400	PCI/L		0 340	0 600		V
874	SW005	SW00590001	01/04/90	URANIUM 238	0 410	PCI/L		0 040	0 445		A
875	SW004	SW004001	03/02/89	URANIUM 238	0 500	PCI/L		0 200			N
876	SW005	SW005009	12/04/89	URANIUM 238	0 500	PCI/L		0 200	0 000		A
877	SW107	SW01802WC	01/20/92	URANIUM 238	0 510	PCI/L	BJ	0 270	0 048		A
878	SW006	SW00690001	01/09/90	URANIUM 238	0 525	PCI/L		0 610	0 675		A
879	SW005	SW00284WC	09/04/90	URANIUM 238	0 658	PCI/L		0 333	0 192		V
880	SW041	SW04190003	03/21/90	URANIUM 238	1 010	PCI/L		0 636	0 362		
881	SW004	SW004003	06/15/89	URANIUM 238	1 100	PCI/L		0 300			
882	SW107	SW10790003	03/13/90	URANIUM 238	1 210	PCI/L		0 540	0 140		A
883	SW041	SW04190002	02/06/90	URANIUM-238	1 345	PCI/L		0 630	0 375		A
884	SW107	SW107004	07/14/89	URANIUM 238	1 400	PCI/L		0 300	0 100		
885	SW041	SW04190001	01/04/90	URANIUM 238	1 720	PCI/L		0 840	0 570		A
886	SW006	SW00690002	02/06/90	URANIUM 238	1 820	PCI/L		0 690	0 150		A

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Summary Statistics for Total Uranium Isotopes in Background Stream Water (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=URANIUM TOTAL

N	Minimum	Maximum	Mean	Std Dev	Range	CV
17	0 1000000	2 2000000	0 5897059	0 5208961	2 1000000	88 3315039

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
79	0 0065500	3 2130000	0 4862292	0 5496561	3 2195500	113 0446332

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
75	0 0300000	0 3755000	0 0491900	0 0745812	0 4055000	151 6186605

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
55	0	1 8200000	0 3641938	0 4315574	1 8200000	118 4966256

Ordered Listing of Dissolved Uranium Isotopes in Background Seep Water (Data from 1993 BGCR DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
88	SW080	SW080001	03/01/89	URANIUM TOTAL	0 10	PCI/L				
89	SW108	SW108001	03/02/89	URANIUM TOTAL	1 20	PCI/L				N
90	SW104	SW104001	03/02/89	URANIUM TOTAL	4 60	PCI/L				N
91	SW080	SW080001	03/01/89	URANIUM 233 234	0 00	PCI/L		0 100		
92	SW104	SW01193WC	06/26/91	URANIUM 233 234	0 06	PCI/L	J	0 168	0 600	
93	SW080	SW00466WC	11/01/90	URANIUM 233 234	0 20	PCI/L	U		0 600	
94	SW080	SW00209WC	08/02/90	URANIUM 233 234	0 59	PCI/L	J	0 162	0 600	V
95	SW108	SW01185WC	06/05/91	URANIUM 233 234	0 60	PCI/L	J	0 347	0 600	
96	SW108	SW108001	03/02/89	URANIUM 233 234	0 70	PCI/L		0 200		N
97	SW108	SW00461WC	11/12/90	URANIUM 233 234	0 70	PCI/L		0 380	0 600	
98	SW108	SW01288WC	07/01/91	URANIUM 233 234	0 73	PCI/L		0 372	0 129	A
99	SW108	SW00873WC	03/05/91	URANIUM 233 234	1 10	PCI/L		0 500	0 600	
100	SW108	SW00565WC	12/03/90	URANIUM 233 234	1 20	PCI/L		0 500	0 600	
101	SW104	SW00203WC	08/07/90	URANIUM 233 234	1 61	PCI/L		0 591	0 600	V
102	SW108	SW00976WC	04/02/91	URANIUM 233 234	1 70	PCI/L		0 400	0 600	
103	SW104	SW104001	03/02/89	URANIUM 233 234	2 60	PCI/L		0 500		N
104	SW104	SW01193WC	06/26/91	URANIUM 235	0 02	PCI/L	J	0 026	0 600	
105	SW108	SW108001	03/02/89	URANIUM 235	0 00	PCI/L		0 100		N
106	SW108	SW01288WC	07/01/91	URANIUM 235	0 00	PCI/L	J	0 131	0 000	A
107	SW080	SW00209WC	08/02/90	URANIUM 235	0 02	PCI/L	J	0 046	0 600	V
108	SW108	SW01185WC	06/05/91	URANIUM 235	0 05	PCI/L	J	0 094	0 600	
109	SW104	SW00203WC	08/07/90	URANIUM 235	0 05	PCI/L	J	0 096	0 600	V
110	SW108	SW00976WC	04/02/91	URANIUM 235	0 09	PCI/L	U		0 600	

111	SW080	SW00466WC	11/01/90	URANIUM 235	0 20	PCI/L	U		0 600	
112	SW108	SW00461WC	11/12/90	URANIUM 235	0 20	PCI/L	U		0 600	
113	SW104	SW104001	03/02/89	URANIUM 235	0 30	PCI/L		0 100		N
114	SW108	SW00565WC	12/03/90	URANIUM 235	0 30	PCI/L	U		0 600	
115	SW108	SW00873WC	03/05/91	URANIUM 235	0 30	PCI/L	U		0 600	
116	SW080	SW080001	03/01/89	URANIUM 238	0 10	PCI/L		0 100		
117	SW104	SW01193WC	06/26/91	URANIUM 238	0 03	PCI/L	J	0 095	0 600	
118	SW080	SW00466WC	11/01/90	URANIUM 238	0 20	PCI/L	U		0 600	
119	SW080	SW00209WC	08/02/90	URANIUM 238	0 29	PCI/L	J	0 107	0 600	V
120	SW108	SW01288WC	07/01/91	URANIUM 238	0 30	PCI/L	J	0 235	0 091	A
121	SW108	SW00461WC	11/12/90	URANIUM 238	0 47	PCI/L		0 320	0 600	
122	SW108	SW108001	03/02/89	URANIUM 238	0 50	PCI/L		0 200		N
123	SW108	SW01185WC	06/05/91	URANIUM 238	0 51	PCI/L	J	0 318	0 600	
124	SW108	SW00565WC	12/03/90	URANIUM 238	0 70	PCI/L		0 410	0 600	
125	SW104	SW00203WC	08/07/90	URANIUM 238	0 80	PCI/L		0 406	0 600	V
126	SW108	SW00873WC	03/05/91	URANIUM 238	0 87	PCI/L		0 480	0 600	
127	SW108	SW00976WC	04/02/91	URANIUM 238	1 60	PCI/L		0 400	0 600	
128	SW104	SW104001	03/02/89	URANIUM 238	1 70	PCI/L		0 400		N

Summary Statistics for Dissolved Uranium Isotopes in Background Seep Water (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=URANIUM TOTAL

N	Minimum	Maximum	Mean	Std Dev	Range	CV
3	0 1000000	4 6000000	1 9000000	2 4269322	4 7000000	127 7332747

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
13	0	2 6000000	0 9064931	0 7346919	2 6000000	81 0477081

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
12	0 0183000	0 3000000	0 1237492	0 1277411	0 3183000	103 2258129

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
13	0 1000000	1 7000000	0 6048154	0 5426485	1 8000000	89 7213421

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Table B 7 Ordered Listing of Total Uranium Isotopes in Background Stream Sediments (Data from 1993 BGCR DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
337	SED020	SED20001	02/22/89	URANIUM TOTAL	0 90	PCI/G				N
338	SED016	SED16001	02/23/89	URANIUM TOTAL	1 10	PCI/G				
339	SED017	SED17001	02/23/89	URANIUM TOTAL	1 10	PCI/G				
340	SED022	SED22001	02/22/89	URANIUM TOTAL	1 10	PCI/G				N
341	SED004	SED04001	02/21/89	URANIUM TOTAL	2 10	PCI/G				N
342	SED023	SED23001	02/21/89	URANIUM TOTAL	2 60	PCI/G				N
343	SED004	SD00204WC	05/02/91	URANIUM 233 234	0 14	PCI/G		0 034	0 300	A
344	SED016	SD00209WC	05/06/91	URANIUM 233 234	0 17	PCI/G		0 033	0 300	A
345	SED023	SD00215WC	05/02/91	URANIUM 233 234	0 30	PCI/G		0 063	0 300	A
346	SED022	SD00214WC	05/07/91	URANIUM 233 234	0 41	PCI/G		0 086	0 300	A
347	SED016	SED16001	02/23/89	URANIUM 233 234	0 50	PCI/G		0 200		
348	SED017	SED17001	02/23/89	URANIUM 233 234	0 50	PCI/G		0 100		
349	SED020	SED20001	02/22/89	URANIUM 233 234	0 50	PCI/G		0 100		N
350	SED017	SD00210WC	05/02/91	URANIUM 233 234	0 53	PCI/G		0 098	0 300	A
351	SED022	SED22001	02/22/89	URANIUM 233 234	0 60	PCI/G		0 100		N
352	SED022	SS00113WC	08/28/90	URANIUM 233 234	0 76	PCI/G		0 192	0 300	V
353	SED022	SD00291WC	12/09/91	URANIUM 233 234	0 81	PCI/G	B	0 190	0 008	
354	SED022	SS00001WC	05/23/90	URANIUM 233 234	0 85	PCI/G		0 330	0 300	
355	SED020	SD00317WC	03/19/92	URANIUM 233 234	0 91	PCI/G		0 230	0 032	A
356	SED004	SS00103WC	08/27/90	URANIUM 233 234	0 98	PCI/G		0 214	0 300	V
357	SED022	SS00180WC	03/05/91	URANIUM 233 234	0 98	PCI/G		0 175	0 000	A
358	SED016	SD00330WC	04/15/92	URANIUM 233 234	0 99	PCI/G		0 255	0 035	A
359	SED004	SD00313WC	03/16/92	URANIUM 233 234	1 01	PCI/G		0 334	0 044	A
360	SED022	SS00146WC	11/12/90	URANIUM 233 234	1 03	PCI/G		0 284	0 000	V
361	SED004	SED04001	02/21/89	URANIUM 233 234	1 05	PCI/G		0 300		N
362	SED023	SED23001	02/21/89	URANIUM 233 234	1 20	PCI/G		0 200		N
363	SED020	SD00342WC	06/22/92	URANIUM 233 234	1 21	PCI/G		0 312	0 059	A
364	SED017	SS00005WC	05/29/90	URANIUM 233 234	1 24	PCI/G		0 610	0 300	
365	SED004	SS00136WC	11/06/90	URANIUM 233 234	1 38	PCI/G		0 292	0 036	A
366	SED016	SS00141WC	11/14/90	URANIUM 233 234	1 40	PCI/G		0 300	0 000	V
367	SED017	SS00142WC	11/14/90	URANIUM 233 234	1 44	PCI/G		0 289	0 000	A
368	SED017	SS00176WC	03/11/91	URANIUM 233 234	1 61	PCI/G		0 188	0 000	A
369	SED020	SS00002WC	05/23/90	URANIUM 233 234	1 69	PCI/G		0 400	0 300	
370	SED020	SS00111WC	08/28/90	URANIUM 233 234	1 78	PCI/G		0 343	0 300	V
371	SED023	SS00024WC	06/04/90	URANIUM 233 234	1 81	PCI/G		0 540	0 300	
372	SED016	SS00175WC	03/11/91	URANIUM 233 234	1 81	PCI/G		0 204	0 009	A
373	SED004	SS00003WC	05/24/90	URANIUM 233 234	1 84	PCI/G		0 170	0 300	
374	SED016	SS00004WC	05/24/90	URANIUM 233 234	1 91	PCI/G		0 440	0 300	
375	SED023	SS00147WC	11/12/90	URANIUM 233 234	2 01	PCI/G		0 603	0 000	A
376	SED023	SD00318WC	03/25/92	URANIUM 233 234	2 07	PCI/G		0 381	0 020	A
377	SED020	SS00144WC	11/06/90	URANIUM 233 234	2 11	PCI/G		0 412	0 041	A
378	SED020	SD00293WC	12/11/91	URANIUM 233 234	2 20	PCI/G	B	0 370	0 030	
379	SED020	SS00178WC	03/04/91	URANIUM 233 234	2 27	PCI/G		0 490	0 000	A
380	SED023	SD00294WC	12/10/91	URANIUM 233 234	2 30	PCI/G	B	0 380	0 020	
381	SED004	SD00289WC	12/09/91	URANIUM 233 234	2 60	PCI/G	B	0 430	0 014	
382	SED020	SD00212WC	05/02/91	URANIUM 233 234	2 69	PCI/G		0 459	0 300	A
383	SED004	SD00338WC	06/08/92	URANIUM 233 234	3 08	PCI/G		0 537	0 032	A
384	SED127	SS00166WC	12/04/90	URANIUM 233 234	3 63	PCI/G		0 608	0 023	V
385	SED017	SS00109WC	08/27/90	URANIUM 233 234	3 69	PCI/G	X	0 560	0 300	
386	SED016	SD00305WC	02/04/92	URANIUM 233 234	3 98	PCI/G		0 672	0 034	A
387	SED016	SS00108WC	08/27/90	URANIUM 233 234	4 11	PCI/G	X	0 629	0 300	
388	SED127	SS00200WC	03/21/91	URANIUM 233 234	4 26	PCI/G		0 661	0 000	V

389	SED016	SD00536WC	08/21/92	URANIUM 233 234	4 50	PCI/G		0 826	0 043	A
390	SED016	SED16001	02/23/89	URANIUM 235	0 00	PCI/G		0 100		
391	SED020	SED20001	02/22/89	URANIUM 235	0 00	PCI/G		0 100		N
392	SED022	SED22001	02/22/89	URANIUM 235	0 00	PCI/G		0 100		N
393	SED004	SD00204WC	05/02/91	URANIUM 235	0 00	PCI/G		0 004	0 300	A
394	SED016	SD00209WC	05/06/91	URANIUM 235	0 01	PCI/G		0 006	0 300	A
395	SED023	SD00215WC	05/02/91	URANIUM 235	0 01	PCI/G		0 008	0 300	A
396	SED022	SS00146WC	11/12/90	URANIUM 235	0 01	PCI/G	J	0 030	0 030	V
397	SED004	SD00313WC	03/16/92	URANIUM 235	0 02	PCI/G	J	0 043	0 044	A
398	SED017	SD00210WC	05/02/91	URANIUM 235	0 02	PCI/G		0 012	0 300	A
399	SED020	SS00002WC	05/23/90	URANIUM 235	0 02	PCI/G		0 040	0 300	
400	SED022	SS00113WC	08/28/90	URANIUM 235	0 02	PCI/G	J	0 030	0 300	V
401	SED022	SD00214WC	05/07/91	URANIUM 235	0 02	PCI/G		0 013	0 300	A
402	SED020	SD00212WC	05/02/91	URANIUM 235	0 02	PCI/G		0 024	0 300	A
403	SED004	SED004001B	10/27/89	URANIUM 235	0 03	PCI/G		0 030	0 000	A
404	SED020	SD00342WC	06/22/92	URANIUM 235	0 03	PCI/G	J	0 040	0 000	A
405	SED016	SS00141WC	11/14/90	URANIUM 235	0 03	PCI/G	J	0 037	0 022	V
406	SED020	SD00317WC	03/19/92	URANIUM 235	0 03	PCI/G	J	0 038	0 000	A
407	SED022	SS00180WC	03/05/91	URANIUM 235	0 03	PCI/G	J	0 027	0 000	A
408	SED022	SD00291WC	12/09/91	URANIUM 235	0 04	PCI/G	J	0 038	0 013	
409	SED004	SS00136WC	11/06/90	URANIUM 235	0 04	PCI/G	J	0 041	0 030	A
410	SED020	SED020001B	10/27/89	URANIUM 235	0 04	PCI/G		0 030	0 020	A
411	SED020	SS00144WC	11/06/90	URANIUM 235	0 04	PCI/G	J	0 046	0 033	A
412	SED004	SED04001	02/21/89	URANIUM 235	0 05	PCI/G		0 100		N
413	SED004	SS00103WC	08/27/90	URANIUM 235	0 06	PCI/G	J	0 047	0 300	V
414	SED017	SS00005WC	05/29/90	URANIUM-235	0 06	PCI/G		0 130	0 300	
415	SED022	SS00001WC	05/23/90	URANIUM 235	0 06	PCI/G		0 080	0 300	
416	SED017	SS00176WC	03/11/91	URANIUM 235	0 06	PCI/G	J	0 023	0 000	A
417	SED020	SS00178WC	03/04/91	URANIUM 235	0 06	PCI/G	J	0 061	0 000	A
418	SED004	SD00338WC	06/08/92	URANIUM 235	0 06	PCI/G	J	0 054	0 000	A
419	SED017	SS00142WC	11/14/90	URANIUM 235	0 06	PCI/G	J	0 049	0 000	A
420	SED016	SS00175WC	03/11/91	URANIUM 235	0 06	PCI/G	J	0 023	0 000	A
421	SED016	SD00305WC	02/04/92	URANIUM 235	0 07	PCI/G	J	0 058	0 024	A
422	SED023	SS00147WC	11/12/90	URANIUM 235	0 07	PCI/G	J	0 089	0 033	A
423	SED020	SS00111WC	08/28/90	URANIUM 235	0 07	PCI/G	J	0 062	0 300	V
424	SED016	SS00004WC	05/24/90	URANIUM 235	0 08	PCI/G		0 080	0 300	
425	SED023	SD00318WC	03/25/92	URANIUM 235	0 08	PCI/G	J	0 059	0 027	A
426	SED016	SS00108WC	08/27/90	URANIUM 235	0 09	PCI/G	J	0 072	0 300	
427	SED004	SD00289WC	12/09/91	URANIUM 235	0 10	PCI/G	J	0 062	0 008	
428	SED004	SS00003WC	05/24/90	URANIUM 235	0 10	PCI/G		0 130	0 300	
429	SED017	SED17001	02/23/89	URANIUM 235	0 10	PCI/G		0 100		
430	SED023	SED23001	02/21/89	URANIUM 235	0 10	PCI/G		0 100		N
431	SED016	SD00330WC	04/15/92	URANIUM 235	0 10	PCI/G	J	0 074	0 035	A
432	SED127	SS00166WC	12/04/90	URANIUM 235	0 13	PCI/G	J	0 077	0 023	V
433	SED023	SD00294WC	12/10/91	URANIUM 235	0 14	PCI/G	J	0 074	0 013	
434	SED017	SS00109WC	08/27/90	URANIUM-235	0 14	PCI/G	J	0 087	0 300	
435	SED023	SS00024WC	06/04/90	URANIUM 235	0 15	PCI/G		0 140	0 300	
436	SED016	SD00536WC	08/21/92	URANIUM 235	0 15	PCI/G	J	0 088	0 013	A
437	SED020	SD00293WC	12/11/91	URANIUM 235	0 16	PCI/G	J	0 078	0 013	
438	SED127	SS00200WC	03/21/91	URANIUM 235	0 19	PCI/G	J	0 089	0 020	V
439	SED004	SD00204WC	05/02/91	URANIUM 238	0 13	PCI/G		0 033	0 300	A
440	SED016	SD00209WC	05/06/91	URANIUM 238	0 14	PCI/G		0 030	0 300	A
441	SED022	SD00214WC	05/07/91	URANIUM 238	0 20	PCI/G		0 052	0 300	A
442	SED023	SD00215WC	05/02/91	URANIUM 238	0 26	PCI/G		0 056	0 300	A
443	SED017	SD00210WC	05/02/91	URANIUM 238	0 39	PCI/G		0 076	0 300	A
444	SED020	SED20001	02/22/89	URANIUM 238	0 40	PCI/G		0 100		N
445	SED020	SED020001B	10/27/89	URANIUM 238	0 45	PCI/G		0 120	0 000	A
446	SED017	SED17001	02/23/89	URANIUM 238	0 50	PCI/G		0 100		

447	SED022	SED22001	02/22/89	URANIUM 238	0 50	PCI/G		0 100		N
448	SED016	SED16001	02/23/89	URANIUM 238	0 60	PCI/G		0 200		
449	SED004	SED004001B	10/27/89	URANIUM 238	0 64	PCI/G		0 200	0 025	A
450	SED022	SS00113WC	08/28/90	URANIUM 238	0 93	PCI/G		0 215	0 300	V
451	SED022	SD00291WC	12/09/91	URANIUM 238	0 94	PCI/G	B	0 210	0 027	
452	SED004	SS00103WC	08/27/90	URANIUM 238	0 96	PCI/G		0 212	0 300	V
453	SED004	SED04001	02/21/89	URANIUM 238	1 00	PCI/G		0 200		N
454	SED022	SS00180WC	03/05/91	URANIUM 238	1 02	PCI/G		0 180	0 000	A
455	SED022	SS00146WC	11/12/90	URANIUM 238	1 05	PCI/G		0 290	0 080	V
456	SED017	SS00142WC	11/14/90	URANIUM 238	1 11	PCI/G		0 244	0 019	A
457	SED016	SS00141WC	11/14/90	URANIUM 238	1 13	PCI/G		0 261	0 053	V
458	SED004	SS00136WC	11/06/90	URANIUM 238	1 30	PCI/G		0 280	0 036	A
459	SED023	SED23001	02/21/89	URANIUM 238	1 30	PCI/G		0 200		N
460	SED017	SS00176WC	03/11/91	URANIUM 238	1 36	PCI/G		0 164	0 009	A
461	SED016	SS00175WC	03/11/91	URANIUM 238	1 42	PCI/G		0 167	0 000	A
462	SED020	SS00111WC	08/28/90	URANIUM 238	1 66	PCI/G		0 328	0 300	V
463	SED020	SD00212WC	05/02/91	URANIUM 238	1 72	PCI/G		0 317	0 300	A
464	SED020	SS00178WC	03/04/91	URANIUM 238	1 73	PCI/G		0 405	0 070	A
465	SED023	SS00147WC	11/12/90	URANIUM 238	1 77	PCI/G		0 533	0 090	A
466	SED020	SD00293WC	12/11/91	URANIUM 238	1 80	PCI/G	B	0 330	0 013	
467	SED020	SS00144WC	11/06/90	URANIUM 238	1 87	PCI/G		0 379	0 041	A
468	SED023	SD00294WC	12/10/91	URANIUM 238	2 30	PCI/G	B	0 380	0 008	
469	SED004	SD00289WC	12/09/91	URANIUM 238	2 60	PCI/G	B	0 430	0 014	
470	SED016	SD00305WC	02/04/92	URANIUM 238	3 14	PCI/G		0 560	0 060	A
471	SED127	SS00166WC	12/04/90	URANIUM 238	3 26	PCI/G		0 559	0 032	V
472	SED017	SS00109WC	08/27/90	URANIUM 238	3 27	PCI/G	X	0 515	0 300	
473	SED127	SS00200WC	03/21/91	URANIUM 238	3 71	PCI/G		0 592	0 034	V
474	SED016	SS00108WC	08/27/90	URANIUM 238	3 82	PCI/G	X	0 598	0 300	

Summary Statistics for Total Uranium Isotopes in Background Stream Sediments (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=URANIUM TOTAL

N	Minimum	Maximum	Mean	Std Dev	Range	CV
6	0 9000000	2 6000000	1 4833333	0 6940221	1 7000000	46 7880063

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
47	0 1360000	4 5000000	1 6773234	1 1452321	4 3640000	68 2773547

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
49	0	0 1910000	0 0617000	0 0479184	0 1910000	77 6635385

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
36	0 1270000	3 8200000	1 3994556	1 0309454	3 6930000	73 6676026

Table B 8 Ordered Listing of Dissolved Plutonium and Americium in Background Groundwater (Data from 1993 BGCR DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
1	B202489	G 2089 0614 02 0901	06/14/90	AMERICIUM 241	0 003	PCI/L		0 004	0 010	
2	B405586	55 86 08 01 89	08/01/89	AMERICIUM 241	0 019	PCI/L		0 015	0 018	
3	B405889	G 4989 0614 02 0930	06/14/90	AMERICIUM 241	0 028	PCI/L		0 022	0 010	
4	B405586	55 86 08 01 89	08/01/89	PLUTONIUM 239 240	0 011	PCI/L		0 006	0 000	

Summary Statistics for Dissolved Plutonium and Americium in Background Groundwater (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
3	0 0030000	0 0280000	0 0166667	0 0126623	0 0250000	75 9736797

ANALYTE=PLUTONIUM 239 240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
1	0 0110000	0 0110000	0 0110000		0	

Table B 9 Ordered Listing of Total Plutonium and Americium in Background Groundwater (Data from 1993 BGCR DOE 1993a)

BS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
1	B400489	G 0489 0608 02 0920	06/08/90	AMERICIUM 241	0 00706	PCI/L		0 006156	0 011000	A
2	B302789	GW00754IT	11/19/90	AMERICIUM 241	0 00337	PCI/L	J	0 006750	0 010000	
3	B202589	G 2189 0601 02 1220	06/01/90	AMERICIUM 241	0 00300	PCI/L		0 010000	0 010000	
4	B302989	GW03401IT	08/13/92	AMERICIUM 241	0 00300	PCI/L	U	0 003000	0 006000	
5	B405889	GW00463IT	10/05/90	AMERICIUM 241	0 00285	PCI/L	J	0 005730	0 000000	V
6	B405489	GW03346IT	08/19/92	AMERICIUM 241	0 00200	PCI/L	U	0 003000	0 006000	
7	B200789	GW03269IT	08/18/92	AMERICIUM 241	0 00100	PCI/L	U	0 006000	0 010000	
8	B405586	GW03343IT	08/18/92	AMERICIUM 241	0 00100	PCI/L	U	0 004000	0 007000	
9	B405586	GW01316IT	05/17/91	AMERICIUM 241	0 00097	PCI/L	J	0 001130	0 006000	A
10	B400389	G 0389 0611 02 1025	06/11/90	AMERICIUM 241	0 00081	PCI/L		0 006362	0 009000	A
11	B304989	GW01342IT	05/29/91	AMERICIUM 241	0 00036	PCI/L	J	0 000713	0 000000	V
12	B405889	GW01720IT	08/27/91	AMERICIUM 241	0 00028	PCI/L	J	0 000560	0 010000	
13	B102389	GW02947IT	05/26/92	AMERICIUM 241	0 00000	PCI/L	U	0 000000	0 011000	
14	B200589	GW00570IT	10/22/90	AMERICIUM 241	0 00000	PCI/L	J	0 003240	0 000000	V
15	B200789	GW00466IT	10/08/90	AMERICIUM 241	0 00000	PCI/L	J	0 007160	0 000000	V
16	B201189	GW01747IT	08/30/91	AMERICIUM 241	0 00000	PCI/L	J	0 003500	0 010000	
17	B201189	GW02972IT	06/05/92	AMERICIUM 241	0 00000	PCI/L	J	0 003360	0 000000	V
18	B202489	GW01072IT	04/08/91	AMERICIUM 241	0 00000	PCI/L	J	0 004810	0 000000	A
19	B203989	GW01756IT	09/11/91	AMERICIUM 241	0 00000	PCI/L	J	0 005110	0 010000	
20	B205589	GW00496IT	10/19/90	AMERICIUM 241	0 00000	PCI/L	J	0 004670	0 000000	V
21	B205589	GW01076IT	04/05/91	AMERICIUM 241	0 00000	PCI/L	J	0 011000	0 000000	A
22	B302989	G 2589 0523 02 1125	05/23/90	AMERICIUM 241	0 00000	PCI/L		0 005000	0 010000	
23	B305389	GW03761IT	10/23/92	AMERICIUM 241	0 00000	PCI/L	J	0 006330	0 010000	
4	B400489	GW01778IT	09/16/91	AMERICIUM 241	0 00000	PCI/L	J	0 003700	0 010000	
5	B401989	GW03339IT	08/06/92	AMERICIUM 241	0 00000	PCI/L	U	0 007000	0 010000	V
26	B405489	GW01322IT	05/22/91	AMERICIUM 241	0 00000	PCI/L	J	0 003090	0 000000	A
27	B405689	GW01783IT	09/17/91	AMERICIUM 241	0 00000	PCI/L	J	0 003350	0 010000	
8	B405889	GW00297IT	08/31/90	AMERICIUM 241	0 00000	PCI/L	J	0 003130	0 010000	
9	B400189	GW03397IT	08/20/92	AMERICIUM 241	0 00050	PCI/L	U	0 007000	0 010000	
30	B203289	GW00111IT	08/03/90	AMERICIUM 241	0 00068	PCI/L	J	0 002870	0 010000	A
31	B202589	GW03766IT	10/21/92	AMERICIUM 241	0 00074	PCI/L	J	0 004110	0 010000	
2	B205589	GW02523IT	02/27/92	AMERICIUM 241	0 00078	PCI/L	J	0 002790	0 000000	A
3	B200889	GW00494IT	10/11/90	AMERICIUM 241	0 00079	PCI/L	J	0 002160	0 010000	
34	B200789	GW02981IT	06/02/92	AMERICIUM 241	0 00082	PCI/L	J	0 002930	0 010000	
35	B400189	GW00722IT	11/15/90	AMERICIUM 241	0 00092	PCI/L	J	0 001830	0 010000	A
6	B200689	GW01780IT	09/17/91	AMERICIUM 241	0 00095	PCI/L	J	0 002620	0 010000	
7	B102389	GW01759IT	09/12/91	AMERICIUM 241	0 00097	PCI/L	J	0 002670	0 010000	
38	B304289	GW00342IT	08/30/90	AMERICIUM 241	0 00098	PCI/L	J	0 002700	0 010000	
39	B102389	GW03224IT	08/11/92	AMERICIUM 241	0 00100	PCI/L	U	0 004000	0 007000	
0	B200689	GW03274IT	08/10/92	AMERICIUM 241	0 00100	PCI/L	U	0 005000	0 010000	V
1	B202589	GW03325IT	08/13/92	AMERICIUM 241	0 00100	PCI/L	U	0 006000	0 010000	
42	B302889	GW03400IT	08/13/92	AMERICIUM 241	0 00100	PCI/L	U	0 002000	0 004000	
3	B305389	GW03405IT	08/18/92	AMERICIUM 241	0 00100	PCI/L	U	0 004000	0 008000	
4	B402189	GW03406IT	08/18/92	AMERICIUM 241	0 00100	PCI/L	U	0 004000	0 006500	
5	B202589	GW01368IT	05/31/91	AMERICIUM 241	0 00101	PCI/L	J	0 005560	0 000000	V
46	B405789	GW01784IT	09/17/91	AMERICIUM 241	0 00105	PCI/L	J	0 002090	0 010000	
7	B405889	GW01323IT	05/21/91	AMERICIUM 241	0 00107	PCI/L	J	0 002940	0 000000	A
8	B401989	GW01745IT	09/06/91	AMERICIUM 241	0 00108	PCI/L	J	0 002970	0 010000	
9	B201589	GW02973IT	06/05/92	AMERICIUM 241	0 00120	PCI/L	J	0 002410	0 000000	V
50	B304989	GW01794IT	09/20/91	AMERICIUM 241	0 00122	PCI/L	J	0 002440	0 010000	
1	B302789	GW02587IT	03/16/92	AMERICIUM 241	0 00122	PCI/L	J	0 002440	0 000000	A
2	B405889	GW02584IT	03/13/92	AMERICIUM 241	0 00128	PCI/L	J	0 002560	0 000000	A
53	B305389	GW02595IT	03/16/92	AMERICIUM 241	0 00129	PCI/L	J	0 002590	0 000000	A
54	B405789	GW00728IT	11/16/90	AMERICIUM 241	0 00129	PCI/L	J	0 001830	0 010000	

B203989	GW02978IT	06/05/92	AMERICIUM 241	0 00130	PCI/L	J	0 002600	0 010000	
B200689	GW01063IT	04/05/91	AMERICIUM 241	0 00135	PCI/L	J	0 002700	0 000000	A
B202489	GW00376IT	09/12/90	AMERICIUM 241	0 00138	PCI/L	J	0 002770	0 010000	
B405689	GW01329IT	05/29/91	AMERICIUM 241	0 00148	PCI/L	J	0 002970	0 000000	A
B302989	GW00126IT	08/06/90	AMERICIUM 241	0 00155	PCI/L	J	0 003100	0 010000	A
B304289	GW00753IT	11/19/90	AMERICIUM 241	0 00159	PCI/L	J	0 003180	0 010000	
B203989	GW00341IT	09/14/90	AMERICIUM 241	0 00163	PCI/L	J	0 003270	0 000000	V
B201189	GW03774IT	10/20/92	AMERICIUM 241	0 00165	PCI/L	J	0 003310	0 010000	
B402189	GW01011IT	03/21/91	AMERICIUM 241	0 00168	PCI/L	J	0 011600	0 000000	V
B201189	GW00497IT	10/19/90	AMERICIUM 241	0 00179	PCI/L	J	0 003590	0 000000	V
B200889	G 0889 0606 02 0915	06/06/90	AMERICIUM 241	0 00198	PCI/L		0 007744	0 010000	A
B200889	GW03273IT	08/17/92	AMERICIUM 241	0 00200	PCI/L	U	0 005000	0 008000	
B302789	GW03052IT	06/09/92	AMERICIUM 241	0 00200	PCI/L	U	0 004000	0 005000	
B302989	GW03051IT	06/04/92	AMERICIUM 241	0 00200	PCI/L	U	0 004000	0 004000	
B304289	G 3789 0620 02 1059	06/20/90	AMERICIUM 241	0 00200	PCI/L		0 004000	0 010000	
B400189	GW03033IT	06/02/92	AMERICIUM 241	0 00200	PCI/L	U	0 004000	0 005000	
B202489	GW02535IT	02/27/92	AMERICIUM 241	0 00201	PCI/L	J	0 003710	0 000000	A
B102289	GW02482IT	02/28/92	AMERICIUM 241	0 00201	PCI/L	J	0 003910	0 000000	A
B102389	GW00106IT	07/27/90	AMERICIUM 241	0 00207	PCI/L	J	0 002400	0 010000	A
B401989	GW02583IT	03/13/92	AMERICIUM 241	0 00209	PCI/L	J	0 003850	0 000000	A
B400289	GW01790IT	09/19/91	AMERICIUM 241	0 00210	PCI/L	J	0 004860	0 010000	
B405689	GW02457IT	02/13/92	AMERICIUM 241	0 00216	PCI/L	J	0 003070	0 000000	A
B400289	GW02458IT	02/13/92	AMERICIUM 241	0 00226	PCI/L	J	0 003210	0 000000	A
B304989	GW03042IT	06/04/92	AMERICIUM 241	0 00227	PCI/L	J	0 003220	0 000000	V
B201189	GW01073IT	04/05/91	AMERICIUM 241	0 00245	PCI/L	J	0 003470	0 000000	V
B405586	GW00357IT	09/05/90	AMERICIUM 241	0 00248	PCI/L	J	0 003190	0 005000	V
B202589	GW00595IT	11/01/90	AMERICIUM 241	0 00252	PCI/L	J	0 004830	0 010000	
B200589	GW03030IT	06/26/92	AMERICIUM 241	0 00255	PCI/L	J	0 010100	0 000000	A
B203989	GW02536IT	03/03/92	AMERICIUM 241	0 00258	PCI/L	J	0 003660	0 000000	A
B405689	GW03036IT	06/29/92	AMERICIUM 241	0 00260	PCI/L	J	0 003690	0 000000	V
B302889	GW01736IT	08/30/91	AMERICIUM 241	0 00263	PCI/L	J	0 003740	0 010000	
B200589	GW01774IT	09/19/91	AMERICIUM 241	0 00266	PCI/L	J	0 003770	0 010000	
B304989	GW02505IT	02/21/92	AMERICIUM 241	0 00268	PCI/L	J	0 003800	0 000000	A
B200789	GW01773IT	09/13/91	AMERICIUM 241	0 00271	PCI/L	J	0 003840	0 010000	
B400389	GW01789IT	09/18/91	AMERICIUM 241	0 00276	PCI/L	J	0 003910	0 010000	
B102289	GW00561IT	10/24/90	AMERICIUM 241	0 00278	PCI/L	J	0 004660	0 002500	V
B400389	GW03479IT	09/23/92	AMERICIUM 241	0 00279	PCI/L	U	0 002020	0 002790	
B200889	GW03027IT	06/04/92	AMERICIUM 241	0 00281	PCI/L	J	0 001800	0 010000	
B405789	GW03419IT	09/22/92	AMERICIUM 241	0 00284	PCI/L	J	0 004030	0 010000	
B302989	GW02492IT	02/21/92	AMERICIUM 241	0 00286	PCI/L	J	0 004060	0 000000	A
B400489	GW03482IT	09/15/92	AMERICIUM 241	0 00300	PCI/L	J	0 005860	0 010000	
B201189	GW03275IT	07/30/92	AMERICIUM 241	0 00300	PCI/L	U	0 004000	0 004000	
B304989	GW03404IT	08/19/92	AMERICIUM 241	0 00300	PCI/L	U	0 008000	0 010000	
B400289	GW02959IT	06/09/92	AMERICIUM 241	0 00300	PCI/L	BJ	0 004000	0 003000	
B405889	GW03309IT	08/17/92	AMERICIUM 241	0 00300	PCI/L	J	0 003000	0 003000	
B200689	GW02497IT	02/20/92	AMERICIUM 241	0 00312	PCI/L	J	0 004430	0 000000	A
B304289	GW01021IT	03/21/91	AMERICIUM 241	0 00313	PCI/L	J	0 004440	0 000000	A
B205589	GW03776IT	10/20/92	AMERICIUM 241	0 00327	PCI/L	J	0 003790	0 010000	
B405789	GW02442IT	02/10/92	AMERICIUM 241	0 00331	PCI/L	J	0 003830	0 000000	A
B204189	GW02122IT	12/12/91	AMERICIUM 241	0 00334	PCI/L	J	0 004260	0 010000	
B203189	GW01781IT	09/18/91	AMERICIUM 241	0 00347	PCI/L	J	0 004030	0 010000	
B200589	G 0589 0607 02 1310	06/07/90	AMERICIUM 241	0 00350	PCI/L		0 010290	0 012000	A
B400289	GW00397IT	09/14/90	AMERICIUM 241	0 00353	PCI/L	J	0 005480	0 000000	V
B305389	GW01739IT	09/19/91	AMERICIUM 241	0 00356	PCI/L	J	0 004130	0 010000	
B400289	GW03468IT	09/08/92	AMERICIUM 241	0 00361	PCI/L	J	0 006500	0 010000	
B304289	GW01738IT	09/18/91	AMERICIUM 241	0 00363	PCI/L	J	0 004210	0 010000	
B400189	GW02456IT	02/13/92	AMERICIUM 241	0 00364	PCI/L	J	0 004230	0 000000	A
B205589	GW01746IT	09/10/91	AMERICIUM 241	0 00368	PCI/L	J	0 003970	0 010000	
B302889	GW02503IT	02/22/92	AMERICIUM 241	0 00370	PCI/L	J	0 004290	0 000000	A
B302989	GW01320IT	05/20/91	AMERICIUM 241	0 00375	PCI/L	J	0 005610	0 006000	A

115	B401989	GW03748IT	10/21/92	AMERICIUM 241	0 00390	PCI/L	J	0 004520	0 010000	
116	B401989	GW00028IT	07/24/90	AMERICIUM 241	0 00391	PCI/L	J	0 005540	0 010000	A
117	B200689	G 0689 0608 02 1320	06/08/90	AMERICIUM 241	0 00396	PCI/L		0 007758	0 009000	A
18	B204089	GW02989IT	05/29/92	AMERICIUM 241	0 00398	PCI/L	J	0 003550	0 000000	A
19	B203989	G 3489 0618 02 1250	06/18/90	AMERICIUM 241	0 00400	PCI/L		0 006000	0 010000	
120	B304989	G 4189 0531 02 0930	06/01/90	AMERICIUM 241	0 00400	PCI/L		0 004000	0 010000	
21	B305389	GW03054IT	06/10/92	AMERICIUM 241	0 00400	PCI/L	J	0 004000	0 003000	
22	B405689	GW03418IT	08/18/92	AMERICIUM 241	0 00400	PCI/L	U	0 006000	0 008000	
23	B202489	GW02119IT	12/11/91	AMERICIUM 241	0 00402	PCI/L	J	0 004660	0 010000	
24	B401989	GW01325IT	05/22/91	AMERICIUM 241	0 00407	PCI/L	J	0 004720	0 000000	A
25	B200889	GW01339IT	05/28/91	AMERICIUM 241	0 00409	PCI/L	J	0 005800	0 000000	A
26	B400189	GW01341IT	06/17/91	AMERICIUM 241	0 00415	PCI/L	J	0 004180	0 010000	
27	B302789	GW03759IT	10/22/92	AMERICIUM 241	0 00420	PCI/L	J	0 008420	0 010000	
28	B304289	GW02588IT	03/16/92	AMERICIUM 241	0 00421	PCI/L	J	0 004880	0 000000	A
29	B400489	GW00461IT	10/05/90	AMERICIUM 241	0 00422	PCI/L	J	0 005990	0 000000	A
30	B102389	GW00571IT	10/24/90	AMERICIUM 241	0 00429	PCI/L	J	0 004310	0 000000	V
31	B202589	GW02544IT	03/26/92	AMERICIUM 241	0 00433	PCI/L	J	0 007200	0 000000	A
32	B200689	GW00285IT	08/23/90	AMERICIUM 241	0 00435	PCI/L	J	0 002930	0 010000	
33	B200589	GW03790IT	11/05/92	AMERICIUM 241	0 00449	PCI/L		0 005680	0 003550	
34	B200689	GW02042IT	11/18/91	AMERICIUM 241	0 00451	PCI/L	J	0 005230	0 010000	
35	B200789	GW02554IT	03/03/92	AMERICIUM 241	0 00458	PCI/L	J	0 005310	0 000000	A
36	B400389	GW00462IT	10/05/90	AMERICIUM 241	0 00460	PCI/L	J	0 005340	0 000000	V
7	B200689	GW00465IT	10/08/90	AMERICIUM 241	0 00470	PCI/L	J	0 004480	0 000000	V
38	B405689	GW00793IT	12/11/90	AMERICIUM 241	0 00478	PCI/L	J	0 006770	0 010000	A
39	B405889	GW03001IT	06/05/92	AMERICIUM 241	0 00481	PCI/L	J	0 005480	0 010000	
0	B402689	GW01716IT	08/27/91	AMERICIUM 241	0 00492	PCI/L	J	0 005710	0 010000	
1	B204189	GW01770IT	09/13/91	AMERICIUM 241	0 00497	PCI/L	J	0 005370	0 010000	
2	B201189	G 1089 0604 02 1000	06/05/90	AMERICIUM 241	0 00500	PCI/L		0 004000	0 010000	
3	B202489	GW02970IT	06/03/92	AMERICIUM 241	0 00500	PCI/L	U	0 006000	0 007000	
4	B205589	G 4689 0604 02 1205	06/05/90	AMERICIUM 241	0 00500	PCI/L		0 008000	0 010000	
5	B102389	GW02485IT	02/13/92	AMERICIUM 241	0 00503	PCI/L	J	0 005060	0 000000	A
6	B402189	GW02540IT	03/23/92	AMERICIUM 241	0 00505	PCI/L	J	0 006100	0 000000	A
7	B402689	GW01303IT	05/21/91	AMERICIUM 241	0 00514	PCI/L	J	0 006400	0 000000	A
8	B200589	GW02322IT	01/28/92	AMERICIUM 241	0 00514	PCI/L	J	0 006870	0 000000	A
9	B201189	GW02522IT	02/27/92	AMERICIUM 241	0 00516	PCI/L	J	0 005870	0 000000	A
0	B402189	GW01742IT	08/29/91	AMERICIUM 241	0 00518	PCI/L	J	0 006160	0 010000	
1	B201589	G 1389 0604 02 1500	06/05/90	AMERICIUM 241	0 00524	PCI/L		0 006168	0 007000	A
2	B405689	GW00036IT	07/19/90	AMERICIUM 241	0 00530	PCI/L	J	0 007540	0 010000	A
3	B405489	GW00777IT	12/07/90	AMERICIUM 241	0 00530	PCI/L	J	0 005730	0 010000	
4	B200889	GW02351IT	02/03/92	AMERICIUM 241	0 00535	PCI/L	J	0 005380	0 000000	A
5	B305389	GW00776IT	12/05/90	AMERICIUM 241	0 00542	PCI/L	J	0 007690	0 010000	
	B400189	GW01750IT	09/17/91	AMERICIUM 241	0 00545	PCI/L	J	0 007100	0 010000	
	B203989	GW01340IT	05/28/91	AMERICIUM 241	0 00555	PCI/L	J	0 005580	0 000000	A
3	B205589	GW02974IT	06/05/92	AMERICIUM 241	0 00577	PCI/L	J	0 005190	0 000000	V
9	B202589	GW02099IT	12/09/91	AMERICIUM 241	0 00588	PCI/L	J	0 007120	0 010000	
	B305389	G 4489 0521 02 1123	05/25/90	AMERICIUM 241	0 00600	PCI/L		0 012000	0 010000	
	B402689	G 2289 0507 02 0903	05/08/90	AMERICIUM 241	0 00600	PCI/L		0 005000	0 010000	
	B405789	GW02963IT	06/08/92	AMERICIUM 241	0 00600	PCI/L	J	0 004000	0 005000	
	B102289	GW01333IT	05/23/91	AMERICIUM 241	0 00601	PCI/L	J	0 006500	0 000000	V
	B304289	GW01306IT	05/20/91	AMERICIUM 241	0 00614	PCI/L	J	0 005300	0 000000	A
	B204189	GW02594IT	03/17/92	AMERICIUM 241	0 00614	PCI/L	J	0 005530	0 006000	A
5	B200889	GW00248IT	08/16/90	AMERICIUM 241	0 00633	PCI/L	J	0 004280	0 010000	
	B400289	GW00762IT	11/29/90	AMERICIUM 241	0 00637	PCI/L	J	0 013300	0 010000	
	B405489	GW02451IT	02/10/92	AMERICIUM 241	0 00641	PCI/L	J	0 005270	0 000000	A
	B202589	GW02967IT	05/29/92	AMERICIUM 241	0 00650	PCI/L	U	0 004000	0 008500	
0	B405586	GW01775IT	09/13/91	AMERICIUM 241	0 00658	PCI/L	J	0 005920	0 010000	
	B302989	GW01672IT	08/29/91	AMERICIUM 241	0 00667	PCI/L	J	0 006010	0 010000	
	B400389	GW02960IT	06/08/92	AMERICIUM 241	0 00700	PCI/L	J	0 006000	0 005000	
	B400489	GW02961IT	06/09/92	AMERICIUM 241	0 00700	PCI/L	BJ	0 004000	0 003000	
	B302889	GW00125IT	08/10/90	AMERICIUM 241	0 00705	PCI/L		0 012500	0 000000	

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B400389	GW02444IT	02/07/92	AMERICIUM 241	0 00713	PCI/L	J	0 006420	0 000000	A
B203989	GW01020IT	03/21/91	AMERICIUM 241	0 00717	PCI/L	J	0 007630	0 007000	V
B402689	GW00658IT	11/07/90	AMERICIUM 241	0 00727	PCI/L	J	0 007870	0 010000	A
B201189	GW02103IT	12/11/91	AMERICIUM 241	0 00731	PCI/L	J	0 006590	0 010000	
B402189	GW01313IT	05/20/91	AMERICIUM 241	0 00757	PCI/L	J	0 007460	0 000000	A
B302889	GW03749IT	11/06/92	AMERICIUM 241	0 00760	PCI/L	U	0 004970	0 007600	
B302989	GW03752IT	11/06/92	AMERICIUM 241	0 00761	PCI/L	U	0 006090	0 007610	
B203289	GW03784IT	11/04/92	AMERICIUM 241	0 00774	PCI/L	U	0 005460	0 007740	
B202489	GW03272IT	07/27/92	AMERICIUM 241	0 00794	PCI/L	J	0 011300	0 000000	A
B102389	GW03798IT	10/16/92	AMERICIUM 241	0 00810	PCI/L		0 007120	0 004390	
B400489	GW00247IT	08/15/90	AMERICIUM 241	0 00863	PCI/L		0 008230	0 000000	
B405489	GW01719IT	08/28/91	AMERICIUM 241	0 00869	PCI/L	J	0 007500	0 010000	
B202489	GW03773IT	10/19/92	AMERICIUM 241	0 00897	PCI/L	U	0 005010	0 008970	
B405586	GW02452IT	03/13/92	AMERICIUM 241	0 00899	PCI/L	J	0 004980	0 000000	A
B102289	G 1889 0514 02 1209	05/14/90	AMERICIUM 241	0 00900	PCI/L		0 011000	0 010000	
B302789	G 2389 0531 02 1255	05/31/90	AMERICIUM 241	0 00900	PCI/L		0 008000	0 010000	
B302889	GW03040IT	06/04/92	AMERICIUM 241	0 00900	PCI/L	U	0 014000	0 014000	
B102289	GW01785IT	09/17/91	AMERICIUM 241	0 00904	PCI/L	J	0 003780	0 010000	
B203289	GW01064IT	04/09/91	AMERICIUM 241	0 00904	PCI/L	J	0 006460	0 000000	V
B200789	GW00271IT	08/20/90	AMERICIUM 241	0 00913	PCI/L	J	0 006180	0 010000	A
B305389	GW01308IT	05/22/91	AMERICIUM 241	0 00919	PCI/L	J	0 009940	0 000000	V
B400189	G 0189 0606 02 1115	06/06/90	AMERICIUM 241	0 00958	PCI/L		0 005267	0 005000	A
B405789	GW03765IT	11/10/92	AMERICIUM 241	0 00967	PCI/L	J	0 008720	0 010000	
B200889	GW01766IT	09/13/91	AMERICIUM 241	0 00993	PCI/L	J	0 007590	0 010000	
B405489	G 4589 0521 02 1445	05/22/90	AMERICIUM 241	0 01000	PCI/L		0 010000	0 010000	
B204189	GW01003IT	03/19/91	AMERICIUM 241	0 01037	PCI/L		0 006080	0 000000	V
B204189	G 3689 0618 02 0945	06/19/90	AMERICIUM 241	0 01100	PCI/L		0 008000	0 010000	
B400189	GW03034IT	06/05/92	AMERICIUM 241	0 01100	PCI/L		0 012000	0 011000	
B400489	GW02443IT	02/10/92	AMERICIUM 241	0 01138	PCI/L		0 007680	0 000000	A
B202589	GW00230IT	08/20/90	AMERICIUM 241	0 01178	PCI/L		0 006350	0 010000	A
B405789	GW00161IT	08/16/90	AMERICIUM 241	0 01191	PCI/L		0 005020	0 010000	
B205589	GW03280IT	07/30/92	AMERICIUM 241	0 01200	PCI/L	U	0 012000	0 014000	
B304989	GW00775IT	12/04/90	AMERICIUM 241	0 01410	PCI/L		0 018000	0 010000	A
B200589	GW03471IT	09/23/92	AMERICIUM 241	0 01473	PCI/L		0 010100	0 010000	
B405689	GW03764IT	11/09/92	AMERICIUM 241	0 01479	PCI/L		0 008680	0 010000	
B200589	GW00270IT	08/21/90	AMERICIUM 241	0 01490	PCI/L		0 010100	0 000000	
B405586	G 5586 0607 02 1331	06/07/90	AMERICIUM 241	0 01554	PCI/L		0 015253	0 019000	A
B304989	GW00212IT	08/17/90	AMERICIUM 241	0 01600	PCI/L		0 010200	0 000000	
B200789	G 0789 0607 02 0940	06/07/90	AMERICIUM 241	0 01646	PCI/L		0 012444	0 010000	A
B202589	GW01753IT	09/10/91	AMERICIUM 241	0 01938	PCI/L		0 009170	0 010000	
B202489	GW03773IT	10/19/92	AMERICIUM 241	0 01973	PCI/L	U	0 005270	0 019730	
B400389	GW03479IT	09/23/92	AMERICIUM 241	0 02000	PCI/L	UY	0 000000	0 020000	
B202489	GW00610IT	11/12/90	AMERICIUM 241	0 02175	PCI/L		0 016700	0 010000	A
B204189	GW01451IT	06/20/91	AMERICIUM 241	0 02421	PCI/L		0 011700	0 010000	
B102289	GW00332IT	08/30/90	AMERICIUM 241	0 03650	PCI/L		0 017400	0 000000	
B200689	GW02980IT	05/29/92	AMERICIUM 241	0 03900	PCI/L	U	0 048000	0 051000	
B305389	GW00137IT	08/09/90	AMERICIUM 241	0 04970	PCI/L		0 071000	0 000000	
B405489	GW00118IT	08/15/90	AMERICIUM 241	0 05160	PCI/L		0 032900	0 000000	
B400389	GW03479IT	09/23/92	AMERICIUM 241	0 06200	PCI/L	UY	0 064000	0 062000	
B402189	GW00101IT	07/20/90	AMERICIUM 241	0 08117	PCI/L	X	0 019500	0 010000	A
B302989	GW00778IT	12/05/90	AMERICIUM 241	0 09698	PCI/L		0 022700	0 010000	
B304289	GW03402IT	09/11/92	AMERICIUM 241	0 10150	PCI/L		0 024800	0 010000	
B200889	GW00494IT	10/11/90	PLUTONIUM 238	0 00067	PCI/L	J	0 000775	0 010000	
B405789	GW00161IT	08/16/90	PLUTONIUM 238	0 00030	PCI/L	J	0 000592	0 010000	
B203289	GW00111IT	08/03/90	PLUTONIUM 238	0 00024	PCI/L	J	0 000346	0 010000	
B200789	GW00271IT	08/20/90	PLUTONIUM 238	0 00000	PCI/L	J	0 002690	0 010000	
B202489	GW00610IT	11/12/90	PLUTONIUM 238	0 00000	PCI/L	J	0 006140	0 010000	
B202589	GW00230IT	08/20/90	PLUTONIUM 238	0 00000	PCI/L	J	0 002900	0 010000	
B405689	GW00036IT	07/19/90	PLUTONIUM 238	0 00028	PCI/L	J	0 003240	0 010000	

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34	B102389	GW00106IT	07/27/90	PLUTONIUM 238	0 00047	PCI/L	J	0 000943	0 010000		
35	B405689	GW00793IT	12/11/90	PLUTONIUM 238	0 00056	PCI/L	J	0 002380	0 010000		
36	B200889	GW00248IT	08/16/90	PLUTONIUM 238	0 00080	PCI/L	J	0 002200	0 010000		
37	B402189	GW00548IT	10/17/90	PLUTONIUM 238	0 00123	PCI/L	J	0 001830	0 010000		
38	B202589	GW00595IT	11/01/90	PLUTONIUM 238	0 00168	PCI/L	J	0 006470	0 010000		
39	B302989	GW00126IT	08/06/90	PLUTONIUM 238	0 00214	PCI/L	J	0 002150	0 010000		
0	B203989	GW00608IT	11/06/90	PLUTONIUM 238	0 00235	PCI/L	J	0 003870	0 010000	A	
1	B304989	GW00775IT	12/04/90	PLUTONIUM 238	0 00340	PCI/L	J	0 004820	0 010000		
2	B204189	GW00604IT	10/30/90	PLUTONIUM 238	0 00371	PCI/L	J	0 006100	0 010000		
3	B400189	GW00722IT	11/15/90	PLUTONIUM 238	0 00485	PCI/L	J	0 007010	0 010000		
4	B401989	GW00028IT	07/24/90	PLUTONIUM 238	0 00595	PCI/L	J	0 004720	0 010000		
5	B402689	GW00658IT	11/07/90	PLUTONIUM 238	0 02816	PCI/L		0 012900	0 010000		
6	B402189	GW00101IT	07/20/90	PLUTONIUM 238	0 03587	PCI/L	X	0 044700	0 010000	V	
7	B200589	GW00270IT	08/21/90	PLUTONIUM 239 240	0 00570	PCI/L		0 021400	0 000000		
8	B400289	GW01334IT	05/23/91	PLUTONIUM 239 240	0 00327	PCI/L	J	0 004880	0 010000	A	
9	B405586	GW00357IT	09/05/90	PLUTONIUM 239 240	0 00257	PCI/L	J	0 003840	0 008000	V	
0	B102289	G 1889 0514 02 1209	05/14/90	PLUTONIUM 239 240	0 00200	PCI/L		0 002000	0 010000		
1	B202589	G 2189 0601 02 1220	06/01/90	PLUTONIUM 239 240	0 00200	PCI/L		0 004000	0 010000		
2	B400189	GW03034IT	06/05/92	PLUTONIUM 239 240	0 00200	PCI/L	U	0 006000	0 011000	A	
3	B400389	GW02960IT	06/08/92	PLUTONIUM 239 240	0 00200	PCI/L	U	0 003000	0 007000		
4	B405789	G 4889 0530 02 1510	05/30/90	PLUTONIUM 239 240	0 00200	PCI/L		0 004000	0 010000		
5	B305389	GW02595IT	03/16/92	PLUTONIUM 239 240	0 00101	PCI/L	J	0 001020	0 005000	A	
6	B202489	GW02970IT	06/03/92	PLUTONIUM 239 240	0 00100	PCI/L	U	0 001000	0 003000	V	
7	B305389	GW03054IT	06/10/92	PLUTONIUM 239 240	0 00100	PCI/L	U	0 002000	0 004000		
8	B400489	GW01778IT	09/16/91	PLUTONIUM 239 240	0 00100	PCI/L	J	0 002000	0 010000		
9	B203989	GW01340IT	05/28/91	PLUTONIUM 239 240	0 00096	PCI/L	J	0 000960	0 005000	V	
0	B204189	GW01003IT	03/19/91	PLUTONIUM 239 240	0 00084	PCI/L	J	0 000971	0 005000	V	
1	B200789	GW02981IT	06/02/92	PLUTONIUM 239 240	0 00067	PCI/L	J	0 001340	0 010000		
2	B200789	GW02554IT	03/03/92	PLUTONIUM 239 240	0 00051	PCI/L	J	0 000720	0 005000	A	
3	B200889	GW01339IT	05/28/91	PLUTONIUM 239 240	0 00051	PCI/L	J	0 000717	0 005000	V	
	B302889	GW02503IT	02/22/92	PLUTONIUM 239 240	0 00049	PCI/L	J	0 000696	0 005000	A	
	B200889	GW02351IT	02/03/92	PLUTONIUM 239 240	0 00047	PCI/L	J	0 000937	0 000000	A	
	B302989	GW01672IT	08/29/91	PLUTONIUM 239 240	0 00046	PCI/L	J	0 000647	0 010000		
7	B400189	GW01750IT	09/17/91	PLUTONIUM 239 240	0 00043	PCI/L	J	0 000859	0 010000		
3	B200589	GW02322IT	01/28/92	PLUTONIUM 239 240	0 00036	PCI/L	J	0 003090	0 002500	A	
2	B302989	GW02492IT	02/21/92	PLUTONIUM 239 240	0 00032	PCI/L	J	0 000639	0 000000	A	
1	B200689	GW01780IT	09/17/91	PLUTONIUM 239 240	0 00030	PCI/L	J	0 000598	0 010000		
1	B405889	GW02584IT	03/13/92	PLUTONIUM 239 240	0 00026	PCI/L	J	0 000522	0 000000	A	
	B200689	GW02042IT	11/18/91	PLUTONIUM 239 240	0 00025	PCI/L	J	0 000508	0 010000		
	B302889	GW01330IT	05/22/91	PLUTONIUM 239 240	0 00024	PCI/L	J	0 000478	0 000000	A	
	B202589	GW02099IT	12/09/91	PLUTONIUM 239 240	0 00023	PCI/L	J	0 000469	0 010000		
	B305389	GW01308IT	05/22/91	PLUTONIUM 239 240	0 00023	PCI/L	J	0 000462	0 000000	V	
	B400489	GW00461IT	10/05/90	PLUTONIUM 239 240	0 00023	PCI/L	J	0 000455	0 000000	V	
	B200689	GW00465IT	10/08/90	PLUTONIUM 239 240	0 00023	PCI/L	J	0 000450	0 000000	V	
	B405889	GW00463IT	10/05/90	PLUTONIUM 239 240	0 00022	PCI/L	J	0 000449	0 000000	V	
	B200589	GW00570IT	10/22/90	PLUTONIUM 239 240	0 00022	PCI/L	J	0 000441	0 000000	V	
	B401989	GW01325IT	05/22/91	PLUTONIUM 239 240	0 00022	PCI/L	J	0 000435	0 000000	V	
	B402189	GW01011IT	03/21/91	PLUTONIUM 239 240	0 00020	PCI/L	J	0 002670	0 002000	V	
	B405789	GW00728IT	11/16/90	PLUTONIUM 239 240	0 00016	PCI/L	J	0 000326	0 010000		
	B202589	GW01753IT	09/10/91	PLUTONIUM 239 240	0 00001	PCI/L	J	0 000695	0 010000		
	B102389	GW01759IT	09/12/91	PLUTONIUM 239 240	0 00000	PCI/L	J	0 003140	0 010000		
	B102389	GW03224IT	08/11/92	PLUTONIUM 239 240	0 00000	PCI/L	U	0 002000	0 006000		
	B200589	GW01774IT	09/19/91	PLUTONIUM 239 240	0 00000	PCI/L	J	0 002980	0 010000		
	B200789	GW00271IT	08/20/90	PLUTONIUM 239 240	0 00000	PCI/L	J	0 002690	0 010000	A	
	B200789	GW03269IT	08/18/92	PLUTONIUM 239 240	0 00000	PCI/L	U	0 003000	0 010000		
	B200889	GW00248IT	08/16/90	PLUTONIUM 239 240	0 00000	PCI/L	J	0 003200	0 010000		
	B200889	GW01766IT	09/13/91	PLUTONIUM 239 240	0 00000	PCI/L	J	0 003480	0 010000		
	B202489	GW00610IT	11/12/90	PLUTONIUM 239 240	0 00000	PCI/L	J	0 006140	0 010000	A	
	B202489	GW02535IT	02/27/92	PLUTONIUM 239 240	0 00000	PCI/L	J	0 003490	0 000000	A	

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3	B202589	GW00230IT	08/20/90	PLUTONIUM 239 240	0 00000	PCI/L	J	0 002890	0 010000	A
	B203289	GW01064IT	04/09/91	PLUTONIUM 239 240	0 00000	PCI/L	J	0 004090	0 000000	A
3	B203989	GW00608IT	11/06/90	PLUTONIUM 239 240	0 00000	PCI/L	J	0 004030	0 010000	A
5	B203989	GW02536IT	03/03/92	PLUTONIUM 239 240	0 00000	PCI/L	J	0 003610	0 000000	A
7	B204189	GW00604IT	10/30/90	PLUTONIUM 239 240	0 00000	PCI/L	J	0 006350	0 010000	
3	B205589	GW01746IT	09/10/91	PLUTONIUM 239 240	0 00000	PCI/L	J	0 002550	0 010000	
9	B302889	GW03400IT	08/13/92	PLUTONIUM 239 240	0 00000	PCI/L	U	0 002000	0 006000	
3	B302989	G 2589 0523 02 1125	05/23/90	PLUTONIUM 239 240	0 00000	PCI/L		0 003000	0 010000	
1	B302989	GW03051IT	06/04/92	PLUTONIUM 239 240	0 00000	PCI/L	U	0 003000	0 003000	V
9	B304989	GW00775IT	12/04/90	PLUTONIUM 239 240	0 00000	PCI/L	J	0 005090	0 010000	V
5	B304989	GW01794IT	09/20/91	PLUTONIUM 239 240	0 00000	PCI/L	J	0 002580	0 010000	
	B400189	GW02456IT	02/13/92	PLUTONIUM 239 240	0 00000	PCI/L	J	0 004120	0 000000	A
	B400189	GW03033IT	06/02/92	PLUTONIUM 239 240	0 00000	PCI/L	U	0 002000	0 002000	A
5	B400289	GW00397IT	09/14/90	PLUTONIUM 239 240	0 00000	PCI/L	J	0 003400	0 000000	V
7	B402189	GW03406IT	08/18/92	PLUTONIUM 239 240	0 00000	PCI/L	U	0 002000	0 006500	
3	B405586	GW03343IT	08/18/92	PLUTONIUM 239 240	0 00000	PCI/L	U	0 002000	0 006000	
9	B405689	GW03036IT	06/29/92	PLUTONIUM 239 240	0 00000	PCI/L	J	0 004070	0 000000	V
3	B405789	GW02442IT	02/10/92	PLUTONIUM 239 240	0 00000	PCI/L	J	0 010400	0 000000	A
1	B405789	GW02963IT	06/08/92	PLUTONIUM 239 240	0 00000	PCI/L	U	0 000000	0 001000	
	B405889	GW01720IT	08/27/91	PLUTONIUM 239 240	0 00000	PCI/L	J	0 003960	0 010000	
5	B405889	GW03001IT	06/05/92	PLUTONIUM 239 240	0 00000	PCI/L	J	0 003190	0 010000	
	B202589	GW02544IT	03/26/92	PLUTONIUM 239 240	0 00006	PCI/L	J	0 002500	0 004500	A
	B202589	GW01014IT	03/28/91	PLUTONIUM 239 240	0 00012	PCI/L	J	0 003840	0 002000	V
	B203289	GW00111IT	08/03/90	PLUTONIUM 239 240	0 00012	PCI/L	J	0 001060	0 010000	A
	B405789	GW03765IT	11/10/92	PLUTONIUM 239 240	0 00022	PCI/L	J	0 002480	0 010000	
3	B400289	GW01790IT	09/19/91	PLUTONIUM 239 240	0 00025	PCI/L	J	0 002300	0 010000	
9	B405689	GW02457IT	02/13/92	PLUTONIUM 239 240	0 00025	PCI/L	J	0 002220	0 005000	A
1	B400489	GW03482IT	09/15/92	PLUTONIUM 239 240	0 00027	PCI/L	J	0 004350	0 010000	
	B400389	GW01789IT	09/18/91	PLUTONIUM 239 240	0 00033	PCI/L	J	0 002920	0 010000	
	B201189	GW00497IT	10/19/90	PLUTONIUM 239 240	0 00044	PCI/L	J	0 001850	0 004000	A
	B102389	GW00571IT	10/24/90	PLUTONIUM 239 240	0 00044	PCI/L	J	0 001870	0 004000	V
	B405689	GW01783IT	09/17/91	PLUTONIUM 239 240	0 00045	PCI/L	J	0 001900	0 010000	
	B205589	GW02523IT	02/27/92	PLUTONIUM 239 240	0 00045	PCI/L	J	0 001920	0 004000	A
	B102389	GW00106IT	07/27/90	PLUTONIUM 239 240	0 00047	PCI/L	J	0 000940	0 010000	A
	B302989	GW01019IT	03/22/91	PLUTONIUM 239 240	0 00050	PCI/L	J	0 002110	0 005000	V
	B200889	GW03027IT	06/04/92	PLUTONIUM 239 240	0 00050	PCI/L	J	0 007950	0 010000	
	B402189	GW02540IT	03/23/92	PLUTONIUM 239 240	0 00051	PCI/L	J	0 003510	0 004000	A
1	B204189	GW02594IT	03/17/92	PLUTONIUM 239 240	0 00051	PCI/L	J	0 002180	0 005000	A
	B202589	GW00595IT	11/01/90	PLUTONIUM 239 240	0 00056	PCI/L	J	0 008620	0 010000	
	B201189	GW01073IT	04/05/91	PLUTONIUM 239 240	0 00057	PCI/L	J	0 002410	0 005000	A
	B205589	GW02974IT	06/05/92	PLUTONIUM 239 240	0 00058	PCI/L	J	0 005070	0 011000	V
	B402689	GW01716IT	08/27/91	PLUTONIUM 239 240	0 00060	PCI/L	J	0 002560	0 010000	
	B405586	GW02452IT	03/13/92	PLUTONIUM 239 240	0 00062	PCI/L	J	0 003040	0 003000	A
	B302889	GW01736IT	08/30/91	PLUTONIUM 239 240	0 00062	PCI/L	J	0 002650	0 010000	
	B405489	GW00777IT	12/07/90	PLUTONIUM 239 240	0 00067	PCI/L	J	0 001840	0 010000	
	B204189	GW01770IT	09/13/91	PLUTONIUM 239 240	0 00068	PCI/L	J	0 002890	0 010000	
	B405586	GW01775IT	09/13/91	PLUTONIUM 239 240	0 00070	PCI/L	J	0 001940	0 010000	
	B400189	GW01045IT	03/28/91	PLUTONIUM 239 240	0 00071	PCI/L	J	0 001940	0 000000	A
	B201189	GW02522IT	02/27/92	PLUTONIUM 239 240	0 00071	PCI/L	J	0 001940	0 000000	A
	B102289	GW00561IT	10/24/90	PLUTONIUM 239 240	0 00071	PCI/L	J	0 003160	0 008000	V
	B200889	GW01018IT	03/22/91	PLUTONIUM 239 240	0 00071	PCI/L	J	0 001970	0 000000	V
	B102289	GW01055IT	03/28/91	PLUTONIUM 239 240	0 00074	PCI/L	J	0 003200	0 003500	V
	B405889	GW01323IT	05/21/91	PLUTONIUM 239 240	0 00074	PCI/L	J	0 002040	0 000000	V
	B401989	GW01745IT	09/06/91	PLUTONIUM 239 240	0 00080	PCI/L	J	0 002190	0 010000	
	B304289	GW00753IT	11/19/90	PLUTONIUM 239 240	0 00080	PCI/L	J	0 001310	0 010000	
	B200689	GW01063IT	04/05/91	PLUTONIUM 239 240	0 00080	PCI/L	J	0 002210	0 000000	A
	B405586	GW01048IT	03/28/91	PLUTONIUM 239 240	0 00081	PCI/L	J	0 003420	0 008000	V
	B201589	GW02973IT	06/05/92	PLUTONIUM 239 240	0 00082	PCI/L	J	0 002250	0 000000	V
	B405689	GW00793IT	12/11/90	PLUTONIUM 239 240	0 00084	PCI/L	J	0 002320	0 010000	A
	B205589	GW00496IT	10/19/90	PLUTONIUM 239 240	0 00085	PCI/L	J	0 002340	0 000000	A

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3	B304989	GW03042IT	06/04/92	PLUTONIUM 239 240	0 00088	PCI/L	J	0 003170	0 000000	V
4	B200889	GW00494IT	10/11/90	PLUTONIUM 239 240	0 00089	PCI/L	J	0 001780	0 010000	
5	B402189	GW03067IT	06/24/92	PLUTONIUM-239 240	0 00090	PCI/L	J	0 003820	0 000000	V
6	B305389	GW01739IT	09/19/91	PLUTONIUM 239 240	0 00090	PCI/L	J	0 003120	0 010000	
7	B405586	GW01316IT	05/17/91	PLUTONIUM 239 240	0 00090	PCI/L	J	0 001810	0 000000	V
8	B405789	GW03419IT	09/22/92	PLUTONIUM 239 240	0 00093	PCI/L	J	0 001850	0 010000	
9	B203189	GW01781IT	09/18/91	PLUTONIUM 239 240	0 00094	PCI/L	J	0 001890	0 010000	
0	B200789	GW01059IT	04/04/91	PLUTONIUM 239 240	0 00096	PCI/L	J	0 001920	0 000000	V
1	B202589	GW01368IT	05/31/91	PLUTONIUM 239 240	0 00098	PCI/L	J	0 000945	0 002000	V
2	B200689	GW00285IT	08/23/90	PLUTONIUM 239 240	0 00099	PCI/L	J	0 001980	0 010000	
3	B102389	GW02947IT	05/26/92	PLUTONIUM 239 240	0 00100	PCI/L	U	0 004000	0 004000	A
4	B200889	GW03273IT	08/17/92	PLUTONIUM 239 240	0 00100	PCI/L	U	0 003000	0 010000	
5	B201189	G 1089 0604 02 1000	06/05/90	PLUTONIUM 239 240	0 00100	PCI/L		0 002000	0 010000	
6	B302789	GW03052IT	06/09/92	PLUTONIUM 239 240	0 00100	PCI/L	J	0 002000	0 001000	
7	B302889	GW03040IT	06/04/92	PLUTONIUM 239 240	0 00100	PCI/L	J	0 002000	0 001000	V
8	B304989	GW03404IT	08/19/92	PLUTONIUM 239 240	0 00100	PCI/L	U	0 002000	0 006000	
9	B402689	G 2289 0507 02 0903	05/08/90	PLUTONIUM 239 240	0 00100	PCI/L		0 003000	0 010000	
0	B405489	GW03346IT	08/19/92	PLUTONIUM 239 240	0 00100	PCI/L	U	0 001000	0 005000	
1	B405689	GW03418IT	08/18/92	PLUTONIUM 239 240	0 00100	PCI/L	U	0 002000	0 004000	
2	B405889	G 4989 0614 02 0930	06/14/90	PLUTONIUM 239 240	0 00100	PCI/L		0 002000	0 010000	
3	B405889	GW03309IT	08/17/92	PLUTONIUM 239 240	0 00100	PCI/L	U	0 001000	0 005000	
	B202589	GW03766IT	10/21/92	PLUTONIUM 239 240	0 00104	PCI/L	J	0 007350	0 010000	
>	B200589	GW03030IT	06/26/92	PLUTONIUM 239 240	0 00104	PCI/L	J	0 006250	0 003000	V
6	B401989	GW03748IT	10/21/92	PLUTONIUM 239 240	0 00105	PCI/L	J	0 002880	0 010000	
7	B400489	GW01058IT	04/03/91	PLUTONIUM 239 240	0 00105	PCI/L	J	0 002110	0 000000	V
3	B202489	GW02119IT	12/11/91	PLUTONIUM 239 240	0 00111	PCI/L	J	0 002210	0 010000	
9	B102389	GW01070IT	04/04/91	PLUTONIUM 239 240	0 00115	PCI/L	J	0 002300	0 000000	V
0	B204189	GW01451IT	06/20/91	PLUTONIUM 239 240	0 00117	PCI/L	J	0 002340	0 010000	
1	B102289	GW01331IT	05/23/91	PLUTONIUM 239 240	0 00122	PCI/L	J	0 007230	0 000000	V
	B402189	GW00101IT	07/20/90	PLUTONIUM 239 240	0 00128	PCI/L	J	0 002560	0 010000	V
5	B302789	GW00754IT	11/19/90	PLUTONIUM 239 240	0 00131	PCI/L	J	0 001670	0 010000	
	B405689	GW00036IT	07/19/90	PLUTONIUM 239 240	0 00141	PCI/L	J	0 002820	0 010000	A
	B102289	GW02482IT	02/28/92	PLUTONIUM 239 240	0 00141	PCI/L	J	0 003600	0 003000	A
	B304989	GW02505IT	02/21/92	PLUTONIUM 239 240	0 00142	PCI/L	J	0 002840	0 000000	A
	B304289	GW01738IT	09/18/91	PLUTONIUM 239 240	0 00142	PCI/L	J	0 002760	0 010000	
3	B304289	GW01306IT	05/20/91	PLUTONIUM 239 240	0 00153	PCI/L	J	0 005290	0 007000	V
>	B400389	GW00462IT	10/05/90	PLUTONIUM 239 240	0 00153	PCI/L	J	0 002520	0 000000	V
)	B102289	GW01785IT	09/17/91	PLUTONIUM 239 240	0 00158	PCI/L	J	0 002310	0 010000	
1	B400289	GW00762IT	11/29/90	PLUTONIUM 239 240	0 00159	PCI/L	J	0 003410	0 010000	
	B200789	GW00466IT	10/08/90	PLUTONIUM 239 240	0 00161	PCI/L	J	0 002640	0 000000	V
5	B200589	GW03471IT	09/23/92	PLUTONIUM 239 240	0 00164	PCI/L	J	0 011700	0 010000	
	B400489	GW02443IT	02/10/92	PLUTONIUM 239 240	0 00165	PCI/L	J	0 003200	0 005000	A
	B405789	GW01338IT	05/28/91	PLUTONIUM 239 240	0 00167	PCI/L	J	0 002750	0 000000	V
	B400389	GW02444IT	02/07/92	PLUTONIUM 239 240	0 00174	PCI/L	J	0 002850	0 000000	A
	B405489	GW02451IT	02/10/92	PLUTONIUM 239 240	0 00174	PCI/L	J	0 002850	0 000000	A
	B405889	GW00297IT	08/31/90	PLUTONIUM 239 240	0 00174	PCI/L	J	0 006020	0 010000	
	B405489	GW02996IT	06/26/92	PLUTONIUM 239 240	0 00175	PCI/L	J	0 003220	0 000000	V
	B401989	GW00544IT	10/12/90	PLUTONIUM 239 240	0 00180	PCI/L	J	0 002550	0 000000	V
	B400389	GW01057IT	04/03/91	PLUTONIUM 239 240	0 00181	PCI/L	J	0 003520	0 006000	A
	B202489	GW00376IT	09/12/90	PLUTONIUM 239 240	0 00181	PCI/L	J	0 002570	0 010000	
	B405489	GW01719IT	08/28/91	PLUTONIUM 239 240	0 00182	PCI/L	J	0 003540	0 010000	
	B200689	GW02497IT	02/20/92	PLUTONIUM 239 240	0 00182	PCI/L	J	0 003000	0 000000	A
	B302889	GW01022IT	03/22/91	PLUTONIUM 239 240	0 00193	PCI/L	J	0 003180	0 000000	V
	B402189	GW01742IT	08/29/91	PLUTONIUM 239 240	0 00200	PCI/L	J	0 002640	0 010000	
	B200689	GW02980IT	05/29/92	PLUTONIUM 239 240	0 00200	PCI/L	BJ	0 002000	0 001000	A
	B202489	G 2089 0614 02 0901	06/14/90	PLUTONIUM 239,240	0 00200	PCI/L		0 002000	0 010000	
	B203989	G 3489 0618 02 1250	06/18/90	PLUTONIUM 239 240	0 00200	PCI/L		0 002000	0 010000	
	B205589	G 4689 0604 02 1205	06/05/90	PLUTONIUM 239 240	0 00200	PCI/L		0 002000	0 010000	
	B302989	GW03401IT	08/13/92	PLUTONIUM 239 240	0 00200	PCI/L	U	0 003000	0 005000	
	B400289	GW02959IT	06/09/92	PLUTONIUM 239 240	0 00200	PCI/L	U	0 004000	0 003000	

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5	B401989	GW02583IT	03/13/92	PLUTONIUM 239 240	0 00201	PCI/L	J	0 004030	0 000000	A
	B203989	GW01756IT	09/11/91	PLUTONIUM 239 240	0 00204	PCI/L	J	0 003250	0 010000	
	B405789	GW00161IT	08/16/90	PLUTONIUM 239 240	0 00206	PCI/L	J	0 003390	0 010000	
	B304989	GW01342IT	05/29/91	PLUTONIUM 239 240	0 00210	PCI/L	J	0 002970	0 000000	V
	B405689	GW03764IT	11/09/92	PLUTONIUM 239 240	0 00211	PCI/L	J	0 005420	0 010000	
3	B201189	GW03774IT	10/20/92	PLUTONIUM 239 240	0 00212	PCI/L	J	0 003900	0 010000	
)	B304289	GW02588IT	03/16/92	PLUTONIUM 239 240	0 00212	PCI/L	J	0 003480	0 000000	A
)	B302989	GW00126IT	08/06/90	PLUTONIUM 239 240	0 00213	PCI/L	J	0 002140	0 010000	A
1	B202489	GW01072IT	04/08/91	PLUTONIUM 239 240	0 00217	PCI/L	J	0 003080	0 000000	A
	B305389	GW03761IT	10/23/92	PLUTONIUM 239 240	0 00222	PCI/L	J	0 004440	0 010000	
5	B200589	GW01067IT	04/04/91	PLUTONIUM 239 240	0 00225	PCI/L	J	0 003190	0 000000	V
	B405789	GW01784IT	09/17/91	PLUTONIUM 239 240	0 00235	PCI/L	J	0 003860	0 010000	
	B203989	GW00341IT	09/14/90	PLUTONIUM 239 240	0 00236	PCI/L	J	0 003350	0 000000	V
	B302989	GW01320IT	05/20/91	PLUTONIUM 239 240	0 00236	PCI/L	J	0 003350	0 004000	V
	B200789	GW01773IT	09/13/91	PLUTONIUM 239 240	0 00236	PCI/L	J	0 003350	0 010000	
3	B205589	GW01076IT	04/05/91	PLUTONIUM 239 240	0 00245	PCI/L	J	0 003470	0 005000	A
)	B402189	GW00548IT	10/17/90	PLUTONIUM 239 240	0 00246	PCI/L	J	0 002620	0 010000	V
)	B405689	GW01329IT	05/29/91	PLUTONIUM 239 240	0 00263	PCI/L	J	0 003360	0 000000	V
1	B204089	GW02989IT	05/29/92	PLUTONIUM 239 240	0 00270	PCI/L	J	0 002920	0 000000	A
)	B304289	GW01021IT	03/21/91	PLUTONIUM 239 240	0 00276	PCI/L	J	0 003200	0 000000	V
5	B204189	GW02122IT	12/12/91	PLUTONIUM 239 240	0 00279	PCI/L	J	0 003960	0 010000	
	B402189	GW01313IT	05/20/91	PLUTONIUM 239 240	0 00292	PCI/L	J	0 003320	0 000000	V
	B302889	G 2489 0522 02 1025	05/22/90	PLUTONIUM 239 240	0 00300	PCI/L		0 004000	0 010000	
)	B401989	GW03339IT	08/06/92	PLUTONIUM 239 240	0 00300	PCI/L	U	0 004000	0 005000	V
7	B405489	G 4589 0521 02 1445	05/22/90	PLUTONIUM 239 240	0 00300	PCI/L		0 004000	0 010000	
3	B304289	GW00342IT	08/30/90	PLUTONIUM 239 240	0 00304	PCI/L	J	0 004300	0 010000	
)	B305389	GW00776IT	12/05/90	PLUTONIUM 239 240	0 00316	PCI/L	J	0 003660	0 010000	
)	B102389	GW03798IT	10/16/92	PLUTONIUM 239 240	0 00329	PCI/L	U	0 002380	0 003290	
1	B400289	GW02458IT	02/13/92	PLUTONIUM 239 240	0 00331	PCI/L	J	0 004690	0 006000	A
	B201189	GW01747IT	08/30/91	PLUTONIUM 239 240	0 00345	PCI/L	J	0 004400	0 010000	
5	B201189	GW02103IT	12/11/91	PLUTONIUM 239 240	0 00357	PCI/L	J	0 003850	0 010000	
	B405489	GW01322IT	05/22/91	PLUTONIUM 239 240	0 00380	PCI/L	J	0 004670	0 004000	V
	B400189	GW00722IT	11/15/90	PLUTONIUM 239 240	0 00387	PCI/L	J	0 003890	0 010000	V
)	B302789	GW02587IT	03/16/92	PLUTONIUM 239 240	0 00390	PCI/L	J	0 004210	0 000000	A
7	B202489	GW03773IT	10/19/92	PLUTONIUM 239 240	0 00392	PCI/L	U	0 002840	0 003920	
3	B202589	GW03325IT	08/13/92	PLUTONIUM 239 240	0 00400	PCI/L	U	0 002000	0 006500	
)	B305389	G 4489 0521 02 1123	05/25/90	PLUTONIUM 239 240	0 00400	PCI/L		0 004000	0 010000	
)	B400289	G 0289 0519 02 1420	05/19/90	PLUTONIUM 239 240	0 00400	PCI/L		0 006000	0 010000	
1	B400189	GW01341IT	06/17/91	PLUTONIUM 239 240	0 00401	PCI/L	J	0 004670	0 010000	
	B102389	GW02485IT	02/13/92	PLUTONIUM 239 240	0 00438	PCI/L	J	0 004710	0 005000	A
5	B400189	GW03397IT	08/20/92	PLUTONIUM 239 240	0 00450	PCI/L	U	0 003000	0 005000	
	B402689	GW01303IT	05/21/91	PLUTONIUM 239 240	0 00466	PCI/L	J	0 004190	0 000000	V
	B401989	GW00028IT	07/24/90	PLUTONIUM 239 240	0 00483	PCI/L	J	0 004370	0 010000	A
	B200689	GW03274IT	08/10/92	PLUTONIUM 239 240	0 00500	PCI/L	U	0 003000	0 006000	V
	B202589	GW02967IT	05/29/92	PLUTONIUM 239 240	0 00500	PCI/L	J	0 004000	0 003500	A
	B204189	G 3689 0618 02 0945	06/19/90	PLUTONIUM 239 240	0 00500	PCI/L		0 004000	0 010000	
	B304989	G 4189 0531 02 0930	06/01/90	PLUTONIUM 239 240	0 00500	PCI/L		0 004000	0 010000	
	B302889	GW03749IT	11/06/92	PLUTONIUM 239 240	0 00510	PCI/L		0 005730	0 004570	
	B400289	GW01047IT	03/28/91	PLUTONIUM 239 240	0 00517	PCI/L	J	0 008150	0 011000	V
	B305389	GW00137IT	08/09/90	PLUTONIUM 239 240	0 00546	PCI/L		0 007750	0 000000	
5	B400389	GW03479IT	09/23/92	PLUTONIUM 239 240	0 00551	PCI/L	U	0 004250	0 005510	
4	B302989	GW03752IT	11/06/92	PLUTONIUM 239 240	0 00580	PCI/L		0 005660	0 003900	
5	B305389	GW03405IT	08/18/92	PLUTONIUM 239 240	0.00600	PCI/L	U	0 007000	0 009000	
6	B400489	GW02961IT	06/09/92	PLUTONIUM 239 240	0 00600	PCI/L	J	0 006000	0 005000	
7	B304989	GW00212IT	08/17/90	PLUTONIUM 239 240	0 00602	PCI/L		0 006420	0 000000	
8	B201189	GW00249IT	08/17/90	PLUTONIUM 239 240	0 00605	PCI/L		0 004100	0 000000	
9	B205589	GW03776IT	10/20/92	PLUTONIUM 239 240	0 00611	PCI/L	J	0 005500	0 010000	
0	B405489	GW00118IT	08/15/90	PLUTONIUM 239 240	0 00638	PCI/L		0 005170	0 000000	
1	B203989	GW02978IT	06/05/92	PLUTONIUM 239 240	0 00646	PCI/L	J	0 006160	0 010000	
2	B204189	GW00310IT	09/05/90	PLUTONIUM 239 240	0 00652	PCI/L		0 007570	0 000000	

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73	B400389	GW00273IT	08/21/90	PLUTONIUM 239 240	0 00659	PCI/L		0 007660	0 000000		
474	B302889	GW00125IT	08/10/90	PLUTONIUM 239 240	0 00728	PCI/L		0 006250	0 000000		
75	B102289	GW02944IT	05/26/92	PLUTONIUM 239 240	0 00750	PCI/L	J	0 006000	0 004000	A	
76	B200589	GW03790IT	11/05/92	PLUTONIUM 239 240	0 00858	PCI/L	U	0 000000	0 008575		
77	B302789	GW03759IT	10/22/92	PLUTONIUM 239 240	0 00915	PCI/L	J	0 013000	0 010000		
478	B203989	GW01020IT	03/21/91	PLUTONIUM 239 240	0 00959	PCI/L	J	0 006020	0 004000	V	
79	B205589	GW00250IT	08/17/90	PLUTONIUM 239 240	0 00968	PCI/L		0 006560	0 000000		
80	B400489	GW00247IT	08/15/90	PLUTONIUM 239 240	0 01120	PCI/L		0 006000	0 000000		
481	B203289	GW03784IT	11/04/92	PLUTONIUM 239 240	0 01613	PCI/L	U	0 005900	0 016130		
482	B400289	GW03468IT	09/08/92	PLUTONIUM 239 240	0 02567	PCI/L	J	0 007070	0 010000		
83	B205589	GW03280IT	07/30/92	PLUTONIUM 239 240	0 03500	PCI/L	B	0 020000	0 013000		
84	B201189	GW03275IT	07/30/92	PLUTONIUM 239 240	0 04200	PCI/L	B	0 012000	0 002000		
485	B304289	GW03402IT	09/11/92	PLUTONIUM 239 240	0 04550	PCI/L		0 019600	0 010000		
486	B102289	GW00332IT	08/30/90	PLUTONIUM 239 240	0 10140	PCI/L		0 035000	0 000000		
87	B402689	GW00658IT	11/07/90	PLUTONIUM 239 240	0 14560	PCI/L		0 032400	0 010000	A	
88	B302989	GW00778IT	12/05/90	PLUTONIUM 239 240	0 22370	PCI/L		0 038100	0 010000		

Ordered Listing of Total Plutonium and Americium in Background Groundwater (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
226	0 0070600	0 1015000	0 0065678	0 0128475	0 1085600	195 6134567

ANALYTE=PLUTONIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
20	0 000669000	0 0358700	0 0045123	0 0096598	0 0365390	214 0785637

ANALYTE=PLUTONIUM 239 240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
242	0 0057000	0 2237000	0 0041338	0 0187998	0 2294000	454 7877173

Table B 10 Ordered Listing of Dissoloved Americium and Plutonium in Background Surface Water (Data from 1993 BGCR DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
1	SW005	SW05001	02/28/89	AMERICIUM 241	0 01	PCI/L		0 03		N
2	SW007	SW07001	02/27/89	AMERICIUM 241	0 01	PCI/L		0 02		N
3	SW041	SW41001	03/01/89	AMERICIUM 241	0 01	PCI/L		0 02		
4	SW004	SW004001	03/02/89	AMERICIUM 241	0 00	PCI/L		0 02		N
5	SW006	SW06001	02/24/89	AMERICIUM 241	0 00	PCI/L		0 02		
6	SW107	SW107001	02/28/89	AMERICIUM 241	0 00	PCI/L		0 02		N
7	SW107	SW50224WC	11/04/92	AMERICIUM 241	0 00	PCI/L	J	0 00	0 01	
8	SW006	SW01855WC	03/23/92	AMERICIUM 241	0 00	PCI/L		4 24	0 01	
9	SW134	SW01851WC	03/23/92	AMERICIUM 241	0 00	PCI/L		6 00	0 01	
10	SW004	SW01848WC	03/30/92	AMERICIUM 241	0 00	PCI/L	J	2 00	0 01	
11	SW107	SW00977WC	04/02/91	AMERICIUM 241	0 00	PCI/L	U		0 01	
12	SW131	SW00881WC	03/13/91	AMERICIUM 241	0 00	PCI/L	U		0 01	
13	SW131	SW00984WC	04/01/91	AMERICIUM 241	0 01	PCI/L	U		0 01	
14	SW107	SW00462WC	11/01/90	AMERICIUM 241	0 01	PCI/L	U		0 01	
15	SW131	SW00675WC	01/03/91	AMERICIUM 241	0 01	PCI/L	U		0 01	
16	SW135	SW01852WC	03/23/92	AMERICIUM 241	0 01	PCI/L		0 01	0 01	
17	SW127	SW00467WC	11/01/90	AMERICIUM 241	0 01	PCI/L		0 01	0 01	
18	SW005	SW00875WC	03/06/91	AMERICIUM 241	0 02	PCI/L	U		0 01	
19	SW006	SW00671WC	01/15/91	AMERICIUM 241	0 02	PCI/L	U		0 01	
20	SW041	SW00522WC	11/05/90	AMERICIUM 241	0 02	PCI/L	U		0 01	
21	SW004	SW00871WC	03/06/91	AMERICIUM 241	0 02	PCI/L		0 01	0 01	
22	SW107	SW00874WC	03/06/91	AMERICIUM 241	0 03	PCI/L		0 02	0 01	
23	SW007	SW00872WC	03/06/91	AMERICIUM 241	0 04	PCI/L	U		0 01	
24	SW131	SW00469WC	11/01/90	AMERICIUM 241	0 04	PCI/L	U		0 01	
25	SW005	SW00463WC	11/08/90	AMERICIUM 241	0 04	PCI/L		0 03	0 01	
26	SW005	SW00669WC	01/02/91	AMERICIUM 241	0 06	PCI/L		0 02	0 01	
27	SW006	SW00877WC	03/06/91	AMERICIUM 241	0 07	PCI/L	U		0 01	
28	SW006	SW00980WC	04/02/91	AMERICIUM 241	0 12	PCI/L	U		0 01	
29	SW005	SW00978WC	04/02/91	AMERICIUM 241	0 18	PCI/L		0 14	0 01	
30	SW006	SW00465WC	11/13/90	AMERICIUM 241	0 20	PCI/L	U		0 01	
31	SW107	SW00566WC	12/03/90	AMERICIUM 241	0 20	PCI/L	U		0 01	
32	SW041	SW00568WC	12/04/90	AMERICIUM 241	0 40	PCI/L	U		0 01	
33	SW006	SW00569WC	12/03/90	AMERICIUM 241	0 41	PCI/L		0 28	0 01	
34	SW005	SW00575WC	12/03/90	AMERICIUM 241	0 50	PCI/L	U		0 01	
194	SW135	SW01852WC	03/23/92	PLUTONIUM 236	0 00	PCI/L		0 00	0 00	
195	SW006	SW01855WC	03/23/92	PLUTONIUM 236	0 00	PCI/L		2 00	0 00	
196	SW004	SW01848WC	03/30/92	PLUTONIUM 236	0 01	PCI/L	J	1 00	0 01	
197	SW134	SW01851WC	03/23/92	PLUTONIUM 236	0 01	PCI/L		1 15	0 01	
198	SW004	SW01848WC	03/30/92	PLUTONIUM-238	0 00	PCI/L		0 00	0 01	
199	SW006	SW01855WC	03/23/92	PLUTONIUM 238	0 00	PCI/L		2 01	0 01	
200	SW135	SW01852WC	03/23/92	PLUTONIUM 238	0 01	PCI/L		2 00	0 01	
201	SW134	SW01851WC	03/23/92	PLUTONIUM 238	0 01	PCI/L		1 12	0 01	
202	SW131	SW00573WC	12/06/90	PLUTONIUM 239 240	0 12	PCI/L	U	0 64	1 14	JA
203	SW004	SW004001	03/02/89	PLUTONIUM 239 240	0 00	PCI/L		0 02		N
204	SW004	SW01848WC	03/30/92	PLUTONIUM 239 240	0 00	PCI/L		0 00	0 01	
205	SW005	SW05001	02/28/89	PLUTONIUM 239 240	0 00	PCI/L		0 02		N
206	SW007	SW07001	02/27/89	PLUTONIUM 239 240	0 00	PCI/L		0 02		N
207	SW041	SW41001	03/01/89	PLUTONIUM 239 240	0 00	PCI/L		0 02		
208	SW107	SW107001	02/28/89	PLUTONIUM 239 240	0 00	PCI/L		0 02		N
209	SW127	SW00571WC	12/03/90	PLUTONIUM 239 240	0 00	PCI/L	U	0 00	0 59	JA
210	SW107	SW50224WC	11/04/92	PLUTONIUM 239 240	0 00	PCI/L	J	0 00	0 01	

211	SW006	SW01855WC	03/23/92	PLUTONIUM 239 240	0 00	PCI/L		4 03	0 01
212	SW006	SW06001	02/24/89	PLUTONIUM 239 240	0 01	PCI/L		0 02	
213	SW107	SW00977WC	04/02/91	PLUTONIUM 239 240	0 01	PCI/L	U		0 01
214	SW006	SW00980WC	04/02/91	PLUTONIUM 239 240	0 01	PCI/L	U		0 01
215	SW134	SW01851WC	03/23/92	PLUTONIUM 239 240	0 01	PCI/L		1 59	0 01
216	SW135	SW01852WC	03/23/92	PLUTONIUM 239 240	0 01	PCI/L		1 15	0 01
217	SW005	SW00978WC	04/02/91	PLUTONIUM 239 240	0 01	PCI/L	U		0 01
218	SW131	SW00984WC	04/01/91	PLUTONIUM 239 240	0 01	PCI/L	U		0 01
219	SW004	SW00871WC	03/06/91	PLUTONIUM 239 240	0 02	PCI/L	U		0 01
220	SW007	SW00872WC	03/06/91	PLUTONIUM 239 240	0 02	PCI/L	U		0 01
221	SW041	SW00568WC	12/04/90	PLUTONIUM 239 240	0 02	PCI/L	U		0 01
222	SW107	SW00874WC	03/06/91	PLUTONIUM 239 240	0 02	PCI/L	U		0 01
223	SW006	SW00877WC	03/06/91	PLUTONIUM 239 240	0 03	PCI/L	U		0 01
224	SW006	SW00671WC	01/15/91	PLUTONIUM 239 240	0 04	PCI/L	U		0 01
225	SW005	SW00875WC	03/06/91	PLUTONIUM 239 240	0 05	PCI/L	U		0 01
226	SW005	SW00463WC	11/08/90	PLUTONIUM 239 240	0 06	PCI/L		0 04	0 01
227	SW131	SW00675WC	01/03/91	PLUTONIUM 239 240	0 06	PCI/L	U		0 01
228	SW005	SW00669WC	01/02/91	PLUTONIUM 239 240	0 20	PCI/L	U		0 01
229	SW107	SW00566WC	12/03/90	PLUTONIUM 239 240	0 20	PCI/L	U		0 01
230	SW006	SW00465WC	11/13/90	PLUTONIUM 239 240	0 30	PCI/L	U		0 01
231	SW107	SW00462WC	11/01/90	PLUTONIUM 239 240	0 30	PCI/L	U		0 01
232	SW131	SW00469WC	11/01/90	PLUTONIUM 239 240	0 30	PCI/L	U		0 01
233	SW006	SW00569WC	12/03/90	PLUTONIUM 239 240	0 40	PCI/L	U		0 01
234	SW041	SW00522WC	11/05/90	PLUTONIUM 239 240	0 40	PCI/L	U		0 01
235	SW127	SW00467WC	11/01/90	PLUTONIUM 239 240	0 40	PCI/L	U		0 01
236	SW131	SW00881WC	03/13/91	PLUTONIUM 239 240	0 52	PCI/L		0 17	0 01
237	SW005	SW00575WC	12/03/90	PLUTONIUM 239 240	0 90	PCI/L	U		0 01

Summary Statistics for Dissolved Plutonium and Americium in Background Surface Water (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
34	0 0100000	0 5000000	0 0704844	0 1292908	0 5100000	183 4316183

ANALYTE=PLUTONIUM 236

N	Minimum	Maximum	Mean	Std Dev	Range	CV
4	0	0 0120000	0 0045000	0 0054467	0 0120000	121 0380344

ANALYTE=PLUTONIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
4	0	0 0130000	0 0052500	0 0055603	0 0130000	105 9100147

ANALYTE=PLUTONIUM 239 240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
36	0 1230000	0 9000000	0 1158294	0 2039908	1 0230000	176 1131336

557	SW004	SW00871WC	03/06/91	URANIUM 238	0 82	PCI/L		0 34	0 60
558	SW041	SW00522WC	11/05/90	URANIUM 238	1 70	PCI/L		0 60	0 60
559	SW005	SW00108WC	07/02/90	URANIUM 238	24 45	PCI/L	X	3 72	0 60

Summary Statistics for Dissolved Uranium Isotopes in Background Surface Water (Data from BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=URANIUM TOTAL

N	Minimum	Maximum	Mean	Std Dev	Range	CV
6	0 1000000	1 4000000	0 7250000	0 4834770	1 3000000	66 6864814

ANALYTE=URANIUM 233 234

N	Minimum	Maximum	Mean	Std Dev	Range	CV
56	0 0157000	31 7500000	0 9199834	4 2102724	31 7657000	457 6465654

ANALYTE=URANIUM 235

N	Minimum	Maximum	Mean	Std Dev	Range	CV
56	0 0178000	0 8951000	0 1399177	0 2030022	0 9129000	145 0868948

ANALYTE=URANIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
56	0	24 4500000	0 7082350	3 2413667	24 4500000	457 6682417

Table B 11 Ordered Listing of Total Plutonium and Americium in Background Surface Water (Data from 1993 BGCR DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
1	SW127	SW01883WC	04/15/92	AMERICIUM 241	0 021	PCI/L	J	0 013	0 010	
2	SW107	SW01884WC	04/14/92	AMERICIUM 241	0 011	PCI/L	J	0 010	0 010	
3	SW006	SW006003	06/08/89	AMERICIUM 241	0 010	PCI/L		0 020	0 010	
4	SW007	SW007003	06/08/89	AMERICIUM 241	0 010	PCI/L		0 020	0 010	
5	SW107	SW107001	02/28/89	AMERICIUM 241	0 010	PCI/L		0 020		N
6	SW130	SW01882WC	04/15/92	AMERICIUM 241	0 010	PCI/L	U	0 010	0 010	
7	SW006	SW02022WC	08/28/92	AMERICIUM 241	0 006	PCI/L	U	0 005	0 010	
8	SW005	SW02018WC	08/27/92	AMERICIUM 241	0 005	PCI/L	U	0 010	0 010	
9	SW127	SW00366WC	10/04/90	AMERICIUM 241	0 004	PCI/L		0 004	0 006	V
10	SW107	SW00283WC	09/05/90	AMERICIUM 241	0 002	PCI/L		0 005	0 008	V
11	SW004	SW004003	06/15/89	AMERICIUM 241	0 000	PCI/L		0 010		
12	SW004	SW01183WC	06/05/91	AMERICIUM 241	0 000	PCI/L	J	0 004	0 010	
13	SW005	SW05001	02/28/89	AMERICIUM 241	0 000	PCI/L		0 020		N
14	SW005	SW005002	05/30/89	AMERICIUM 241	0 000	PCI/L		0 010		
15	SW005	SW005004	07/13/89	AMERICIUM 241	0 000	PCI/L		0 010	0 010	
16	SW005	SW005005	08/01/89	AMERICIUM 241	0 000	PCI/L		0 010	0 010	
17	SW005	SW005006	09/05/89	AMERICIUM 241	0 000	PCI/L	U	0 006	0 010	V
18	SW005	SW00108WC	07/02/90	AMERICIUM 241	0 000	PCI/L		0 006	0 006	
19	SW005	SW00284WC	09/04/90	AMERICIUM 241	0 000	PCI/L		0 008	0 012	V
20	SW005	SW02027WC	12/08/92	AMERICIUM 241	0 000	PCI/L	J	0 004	0 010	
21	SW006	SW006002	05/31/89	AMERICIUM 241	0 000	PCI/L		0 010		
22	SW006	SW006004	07/13/89	AMERICIUM 241	0 000	PCI/L		0 010	0 010	
23	SW006	SW006005	08/01/89	AMERICIUM 241	0 000	PCI/L		0 010	0 010	
24	SW006	SW01189WC	06/05/91	AMERICIUM 241	0 000	PCI/L	J	0 005	0 010	
25	SW006	SW01937WC	06/30/92	AMERICIUM 241	0 000	PCI/L	U	0 007	0 010	V
26	SW007	SW007002	05/31/89	AMERICIUM 241	0 000	PCI/L		0 010		
27	SW007	SW007005	08/01/89	AMERICIUM 241	0 000	PCI/L		0 010	0 010	
28	SW007	SW00790003	03/05/90	AMERICIUM 241	0 000	PCI/L		0 005	0 006	
29	SW041	SW041002	05/26/89	AMERICIUM 241	0 000	PCI/L		0 020		
30	SW041	SW041003	06/16/89	AMERICIUM 241	0 000	PCI/L		0 010		
31	SW107	SW107002	05/26/89	AMERICIUM 241	0 000	PCI/L		0 020		
32	SW107	SW107003	06/16/89	AMERICIUM 241	0 000	PCI/L		0 010		
33	SW107	SW01289WC	07/01/91	AMERICIUM 241	0 000	PCI/L	J	0 005	0 000	V
34	SW130	SW01401WC	08/01/91	AMERICIUM 241	0 000	PCI/L	J	0 004	0 010	
35	SW131	SW01194WC	06/04/91	AMERICIUM 241	0 000	PCI/L	J	0 005	0 010	
36	SW131	SW01297WC	07/08/91	AMERICIUM 241	0 000	PCI/L	J	0 031	0 010	
37	SW137	SW01840WC	03/19/92	AMERICIUM 241	0 000	PCI/L		0 004	0 011	A
38	SW006	SW00690003	03/05/90	AMERICIUM-241	0 000	PCI/L		0 008	0 009	
39	SW041	SW01397WC	08/05/91	AMERICIUM 241	0 000	PCI/L	J	0 003	0 010	
40	SW006	SW02028WC	12/02/92	AMERICIUM 241	0 001	PCI/L	J	0 006	0 010	
41	SW005	SW01850WC	03/18/92	AMERICIUM 241	0 001	PCI/L		0 012	0 025	A
42	SW107	SW50224WC	11/04/92	AMERICIUM 241	0 001	PCI/L	J	0 002	0 010	
43	SW005	SW00590003	03/22/90	AMERICIUM 241	0 001	PCI/L		0 005	0 006	
44	SW007	SW01184WC	06/03/91	AMERICIUM 241	0 001	PCI/L	J	0 003	0 010	
45	SW041	SW00207WC	08/06/90	AMERICIUM 241	0 001	PCI/L	J	0 002	0 010	V
46	SW005	SW01187WC	06/10/91	AMERICIUM 241	0 002	PCI/L	J	0 003	0 005	V
47	SW004	SW02026WC	12/02/92	AMERICIUM 241	0 002	PCI/L	J	0 002	0 010	
48	SW005	SW005W060190A	06/01/90	AMERICIUM 241	0 002	PCI/L		0 004	0 010	
49	SW006	SW006009	12/04/89	AMERICIUM 241	0 002	PCI/L		0 006	0 004	A
50	SW007	SW00790001	01/09/90	AMERICIUM 241	0 002	PCI/L		0 007	0 011	
51	SW127	SW02009WC	08/19/92	AMERICIUM 241	0 002	PCI/L	J	0 004	0 000	V
52	SW006	SW01292WC	07/01/91	AMERICIUM 241	0 002	PCI/L	J	0 003	0 000	V
53	SW131	SW01403WC	08/05/91	AMERICIUM 241	0 002	PCI/L	J	0 003	0 010	
54	SW127	SW02032WC	12/08/92	AMERICIUM 241	0 003	PCI/L	J	0 004	0 010	

55	SW107	SW01186WC	06/03/91	AMERICIUM 241	0 003	PCI/L	J	0 004	0 010	
56	SW004	SW004W060190A	06/01/90	AMERICIUM 241	0 003	PCI/L		0 004	0 010	
57	SW005	SW005009	12/04/89	AMERICIUM 241	0 003	PCI/L		0 005	0 004	A
58	SW127	SW01400WC	08/01/91	AMERICIUM 241	0 003	PCI/L	J	0 004	0 010	
59	SW041	SW00285WC	09/05/90	AMERICIUM 241	0 003	PCI/L		0 009	0 010	V
60	SW006	SW01086WC	05/30/91	AMERICIUM 241	0 003	PCI/L	J	0 004	0 000	V
61	SW005	SW01290WC	07/01/91	AMERICIUM 241	0 004	PCI/L	J	0 004	0 000	V
62	SW005	SW005W050190	05/01/90	AMERICIUM 241	0 004	PCI/L		0 005	0 010	A
63	SW007	SW01841WC	03/05/92	AMERICIUM 241	0 004	PCI/L	J	0 997	0 010	
64	SW107	SW107009	12/04/89	AMERICIUM 241	0 004	PCI/L		0 005	0 004	A
65	SW107	SW107W06190A	06/01/90	AMERICIUM 241	0 004	PCI/L		0 006	0 010	
66	SW041	SW01188WC	06/04/91	AMERICIUM 241	0 004	PCI/L	J	0 005	0 010	
67	SW007	SW02029WC	12/03/92	AMERICIUM 241	0 004	PCI/L	J	0 005	0 010	
68	SW107	SW01802WC	01/20/92	AMERICIUM 241	0 005	PCI/L	J	0 004	0 002	A
69	SW130	SW02008WC	08/19/92	AMERICIUM 241	0 006	PCI/L	J	0 007	0 007	V
70	SW004	SW00490003	03/26/90	AMERICIUM 241	0 006	PCI/L		0 015	0 010	
71	SW007	SW01923WC	06/08/92	AMERICIUM 241	0 006	PCI/L	J	0 006	0 010	
72	SW107	SW10790001	01/09/90	AMERICIUM 241	0 006	PCI/L		0 015	0 018	
73	SW107	SW107W050190A	05/01/90	AMERICIUM 241	0 006	PCI/L		0 006	0 010	
74	SW131	SW00368WC	10/02/90	AMERICIUM 241	0 006	PCI/L		0 007	0 011	V
75	SW136	SW01853WC	03/19/92	AMERICIUM 241	0 006	PCI/L		0 006	0 000	A
76	SW006	SW01398WC	08/01/91	AMERICIUM 241	0 006	PCI/L	J	0 006	0 010	
77	SW041	SW04190003	03/21/90	AMERICIUM 241	0 007	PCI/L		0 008	0 010	
78	SW041	SW00112WC	07/05/90	AMERICIUM 241	0 007	PCI/L		0 008	0 008	
79	SW107	SW02010WC	08/19/92	AMERICIUM 241	0 008	PCI/L	J	0 008	0 007	V
80	SW005	SW01396WC	08/01/91	AMERICIUM 241	0 008	PCI/L	J	0 007	0 010	
81	SW005	SW00590002	02/05/90	AMERICIUM 241	0 008	PCI/L		0 006	0 005	A
82	SW005	SW01932WC	06/22/92	AMERICIUM 241	0 008	PCI/L	U	0 009	0 010	V
83	SW007	SW007W050190	05/01/90	AMERICIUM 241	0 008	PCI/L		0 006	0 010	A
84	SW107	SW10790002	02/05/90	AMERICIUM-241	0 008	PCI/L		0 008	0 008	A
85	SW107	SW00111WC	07/02/90	AMERICIUM 241	0 008	PCI/L		0 008	0 009	
86	SW005	SW00206WC	08/01/90	AMERICIUM 241	0 008	PCI/L	J	0 004	0 010	A
87	SW004	SW004W050190	05/01/90	AMERICIUM 241	0 009	PCI/L		0 005	0 010	A
88	SW007	SW007W060190A	06/01/90	AMERICIUM 241	0 009	PCI/L		0 010	0 010	
89	SW041	SW04190001	01/04/90	AMERICIUM 241	0 009	PCI/L		0 013	0 017	
90	SW005	SW005003	06/09/89	AMERICIUM 241	0 010	PCI/L		0 010		
91	SW107	SW107004	07/14/89	AMERICIUM 241	0 010	PCI/L		0 010	0 010	
92	SW006	SW00286WC	09/05/90	AMERICIUM 241	0 011	PCI/L		0 009	0 005	V
93	SW005	SW005900010	01/04/90	AMERICIUM 241	0 011	PCI/L		0 013	0 015	
94	SW107	SW00205WC	08/01/90	AMERICIUM 241	0 011	PCI/L		0 005	0 010	A
95	SW041	SW041008	11/20/89	AMERICIUM 241	0 012	PCI/L		0 009	0 008	A
96	SW041	SW04190002	02/06/90	AMERICIUM 241	0 013	PCI/L		0 009	0 011	A
97	SW041	SW041W060490A	06/04/90	AMERICIUM 241	0 013	PCI/L		0 010	0 010	
98	SW006	SW06001	02/24/89	AMERICIUM 241	0 015	PCI/L		0 010		
99	SW006	SW006006	09/05/89	AMERICIUM 241	0 015	PCI/L		0 008	0 010	V
100	SW006	SW00690001	01/09/90	AMERICIUM 241	0 016	PCI/L		0 013	0 009	
101	SW107	SW10790003	03/13/90	AMERICIUM 241	0 016	PCI/L		0 013	0 011	A
102	SW006	SW00690002	02/06/90	AMERICIUM 241	0 017	PCI/L		0 008	0 000	A
103	SW041	SW41001	03/01/89	AMERICIUM 241	0 020	PCI/L		0 030		N
104	SW041	SW01291WC	07/08/91	AMERICIUM 241	0 023	PCI/L		0 023	0 010	
105	SW041	SW041W050290A	05/02/90	AMERICIUM 241	0 024	PCI/L		0 017	0 010	
106	SW007	SW02016WC	08/26/92	AMERICIUM 241	0 038	PCI/L	U	0 007	0 010	
380	SW005	SW02018WC	08/27/92	PLUTONIUM 236	0 008	PCI/L	U	0 005	0 010	
381	SW130	SW01882WC	04/15/92	PLUTONIUM 236	0 004	PCI/L		0 004	0 000	
382	SW005	SW02018WC	08/27/92	PLUTONIUM 236	0 004	PCI/L		0 008	0 000	
383	SW127	SW01883WC	04/15/92	PLUTONIUM 236	0 004	PCI/L		0 006	0 000	
384	SW007	SW02016WC	08/26/92	PLUTONIUM 236	0 001	PCI/L		0 003	0 000	
385	SW005	SW01850WC	03/18/92	PLUTONIUM 236	0 000	PCI/L		0 000	0 000	
386	SW007	SW01923WC	06/08/92	PLUTONIUM 236	0 000	PCI/L		0 000	0 000	

387	SW136	SW01853WC	03/19/92	PLUTONIUM 236	0 000	PCI/L		0 000	0 000	
388	SW137	SW01840WC	03/19/92	PLUTONIUM 236	0 000	PCI/L		0 000	0 000	
389	SW006	SW02022WC	08/28/92	PLUTONIUM-236	0 000	PCI/L		0 003	0 000	
390	SW107	SW01884WC	04/14/92	PLUTONIUM 236	0 001	PCI/L		0 003	0 000	
391	SW007	SW01841WC	03/05/92	PLUTONIUM 236	0 002	PCI/L		1 999	0 000	
392	SW130	SW01882WC	04/15/92	PLUTONIUM 238	0 016	PCI/L	J	0 011	0 010	
393	SW127	SW01883WC	04/15/92	PLUTONIUM 238	0 007	PCI/L	U	0 012	0 010	
394	SW107	SW01884WC	04/14/92	PLUTONIUM 238	0 007	PCI/L	J	0 010	0 010	
395	SW007	SW02016WC	08/26/92	PLUTONIUM 238	0 004	PCI/L	U	0 006	0 010	
396	SW006	SW02022WC	08/28/92	PLUTONIUM 238	0 003	PCI/L	U	0 005	0 010	
397	SW005	SW00206WC	08/01/90	PLUTONIUM 238	0 001	PCI/L	J	0 001	0 010	
398	SW107	SW00205WC	08/01/90	PLUTONIUM 238	0 000	PCI/L	J	0 001	0 010	
399	SW041	SW00207WC	08/06/90	PLUTONIUM 238	0 000	PCI/L	J	0 001	0 010	V
400	SW007	SW01923WC	06/08/92	PLUTONIUM 238	0 000	PCI/L	U	0 000	0 010	
401	SW137	SW01840WC	03/19/92	PLUTONIUM 238	0 000	PCI/L		0 000	0 010	
402	SW007	SW01841WC	03/05/92	PLUTONIUM 238	0 006	PCI/L	J	1 221	0 010	
403	SW136	SW01853WC	03/19/92	PLUTONIUM 238	0 006	PCI/L		1 054	0 010	
404	SW005	SW02018WC	08/27/92	PLUTONIUM 239 240	0 016	PCI/L	U	0 015	0 010	
405	SW007	SW02016WC	08/26/92	PLUTONIUM 239 240	0 006	PCI/L	U	0 006	0 010	
406	SW107	SW01884WC	04/14/92	PLUTONIUM 239 240	0 003	PCI/L	U	0 012	0 010	
407	SW130	SW02008WC	08/19/92	PLUTONIUM 239 240	0 001	PCI/L	J	0 003	0 006	V
408	SW005	SW02027WC	12/08/92	PLUTONIUM 239 240	0 001	PCI/L	J	0 001	0 010	
409	SW005	SW005006	09/05/89	PLUTONIUM 239 240	0 001	PCI/L		0 003	0 006	
410	SW005	SW005009	12/04/89	PLUTONIUM 239 240	0 001	PCI/L		0 004	0 004	V
411	SW107	SW50224WC	11/04/92	PLUTONIUM 239 240	0 001	PCI/L	J	0 002	0 010	
412	SW127	SW02032WC	12/08/92	PLUTONIUM 239 240	0 000	PCI/L	J	0 001	0 010	
413	SW107	SW00205WC	08/01/90	PLUTONIUM 239 240	0 000	PCI/L	J	0 001	0 010	A
414	SW004	SW004003	06/15/89	PLUTONIUM 239 240	0 000	PCI/L		0 010		
415	SW005	SW005002	05/30/89	PLUTONIUM 239 240	0 000	PCI/L		0 010		
416	SW005	SW005003	06/09/89	PLUTONIUM 239 240	0 000	PCI/L		0 010		
417	SW005	SW005004	07/13/89	PLUTONIUM 239 240	0 000	PCI/L		0 010	0 000	
418	SW005	SW005005	08/01/89	PLUTONIUM 239 240	0 000	PCI/L		0 010	0 010	
419	SW005	SW01187WC	06/10/91	PLUTONIUM 239 240	0 000	PCI/L	J	0 004	0 000	V
420	SW005	SW01396WC	08/01/91	PLUTONIUM 239 240	0 000	PCI/L	J	0 003	0 010	
421	SW006	SW06001D	02/24/89	PLUTONIUM 239 240	0 000	PCI/L		0 020		
422	SW006	SW006002	05/31/89	PLUTONIUM 239 240	0 000	PCI/L		0 010		
423	SW006	SW006003	06/08/89	PLUTONIUM 239 240	0 000	PCI/L		0 010	0 010	
424	SW006	SW006004	07/13/89	PLUTONIUM 239 240	0 000	PCI/L		0 010	0 000	
425	SW006	SW006005	08/01/89	PLUTONIUM 239 240	0 000	PCI/L		0 010	0 010	
426	SW007	SW007003	06/08/89	PLUTONIUM 239 240	0 000	PCI/L		0 010	0 010	
427	SW007	SW007005	08/01/89	PLUTONIUM 239 240	0 000	PCI/L		0 010	0 010	
428	SW007	SW007W060190A	06/01/90	PLUTONIUM 239 240	0 000	PCI/L		0 002	0 010	
429	SW007	SW01923WC	06/08/92	PLUTONIUM 239 240	0 000	PCI/L	U	0 000	0 010	
430	SW041	SW041002	05/26/89	PLUTONIUM 239 240	0 000	PCI/L		0 010		
431	SW107	SW107002	05/26/89	PLUTONIUM 239 240	0 000	PCI/L		0 010		
432	SW107	SW107003	06/16/89	PLUTONIUM 239 240	0 000	PCI/L		0 010		
433	SW107	SW107004	07/14/89	PLUTONIUM 239 240	0 000	PCI/L		0 010	0 000	
434	SW107	SW01186WC	06/03/91	PLUTONIUM 239 240	0 000	PCI/L	J	0 004	0 010	
435	SW130	SW01401WC	08/01/91	PLUTONIUM 239 240	0 000	PCI/L	J	0 004	0 010	
436	SW041	SW00207WC	08/06/90	PLUTONIUM 239 240	0 000	PCI/L	J	0 001	0 010	V
437	SW131	SW01297WC	07/08/91	PLUTONIUM 239 240	0 000	PCI/L	J	0 003	0 010	
438	SW006	SW01292WC	07/01/91	PLUTONIUM 239 240	0 001	PCI/L	J	0 002	0 000	V
439	SW130	SW01192WC	06/03/91	PLUTONIUM 239 240	0 001	PCI/L	J	0 002	0 010	
440	SW007	SW01184WC	06/03/91	PLUTONIUM 239 240	0 001	PCI/L	J	0 002	0 010	
441	SW004	SW004W050190	05/01/90	PLUTONIUM 239 240	0 001	PCI/L		0 002	0 000	A
442	SW006	SW006009	12/04/89	PLUTONIUM 239 240	0 001	PCI/L		0 006	0 006	V
443	SW006	SW01937WC	06/30/92	PLUTONIUM 239 240	0 001	PCI/L	U	0 003	0 008	A
444	SW041	SW01503WC	09/05/91	PLUTONIUM 239 240	0 001	PCI/L	U	0 002	0 003	

445	SW131	SW01194WC	06/04/91	PLUTONIUM 239 240	0 001	PCI/L	J	0 003	0 010	
446	SW041	SW01397WC	08/05/91	PLUTONIUM 239 240	0 001	PCI/L	J	0 003	0 010	
447	SW005	SW01290WC	07/01/91	PLUTONIUM 239 240	0 001	PCI/L	J	0 002	0 000	V
448	SW006	SW02028WC	12/02/92	PLUTONIUM 239 240	0 001	PCI/L	J	0 004	0 010	
449	SW004	SW02026WC	12/02/92	PLUTONIUM 239 240	0 001	PCI/L	J	0 002	0 010	
450	SW041	SW01188WC	06/04/91	PLUTONIUM 239 240	0 001	PCI/L	J	0 002	0 010	
451	SW005	SW00206WC	08/01/90	PLUTONIUM 239 240	0 001	PCI/L	J	0 002	0 010	A
452	SW127	SW01400WC	08/01/91	PLUTONIUM 239 240	0 001	PCI/L	J	0 002	0 010	
453	SW006	SW00286WC	09/05/90	PLUTONIUM 239 240	0 001	PCI/L		0 004	0 006	A
454	SW006	SW01086WC	05/30/91	PLUTONIUM 239 240	0 001	PCI/L	J	0 003	0 000	V
455	SW127	SW02009WC	08/19/92	PLUTONIUM 239 240	0 002	PCI/L	J	0 006	0 008	V
456	SW006	SW01398WC	08/01/91	PLUTONIUM 239 240	0 002	PCI/L	J	0 003	0 010	
457	SW131	SW01403WC	08/05/91	PLUTONIUM 239 240	0 002	PCI/L	J	0 004	0 010	
458	SW041	SW01291WC	07/08/91	PLUTONIUM 239 240	0 002	PCI/L	J	0 003	0 010	
459	SW005	SW01932WC	06/22/92	PLUTONIUM 239 240	0 002	PCI/L	U	0 007	0 010	A
460	SW107	SW107W050190A	05/01/90	PLUTONIUM 239 240	0 002	PCI/L		0 004	0 010	
461	SW107	SW107W06190A	06/01/90	PLUTONIUM 239 240	0 002	PCI/L		0 002	0 010	
462	SW107	SW01802WC	01/20/92	PLUTONIUM 239 240	0 002	PCI/L	J	0 002	0 001	V
463	SW107	SW00283WC	09/05/90	PLUTONIUM 239 240	0 002	PCI/L		0 005	0 007	A
464	SW107	SW02010WC	08/19/92	PLUTONIUM 239 240	0 002	PCI/L	J	0 003	0 000	V
465	SW041	SW00112WC	07/05/90	PLUTONIUM 239 240	0 002	PCI/L		0 004	0 007	
466	SW006	SW02022WC	08/28/92	PLUTONIUM 239 240	0 002	PCI/L	U	0 006	0 010	
467	SW006	SW00690003	03/05/90	PLUTONIUM 239 240	0 002	PCI/L		0 005	0 005	
468	SW007	SW00790003	03/05/90	PLUTONIUM 239 240	0 003	PCI/L		0 003	0 003	
469	SW005	SW00590003	03/22/90	PLUTONIUM 239 240	0 003	PCI/L		0 005	0 006	
470	SW005	SW00108WC	07/02/90	PLUTONIUM 239 240	0 003	PCI/L		0 007	0 010	
471	SW131	SW00368WC	10/02/90	PLUTONIUM 239 240	0 003	PCI/L		0 003	0 004	V
472	SW005	SW005W050190	05/01/90	PLUTONIUM 239 240	0 003	PCI/L		0 004	0 010	A
473	SW107	SW00111WC	07/02/90	PLUTONIUM-239 240	0 003	PCI/L		0 005	0 007	
474	SW006	SW01189WC	06/05/91	PLUTONIUM 239 240	0 004	PCI/L	J	0 005	0 010	
475	SW004	SW004W060190A	06/01/90	PLUTONIUM 239 240	0 004	PCI/L		0 008	0 010	
476	SW005	SW005W060190A	06/01/90	PLUTONIUM 239 240	0 004	PCI/L		0 006	0 010	
477	SW006	SW006006	09/05/89	PLUTONIUM 239 240	0 004	PCI/L		0 004	0 007	
478	SW007	SW007W050190	05/01/90	PLUTONIUM 239 240	0 004	PCI/L		0 005	0 010	A
479	SW041	SW041W050290A	05/02/90	PLUTONIUM 239 240	0 004	PCI/L		0 005	0 010	
480	SW041	SW04190003	03/21/90	PLUTONIUM 239 240	0 004	PCI/L		0 006	0 009	
481	SW107	SW01289WC	07/01/91	PLUTONIUM 239 240	0 004	PCI/L	J	0 004	0 000	V
482	SW004	SW01183WC	06/05/91	PLUTONIUM 239 240	0 005	PCI/L	J	0 005	0 010	
483	SW107	SW107009	12/04/89	PLUTONIUM 239 240	0 005	PCI/L		0 005	0 000	V
484	SW107	SW10790003	03/13/90	PLUTONIUM 239 240	0 005	PCI/L		0 005	0 000	A
485	SW041	SW00363WC	10/02/90	PLUTONIUM 239 240	0 006	PCI/L		0 008	0 010	
486	SW007	SW02029WC	12/03/92	PLUTONIUM 239 240	0 006	PCI/L	J	0 006	0 010	
487	SW041	SW00285WC	09/05/90	PLUTONIUM 239 240	0 006	PCI/L		0 005	0 007	A
488	SW127	SW00366WC	10/04/90	PLUTONIUM 239 240	0 007	PCI/L		0 008	0 011	V
489	SW107	SW10790002	02/05/90	PLUTONIUM 239 240	0 008	PCI/L		0 007	0 007	A
90	SW041	SW04190002	02/06/90	PLUTONIUM 239 240	0 009	PCI/L		0 006	0 007	A
91	SW006	SW00690002	02/06/90	PLUTONIUM 239 240	0 009	PCI/L		0 009	0 007	A
92	SW007	SW01841WC	03/05/92	PLUTONIUM 239 240	0 009	PCI/L	J	1 148	0 010	
93	SW005	SW05001	02/28/89	PLUTONIUM 239 240	0 010	PCI/L		0 020		
494	SW005	SW00590002	02/05/90	PLUTONIUM 239 240	0 010	PCI/L		0 009	0 006	A
495	SW006	SW006007	10/02/89	PLUTONIUM 239 240	0 011	PCI/L		0 005	0 009	
496	SW006	SW00690001	01/09/90	PLUTONIUM 239 240	0 012	PCI/L		0 007	0 007	
497	SW005	SW00284WC	09/04/90	PLUTONIUM 239 240	0 012	PCI/L		0 009	0 008	A
498	SW130	SW01882WC	04/15/92	PLUTONIUM 239 240	0 012	PCI/L		0 023	0 010	
499	SW107	SW10790001	01/09/90	PLUTONIUM 239 240	0 013	PCI/L		0 010	0 010	
500	SW005	SW00590001D	01/04/90	PLUTONIUM 239 240	0 014	PCI/L		0 012	0 009	
501	SW007	SW00790001	01/09/90	PLUTONIUM 239 240	0 015	PCI/L		0 009	0 000	
502	SW041	SW04190001	01/04/90	PLUTONIUM 239 240	0 016	PCI/L		0 007	0 005	
503	SW005	SW005007	10/02/89	PLUTONIUM 239 240	0 018	PCI/L		0 015	0 012	
504	SW007	SW007002	05/31/89	PLUTONIUM 239 240	0 020	PCI/L		0 010		

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505	SW107	SW107006	09/20/89	PLUTONIUM 239 240	0 020	PCI/L	0 012	0 007
506	SW041	SW041W060490A	06/04/90	PLUTONIUM 239 240	0 038	PCI/L	0 014	0 010
507	SW041	SW041003	06/16/89	PLUTONIUM 239 240	0 040	PCI/L	0 010	
508	SW127	SW01883WC	04/15/92	PLUTONIUM 239 240	0 048	PCI/L	0 021	0 010

Summary Statistics for Total Plutonium and Americium in Background Surface Water (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
106	0 0210000	0 0380000	0 0039133	0 0075605	0 0590000	193 2019888

ANALYTE=PLUTONIUM 236

N	Minimum	Maximum	Mean	Std Dev	Range	CV
12	0 0083000	0 0020000	0 0015535	0 0029875	0 0103000	192 3079844

ANALYTE=PLUTONIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
12	0 0160000	0 0060000	0 0021222	0 0059393	0 0220000	279 8711427

ANALYTE=PLUTONIUM 239 240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
105	0 0158000	0 0480000	0 0042548	0 0083379	0 0638000	195 9638397

Table B 12 Ordered Listing of Dissolved Plutonium and Americium in Background Seep Water (Data from 1993 BGCR DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
1	SW080	SW080001	03/01/89	AMERICIUM 241	0 00	PCI/L		0 020		
2	SW104	SW104001	03/02/89	AMERICIUM 241	0 00	PCI/L		0 030		N
3	SW108	SW108001	03/02/89	AMERICIUM 241	0 00	PCI/L		0 020		N
4	SW108	SW00976WC	04/02/91	AMERICIUM 241	0 01	PCI/L	U		0 010	
5	SW108	SW00461WC	11/12/90	AMERICIUM 241	0 01	PCI/L	U		0 010	
6	SW108	SW00873WC	03/05/91	AMERICIUM 241	0 01	PCI/L	U		0 010	
7	SW108	SW00565WC	12/03/90	AMERICIUM 241	0 20	PCI/L	U		0 010	
8	SW080	SW00466WC	11/01/90	AMERICIUM 241	0 80	PCI/L	U		0 010	
44	SW108	SW108001	03/02/89	PLUTONIUM 239 240	0 00	PCI/L		0 020		N
45	SW080	SW080001	03/01/89	PLUTONIUM 239 240	0 01	PCI/L		0 020		
46	SW104	SW104001	03/02/89	PLUTONIUM 239 240	0 01	PCI/L		0 020		N
47	SW108	SW00976WC	04/02/91	PLUTONIUM 239 240	0 01	PCI/L	U		0 010	
48	SW108	SW00873WC	03/05/91	PLUTONIUM 239 240	0 02	PCI/L	U		0 010	
49	SW108	SW00565WC	12/03/90	PLUTONIUM 239 240	0 04	PCI/L	U		0 010	
50	SW108	SW00461WC	11/12/90	PLUTONIUM 239 240	0 30	PCI/L	U		0 010	
51	SW080	SW00466WC	11/01/90	PLUTONIUM 239 240	0 40	PCI/L	U		0 010	

Summary Statistics for Dissolved Plutonium and Americium IN BACKGROUND Seep Water (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
8	0	0 8000000	0 1283750	0 2799000	0 8000000	218 0330674

ANALYTE=PLUTONIUM 239 240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
8	0	0 4000000	0 0987500	0 1577917	0 4000000	159 7890431

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Table B 13 Ordered Listing of Total Plutonium and Americium in Background Seep Water (Data from 1993 BGCR DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
1	SW080	SW080003	06/16/89	AMERICIUM 241	0 00	PCI/L		0 01		
2	SW080	SW080004	07/14/89	AMERICIUM 241	0 00	PCI/L		0 01	0 01	
3	SW104	SW104005	08/04/89	AMERICIUM 241	0 00	PCI/L		0 01	0 01	
4	SW108	SW108002	05/30/89	AMERICIUM 241	0 00	PCI/L		0 01		
5	SW108	SW108003	06/15/89	AMERICIUM 241	0 00	PCI/L		0 01		
6	SW108	SW108004	07/13/89	AMERICIUM 241	0 00	PCI/L		0 01	0 01	
7	SW108	SW01849WC	03/19/92	AMERICIUM 241	0 00	PCI/L		0 00	0 02	A
8	SW108	SW01288WC	07/01/91	AMERICIUM 241	0 00	PCI/L	J	0 00	0 00	V
9	SW108	SW01849WC	03/19/92	AMERICIUM 241	0 00	PCI/L		7 75	0 01	A
10	SW108	SW00282WC	09/05/90	AMERICIUM 241	0 00	PCI/L		0 01	0 01	V
11	SW108	SW10890002	02/07/90	AMERICIUM 241	0 00	PCI/L		0 01	0 02	A
12	SW080	SW080007	10/13/89	AMERICIUM 241	0 00	PCI/L		0 01	0 01	A
13	SW104	SW104W060490A	06/04/90	AMERICIUM 241	0 00	PCI/L		0 01	0 01	
14	SW108	SW02025WC	12/02/92	AMERICIUM 241	0 00	PCI/L	J	0 00	0 01	
15	SW108	SW01185WC	06/05/91	AMERICIUM 241	0 00	PCI/L	J	0 00	0 01	
16	SW104	SW01193WC	06/26/91	AMERICIUM 241	0 00	PCI/L	J	0 00	0 01	
17	SW104	SW104009	12/04/89	AMERICIUM 241	0 00	PCI/L		0 01	0 00	A
18	SW108	SW10890003	03/26/90	AMERICIUM 241	0 01	PCI/L		0 00	0 01	
19	SW104	SW10490001	01/10/90	AMERICIUM 241	0 01	PCI/L		0 01	0 01	
20	SW104	SW10490003	03/22/90	AMERICIUM 241	0 01	PCI/L		0 01	0 01	
21	SW080	SW080W050290A	05/02/90	AMERICIUM 241	0 01	PCI/L		0 01	0 01	
22	SW104	SW104007	10/13/89	AMERICIUM 241	0 01	PCI/L		0 01	0 00	A
23	SW080	SW080005	08/10/89	AMERICIUM 241	0 01	PCI/L		0 01	0 01	
24	SW080	SW08090002	02/06/90	AMERICIUM 241	0 01	PCI/L		0 01	0 01	A
25	SW104	SW104002	06/01/89	AMERICIUM 241	0 01	PCI/L		0 01		
26	SW104	SW00114WC	07/05/90	AMERICIUM 241	0 01	PCI/L		0 01	0 01	
27	SW104	SW104W050290A	05/02/90	AMERICIUM 241	0 01	PCI/L		0 01	0 01	
28	SW080	SW08090003	03/22/90	AMERICIUM 241	0 01	PCI/L		0 01	0 01	
29	SW104	SW104008	11/20/89	AMERICIUM 241	0 01	PCI/L		0 01	0 01	A
30	SW108	SW10890001	01/10/90	AMERICIUM 241	0 02	PCI/L		0 01	0 01	
31	SW104	SW10490002	02/05/90	AMERICIUM 241	0 02	PCI/L		0 01	0 01	A
32	SW104	SW104004	07/14/89	AMERICIUM-241	0 02	PCI/L		0 01	0 01	
33	SW080	SW08090001	01/09/90	AMERICIUM 241	0 03	PCI/L		0 01	0 01	
34	SW080	SW080W060490A	06/04/90	AMERICIUM 241	0 03	PCI/L		0 01	0 01	
35	SW080	SW080008	11/20/89	AMERICIUM 241	0 06	PCI/L		0 02	0 01	A
36	SW104	SW104003	06/16/89	AMERICIUM 241	0 06	PCI/L		0 02		
37	SW080	SW080001	03/01/89	AMERICIUM-241	0 10	PCI/L		0 07		N
121	SW108	SW108003	06/15/89	PLUTONIUM 239 240	0 00	PCI/L		0 01		
122	SW108	SW108004	07/13/89	PLUTONIUM 239 240	0 00	PCI/L		0 01	0 00	
123	SW108	SW01185WC	06/05/91	PLUTONIUM 239 240	0 00	PCI/L	J	0 00	0 01	
124	SW108	SW02025WC	12/02/92	PLUTONIUM 239 240	0 00	PCI/L	J	0 00	0 01	
125	SW108	SW00282WC	09/05/90	PLUTONIUM 239 240	0 00	PCI/L		0 00	0 01	A
126	SW108	SW01288WC	07/01/91	PLUTONIUM 239 240	0 00	PCI/L	J	0 00	0 00	V
127	SW104	SW104W050290A	05/02/90	PLUTONIUM 239 240	0 00	PCI/L		0 01	0 01	
128	SW104	SW00114WC	07/05/90	PLUTONIUM 239 240	0 00	PCI/L		0 01	0 01	
129	SW104	SW104007	10/13/89	PLUTONIUM 239 240	0 00	PCI/L		0 01	0 02	A
130	SW104	SW01193WC	06/26/91	PLUTONIUM 239 240	0 00	PCI/L	J	0 01	0 01	
131	SW104	SW10490001	01/10/90	PLUTONIUM 239 240	0 01	PCI/L		0 01	0 00	
132	SW104	SW104W060490A	06/04/90	PLUTONIUM 239 240	0 01	PCI/L		0 01	0 01	
133	SW080	SW08090003	03/22/90	PLUTONIUM 239 240	0 01	PCI/L		0 01	0 00	
134	SW080	SW08090002	02/06/90	PLUTONIUM 239 240	0 01	PCI/L		0 01	0 00	A
135	SW104	SW10490002	02/05/90	PLUTONIUM 239 240	0 01	PCI/L		0 01	0 00	A
136	SW080	SW080006	09/19/89	PLUTONIUM 239 240	0 01	PCI/L		0 01	0 00	

137	SW080	SW080007	10/13/89	PLUTONIUM 239 240	0 01	PCI/L	0 01	0 01	A
138	SW104	SW104006	09/19/89	PLUTONIUM 239 240	0 01	PCI/L	0 01	0 00	
139	SW108	SW108001	03/02/89	PLUTONIUM 239 240	0 01	PCI/L	0 02		
140	SW108	SW10890001	01/10/90	PLUTONIUM 239 240	0 01	PCI/L	0 01	0 00	
141	SW108	SW10890002	02/07/90	PLUTONIUM 239 240	0 01	PCI/L	0 01	0 00	A
142	SW080	SW08090001	01/09/90	PLUTONIUM 239 240	0 01	PCI/L	0 01	0 00	
143	SW104	SW10490003	03/22/90	PLUTONIUM 239 240	0 01	PCI/L	0 01	0 01	
144	SW080	SW00209WC	08/02/90	PLUTONIUM 239 240	0 07	PCI/L	0 03	0 01	A
145	SW080	SW080W060490A	06/04/90	PLUTONIUM 239 240	0 08	PCI/L	0 02	0 01	
146	SW104	SW104001	03/02/89	PLUTONIUM 239 240	0 08	PCI/L	0 03		
147	SW104	SW104002	06/01/89	PLUTONIUM 239 240	0 08	PCI/L	0 03		
148	SW104	SW104004	07/14/89	PLUTONIUM 239 240	0 14	PCI/L	0 02	0 00	
149	SW080	SW080005	08/10/89	PLUTONIUM 239 240	0 15	PCI/L	0 07	0 01	
150	SW104	SW104003	06/16/89	PLUTONIUM 239 240	0 19	PCI/L	0 03		
151	SW080	SW080003	06/16/89	PLUTONIUM 239 240	0 74	PCI/L	0 05		
152	SW080	SW080001	03/01/89	PLUTONIUM 239 240	1 00	PCI/L	0 10		
153	SW080	SW080004	07/14/89	PLUTONIUM 239 240	4 40	PCI/L	0 10	0 00	

Summary Statistics for Total Plutonium and Americium in Background Seep Water (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
37	0	0 1000000	0 0126499	0 0203667	0 1000000	161 0027541

ANALYTE=PLUTONIUM 239 240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
33	0	4 4000000	0 2135611	0 7807230	4 4000000	365 5736059

202

Table B 14 Ordered Listing of Total Plutonium and Americium in Background Stream Sediments (Data from 1993 BGCR DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
1	SED016	SED16001	02/23/89	AMERICIUM 241	0 01	PCI/G		0 020		
2	SED017	SED17001	02/23/89	AMERICIUM 241	0 01	PCI/G		0 020		
3	SED020	SED20001	02/22/89	AMERICIUM 241	0 01	PCI/G		0 020		N
4	SED023	SED23001	02/21/89	AMERICIUM 241	0 01	PCI/G		0 020		N
5	SED016	SS00108WC	08/27/90	AMERICIUM 241	0 00	PCI/G	J	0 001	0 020	
6	SED004	SED04001	02/21/89	AMERICIUM 241	0 00	PCI/G		0 030		N
7	SED022	SED22001	02/22/89	AMERICIUM 241	0 00	PCI/G		0 020		N
8	SED004	SS00103WC	08/27/90	AMERICIUM 241	0 00	PCI/G	J	0 001	0 020	A
9	SED022	SS00113WC	08/28/90	AMERICIUM 241	0 00	PCI/G	J	0 001	0 020	A
10	SED017	SS00109WC	08/27/90	AMERICIUM 241	0 00	PCI/G	J	0 001	0 020	
11	SED020	SS00111WC	08/28/90	AMERICIUM 241	0 00	PCI/G	J	0 001	0 020	A
12	SED016	SS00175WC	03/11/91	AMERICIUM 241	0 00	PCI/G	J	0 005	0 000	V
13	SED016	SD00305WC	02/04/92	AMERICIUM 241	0 00	PCI/G	J	0 005	0 000	A
14	SED022	SS00180WC	03/05/91	AMERICIUM 241	0 00	PCI/G	J	0 005	0 005	V
15	SED020	SD00317WC	03/19/92	AMERICIUM 241	0 00	PCI/G	J	0 005	0 000	V
16	SED020	SD00342WC	06/22/92	AMERICIUM 241	0 01	PCI/G	J	0 006	0 000	V
17	SED020	SS00144WC	11/06/90	AMERICIUM 241	0 01	PCI/G	J	0 005	0 000	A
18	SED004	SS00170WC	03/04/91	AMERICIUM 241	0 01	PCI/G	J	0 005	0 000	V
19	SED020	SS00178WC	03/04/91	AMERICIUM 241	0 01	PCI/G	J	0 005	0 000	V
20	SED127	SS00166WC	12/04/90	AMERICIUM 241	0 01	PCI/G	J	0 005	0 005	A
21	SED022	SS00146WC	11/12/90	AMERICIUM 241	0 01	PCI/G	J	0 006	0 000	V
22	SED023	SD00318WC	03/25/92	AMERICIUM 241	0 01	PCI/G	J	0 006	0 006	V
23	SED127	SS00200WC	03/21/91	AMERICIUM 241	0 01	PCI/G	J	0 007	0 000	A
24	SED016	SD00536WC	08/21/92	AMERICIUM 241	0 01	PCI/G	J	0 006	0 000	V
25	SED023	SS00181WC	03/04/91	AMERICIUM 241	0 01	PCI/G	J	0 007	0 000	V
26	SED004	SS00136WC	11/06/90	AMERICIUM 241	0 01	PCI/G	J	0 008	0 000	A
27	SED016	SD00330WC	04/15/92	AMERICIUM 241	0 01	PCI/G	J	0 010	0 000	V
28	SED004	SD00313WC	03/16/92	AMERICIUM 241	0 02	PCI/G	J	0 009	0 000	V
29	SED016	SS00141WC	11/14/90	AMERICIUM 241	0 02	PCI/G		0 014	0 008	V
30	SED017	SS00142WC	11/14/90	AMERICIUM 241	0 03	PCI/G		0 017	0 015	A
31	SED004	SD00338WC	06/08/92	AMERICIUM 241	0 09	PCI/G		0 026	0 000	V
32	SED004	SS00003WC	05/24/90	AMERICIUM 241	0 47	PCI/G		0 076	0 000	A
33	SED023	SS00024WC	06/04/90	AMERICIUM 241	0 53	PCI/G		0 075	0 000	V
34	SED022	SS00001WC	05/23/90	AMERICIUM 241	0 54	PCI/G		0 082	0 000	A
35	SED017	SS00005WC	05/29/90	AMERICIUM 241	0 82	PCI/G		0 115	0 000	A
36	SED020	SS00002WC	05/23/90	AMERICIUM 241	1 30	PCI/G		0 168	0 000	A
37	SED016	SS00004WC	05/24/90	AMERICIUM 241	2 53	PCI/G		0 302	0 007	A
161	SED016	SS00108WC	08/27/90	PLUTONIUM 238	0 00	PCI/G	J	0 000	0 030	
162	SED004	SS00103WC	08/27/90	PLUTONIUM 238	0 00	PCI/G	J	0 001	0 030	
163	SED020	SS00111WC	08/28/90	PLUTONIUM 238	0 00	PCI/G	J	0 003	0 030	
164	SED017	SS00109WC	08/27/90	PLUTONIUM 238	0 00	PCI/G	J	0 000	0 030	
165	SED022	SS00113WC	08/28/90	PLUTONIUM 238	0 00	PCI/G	J	0 001	0 030	
166	SED004	SED04001	02/21/89	PLUTONIUM 239 240	0 00	PCI/G		0 020		
167	SED016	SED16001	02/23/89	PLUTONIUM 239 240	0 00	PCI/G		0 020		
168	SED020	SED20001	02/22/89	PLUTONIUM 239 240	0 00	PCI/G		0 020		
169	SED022	SS00113WC	08/28/90	PLUTONIUM 239 240	0 00	PCI/G	J	0 001	0 030	A
170	SED004	SS00103WC	08/27/90	PLUTONIUM 239 240	0 00	PCI/G	J	0 002	0 030	A
171	SED004	SS00170WC	03/04/91	PLUTONIUM 239 240	0 00	PCI/G	J	0 003	0 000	A
172	SED020	SS00111WC	08/28/90	PLUTONIUM 239 240	0 00	PCI/G	J	0 002	0 030	A
173	SED004	SD00313WC	03/16/92	PLUTONIUM 239 240	0 00	PCI/G	J	0 006	0 008	V
174	SED022	SD00291WC	12/09/91	PLUTONIUM 239 240	0 00	PCI/G	U	0 006	0 010	
175	SED016	SD00330WC	04/15/92	PLUTONIUM 239 240	0 00	PCI/G	J	0 004	0 005	V

176	SED022	SS00180WC	03/05/91	PLUTONIUM 239 240	0 00	PCI/G	J	0 003	0 000	A
177	SED017	SS00109WC	08/27/90	PLUTONIUM 239 240	0 00	PCI/G	J	0 002	0 030	
178	SED016	SS00108WC	08/27/90	PLUTONIUM 239 240	0 01	PCI/G	J	0 003	0 030	
179	SED004	SD00338WC	06/08/92	PLUTONIUM 239 240	0 01	PCI/G	J	0 009	0 009	V
180	SED127	SS00200WC	03/21/91	PLUTONIUM 239 240	0 01	PCI/G	J	0 007	0 000	V
181	SED017	SED17001	02/23/89	PLUTONIUM 239 240	0 01	PCI/G		0 020		
182	SED022	SED22001	02/22/89	PLUTONIUM 239 240	0 01	PCI/G		0 020		
183	SED023	SED23001	02/21/89	PLUTONIUM 239 240	0 01	PCI/G		0 020		
184	SED022	SS00146WC	11/12/90	PLUTONIUM 239 240	0 01	PCI/G	J	0 008	0 000	V
185	SED016	SS00141WC	11/14/90	PLUTONIUM 239 240	0 01	PCI/G	J	0 013	0 013	A
186	SED020	SD00342WC	06/22/92	PLUTONIUM 239 240	0 01	PCI/G	J	0 008	0 007	V
187	SED023	SS00147WC	11/12/90	PLUTONIUM 239 240	0 01	PCI/G	J	0 011	0 000	A
188	SED017	SS00176WC	03/11/91	PLUTONIUM 239 240	0 01	PCI/G	J	0 011	0 000	A
189	SED127	SS00166WC	12/04/90	PLUTONIUM 239 240	0 01	PCI/G	J	0 010	0 007	V
190	SED016	SS00175WC	03/11/91	PLUTONIUM 239 240	0 02	PCI/G	J	0 010	0 000	A
191	SED016	SD00305WC	02/04/92	PLUTONIUM 239 240	0 02	PCI/G	J	0 016	0 000	A
192	SED004	SD00289WC	12/09/91	PLUTONIUM 239 240	0 02	PCI/G	BJ	0 010	0 002	
193	SED020	SED020001B	10/27/89	PLUTONIUM 239 240	0 02	PCI/G		0 005	0 007	A
194	SED023	SD00318WC	03/25/92	PLUTONIUM 239 240	0 02	PCI/G	J	0 014	0 014	V
195	SED020	SD00293WC	12/11/91	PLUTONIUM 239 240	0 02	PCI/G	BJ	0 012	0 002	
196	SED023	SD00294WC	12/10/91	PLUTONIUM 239 240	0 02	PCI/G	J	0 014	0 008	
197	SED016	SD00536WC	08/21/92	PLUTONIUM 239 240	0 02	PCI/G	J	0 009	0 004	V
198	SED020	SD00317WC	03/19/92	PLUTONIUM 239 240	0 03	PCI/G	J	0 015	0 011	V
199	SED020	SS00144WC	11/06/90	PLUTONIUM 239 240	0 03	PCI/G		0 014	0 000	V
200	SED020	SS00178WC	03/04/91	PLUTONIUM 239 240	0 03	PCI/G		0 014	0 000	A
201	SED023	SS00181WC	03/04/91	PLUTONIUM 239 240	0 03	PCI/G		0 020	0 012	A
202	SED017	SS00142WC	11/14/90	PLUTONIUM 239 240	0 04	PCI/G		0 016	0 000	V
203	SED004	SED004001B	10/27/89	PLUTONIUM 239 240	0 04	PCI/G		0 015	0 002	A
204	SED004	SS00136WC	11/06/90	PLUTONIUM 239 240	0 04	PCI/G		0 021	0 000	V
205	SED023	SS00024WC	06/04/90	PLUTONIUM 239 240	2 20	PCI/G		0 413	0 000	A
206	SED016	SS00004WC	05/24/90	PLUTONIUM 239 240	2 24	PCI/G		0 248	0 000	V
207	SED004	SS00003WC	05/24/90	PLUTONIUM 239 240	2 36	PCI/G		0 267	0 000	V
208	SED022	SS00001WC	05/23/90	PLUTONIUM 239 240	3 49	PCI/G		0 381	0 007	V
209	SED017	SS00005WC	05/29/90	PLUTONIUM 239 240	4 44	PCI/G		0 466	0 000	V
210	SED020	SS00002WC	05/23/90	PLUTONIUM 239 240	8 93	PCI/G		0 926	0 000	V

Summary Statistics for Total Plutonium and Americium in Background Stream Sediments (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE=AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
37	0 0100000	2 5260000	0 1734474	0 4842557	2 5360000	279 1945938

ANALYTE=PLUTONIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
5	0 000103000	0 000751100	0 000152140	0 000343404	0 000854100	225 7159898

ANALYTE=PLUTONIUM 239 240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
45	0	8 9330000	0 5374681	1 6100404	8 9330000	299 5601905

Table B 15 Ordered Listing of Total Plutonium and Americium in Background Seep Sediments (Data from 1993 BGCR DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
1	SED019	SED19001	02/23/89	AMERICIUM 241	0 000	PCI/G		0 020		
2	SED021	SED21001	02/22/89	AMERICIUM 241	0 000	PCI/G		0 020		N
3	SED021	SD00316WC	03/19/92	AMERICIUM 241	0 001	PCI/G	J	0 003	0 005	V
4	SED019	SS00169WC	03/11/91	AMERICIUM 241	0 002	PCI/G	J	0 007	0 000	V
5	SED021	SS00112WC	08/28/90	AMERICIUM 241	0 003	PCI/G	J	0 002	0 020	A
6	SED021	SS00179WC	03/05/91	AMERICIUM 241	0 003	PCI/G	J	0 004	0 000	V
7	SED018	SS00143WC	11/14/90	AMERICIUM 241	0 004	PCI/G	J	0 006	0 007	V
8	SED019	SS00102WC	08/21/90	AMERICIUM 241	0 010	PCI/G	J	0 004	0 020	
9	SED018	SS00177WC	03/11/91	AMERICIUM 241	0 010	PCI/G	J	0 010	0 000	A
10	SED018	SS00110WC	08/23/90	AMERICIUM 241	0 016	PCI/G	J	0 006	0 020	
11	SED018	SED18001	02/23/89	AMERICIUM 241	0 020	PCI/G		0 040		
12	SED019	SS00007WC	05/30/90	AMERICIUM 241	0 093	PCI/G		0 025	0 000	A
13	SED021	SS00023WC	06/04/90	AMERICIUM 241	0 542	PCI/G		0 077	0 000	A
14	SED018	SS00006WC	05/29/90	AMERICIUM 241	1 072	PCI/G		0 139	0 000	A
57	SED019	SS00102WC	08/21/90	PLUTONIUM 238	0 001	PCI/G	J	0 001	0 030	
58	SED021	SS00112WC	08/28/90	PLUTONIUM 238	0 001	PCI/G	J	0 001	0 030	
59	SED018	SS00110WC	08/23/90	PLUTONIUM 238	0 001	PCI/G	J	0 002	0 030	
60	SED021	SS00179WC	03/05/91	PLUTONIUM 239 240	0 000	PCI/G	J	0 006	0 009	A
61	SED021	SD00292WC	12/09/91	PLUTONIUM 239 240	0 003	PCI/G	U	0 004	0 005	
62	SED021	SD00316WC	03/19/92	PLUTONIUM 239 240	0 004	PCI/G	J	0 007	0 008	A
63	SED018	SS00177WC	03/11/91	PLUTONIUM 239 240	0 005	PCI/G	J	0 005	0 000	A
64	SED019	SS00169WC	03/11/91	PLUTONIUM 239 240	0 008	PCI/G	J	0 012	0 013	A
65	SED021	SS00112WC	08/28/90	PLUTONIUM 239 240	0 009	PCI/G	J	0 004	0 030	A
66	SED018	SS00143WC	11/14/90	PLUTONIUM 239 240	0 013	PCI/G	J	0 009	0 000	V
67	SED021	SED021001B	10/27/89	PLUTONIUM 239 240	0 019	PCI/G		0 008	0 000	A
68	SED018	SED18001	02/23/89	PLUTONIUM 239 240	0 030	PCI/G		0 020		
69	SED019	SS00102WC	08/21/90	PLUTONIUM 239 240	0 037	PCI/G	X	0 008	0 030	
70	SED019	SED19001	02/23/89	PLUTONIUM 239 240	0 040	PCI/G		0 030		
71	SED018	SS00110WC	08/23/90	PLUTONIUM 239 240	0 044	PCI/G	X	0 010	0 030	
72	SED021	SED21001	02/22/89	PLUTONIUM 239 240	0 080	PCI/G		0 020		
73	SED019	SS00007WC	05/30/90	PLUTONIUM 239 240	0 558	PCI/G		0 077	0 000	V
74	SED021	SS00023WC	06/04/90	PLUTONIUM 239 240	2 299	PCI/G		0 249	0 000	V
75	SED018	SS00006WC	05/29/90	PLUTONIUM 239 240	6 667	PCI/G		0 680	0 000	V

Summary Statistics for Total Plutonium and Americium in Background Seep Sediments (Data from 1993 BGCR DOE 1993a)

Analysis Variable RESULT

ANALYTE AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
14	0	1 0720000	0 1268616	0 3072741	1 0720000	242 2119617

ANALYTE=PLUTONIUM 238

N	Minimum	Maximum	Mean	Std Dev	Range	CV
3	0 000649400	0 0014380	0 0010345	0 000394624	0 000788600	38 1475987

ANALYTE=PLUTONIUM 239 240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
16	0	6 6670000	0 6133826	1 7134449	6 6670000	279 3435905

206

Table B 16 Ordered Listing of Total Plutonium and Americium IN BACKGROUND Boreholes (Data from 1993 BGCR DOE 1993a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	RL	VAL
1	B200589	BH05890003	02/22/89	AMERICIUM 241	0 015	PCI/G		0 02		
2	B200589	BH05890003R	03/08/89	AMERICIUM 241	0 010	PCI/G		0 02		
3	B200689	BH06890104	02/28/89	AMERICIUM 241	0 010	PCI/G		0 02		N
4	B200689	BH06891824	02/28/89	AMERICIUM 241	0 010	PCI/G		0 02		N
5	B200689	BH06892430	02/28/89	AMERICIUM 241	0 010	PCI/G		0 02		N
6	B200789	BH07890003	03/08/89	AMERICIUM 241	0 010	PCI/G		0 01		N
7	B200889	BH08890106	03/06/89	AMERICIUM 241	0 010	PCI/G		0 01		N
8	B200889	BH08890003	03/08/89	AMERICIUM 241	0 010	PCI/G		0 01		N
9	B200589	BH05891317	02/22/89	AMERICIUM 241	0 000	PCI/G		0 02		N
10	B200589	BH05892530	02/23/89	AMERICIUM 241	0 000	PCI/G		0 02		N
11	B200689	BH06890410	02/28/89	AMERICIUM 241	0 000	PCI/G		0 02		N
12	B200689	BH06891016	02/28/89	AMERICIUM 241	0 000	PCI/G		0 02		N
13	B200689	BH06891618	02/28/89	AMERICIUM 241	0 000	PCI/G		0 02		N
14	B200789	BH07890103	03/01/89	AMERICIUM 241	0 000	PCI/G		0 01		N
15	B200789	BH07890306	03/01/89	AMERICIUM 241	0 000	PCI/G		0 01		N
16	B200789	BH07890612	03/01/89	AMERICIUM 241	0 000	PCI/G		0 04		N
17	B200789	BH07891218	03/01/89	AMERICIUM 241	0 000	PCI/G		0 01		N
18	B200789	BH07891824	03/01/89	AMERICIUM 241	0 000	PCI/G		0 01		N
19	B200789	BH07892426	03/01/89	AMERICIUM 241	0 000	PCI/G		0 01		N
20	B200889	BH08890608	03/06/89	AMERICIUM 241	0 000	PCI/G		0 02		N
21	B200889	BH08890814	03/06/89	AMERICIUM 241	0 000	PCI/G		0 01		N
22	B200889	BH08891420	03/06/89	AMERICIUM 241	0 000	PCI/G		0 02		N
23	B200889	BH08892022	03/06/89	AMERICIUM 241	0 000	PCI/G		0 02		N
24	B200989	BH09890003	03/08/89	AMERICIUM 241	0 000	PCI/G		0 02		N
25	B200589	BH05890308	02/22/89	AMERICIUM 241	0 010	PCI/G		0 03		N
26	B200589	BH05890913	02/22/89	AMERICIUM 241	0 010	PCI/G		0 02		N
27	B200589	BH05891723	02/22/89	AMERICIUM 241	0 010	PCI/G		0 02		N
28	B200589	BH05892325	02/22/89	AMERICIUM 241	0 010	PCI/G		0 03		N
389	B200689	BH06890104	02/28/89	PLUTONIUM 239 240	0 010	PCI/G		0 02		
390	B200689	BH06890410	02/28/89	PLUTONIUM 239 240	0 010	PCI/G		0 02		
391	B200789	BH07891824	03/01/89	PLUTONIUM 239 240	0 010	PCI/G		0 02		
392	B201189	BH11893541	03/23/89	PLUTONIUM 239 240	0 010	PCI/G		0 02		
393	B201589	BH14891417	03/16/89	PLUTONIUM 239 240	0 010	PCI/G		0 01		
394	B201589	BH14891720	03/16/89	PLUTONIUM 239 240	0 010	PCI/G		0 01		
395	B405189	BH01890915	03/09/89	PLUTONIUM 239 240	0 010	PCI/G		0 02		
396	B200889	BH08891420	03/06/89	PLUTONIUM 239 240	0 005	PCI/G		0 02		
397	B201189	BH11890309	03/17/89	PLUTONIUM 239 240	0 005	PCI/G		0 01		
398	B200589	BH05890003	02/22/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
399	B200589	BH05890913	02/22/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
400	B200589	BH05891317	02/22/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
401	B200689	BH06891618	02/28/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
402	B200689	BH06892430	02/28/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
403	B200689	BH06890003	03/09/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
404	B200789	BH07890306	03/01/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
405	B200789	BH07892426	03/01/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
406	B200889	BH08890608	03/06/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
407	B200889	BH08890814	03/06/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
408	B200889	BH08890003	03/08/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
409	B200989	BH09891620	03/02/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
410	B200989	BH09891016	03/02/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
411	B201089	BH10891319	03/02/89	PLUTONIUM 239 240	0 000	PCI/G		0 01		
412	B201089	BH10890003	03/09/89	PLUTONIUM 239 240	0 000	PCI/G		0 02		
413	B201189	BH11891521	03/17/89	PLUTONIUM 239 240	0 000	PCI/G		0 01		

414	B201189	BH11894146	03/23/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
415	B201289	BH12890003	03/22/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
416	B201289	BH12891521	03/23/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
417	B201289	BH12892329	03/23/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
418	B201289	BH12892930	03/23/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
419	B201289	BH12893032	03/23/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
420	B201489	BH13890307	03/10/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
421	B201589	BH14890307	03/15/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
422	B201589	BH14890814	03/16/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
423	B301889	BH15890309	03/07/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
424	B301889	BH15891521	03/07/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
425	B302089	BH17890003	03/28/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
426	B302089	BH17890306	03/28/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
427	B400289	BH02890309	04/12/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
428	B400289	BH02890915	04/12/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
429	B400289	BH02892130	04/13/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
430	B400289	BH02893036	04/14/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
431	B400289	BH02893642	04/14/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
432	B400289	BH02894248	04/17/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
433	B400389	BH03892733	04/05/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
434	B400389	BH03890003	04/25/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
435	B400389	BH03890309	04/25/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
436	B400389	BH03890915	04/25/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
437	B400389	BH03891521	04/25/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
438	B400389	BH03892127	04/25/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
439	B400389	BH03893339	04/25/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
440	B400389	BH03893945	04/26/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
441	B400389	BH03894548	04/26/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
442	B400489	BH04890003	04/28/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
443	B400489	BH04890309	04/28/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
444	B400489	BH04890915	04/28/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
445	B400489	BH04891521	04/28/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
446	B400489	BH04892127	04/28/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
447	B400489	BH04892733	05/01/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
448	B400489	BH04893335	05/01/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
449	B400489	BH04893538	05/01/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
450	B400489	BH04893840	05/01/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
451	B400489	BH04894046	05/01/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
452	B400489	BH04894652	05/01/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
453	B400489	BH04895254	05/01/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
454	B401989	BH16890003	04/05/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
455	B401989	BH16890309	04/05/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
456	B401989	BH16890915	04/05/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
457	B401989	BH16892127	04/05/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
458	B402189	BH18890713	03/29/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
459	B402189	BH18891319	03/29/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
460	B405189	BH01890309	03/09/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
461	B405189	BH01891521	03/09/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
462	B405189	BH01892127	03/09/89	PLUTONIUM 239 240	0 000	PCI/G	0 02
463	B405189	BH01893638	03/10/89	PLUTONIUM 239 240	0 000	PCI/G	0 01
464	B200589	BH05891723	02/22/89	PLUTONIUM 239 240	0 005	PCI/G	0 02
465	B201289	BH12890915	03/23/89	PLUTONIUM 239 240	0 005	PCI/G	0 01
466	B200589	BH05890308	02/22/89	PLUTONIUM 239 240	0 010	PCI/G	0 03
467	B200589	BH05892325	02/22/89	PLUTONIUM 239 240	0 010	PCI/G	0 03
468	B200589	BH05892530	02/23/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
469	B200589	BH05890003R	03/08/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
470	B200689	BH06891016	02/28/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
471	B200689	BH06891824	02/28/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
472	B200789	BH07890103	03/01/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
473	B200789	BH07890612	03/01/89	PLUTONIUM 239 240	0 010	PCI/G	0 02

474	B200789	BH07890003	03/08/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
475	B200889	BH08890106	03/06/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
476	B200889	BH08892022	03/06/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
477	B200989	BH09890104	03/02/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
478	B200989	BH09890410	03/02/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
479	B201089	BH10890106	03/02/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
480	B201089	BH10890713	03/02/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
481	B201189	BH11890003	03/17/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
482	B201189	BH11890915	03/17/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
483	B201189	BH11892733	03/17/89	PLUTONIUM 239 240	0 010	PCI/G	0 01
484	B201489	BH13890003	03/10/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
485	B201489	BH13890709	03/10/89	PLUTONIUM 239 240	0 010	PCI/G	0 01
486	B201489	BH13891015	03/10/89	PLUTONIUM 239 240	0 010	PCI/G	0 01
487	B201489	BH13891519	03/10/89	PLUTONIUM 239 240	0 010	PCI/G	0 01
488	B201589	BH14890003	03/15/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
489	B301889	BH15890915	03/07/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
490	B301889	BH15892228	03/07/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
491	B301889	BH15892834	03/07/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
492	B302089	BH17891319	03/28/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
493	B302089	BH17891925	03/28/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
494	B400289	BH02890003	04/12/89	PLUTONIUM 239 240	0 010	PCI/G	0 01
495	B400289	BH02891521	04/13/89	PLUTONIUM 239 240	0 010	PCI/G	0 01
496	B401989	BH16891519	04/05/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
497	B401989	BH16892733	04/05/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
498	B405189	BH01893036	03/10/89	PLUTONIUM 239 240	0 010	PCI/G	0 02
499	B405189	BH01893844	03/10/89	PLUTONIUM 239 240	0 010	PCI/G	0 01
500	B405189	BH01894448	03/10/89	PLUTONIUM 239 240	0 010	PCI/G	0 01
501	B200789	BH07891218	03/01/89	PLUTONIUM 239 240	0 020	PCI/G	0 02
502	B200989	BH09890003	03/08/89	PLUTONIUM 239 240	0 020	PCI/G	0 02
503	B201189	BH11892127	03/17/89	PLUTONIUM 239 240	0 020	PCI/G	0 02
504	B201289	BH12890307	03/22/89	PLUTONIUM 239 240	0 020	PCI/G	0 02
505	B301889	BH15890003	03/07/89	PLUTONIUM 239 240	0 020	PCI/G	0 02
506	B402189	BH18890003	03/29/89	PLUTONIUM 239 240	0 020	PCI/G	0 02
507	B402189	BH18890307	03/29/89	PLUTONIUM 239 240	0 020	PCI/G	0 02
508	B405189	BH01890003	03/09/89	PLUTONIUM 239 240	0 030	PCI/G	0 03

Summary Statistics for Total Plutonium and Americium in Background Subsurface Soils (Boreholes) (Data from 1993 BGCR)

Analysis Variable RESULT

ANALYTE=AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
28	0 0150000	0 0100000	0 0016071	0 0068114	0 0250000	423 8219640

ANALYTE=PLUTONIUM 239 240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
120	0 0100000	0 0300000	0 0037500	0 0072833	0 0400000	194 2208932

Figure B 17 Ordered Listing of Plutonium and Americium in Background Surface Soils (BSCP DOE 1995a)

OBS	LOCATION	SAMPLE	SDATE	ANALYTE	RESULT	UNITS	QUAL	ERROR	DETECT	VAL
1	SS110594	SS00159EG	06/30/94	AMERICIUM 241	0 001	PCI/G	U	0 006	0 010	A
2	SS109994	SS00153EG	06/28/94	AMERICIUM 241	0 002	PCI/G	U	0 005	0 008	V
3	SS110294	SS00156EG	06/29/94	AMERICIUM 241	0 002	PCI/G	U	0 004	0 006	V
4	SS110394	SS00157EG	06/30/94	AMERICIUM 241	0 002	PCI/G	U	0 004	0 008	V
5	SS108394	SS00136EG	06/16/94	AMERICIUM 241	0 004	PCI/G	U	0 008	0 010	V
6	SS109094	SS00143EG	06/22/94	AMERICIUM 241	0 004	PCI/G	U	0 005	0 008	V
7	SS109394	SS00147EG	06/23/94	AMERICIUM 241	0 004	PCI/G	U	0 005	0 007	V
8	SS104394	SS00094EG	05/16/94	AMERICIUM 241	0 005	PCI/G	U	0 006	0 007	V
9	SS108894	SS00141EG	06/22/94	AMERICIUM 241	0 005	PCI/G	U	0 006	0 010	V
10	SS109294	SS00146EG	07/29/94	AMERICIUM 241	0 005	PCI/G	U	0 006	0 010	A
11	SS110194	SS00155EG	06/29/94	AMERICIUM 241	0 005	PCI/G	U	0 006	0 008	V
12	SS108994	SS00142EG	06/22/94	AMERICIUM 241	0 006	PCI/G	J	0 006	0 005	V
13	SS104594	SS00096EG	05/24/94	AMERICIUM 241	0 007	PCI/G	U	0 006	0 010	V
14	SS105194	SS00102EG	06/01/94	AMERICIUM 241	0 007	PCI/G	J	0 005	0 005	V
15	SS107894	SS00131EG	06/14/94	AMERICIUM 241	0 007	PCI/G	U	0 008	0 010	V
16	SS107994	SS00132EG	06/15/94	AMERICIUM 241	0 007	PCI/G	J	0 006	0 007	V
17	SS109494	SS00148EG	06/23/94	AMERICIUM 241	0 007	PCI/G	U	0 008	0 010	V
18	SS109894	SS00152EG	06/28/94	AMERICIUM 241	0 007	PCI/G	U	0 007	0 009	V
19	SS104194	SS00091EG	05/23/94	AMERICIUM 241	0 008	PCI/G	U	0 007	0 010	V
20	SS104894	SS00099EG	05/25/94	AMERICIUM 241	0 009	PCI/G	J	0 006	0 009	V
21	SS109194	SS00144EG	06/22/94	AMERICIUM 241	0 009	PCI/G	U	0 007	0 010	V
22	SS109594	SS00149EG	06/27/94	AMERICIUM 241	0 009	PCI/G	J	0 007	0 006	V
23	SS110294	SS00167EG	06/29/94	AMERICIUM 241	0 009	PCI/G	J	0 005	0 005	V
24	SS110494	SS00158EG	06/30/94	AMERICIUM 241	0 009	PCI/G	J	0 006	0 006	V
25	SS110694	SS00160EG	07/01/94	AMERICIUM 241	0 009	PCI/G	J	0 007	0 006	V
26	SS110894	SS00162EG	07/01/94	AMERICIUM 241	0 009	PCI/G	U	0 008	0 010	V
27	SS111094	SS00164EG	07/29/94	AMERICIUM 241	0 009	PCI/G	J	0 008	0 009	A
28	SS111194	SS00165EG	07/29/94	AMERICIUM 241	0 009	PCI/G	U	0 009	0 010	V
29	SS104994	SS00100EG	06/01/94	AMERICIUM 241	0 010	PCI/G	J	0 006	0 008	V
30	SS108194	SS00134EG	06/16/94	AMERICIUM 241	0 010	PCI/G	J	0 009	0 010	V
31	SS108794	SS00140EG	06/20/94	AMERICIUM 241	0 010	PCI/G	J	0 006	0 008	V
32	SS109794	SS00151EG	06/27/94	AMERICIUM 241	0 010	PCI/G	J	0 006	0 007	A
33	SS110094	SS00154EG	06/28/94	AMERICIUM 241	0 010	PCI/G	J	0 008	0 010	V
34	SS111194	SS00169EG	07/29/94	AMERICIUM 241	0 010	PCI/G	J	0 009	0 010	V
35	SS104494	SS00095EG	05/24/94	AMERICIUM 241	0 012	PCI/G	J	0 006	0 006	V
36	SS105294	SS00104EG	06/01/94	AMERICIUM 241	0 012	PCI/G	J	0 008	0 010	V
37	SS107494	SS00127EG	06/14/94	AMERICIUM 241	0 013	PCI/G	U	0 010	0 020	V
38	SS109694	SS00150EG	06/27/94	AMERICIUM 241	0 013	PCI/G	J	0 007	0 006	V
39	SS104694	SS00097EG	05/25/94	AMERICIUM 241	0 014	PCI/G	J	0 008	0 008	V
40	SS110794	SS00161EG	07/01/94	AMERICIUM 241	0 014	PCI/G	J	0 008	0 008	V
41	SS104794	SS00098EG	05/25/94	AMERICIUM 241	0 015	PCI/G	J	0 008	0 007	V
42	SS108494	SS00137EG	06/16/94	AMERICIUM 241	0 015	PCI/G	J	0 006	0 005	V
43	SS108594	SS00138EG	06/20/94	AMERICIUM 241	0 015	PCI/G	J	0 007	0 005	V
44	SS107794	SS00130EG	06/15/94	AMERICIUM 241	0 016	PCI/G	J	0 009	0 007	V
45	SS108694	SS00139EG	06/20/94	AMERICIUM 241	0 017	PCI/G	J	0 007	0 005	V
46	SS105094	SS00101EG	06/01/94	AMERICIUM 241	0 018	PCI/G	J	0 009	0 008	V
47	SS104294	SS00092EG	05/23/94	AMERICIUM 241	0 019	PCI/G	J	0 009	0 010	V
48	SS107594	SS00128EG	06/14/94	AMERICIUM 241	0 019	PCI/G	J	0 009	0 007	V
49	SS108094	SS00133EG	06/16/94	AMERICIUM 241	0 019	PCI/G	J	0 008	0 007	V
50	SS107694	SS00129EG	06/15/94	AMERICIUM 241	0 021	PCI/G		0 010	0 008	V
51	SS108294	SS00135EG	06/16/94	AMERICIUM 241	0 023	PCI/G		0 012	0 010	V
52	SS107394	SS00126EG	06/14/94	AMERICIUM 241	0 025	PCI/G		0 010	0 010	V
53	SS104694	SS00093EG	05/25/94	AMERICIUM 241	0 031	PCI/G		0 012	0 010	V

54	SS110294	SS00167EG	06/29/94	PLUTONIUM	239/240	0 016	PCI/G	J	0 005	0 005	V
55	SS110594	SS00159EG	06/30/94	PLUTONIUM	239/240	0 017	PCI/G	J	0 008	0 009	V
56	SS110294	SS00156EG	06/29/94	PLUTONIUM	239/240	0 018	PCI/G	J	0 005	0 005	V
57	SS110094	SS00154EG	06/28/94	PLUTONIUM	239/240	0 021	PCI/G	J	0 011	0 010	V
58	SS109394	SS00147EG	06/23/94	PLUTONIUM	239/240	0 022	PCI/G	J	0 010	0 009	V
59	SS110894	SS00162EG	07/01/94	PLUTONIUM	239/240	0 022	PCI/G	J	0 010	0 009	V
60	SS108894	SS00141EG	06/22/94	PLUTONIUM	239/240	0 023	PCI/G	J	0 009	0 007	V
61	SS104294	SS00092EG	05/23/94	PLUTONIUM	239/240	0 024	PCI/G	J	0 010	0 006	V
62	SS104594	SS00096EG	05/24/94	PLUTONIUM	239/240	0 024	PCI/G	J	0 008	0 005	V
63	SS104394	SS00094EG	05/16/94	PLUTONIUM	239/240	0 025	PCI/G	J	0 010	0 009	V
64	SS107994	SS00132EG	06/15/94	PLUTONIUM	239/240	0 025	PCI/G	J	0 010	0 006	V
65	SS108394	SS00136EG	06/16/94	PLUTONIUM	239/240	0 026	PCI/G	J	0 011	0 010	V
66	SS108994	SS00142EG	06/22/94	PLUTONIUM	239/240	0 026	PCI/G	J	0 010	0 008	V
67	SS109294	SS00146EG	07/29/94	PLUTONIUM	239/240	0 027	PCI/G	J	0 008	0 006	V
68	SS110494	SS00158EG	06/30/94	PLUTONIUM	239/240	0 027	PCI/G	J	0 006	0 005	V
69	SS104194	SS00091EG	05/23/94	PLUTONIUM	239/240	0 029	PCI/G	J	0 008	0 006	V
70	SS109194	SS00144EG	06/22/94	PLUTONIUM	239/240	0 029	PCI/G	J	0 010	0 009	V
71	SS111194	SS00165EG	07/29/94	PLUTONIUM	239/240	0 030	PCI/G		0 008	0 007	V
72	SS109594	SS00149EG	06/27/94	PLUTONIUM	239/240	0 031	PCI/G		0 010	0 007	V
73	SS109894	SS00152EG	06/28/94	PLUTONIUM	239/240	0 031	PCI/G		0 009	0 006	V
74	SS109094	SS00143EG	06/22/94	PLUTONIUM	239/240	0 033	PCI/G		0 014	0 010	V
75	SS109794	SS00151EG	06/27/94	PLUTONIUM	239/240	0 033	PCI/G		0 016	0 010	V
76	SS110694	SS00160EG	07/01/94	PLUTONIUM	239/240	0 033	PCI/G		0 008	0 004	V
77	SS105194	SS00102EG	06/01/94	PLUTONIUM	239/240	0 034	PCI/G		0 011	0 009	V
78	SS110394	SS00157EG	06/30/94	PLUTONIUM	239/240	0 034	PCI/G		0 008	0 004	V
79	SS107894	SS00131EG	06/14/94	PLUTONIUM	239/240	0 035	PCI/G		0 011	0 009	V
80	SS108694	SS00139EG	06/20/94	PLUTONIUM	239/240	0 035	PCI/G		0 012	0 010	V
81	SS109694	SS00150EG	06/27/94	PLUTONIUM	239/240	0 036	PCI/G		0 010	0 005	V
82	SS111194	SS00169EG	07/29/94	PLUTONIUM	239/240	0 036	PCI/G		0 009	0 007	V
83	SS104894	SS00099EG	05/25/94	PLUTONIUM	239/240	0 037	PCI/G		0 012	0 007	V
84	SS107794	SS00130EG	06/15/94	PLUTONIUM	239/240	0 037	PCI/G		0 010	0 006	V
85	SS108494	SS00137EG	06/16/94	PLUTONIUM	239/240	0 038	PCI/G		0 012	0 010	V
86	SS108194	SS00134EG	06/16/94	PLUTONIUM	239/240	0 040	PCI/G		0 012	0 006	V
87	SS110194	SS00155EG	06/29/94	PLUTONIUM	239/240	0 040	PCI/G		0 012	0 010	V
88	SS105094	SS00101EG	06/01/94	PLUTONIUM	239/240	0 041	PCI/G		0 015	0 010	V
89	SS104494	SS00095EG	05/24/94	PLUTONIUM	239/240	0 044	PCI/G		0 010	0 005	V
90	SS107494	SS00127EG	06/14/94	PLUTONIUM	239/240	0 044	PCI/G		0 007	0 002	V
91	SS107594	SS00128EG	06/14/94	PLUTONIUM	239/240	0 046	PCI/G		0 014	0 010	V
92	SS109494	SS00148EG	06/23/94	PLUTONIUM	239/240	0 046	PCI/G		0 011	0 005	V
93	SS108094	SS00133EG	06/16/94	PLUTONIUM	239/240	0 047	PCI/G		0 011	0 004	A
94	SS104794	SS00098EG	05/25/94	PLUTONIUM	239/240	0 050	PCI/G		0 013	0 007	V
95	SS107694	SS00129EG	06/15/94	PLUTONIUM	239/240	0 050	PCI/G		0 016	0 010	V
96	SS105294	SS00104EG	06/01/94	PLUTONIUM	239/240	0 052	PCI/G		0 013	0 006	V
97	SS108294	SS00135EG	06/16/94	PLUTONIUM	239/240	0 054	PCI/G		0 015	0 008	V
98	SS110794	SS00161EG	07/01/94	PLUTONIUM	239/240	0 055	PCI/G		0 011	0 007	V
99	SS111094	SS00164EG	07/29/94	PLUTONIUM	239/240	0 055	PCI/G		0 011	0 005	V
100	SS109994	SS00153EG	06/28/94	PLUTONIUM	239/240	0 063	PCI/G		0 013	0 006	V
101	SS107394	SS00126EG	06/14/94	PLUTONIUM	239/240	0 065	PCI/G		0 019	0 010	V
102	SS104694	SS00093EG	05/25/94	PLUTONIUM	239/240	0 067	PCI/G		0 015	0 009	V
103	SS108594	SS00138EG	06/20/94	PLUTONIUM	239/240	0 067	PCI/G		0 021	0 010	V
104	SS104994	SS00100EG	06/01/94	PLUTONIUM	239/240	0 072	PCI/G		0 020	0 010	V
105	SS104694	SS00097EG	05/25/94	PLUTONIUM	239/240	0 076	PCI/G		0 017	0 010	V
106	SS108794	SS00140EG	06/20/94	PLUTONIUM	239/240	0 350	PCI/G		0 043	0 009	V

Summary Statistics for Plutonium and Americium in Background Surface Soils (BSCP DOE 1995a)

Analysis Variable RESULT

ANALYTE=AMERICIUM 241

N	Minimum	Maximum	Mean	Std Dev	Range	CV
53	0 0010000	0 0310000	0 0106981	0 0062314	0 0300000	58 2475364

ANALYTE=PLUTONIUM 239/240

N	Minimum	Maximum	Mean	Std Dev	Range	CV
53	0 0160000	0 3500000	0 0441132	0 0452950	0 3340000	102 6790932

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APPENDIX C

First Draft of a Litaor *et al* Paper Submitted to the Journal, *Science,* with a copy of review comments by RMRS Environmental Restoration Department

The Hydrogeochemistry of Plutonium in Soils of Rocky Flats, Colorado

by

M. Iggy Litaor[1], G Barth[2], E.M. Zika[2], J Moffitt[2], H. Daniels[2], G Litus[2], and T Illangasekare[2]

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Summary

During the spring of 1995 more than 24 9 cm of precipitation fell on Pu-contaminated soils in Rocky Flats, Colorado The resulting throughflow which lasted for 65 days, saturated the soils rendering them anaerobic Using conservative assumptions we calculated a minimum of 8 2 MBq of Pu was transported across a heavily instrumented toposequence With less stringent assumptions more than 50 MBq of Pu were transported across the entire contaminated slope This hydrogeochemically induced transport was not envisioned under any previous transport scenario and it challenges the framework of remedial investigation/feasibility studies (RI/FS) in hazardous waste sites across the DOE complex.

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Plutonium contamination of soils at Rocky Flats Plant, located 25 km northwest of Denver Colorado originated primarily from a former storage area where steel drums were used to store plutonium-contaminated industrial oils from 1958 to 1968 (1) A thorough understanding of the fate and transport of Pu in soil, is essential for the selection of remedial alternatives, and potential litigation issues regarding the affected areas

A comprehensive characterization and monitoring program was undertaken to study the physicochemical behavior and transport of radionuclides in the soils of Rocky Flats (2,3) Small scale (6 m^2) rain simulations did not transport significant amounts of Pu and Am from the contaminated soil to groundwater (4) Large-scale (180 m^2) rain simulations of 100-yr recurrence interval transported 1 to 3 3 % of the Pu and Am stored in these soils to groundwater (5)

The spring of 1995 was unseasonably wet. Total precipitation at Rocky Flats during the months of April and May exceeded 24 9 cm (a 25 to 50-year event), which is more than 200 % of the average precipitation for this period (6) A May 17 storm (a 15-yr event) produced significant overland flow which remobilized at least 0 01 MBq of Pu-239+240 between the instrumented site and the southern interception ditch (Fig. 1)(5) Following the runoff the soil became completely saturated and emanated strong decay odors, localized ponding and runoff episodes were also observed.

To assess the fate and transport of radionuclides in contaminated soils, an advanced monitoring system (MS) (7) was installed in five pits (TR 1 to 5) along a southeast facing toposequence (Fig 1) which exhibits a reclaimed mixed grassland transected by a wet meadow/marsh ecotone The soils were Cumulic Haplustolls and Aridic Argiustolls

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During the May 17 runoff the soil moisture content increased significantly in all sampling depths and the water table rose to 80 cm below the ground surface (Fig 2) Following the runoff the soil began to dry with a concurrent drop in groundwater elevation, however on May 29 1995 the soil became completely saturated because the groundwater suddenly rose to the soil surface These conditions persisted for at least 65 days with a distinct pattern of groundwater response the shallow groundwater (0 to 4 5 m) that originated from a sandstone aquifer remained at the surface while the deeper groundwater (> 4.5 m) contained within a mixed silt and claystone that underlies the sandstone quickly declined (Fig 2)

In July of 1995 a flux test was performed using two lateral zero-tension samplers (8) installed at 0 5-0 7 m, in TR 2 and 3 yielded a flow of 35 to 40 $m^3 m^{-2} d^{-1}$ This lateral flow was observed across the toposequence and was in striking contrast to the complete lack of lateral flow observed during the previous 3 years of monitoring and numerous rain simulations

The nature of the piezometric surface the azimuth and magnitude of the measured flux and the geological data suggested two concurrently operating recharge mechanisms. Paleochannels incised into the sandstone and claystone underlying the Rocky Flats Alluvium (9 see Figures 3 5-6 to 3 5 16) filled with recharge water which eventually overtopped the southern paleoridge, and flowed southward, creating a group of ephemeral seeps (Fig 1) Secondly within the central and eastern portions of the toposequence, a subcropping sandstone aquifer rests in hydrologic contact with the alluvium filled paleostream above it and provides a conduit to drain the water-filled paleochannel During the spring and summer of 1995 a hydraulic head of 16 m developed between

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the paleostream (well 1587 see Fig. 1) and the toeslope position (TR 1 & 2) resulting in lateral flow across the toposequence

The comprehensive data set collected by the MS allowed the use of a numerical model to estimate the water flux across the toposequence The addition of four wells outside the instrumented site allowed for a flux estimate across the entire slope The boundary conditions were set by the hydraulic head measured above the paleochannel and by ephemeral seeps at the toeslope (Fig 1) The piezometric surface (Fig 2) suggested two distinct hydrostratigraphic units (i) the soil in hydrological contact with the sandstone aquifer and (ii) the silt claystone aquitard below it. The flux calculations were restricted to the upper 3 meters of the soil/alluvium because most of the Pu is confined to the top soil layer (2)

A three-dimensional groundwater model (10) was used to compute the flux across the slope for the period of saturation The initial model parameters such as hydraulic conductivity (Ks) (4) head and layer thickness were measured in the field (TR 1 to 5) Because the water table remained at the surface for 65 days, a steady state model was used for that period The spatial discretization of the slope was derived from the pit size (6 m long)

A trial-and-error calibration was used to match the calculated and observed heads (Table 1) The calculated piezometric surface at the toeslope was overestimated by 0 2 m, whereas the piezometric surface at the backslope position (TR 5) was underestimated by 0 6 m These results are conservative because the total modeled head was lower than the observed, resulting in a smaller flux The calculated flux varied between 0 23 to 0 97 $m^3 m^{-2} d^{-1}$ compared with the observed flux of 35 to 40 $m^3 m^{-2} d^{-1}$ The profound difference between the modeled and the

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observed flux is explained by the averaging of the calculated flux over the entire slope whereas the observed flux was measured once, in two locations, at the toeslope where the hydraulic head difference was the greatest. Ponding intermittent surface flow and rainfall recharge were observed during most of the saturated period (65 d) but were not considered in the calibration process because of the large heterogeneity of these processes across the toposequence

Sensitivity analysis tested the uniqueness of the calibrated model using Ks as the most significant parameter in terms of flow The most responsive section of the toposequence to change in Ks was the toeslope where the subcropping sandstone and the saturated soil are in hydrological contact. Reducing Ks by half at the toeslope position produced the smallest error between the observed and the calculated head (Table 1) Under these calibration conditions the model results exhibited less than 0 06 % discrepancy in water balance

Plutonium activity in the top soil (0 0 2 m) ranged from 2,200 Bq/kg at the toeslope position (TR 1) to 11 500 Bq/kg at the backslope position (TR 5), to 164 000 Bq/kg at the summit of the toposequence (TR 8) In soil solutions, Pu exhibited the highest activity in the top sampling depth of Pit 5 followed by a systematic decrease across the toposequence and with depth of sampling ($F = 45$ $P < 0\ 001$ $F = 140$ $P < 0\ 001$ respectively)

The Pu activity in soil solution exhibited an exponential decrease with depth of sampling but showed a considerable increase in seep water at SW 53 (Fig 3) The mean Pu activity in the seep v ater was higher than the mean activity in interstitial water collected from the 0 2-0 4 m sampling depth attesting to the influence of more-contaminated water discharging from the top sampling depth (0 0 2 m) into the seep face

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To estimate the total amount of Pu transport across the toposequence the Pu activities in the soil solution (Fig 3) were multiplied by the calculated water flux (Table 2) Between 8 2 to 9 9 MBq of Pu were transported during the period of saturation The depth to groundwater along the mesa above the toposequence varied between 2 m at the former storage area to 1 2 m at well 2684 (Fig 1) Hence, it is highly probable that the hydrogeological conditions observed in the toposequence prevailed elsewhere across the entire slope (see Fig 1) which yielded a Pu flux of at least 50 MBq

The Pu inventory across the instrumented site ranged between 4,200 MBq in the top sampling depth to 10 MBq in the deeper sampling depth (11) The estimated flux of Pu suggested that less than 1% of the stored Pu in the top 0 2 m of soil left the slope during the spring and summer of 1995 (Table 2) However a significant increase in the relative remobilization (~ 8 %) of Pu was observed with depth The persistent throughflow transformed the generally aerobic soils of the toposequence to water logged and anaerobic (< 2mg L^{-1} DO) soils The anaerobic conditions probably facilitated enhanced dissolution of Fe and Mn oxides to which as much as 40 % of Pu is adsorbed (12) Hence, the potential dissolution of iron and manganese oxides may result in release of Pu to the soil solutions

The throughflow across the slope was collected by an interception ditch (SID) (Fig 1) that drained into a holding pond. Flow data coupled with Pu measurements performed between May and July 1995 yielded Pu flux estimate of at least 5 3 MBq Similar calculations performed at the effluent of the holding pond yielded Pu flux estimate of 0.02 MBq that was released offsite The difference between the various Pu flux estimates suggested that most of the

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transported Pu was retained by the soils across the slope and the pond sediments However the drainage efficiency of the SID has never been tested thus it is plausible that some of the throughflow bypassed the SID and flowed offsite resulting in higher Pu release to the water supplies of the Greater Denver area.

Site investigation and remediation under the Superfund program follows the remedial investigation/feasibility study (RI/FS) process The goal of the RI/FS is to reach a record of decision (ROD) regarding cleanup options in a timely manner Studies performed during Phase II of the RI/FS suggested that Pu and other radionuclides remained largely immobile in soils (2 4) Therefore a no-action option for Pu contaminated soils (< 60 MBq) was advocated by the senior author of this report. Phase II studies were conducted from 1992 to 1994 during which time the groundwater elevation above the paleochannel was below average Significantly higher groundwater levels had been observed between 1989 and 1991 hence, the need for long term monitoring to ensure that the fate and transport of Pu and other radionuclides are better understood and the risk to the public and the environment is minimal was also recommended The hydrogeochemically induced transport mechanism described above was not envisioned under any previous environmental and hydrogeochemical modeling scenarios for Rocky Flats (13) Unfortunately major reductions in funding for environmental restoration were implemented in mid 1995 with little regard for the RI/FS process The MS was partially disabled and plans were in place for its removal Had this removal been accomplished, the massive transport of Pu in soils would not have been recorded, and the ROD may have been signed by the regulatory agencies without this knowledge

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Clearly the situation described above represents a new challenge to the scientific community and DOE The common wisdom that Pu in soils of a semi-arid environment is largely immobile has been shown to be an oversimplification The full scale of the Pu transport at Rocky Flats and the hydrogeochemical processes that affect Pu mobility at the field scale are still poorly understood hence the predictive power of existing transport models is greatly inadequate

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References and Notes

1 P W Krey and E.P Hardy Plutonium in soil around the Rocky Flats Plant. HASL-235 (1970)

2. M.I. Litaor M L. Thompson, G R. Barth, and P C. Molzer J Environ. Qual 23 1231 (1994)

3 M.I Litaor J Environ. Qual 24 506 (1995a)

4 M.I Litaor G.R. Barth, E.M Zika, J Environ. Qual in press.

5 M I. Litaor unpublished material

6 E.M. Zika, thesis, University of Colorado (1996)

7 The MS consisted of five major modules (1) automated zero-tension samplers that collected water flowing gravitationally (2) time-domain reflectometry probes, which measured in-situ water content; (3) automated piezometers that monitored groundwater level (4) deep soil water samplers and wells, and (5) a graphic user interface (GUI) and telemetry that processed and archived remotely acquired data.

8 Lateral zero-tension sampler was designed to collect lateral flow from a cross section of 174 cm^2 The two flux tests consisted of continuous sampling of soil solutions (~ 1L/min.) during 3 hours period.

9 Final Phase II RFI/RI Report 903 Pad Mound, and East Trenches area Operable Unit No 2. RF/ER 95-0079 UN (1995)

10 The computer code MODFLOW is widely used and well documented

11 The inventories were calculated using 82 Pu analyses and 80 bulk density measurements across the soilscape (4 5) The spatial analysis was conducted using ordinary kriging coupled with pairwise relative variogram.

12 M.I Litaor and S Ibrahim, J Environ. Qual in press.

13 "Final RFI/RI Work Plan for Operable Unit 2, Alluvial. 903 Pad, Mound, and East Trenches Area" EG&G Rocky Flats Inc Golden Colorado RF/ER 95-0079 UN (1991)

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Table 1 Calibration statistics before and after sensitivity analysis

Piezometer/Pit/ well*	Observed Head	Calculated Head (before)	Error	Calculated Head (After)	Error
		m			
TR 5	1806.9	1806.3	0 6	1806 7	0 2
TR-4	1804 6	1804 3	0 3	1804 6	0 02
TR-4	1803 1	1803 0	0 1	1803 0	0 1
TR 3	1802 9	1803 1	-0.2	1803 0	-0 1
TR 2	1801 0	1800 9	0 1	1800 8	-0 2
Well 11791	1800 4	1800 2	0 2	1800 0	0 4

*Ks in the toeslope multiplied by 0 5 exhibits the lowest reduced sum of squares
All the Ks were measured in the field (4)

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Table 2 Statistics of Pu flux (activity and percentage) across the toposequence.

Depth	Mean	75 % Quartile	Inventory
m		MBq (%)	
0 0 0 2	5 7 (0 13)	6 8 (0 16)	4200
0 2 0 4	1 1 (0 45)	1 1 (0 45)	240
0 4 0 7	0 5 (5 0)	0 8 (8 0)	10
0 7 3 0	0 9 (ND)	1 2 (ND)	ND
Total	8.2	9 9	

The 75% quartile better represents the Pu flux because the soil solutions were mainly collected at the lower reaches of the toposequence which exhibited the least amount of Pu

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Figure 1 The toposequence is the area between well 191 13591 ephemeral seep SW051 and SW053 (~ 17000 m^2) The entire slope is the area between the former storage area, well 2687 ephemeral seep SW053 and SW052 (~ 85000 m^2)

Figure 2 The piezometric surface recorded in Pit 2 Similar hydrological conditions were observed across the toposequence

Figure 3 Plutonium distribution in soil solutions and seep water (SW 53) sampled between May to July 1995 Soil solutions were collected by zero-tension samplers (0 0 7 m) tension samplers (0 7 to 2 7 m) and wells (2 7 to 6 6 m) The boxplot depicts the limits, quartiles, mean, outliers (o) and extremes (*)

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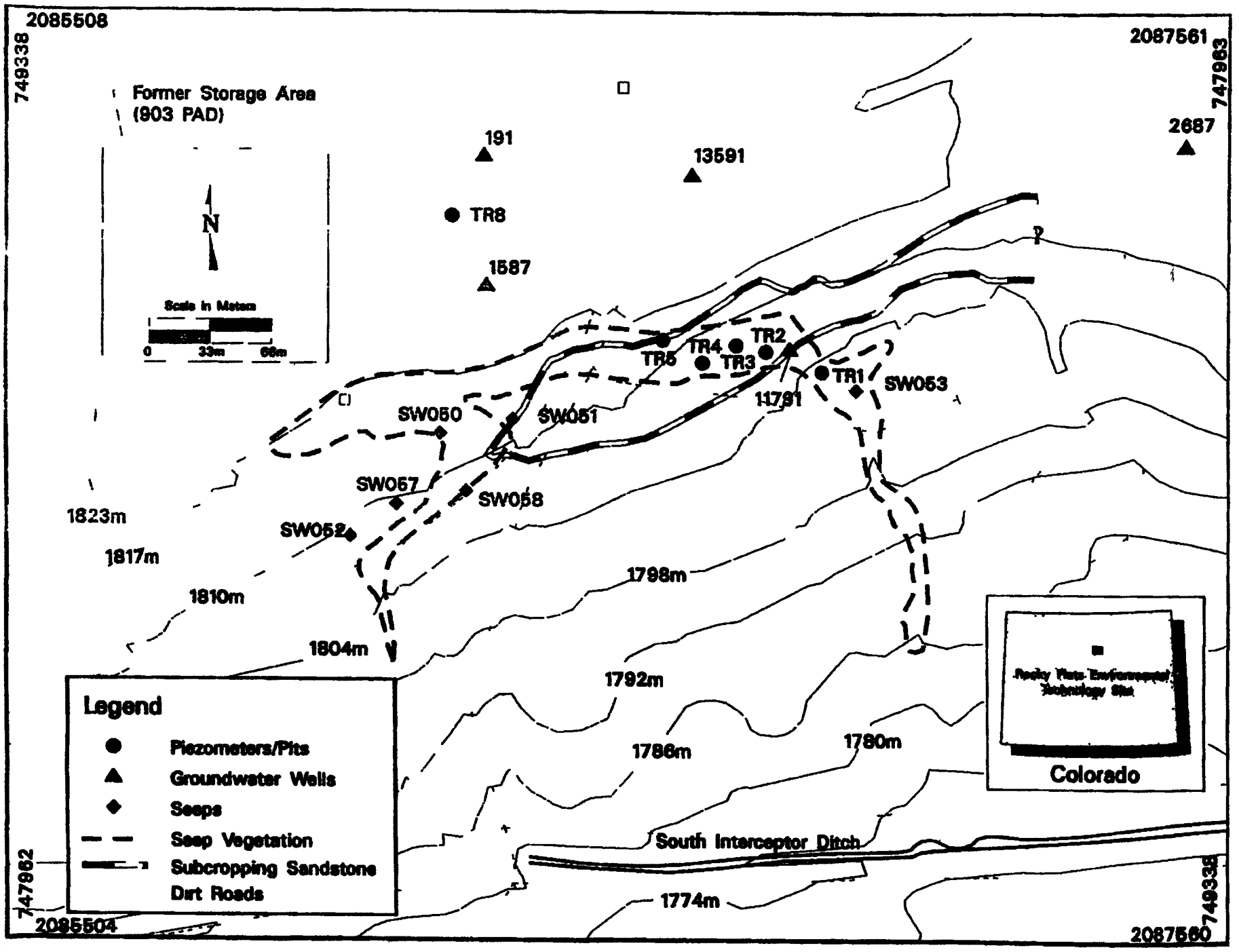
2085508
749338
2087561
747963
Former Storage Area
(903 PAD)
N
Scale in Meters
0
33m
66m
191
13591
2687
TR8
1587
TR5
TR4
TR3
TR2
TR1
11791
SW053
SW050
SW051
SW057
SW058
SW052
1823m
1817m
1810m
1804m
1798m
1792m
1786m
1780m
1774m
Legend
Piezometers/Pits
Groundwater Wells
Seeps
Seep Vegetation
Subcropping Sandstone
Dirt Roads
Colorado
South Interceptor Ditch
747962
2085504
2087560
749335

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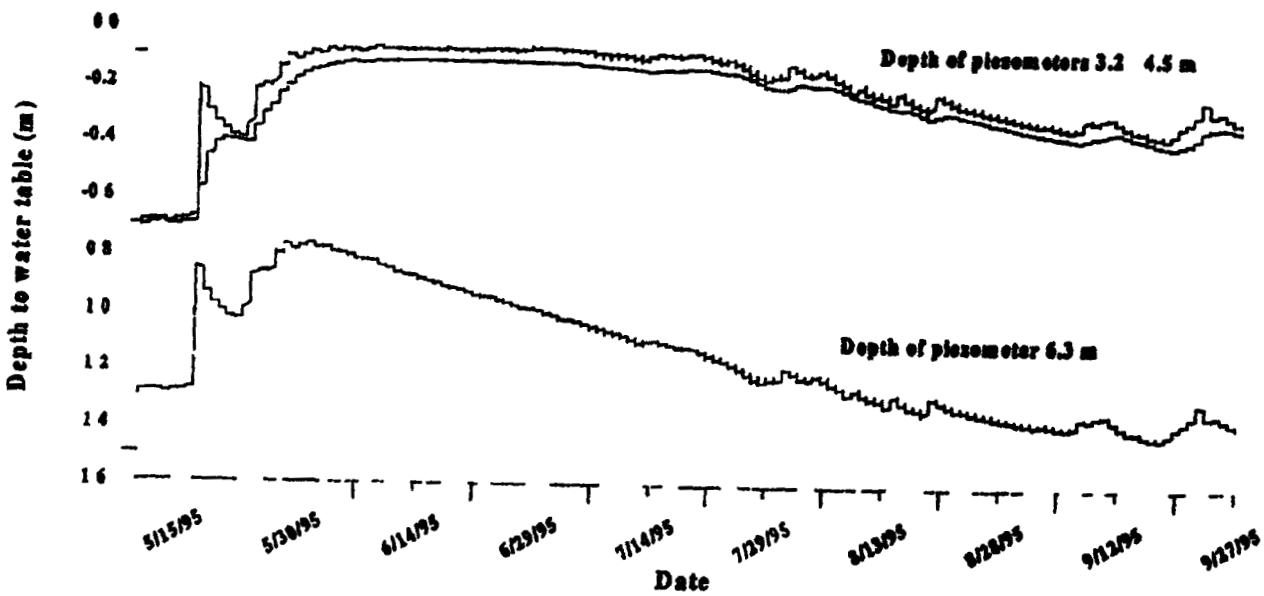
Figure 2


Depth of piezometers 3.2 4.5 m
Depth of piezometer 6.3 m
Depth to water table (m)
0.0
-0.2
-0.4
-0.6
0.8
1.0
1.2
1.4
1.6
5/15/95
5/30/95
6/14/95
6/29/95
7/14/95
7/29/95
8/13/95
8/28/95
9/12/95
9/27/95
Date

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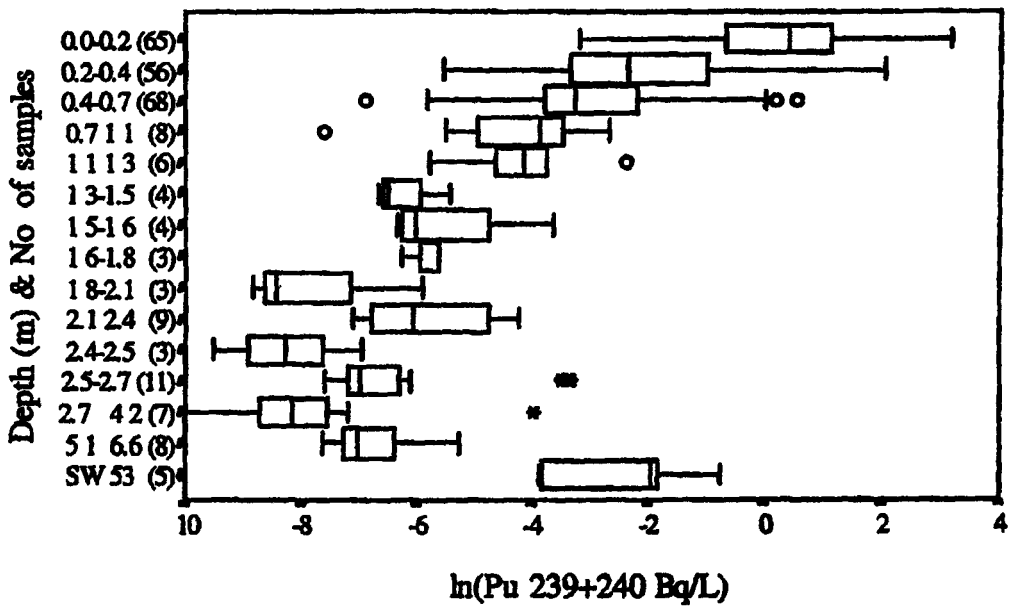
Depth (m) & No of samples
0.0-0.2 (65)
0.2-0.4 (56)
0.4-0.7 (68)
0.7 1 1 (8)
1 1 1 3 (6)
1 3-1.5 (4)
1 5-1 6 (4)
1 6-1.8 (3)
1 8-2.1 (3)
2.1 2.4 (9)
2.4-2.5 (3)
2.5-2.7 (11)
2.7 4 2 (7)
5 1 6.6 (8)
SW 53 (5)
10
-8
-6
-4
-2
0
2
4
ln(Pu 239+240 Bq/L)

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RMRS Rocky Mountain Remediation Services L L.C
protecting the environment

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August 28 1996

96 RF 04934
96-RM ER 0140 KH

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REVIEW OF *THE HYDROGEOCHEMISTRY OF PLUTONIUM IN SOILS OF ROCKY FLATS COLORADO* SUBMITTED BY DR IGGY LITAOR ET AL JEL 169 96

Per your request RMRS has reviewed and has attached comments on *The Hydrogeochemistry of Plutonium in Soils of Rocky Flats Colorado* submitted by Dr Iggy Litaor for inclusion in the Actinide Migration white paper being prepared by RMRS John Rampe of DOE RFFO has also requested that these comments be prepared We recommend that copies of these comments be distributed to the Actinide Migration Expert Panel

The paper provides no back up data for several key assumptions and calculations Dr Litaor has made which support his theories on actinides Dr Litaor should provide these data for review by the scientific community The main issues requiring data are

> The paper assumes that anaerobic conditions existed in groundwater thereby aiding in mobilization of plutonium by enhanced dissolution of iron and manganese oxides RMRS will search the databases in nearby wells to verify whether or not we have information on increased levels of dissolved iron or manganese at the time
>
> Modeling was used to estimate fluxes and the estimates of plutonium migration are based on these flux calculations Modeling input parameters and how these parameters were derived are required in order to peer review flux calculations

Please call John Hopkins on extension 4974 or myself on extension 4842 if you have any questions

John E Law P E
Remediation Manager
Sitewide Actions

JKH slm

Attachment
As Stated

cc
Actinide Panel (5 copies)

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RMRS COMMENTS ON

THE HYDROGEOCHEMISTRY OF PLUTONIUM IN SOILS OF ROCKY FLATS COLORADO
Submitted by
M IGGY LITAOR, ET AL

1 Page 1 Paragraph 2 sentence 1 Delete comprehensive

2 Page 1 Paragraph 2 Last sentence refers to 1 to 3 3 % of Pu and Am stored in surface soils to the groundwater Note # 5 is cited This note is M I Litaor Unpublished material Since there is not a publication cited for the reader to refer to please include the data and a brief explanation of (or cite a published document that describes) sample collection methods analytical methods and data interpretation

3 Page 1 Paragraph 3 Quantifies the amount of Pu 239+240 mobilized during the May 17 1995 storm and cites note #5 Since there is not a publication cited for the reader to refer to please include the data and a brief explanation of (or cite a published document that describes) sample collection methods analytical methods analytical results and data interpretation methods

4 Page 1 Paragraph 4 Discusses the advanced monitoring system and cites note #7 Pulling the note into the main text to explain what the MS is would help the reader Also a general schematic of each of the main components of the MS would assist in determining how the data were obtained and used. Cite the documents and/or publications where the MS is described in detail What kind of data does the MS acquire remotely? Does the MS measure Pu 239+240? Were samples from the MS collected during/after the May 1995 storm?

5 Page 4 First Paragraph Add piezometer numbers to both text and Figure 2 Show piezometer construction details in an attachment, including the elevation of ground surface and top of casing for each piezometer From Figure 2 it is unclear if the depth is below top of casing or below the ground surface Show the location of piezometers and elevation of top of piezometers and top of casing either on Figure 1 or on a new figure (more detailed than Figure 1)

6 Page 4 First Paragraph Second Sentence Which soil became completely saturated? Why did the water surface suddenly raise ten days after the storm? This is indicative of transient conditions

7 Page 4 First Paragraph How do your data and interpretation account for the focused recharge uphill from the study site caused by paving of the 903 pad (generating runoff) and the installation of a coarse subgrade that extends beyond the paved portion of the 903 pad increasing and focusing infiltration above what would be expected for undisturbed Rocky Flats Alluvium?

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8 Page 4 First Paragraph A figure showing the depth (or elevation) of groundwater over time at specified points would be informative Also geologic cross sections of the area would aid the reader in understanding the geologic setting

9 Page 4 First Paragraph There is no sandstone aquifer' in the upper hydrostratigraphic unit at the study site Clarify that there are sandstone lenses within the clay and siltstone Showing a cross section of the area, with the referenced piezometer(s) shown to be completed in the sandstone lens at the point under discussion would clarify this

10 Page 4 Second Paragraph Please show data used in the flux calculations Explain how the lateral zero-tension sampler works Include and reference a figure that shows an outline of the area for which flux was calculated Over what time increment was the flux measured? A one-time measurement at the peak of the flow would not be representative of flow over the saturated (65 days) period" How did you interpolate two very shallow zero tension data points over the whole area? How was this lateral flow observed across the toposequence? Is the lateral flow referred to and measured by the lateral zero-tension samplers surface or shallow subsurface? If it was shallow subsurface how exactly was it observed "across the toposequence"? Define the "toposequence" does the discussion just refer to the instrumented site or to a larger area?

11 Page 4 Third Paragraph First Sentence The sentence states The nature of the piezometric surface and the azimuth and magnitude of the measure flux suggest two concurrently operating recharge mechanisms What potentiometric surface? Show the potentiometric surface over the same topologic sequence area that the flux is calculated for If there are two surfaces show them both, and differentiate very shallow (<4 5m piezometers) and shallow (>4 5 m) surfaces Which data specifically were used for the flux calculations? Also cross reference to how the two zero tension data points were interpolated over the whole toposequence

12 Page 4 Third Paragraph last sentence continued on Page 5 Referring to the 16 m of hydraulic head between Well 1587 and TR 1 and TR 2 no water level elevation data are included in the paper Also well completion diagrams are needed for the well and both TR 1 and TR 2 to demonstrate that they are screened across the same hydrologic interval

13 Page 5 First Full Paragraph Specify in the main body of the text the model used. The model boundaries and grid should be provided as a figure Key points of interest (i e monitoring pits wells water surface elevations (known and inferred) should be indicated. Clarify what is meant by the "entire slope" what are the bounds of this calculation? Also assumptions made as to the elevation/location of the aquitard should be provided The Department of Energy should be provided with the model input and development notes for further evaluation

14 Page 5 First Full Paragraph Please be more specific regarding the statement regarding restricting calculation of flux in the upper 3 meters More specifically at what points in the modeled area was flux measured? The

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flux measurements noted from TR 2 and TR 3 on page 4 were from depths of 0 5 and 0 7 m Is it inferred that the same magnitude of flux would occur at the 3 2 to 4 5 m depths the piezometers in Figure 2? Figure 2 is referenced in regard to the piezometric surface Figure 2 does not show a surface it presents hydrographs for three unspecified points at unknown locations As noted previously please show the two potentiometric surfaces over the area for which flux is calculated, and note what wells/piezometers and trenches were used to construct the surfaces

15 Page 5 Second Full Paragraph Third Sentence A steady state model may not be appropriate for analysis of this transient phenomena. Where did the water table remain at the surface? See also comments 4 7 and 13

16 Page 5 Last Paragraph, First Sentence Are the observed heads average values? If so what dates were used to obtain the averages? If not, what date was used and why was a single date used? Were the observed heads used all for the same date or were different dates used for different points?

17 Page 5 Last Paragraph First Sentence and Table 1 The data shown in Table 1 are for trenches and 1 well that are located in relatively close proximity to each other Is the model limited to this area for which data are used and a sensitivity analysis was performed? It is not clear over what area the flux has been calculated (modeled)

18 Page 5 Last Paragraph Last Complete Sentence The conceptual model of the site is that of an aquifer overlying an aquitard which forces flow to daylight at a seepage face Figure 1 as well as field observation following the May storm shows that this seepage is concentrated into two areas of surface flow Measurements of surface flows at these culverts would provide a good check on the estimated magnitude of model fluxes Measurement of both dissolved and total actinide concentrations at these points would also be an excellent indicator of actual Pu/Am flux resulting from combined surface water and groundwater flows Please provide any measurements of flow or actinide concentration at these points

19 Page 5-6 continued paragraph Could the 'profound difference between the modeled and observed flux" also be related to the very shallow (0 5 -0 7 m) depth the flux was measured at?

20 Page 6 First (incomplete) paragraph "Ponding, intermittent surface flow and rainfall recharge were observed during most of the saturated period (65 d) but were not considered in the calibration process because of the large heterogeneity of these processes across the toposequence " Reconcile this statement with the use of a steady state model

21 Page 6 Second Full Paragraph Last Sentence What is a "soil solution" ?

22 Page 6 Second Full Paragraph Last Sentence Please explain the meaning and units of the variables F and P

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23 Page 6 Last Paragraph First Sentence and Figure 3 Please provide the data from which Figure 3 is constructed Briefly explain how the data were collected, and cite the reference where both the data collection and data are discussed in detail Are these data for filtered or unfiltered samples? Soil water data for unfiltered samples would expect to correlate very well to soil data for the same depths Figure 3 has no title or caption

24 Page 6 Last Paragraph Please provide the data sequence for Pu activity at SW 53 (and flow data if available) Is it possible that increased seepage velocities resulting from higher heads remobilized Pu in near surface soils at the point where the seep daylights? How were the seep samples collected? If the data are all for unfiltered samples it is difficult to see how one could quantify the Pu bound to particulates and transported via surface run off from the Pu in the local soils at the seep and further how Pu bound to particulates would be quantified relative to Pu transported as a dissolved phase or colloidal (<0 45 μm) particles

25 Page 7 First Paragraph, First Sentence Please show the data used for constructing Figure 3 and note the locations where this data was collected. What percentage of the Pu in each soil horizon is assumed to be mobilized? What is the assumed relationship between soil and water concentrations? What is the basis for these assumptions? The authors should clearly state that calculations associated with plutonium flux are relative only to a single area within the soil column and not indicative of anticipated flux off the study site See also comment 13

26 Page 7 First Paragraph, Second Sentence Add to first of sentence "Based on these calculations an estimated

27 Page 7 First Paragraph, Last Sentence Please provide the assumptions related to the area/location of flux calculation and lateral and vertical Pu distribution as well as the assumptions regarding the relationship between Pu in water/soil relationship Without this information these contaminant flux calculations are not supported

28 Page 7 Second Paragraph, Second Sentence Table 2 Provide the locations an data from which this table is derived Provide a more thorough discussion of the use of the 75% Quartile The concentration of Pu in soils and in unfiltered soil pore water from the same depths would be expected to have a high correlation

29 Page 7 Second Paragraph, Third Sentence Please provide the basis for this statement

30 Page 7 Second Paragraph Fourth Sentence Please provide the data which shows that anaerobic conditions existed in groundwater during this event. This data would aid in supporting the authors speculation that mobilization of Pu is facilitated by enhanced dissolution of Fe and Mn oxides Would the authors anticipate that Pu would re associate with Fe and Mn oxides upon resumption of aerobic conditions? Such conditions would likely occur at points where groundwater is forced to the surface at contact seeps such as those which occur in the author s study area

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31 Were any data on dissolved Fe and Mn collected from either the trenches or from local shallow groundwater monitoring wells following May 95? Do these data show an increase in ***dissolved*** Fe or Mn over historic values?

32 Page 7 Last Paragraph Second Sentence What are the data and assumptions used for this calculation? We are aware of only two measurements of total (unfiltered) Pu activity at this point Was it assumed that these concentrations are constant?

33 Page 8 First Full Sentence Please clarify what is meant by the terms drainage efficiency and 'throughflow The SID is designed to intercept surface water flows from plant site areas where soils are contaminated with significant quantities of actinides If the authors are aware of tributary areas containing significant contamination which are not now captured by the SID then please immediately provide this information to the DOE and K H so that this information may be acted upon Otherwise this type of alarming speculation should be deleted from this paper

Should flows bypass the SID they would enter Woman Creek or its alluvium Woman Creek eventually flows into Woman Creek Reservoir which is designed to protect the water supplies of Northglenn, Thornton and Westminster in the unlikely event of a release from Rocky Flats This water does not supply the Greater Denver area. If the authors wish to retain a statement of this type then this correction should be made

34 Page 8 First Full Paragraph Although the Remedial Investigation phase has been completed for Operable Unit 2 (the area containing the author s study area) this does not mean that no additional action will be required in this area. The final remedy selection and Record of Decision for this area is not scheduled until accelerated actions have been performed, removing most of the risk As a matter of fact, this area has been identified as one of the top ten high risk Environmental Restoration sites at Rocky Flats Remediation of the 903 Pad and surrounding soils is a very high priority to DOE and K H Funding reductions to the ER program in FY 95 were made with the full knowledge of the EPA and State and at the recommendation of the stakeholders This funding reduction was done with full understanding of the RI/FS process and was done to provide more funding to higher risk plutonium stabilization activities Even without the authors instrumentation significant changes in Pu concentrations would be noted in the extensive surface and groundwater monitoring system at the site In addition, Superfund regulation requires continued performance monitoring in support of a Record of Decision to account for the fact that the RI/FS process cannot reasonably anticipate all potential conditions

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2073730
2078250
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2091000
2094139
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7548000
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EXPLANATION
Operabl U it 1
Operabl U it 2
Operabl U it 4
Operabl U it 5
Op rabl U it 6
Operabl U it 7
Op rabl U it 8
Operabl U it 9
Operable U it 10
Operabl Unit 11
Operable U it 12
Operabl U it 13
Operable U it 14
Operabl U it 15
Operabl U it 16
UHSU
M it n g W ll
Streams,Ditches, d
Drainages
Rocky Flats Plant
S te and Secu rty Zon
Boundaries
Rocky Flats
B ffer Zon B undary
S rface Wat r
Impoundm t
N
S le 1 20400
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Stat Plan Coordinat Sy t m
Colorado Central Zone
Datum NAD27
PREPARED FOR
U S. DEPARTMENT OF ENERGY
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN COLORADO
FIGURE 1 2
Locations of UHSU Monitoring W lls
Source: Groundwater Geochemistry Report, January 1995

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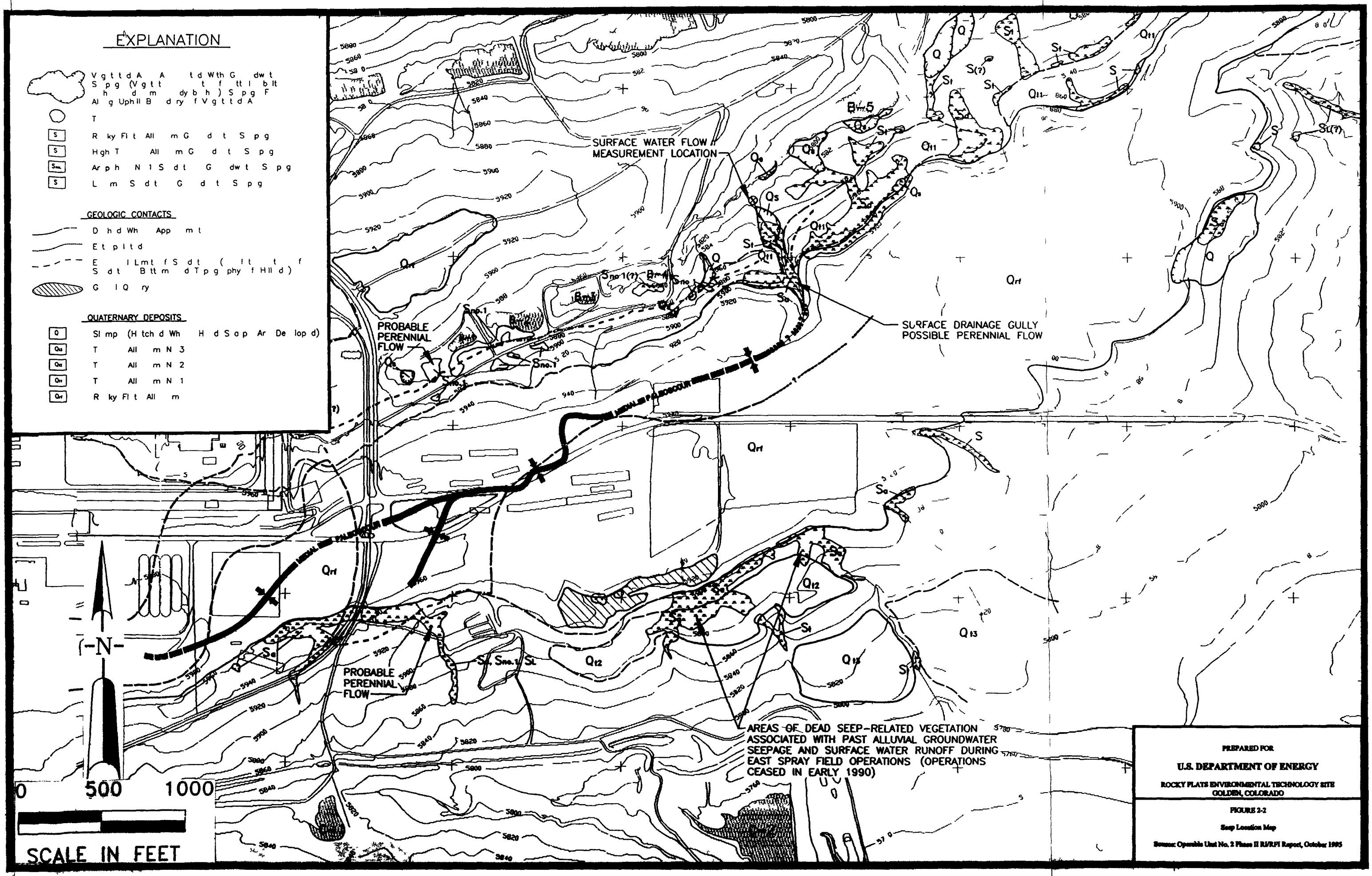
EXPLANATION
GEOLOGIC CONTACTS
QUATERNARY DEPOSITS
SURFACE WATER FLOW MEASUREMENT LOCATION
PROBABLE PERENNIAL FLOW
SURFACE DRAINAGE GULLY POSSIBLE PERENNIAL FLOW
PROBABLE PERENNIAL FLOW
AREAS OF DEAD SEEP-RELATED VEGETATION ASSOCIATED WITH PAST ALLUVIAL GROUNDWATER SEEPAGE AND SURFACE WATER RUNOFF DURING EAST SPRAY FIELD OPERATIONS (OPERATIONS CEASED IN EARLY 1990)
-N-
0 500 1000
SCALE IN FEET
PREPARED FOR
U.S. DEPARTMENT OF ENERGY
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO
FIGURE 2-2
Seep Location Map
Source: Operable Unit No. 2 Phase II RI/RFI Report, October 1995

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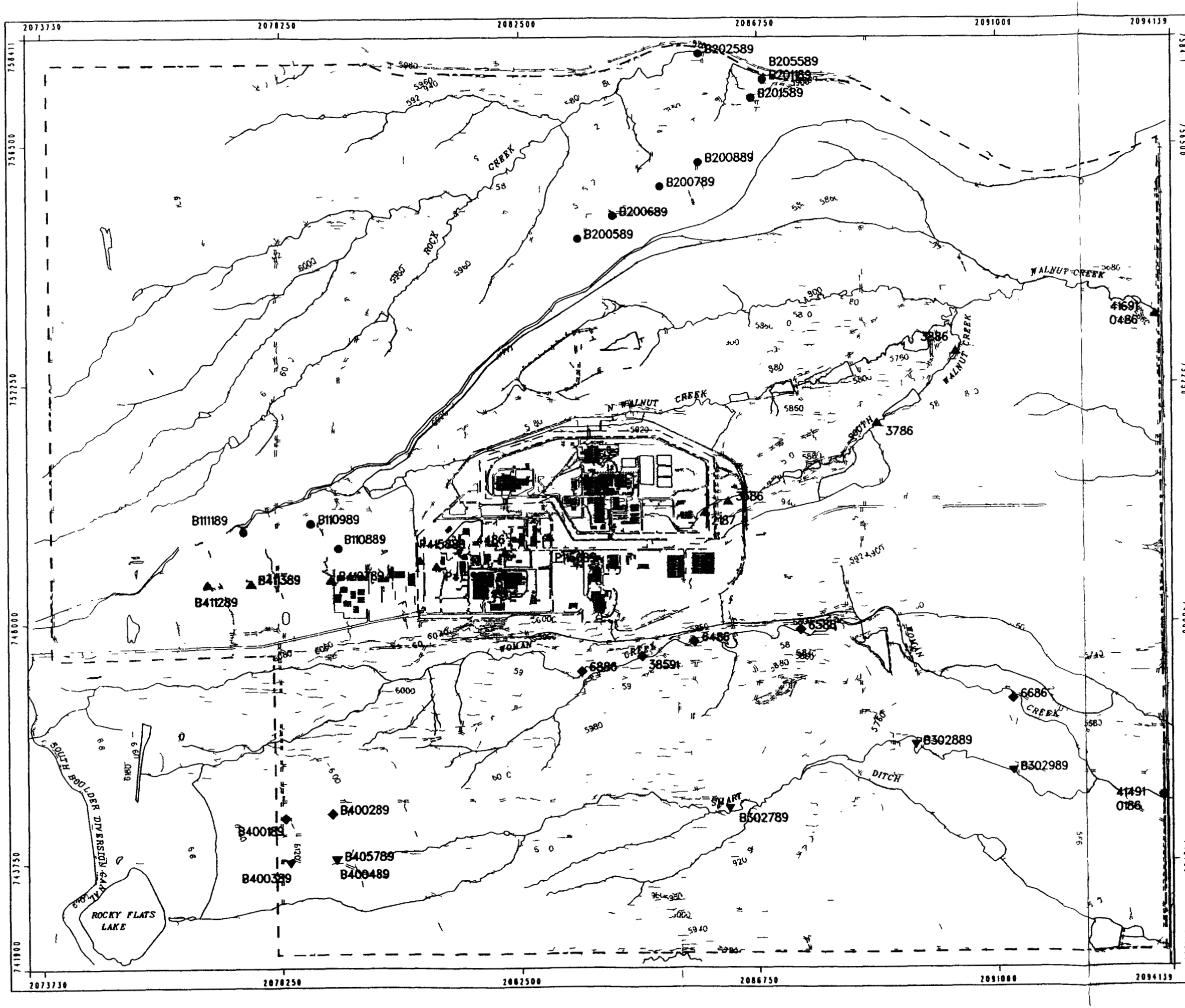

EXPLANATION

- Rock C ek Flow Path
- I dustrial Area Flow Path
- Woman Creek Flow Path
- Souther Flow Path
- Streams, Ditches, d Drainages
- Paved Roads
- Dirt Roads
- Industrial Area and Security Zone Bounderies
- Buffer Zon Bo ndary
- Surface Water Impoundm nt
- Buildings
- Individual Hazardous Substance Sites

S ale = 1 20400
1 inch = 1700 f t

State Plane Coordinate System
Colorado Central Zone
Datum NAD27

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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN COLORADO

FIGURE 3-2
MONITORING WELLS ALONG FOUR UHSU FLOW PATHS
Source: Groundwater Geochemistry Report, January 1995

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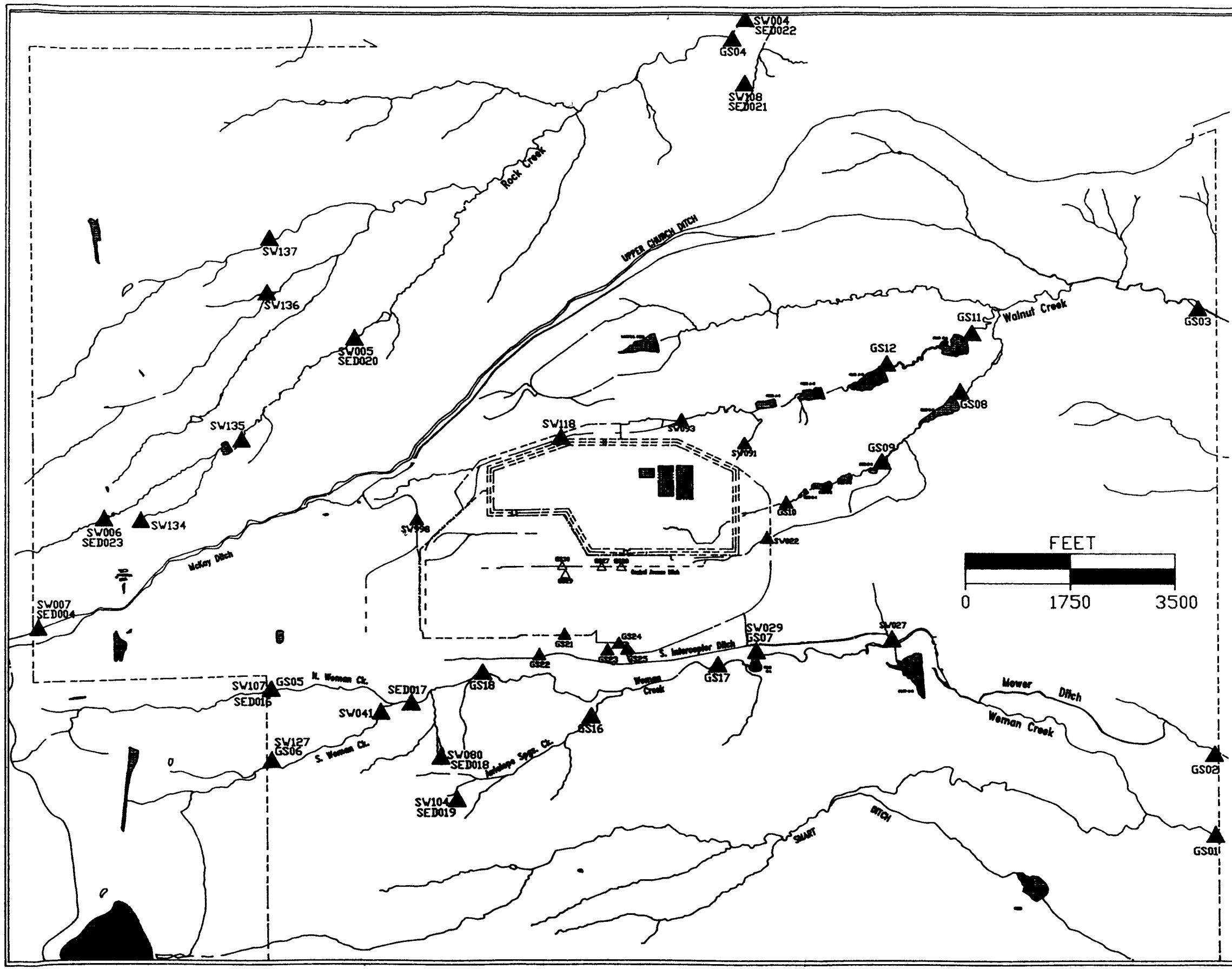

LEGEND

- Gaging and Sampling Stations
- Streams Ditches Drainage Features
- Security Fences

FIGURE 3-3
RFETS
Gaging Station Network
Stormwater
Monitoring Locations

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