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Volume I

PADUCAH SITE

Annual Site Environmental Report

2001

BJC/PAD - 219

Paducah Site

Annual Site Environmental Report for Calendar Year 2001

September 2002

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by

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Acronyms and Abbreviations

ACO	Administrative Consent Order
AIP	KDEP Agreement in Principle
^{241}Am	americium-241
AOC	area of concern
ASER	Annual Site Environmental Report
ASTM	American Society of Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
BJC	Bechtel Jacobs Company LLC
BWMA	Ballard Wildlife Management Area
°C	degrees centigrade
CAA	Clean Air Act
CAB	Paducah Citizens Advisory Board
CEDE	committed effective dose equivalent
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Ci	Curies
^{60}Co	cobalt-60
COC	contaminant of concern
COE	U.S. Army Corps of Engineers
^{134}Cs	cesium-134
^{137}Cs	cesium-137
CSOU	comprehensive site-wide operable unit
CSTP	Conceptual Site Treatment Plan
CWA	Clean Water Act
CX	categorical exclusion
CY	calendar year
D&D	decontamination and decommissioning

DCG	derived concentration guide
DMSA	DOE Material Storage Area
DNAPL	dense nonaqueous phase liquid
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
DOD	U. S. Department of Defense
DPT	Direct Push Technology
DQO	data quality objective
DSTP	Draft Site Treatment Plan
DUF_6	depleted uranium hexafluoride
EA	environmental assessment
EDD	electronic data deliverable
EDTA	ethylenediaminetetraacetic acid
EE/CA	engineering evaluation/cost analysis
EIC	DOE Environmental Information Center
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EPT	Ephemeroptera, Plecoptra, and Trichoptera
EQADMP	Environmental Services Quality Assurance and Data Management Plan
°F	degrees Fahrenheit
FDA	Food and Drug Administration
FFA	Federal Facility Agreement
FFC Act	Federal Facility Compliance Act
FFCA	Federal Facility Compliance Agreement
FS	feasibility study
ft	foot (feet)
FY	fiscal year
ha	hectare(s)
HAP	hazardous air pollutant
HSWA	Hazardous and Solid Waste Amendments

ICRP	International Commission on Radiological Protection
IRA	interim remedial action
^{40}K	potassium-40
KAR	Kentucky Administrative Regulation
KCHS	Kentucky Cabinet for Health and Safety
KDAQ	Kentucky Division for Air Quality
KDEP	Kentucky Department for Environmental Protection
KDOW	Kentucky Division of Water
KDWM	Kentucky Division of Waste Management
kg	kilogram(s)
km	kilometer(s)
KOW	Kentucky Ordnance Works
KPDES	Kentucky Pollutant Discharge Elimination System
KRS	Kentucky Revised Statute
L	liter(s)
LRGA	Lower Regional Gravel Aquifer
m	meter(s)
MCL	maximum contaminant level
µg	microgram
mg	milligrams
mR	milliRoentgen
mrem	millirem(s)
MSDS	material safety data sheet
mt	metric ton(s)
MW	monitoring well
NBIC	National Board Inspection Code
NCS	Nuclear Criticality Safety
ND	non detect
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants

NOV	notice of violation
^{237}Np	neptunium-237
NPL	National Priorities List
OREIS	Oak Ridge Environmental Information System
OU	operable unit
^{234m}Pa	protactinium-234m
^{210}Pb	lead-210
PCB	polychlorinated biphenyl
pCi	picoCurie(s)
PEMS	Project Environmental Measurement Systems
PGDP	Paducah Gaseous Diffusion Plant
pH	hydrogen-ion concentration
PHA	public health assessment
POE	point of exposure
ppb	parts per billion
PP/WM	Pollution Prevention/Waste Minimization
PSTP	Proposed Site Treatment Plan
^{238}Pu	plutonium-238
^{239}Pu	plutonium-239
P-wave	seismic reflection survey
QA	Quality Assurance
QC	Quality Control
^{226}Ra	radium-226
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RGA	Regional Gravel Aquifer
RI	remedial investigation
ROD	Record of Decision
S	shear

SAR	SWMU Assessment Report
SARA	Superfund Amendments and Reauthorization Act
SCPT	seismic cone penetrometer test
SE	site evaluation
SHPO	State Historic Preservation Officer
SMCL	secondary maximum contaminant level
SMO	Sample Management Office
SMP	Site Management Plan
SOW	statement of work
^{90}Sr	strontium-90
SWMU	solid waste management unit
^{99}Tc	technetium-99
TCE	trichloroethylene (also called trichloroethene)
TCLP	Toxicity Characteristic Leaching Procedure
^{228}Th	thorium-228
^{230}Th	thorium-230
^{232}Th	thorium-232
^{234}Th	thorium-234
TLD	thermoluminescent dosimeter
TRE	Toxicity Reduction Evaluation
TSCA	Toxic Substances Control Act
TUa	acute toxicity unit
TUc	chronic toxicity unit
^{234}U	uranium-234
^{235}U	uranium-235
^{238}U	uranium-238
UCRS	Upper Continental Recharge System
UE	uranium enrichment
UF_4	uranium tetrafluoride
UF_6	uranium hexafluoride
UO_3	uranium trioxide
URGA	Upper Regional Gravel Aquifer

USEC	United States Enrichment Corporation
UST	underground storage tank
VOC	volatile organic compound
WAG	waste area group
WKWMA	West Kentucky Wildlife Management Area

Request for Comments

The U. S. Department of Energy (DOE) requires an annual site environmental report from each of the sites operating under its authority. This report presents the results from the various environmental monitoring programs and activities carried out during the year. This *Paducah Site Annual Site Environmental Report for Calendar Year 2001* was prepared to fulfill DOE requirements. This report is a public document, distributed to government regulators, business persons, special interest groups, and members of the public at large.

This report is based on thousands of environmental samples collected at or near the Paducah Site. Significant efforts were made to provide the data collected and details of the site environmental management programs in a clear and concise manner, while presenting summary information. The editors of this report encourage comments in order to better address the needs of our readers in future site environmental reports. Please send your comments to the following address:

Paducah Site Office

U. S. Department of Energy

P. O. Box 1410

Paducah, Kentucky 42002

1 Site Operation and Overview

Abstract

The Paducah Gaseous Diffusion Plant (PGDP), located in McCracken County, Kentucky, has been producing enriched uranium since 1952. In July 1993, the U.S. Department of Energy (DOE) leased the production areas of the site to the United States Enrichment Corporation (USEC), a private company. Responsibility for the environmental restoration, legacy waste management, facilities management, uranium hexafluoride (UF_6) cylinder management, decontamination and decommissioning (D&D)/DOE Material Storage Areas (DMSA) programs is maintained by DOE. DOE also oversees an environmental monitoring and management program to ensure protection of human health and the environment and compliance with all applicable regulatory requirements. This document summarizes calendar year (CY) 2001 environmental management activities, including effluent monitoring, environmental surveillance, and environmental compliance status. It also highlights significant site program efforts conducted by DOE and its contractors and subcontractors at the Paducah Site. ***This report does not include USEC environmental monitoring activities.***

Introduction

DOE requires that environmental monitoring be conducted and documented for all of its facilities under the purview of DOE Order 231.1 Chg 2, *Environment, Safety and Health Reporting* (DOE 1996a). Several other laws, regulations, and DOE directives require compliance with environmental standards. The purpose of this document is to summarize CY 2001 environmental management activities, including effluent monitoring, environmental surveillance, and environmental compliance status, and to highlight significant site program efforts. Since April 1, 1998, Paducah Site programs have been coordinated by DOE's managing and integrating contractor, Bechtel Jacobs Company LLC (BJC). References in this report to the Paducah Site generally mean the property, programs, and facilities at or near the PGDP for which DOE has ultimate responsibility.

Environmental monitoring consists of the following two major activities: effluent monitoring and environmental surveillance. Effluent monitoring is the direct measurement, or the collection and analysis of samples, and of liquid and gaseous discharges to the environment. Environmental surveillance is the direct measurement, or the collection and analysis of samples consisting of air, water, soil, biota, and other media. Environmental monitoring is performed to characterize and quantify contaminants, assess radiation exposure, demonstrate compliance with applicable standards and permit requirements, and detect and assess the effects (if any) on the local population and environment. Multiple samples are collected throughout the year and are analyzed for radioactivity, chemical content, and various physical attributes.

The overall goal for environmental management is to protect site personnel, the environment, and the Paducah Site's neighbors, and to maintain full compliance with all current environmental regulations. The current environmental strategy is to prevent compliance problems, to identify any compliance problems, and to develop a system to resolve them. The long-range goal of environmental management is to reduce exposures of the public, workers, and biota to harmful chemicals and radiation.

Background

Before World War II, the area now occupied by the PGDP was used for agricultural purposes. Numerous small farms produced various grain crops and provided pasture for livestock. Early in the war, a 6526-hectare (ha) (16,126-acre) tract was assembled for construction of the Kentucky Ordnance Works (KOW), which was subsequently operated by the Atlas Powder Company until the end of the war. At that time, it was turned over to the Federal Farm Mortgage Corporation, and then to the General Services Administration.

In 1950, the U. S. Department of Defense (DOD) and DOE's predecessor, the Atomic Energy Commission, began efforts to expand fissionable material production capacity. As part of this effort, the National Security Resources Board was instructed to designate power areas within a strategically safe area of the United States. Eight government-owned sites were initially selected as candidate areas, one of which was the KOW site. In October 1950, as a result of joint recommendations from the DOD, Department of State, and the Atomic Energy Commission, President Truman directed the Atomic Energy Commission to further expand production of atomic weapons. One of the principal facets of this expansion program was the provision for a new gaseous diffusion plant. On October 18, 1950, the Atomic Energy Commission approved the Paducah Site for uranium enrichment operations and formally requested the Department of the Army to transfer the site from the General Services Administration to the Atomic Energy Commission.

Although construction of PGDP was not completed until 1954 (Figure 1.1), production of enriched uranium began in 1952. The plant's mission, uranium enrichment, has continued unchanged and the original facilities are still in operation, albeit with substantial upgrading and refurbishment. Of the 3062 ha (7566 acres) acquired by the Atomic Energy Commission, 551 ha (1361 acres) were subsequently transferred to the Tennessee Valley Authority (Shawnee Steam Plant site) and 1125 ha (2781 acres) were conveyed to the

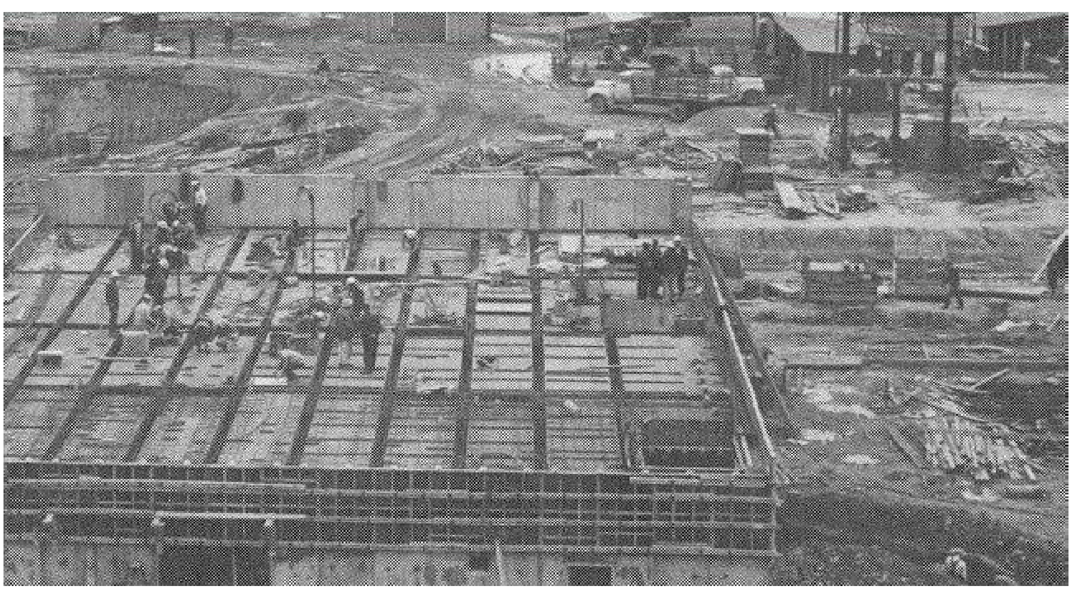

Figure 1.1 Construction of the Paducah Gaseous Diffusion Plant.

Commonwealth of Kentucky for use in wildlife conservation and for recreational purposes [West Kentucky Wildlife Management Area (WKWMA)]. DOE's current holdings at the Paducah Site total 1386 ha (3423 acres).

At Paducah's uranium enrichment plant, recycled uranium from nuclear reactors was introduced into the PGDP enrichment "cascade" in 1953 and continued through 1964. In 1964, cascade feed material was switched solely to virgin-mined uranium. Use of recycled uranium was resumed in 1969 and continued through 1976. In 1976, the practice of recycling uranium feed material from nuclear reactors was halted and never resumed. During the recycling time periods, Paducah received approximately 100,000 tons (90,000 metric tons) of recycled uranium containing an estimated 328 grams of plutonium-239 (^{239}Pu), 18,400 grams of neptunium-237 (^{237}Np), and 661,000 grams of technetium-99 (^{99}Tc). The majority of the ^{239}Pu and ^{237}Np was separated out as waste during the initial chemical conversion to UF_6. Concentrations of transuranics (e.g., ^{239}Pu and ^{237}Np) and ^{99}Tc are believed to have been deposited on internal surfaces of process equipment, with concentrations also being deposited in waste products.

In October 1992, congressional passage of the National Energy Policy Act established USEC. Effective July 1, 1993, DOE leased the plant production operation facilities to USEC. Under the terms of the lease, USEC assumed responsibility for environmental compliance activities directly associated with uranium enrichment operations.

Under the lease agreement with USEC, DOE retained responsibility for the site Environmental Restoration Program; the Enrichment Facilities Program; and the Legacy Waste Management Program, including all waste inventories predating July 1, 1993, and wastes generated by current DOE activities. DOE is responsible for Kentucky Pollutant Discharge Elimination System (KPDES) compliance at outfalls not leased to USEC. DOE has also retained manager and cooperator status of facilities not leased to USEC. DOE and USEC have negotiated the lease of specific plant site facilities, written memoranda of agreement to define their respective roles and responsibilities under the lease, and developed organizations and budgets to support their respective functions. DOE is the owner and BJC with DOE are operators for Resource Conservation and Recovery Act (RCRA) permitted facilities and are responsible for compliance with the RCRA permit.

Figure 1.2 depicts a timeline of activities and events associated with the Paducah Gaseous Diffusion Plant.

Description of Site Locale

Location

The Paducah Site is located in a generally rural area of McCracken County, Kentucky. The center of PGDP is about 16 kilometers (km) (10 miles) west of Paducah, Kentucky, and 5 km (3 miles) south of the Ohio River (Figure 1.3). The industrial portion of the PGDP is situated within a fenced security area and constitutes about 303 ha (748 acres). Within this area, which is designated as secured industrial land use, are numerous active and inactive production buildings, offices, equipment and material storage areas, active and inactive waste management units, and other support facilities (Figure 1.4). The additional DOE-owned land at the Paducah Site is 1083 ha (2675 acres). Of this land, 279 ha (689 acres) is a "buffer zone" designated as unsecured industrial land. DOE licensed 1125 ha (2781 acres) to the Commonwealth of Kentucky as part of the 2793-ha (6900-acre) WKWMA. There are no residences on DOE property at the Paducah Site. DOE has also acquired approximately 133 acres in easements.

The following three small communities are located within 5 km (3 miles) of the DOE property boundary at PGDP: Heath and Grahamville to the east, and Kevil to the southwest. The closest commercial airport is Barkley Field approximately 8 km (5 miles) to the southeast. The population within an 80-km (50-mile) radius of PGDP is about 500,000, of which about 66,000 residents are located within a 16-km (10-mile) radius (DOC 1994).

1951-1954 Construction of PGDP as the second gaseous diffusion plant in the United States. Oak Ridge, Tennessee, was first and Portsmouth, Ohio, third.

1952 Enriched uranium hexafluoride production begins. First cylinders of depleted uranium hexafluoride generated and stored inside the PGDP security fence.

1952-1984 Union Carbide Corporation manages and operates the Paducah and Oak Ridge gaseous diffusion plants under federal contract.

1964 Use of ongoing enrichment services ended for nuclear weapons production. Primary customer becomes utility companies with nuclear power reactors, and until 1991, for Navy nuclear-powered submarines.

1979 Waste Management function established at Paducah.

1984 Martin Marietta Energy Systems Inc. becomes management and operating contractor for DOE facilities at Paducah and Oak Ridge (Portsmouth added in 1986).

1988 Contaminated groundwater was discovered outside the DOE Property Boundary. DOE policy of extending water lines to homes in area begins.

1989-1990 Creeks and ditches near the plant are posted to restrict public access. Expanded network of groundwater monitoring wells begins. First major site investigation begins to determine nature and extent of contamination outside the PGDP security fence.

1990 Second phase of sitewide investigation begins to further determine nature and extent of contamination outside the PGDP security fence.

1993 DOE leases enrichment production facilities to USEC. Plant ends use of the degreasor trichloroethene, the primary groundwater contaminant. DOE opens the Environmental Information Center in the West Kentucky Technology Park at Kevil.

1994 Groundwater treatment begins to remove trichloroethene and technetium-99. The Environmental Protection Agency adds PGDP to its Superfund National Priorities List. Treatment and re-routing of flow in the plant's North South Diversion Ditch begins.

1995 PGDP is chosen as national demonstration site for Lasagna™ soil cleanup technology; removal of rust and painting of depleted uranium cylinders begins; shipped 6,500 polychlorinated biphenyl capacitors off-site for disposal.

1997 Concrete cylinder yards built; tons of contaminated concrete, soil and gravel removed; cleanup actions completed around closed landfill; new solid waste contained landfill constructed. Paducah Area Community Reuse Organization chartered.

1998 Completed Federal Facility Agreement with state and federal regulators for long-term cleanup plan; made major strides in waste treatment and disposal. DOE awards Management and Integration contract to BJC. USEC privatizes.

1999 Implemented new clean-up strategy that is expected to complete work more rapidly; implemented new waste management strategy that prioritizes waste disposition based on risk.

2000 Continued operation of the Lasagna™ technology; removal of Drum Mountain; mobilization and a Phase 1 attempt of the Permeable Treatment Zone study; continued operation of the Northwest and Northeast Plume Groundwater Treatment Systems; initiation of the Rubble Pile Removal project.

2001 Continued operation of the Lasagna™ technology; continued operation of the Northwest and Northeast Plume Groundwater Treatment Systems; initiation of the Scrap Yard Sedimentation Basin; preparation of several project documents written for work in 2002.

Figure 1.2 Timeline of Events at the Paducah Gaseous Diffusion Plant.

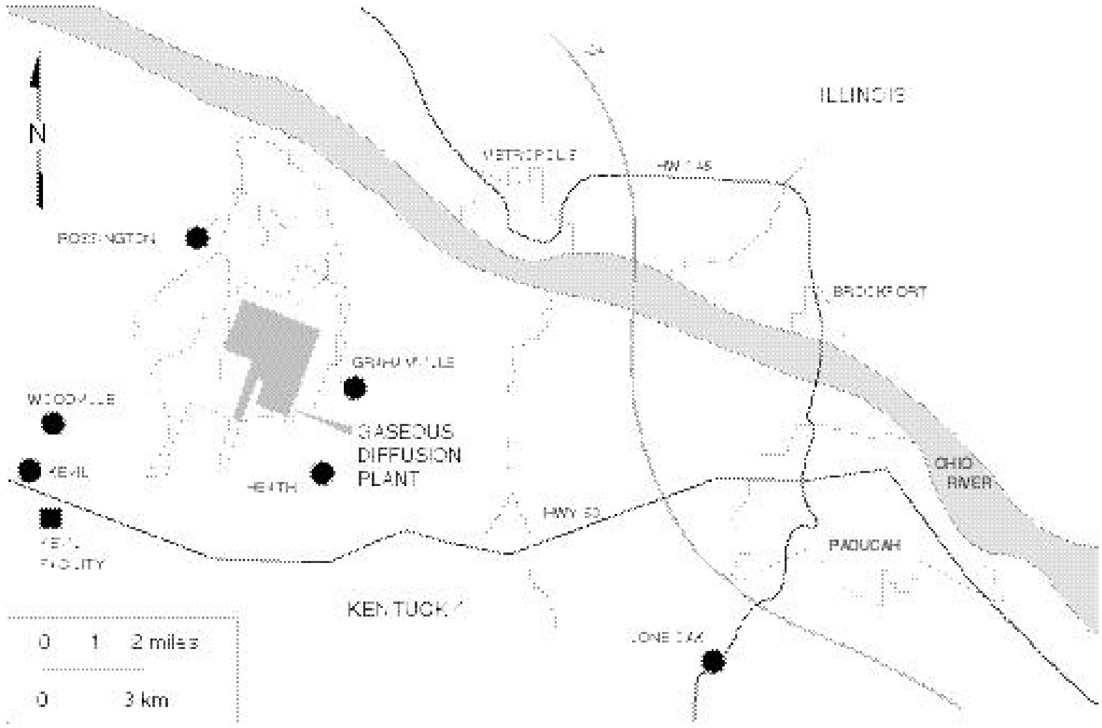

Figure 1.3 Location of the Paducah Site.

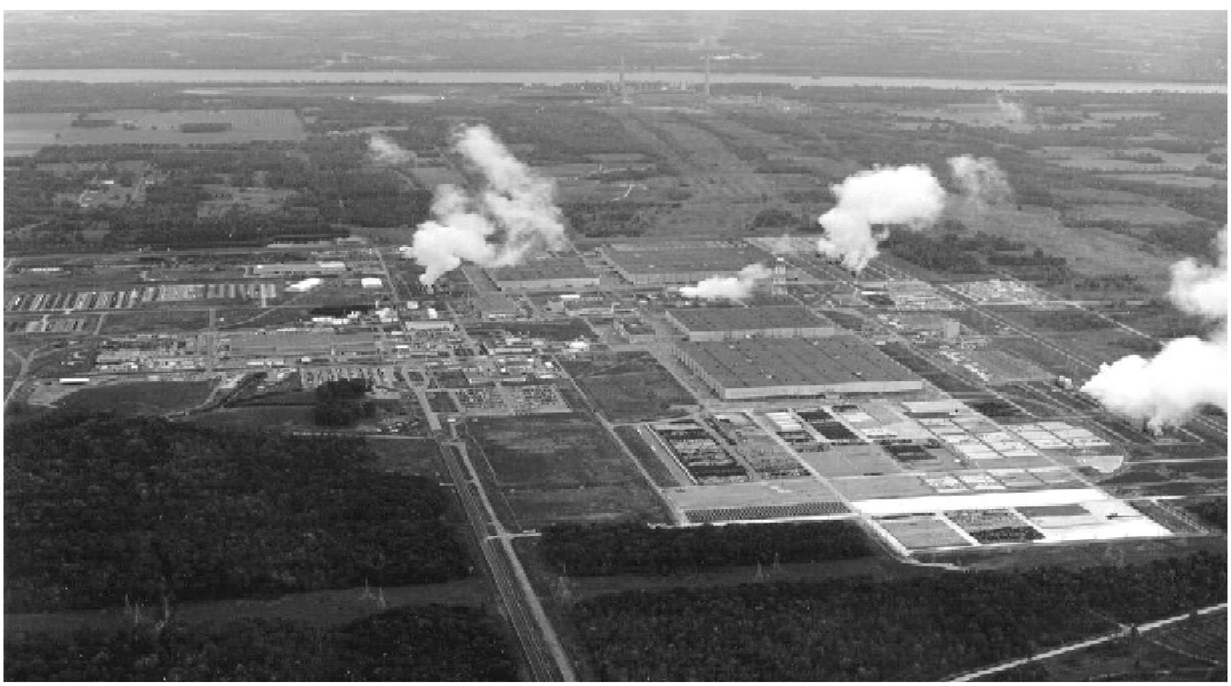

Figure 1.4 The Paducah Gaseous Diffusion Plant.

Climate

The Paducah Site is located in the humid continental zone where summers are warm [July averages 26°C (79°F)] and winters are moderately cold [January averages 1.7°C (35°F)]. Yearly precipitation averages about 125 centimeters (49 inches). The prevailing wind is from the south-southwest at approximately 16 km (10 miles) per hour.

Surface Water Drainage

The Paducah Site is situated in the western part of the Ohio River basin. The confluence of the Ohio River with the Tennessee River is about 24 km (15 miles) upstream of the site, and the confluence of the Ohio River with the Mississippi River is about 56 km (35 miles) downstream. The plant is located on a local drainage divide; surface flow is east-northeast toward Little Bayou Creek and west-northwest toward Bayou Creek [commonly referred to as "Big Bayou Creek" in previous Annual Site Environmental Reports (ASERs)]. Bayou Creek is a perennial stream that flows toward the Ohio River along a 14-km (9-mile) course. Little Bayou Creek is an intermittent stream that flows north toward the Ohio River along a 11-km (7-mile) course. The two creeks converge 5 km (3 miles) north of the plant before emptying into the Ohio River.

Flooding in the area is associated with Bayou and Little Bayou creeks and the Ohio River. Maps of the 100-year flood elevations calculated show that all three have 100-year floodplains within the DOE boundary at PGDP ranging from approximately 340 to 380 feet (ft) above mean sea level. Plant elevations range from about 370 to 385 ft above mean sea level. (COE 1994).

Wetlands

More than 1100 separate wetlands, totaling over 648 ha (1600 acres), were found in a study area of about 4860 ha (12,000 acres) in and around the Paducah Site (COE 1994 and CDM 1994). These wetlands have been classified into 16 cover types. More than 60% of the total wetland area is forested.

Soils and Hydrogeology

Soils of the area are predominantly silt loams that are poorly drained, acidic, and have little organic content. Of the six primary soil types associated with the Paducah Site, five commonly have the characteristics necessary to be considered prime farmland by the Natural Resources Conservation Service, formerly the Soil Conservation Service (Humphrey 1976).

The local groundwater flow system at the Paducah Site contains the following four major components (listed from shallowest to deepest): (1) the terrace gravels, (2) the Upper Continental Recharge System (UCRS), (3) the Regional Gravel Aquifer (RGA), and (4) the McNairy flow system. The terrace gravels consist of shallow Pliocene gravel deposits in the southern portion of the plant site. These deposits usually lack sufficient thickness and saturation to constitute an aquifer, but may be an important source of groundwater recharge to the RGA.

The UCRS consists mainly of clay silt with interbedded sand and gravel in the upper continental deposits. The system is so named because of its characteristic recharge to the RGA.

The RGA consists of sand and gravel facies in the lower continental deposits, gravel and coarse sand portions of the upper McNairy that are directly adjacent to the lower continental deposits, coarse-grained sediments at the base of the upper continental deposits, and alluvium adjacent to the Ohio River. These deposits have an average thickness of 9 meters (m) (30 ft) and can be more than 21 m (70 ft) thick along an axis that trends east-west through the site. The RGA is the uppermost and primary aquifer, formerly used by private residences north of the Paducah Site.

The McNairy formation is composed of interbedded and interlensing sand, silt accessory, and clay. Near PGDP, the McNairy Formation can be subdivided into three members: (1) an 18 m (60 ft)-thick sand-dominant lower member; (2) a 30-to 40 m (100- to 130-ft)-thick middle member composed predominately of silty and clayey fine sand; and (3) a 9-to 15 m (30-to 50-ft)-thick upper member consisting of interbedded sands, silts, clays, and occasional gravel. Sand facies account for 40 to 50% of the total formation thickness of approximately 69 m (225 ft).

Groundwater flow originates south of the Paducah Site within Eocene sands and the terrace gravels. Groundwater within the terrace gravels either discharges to local streams or recharges the RGA, although the flow regime of the terrace gravels is not fully understood. Groundwater flow through the UCRS is ultimately downward, also recharging the RGA. From the plant site, groundwater flows generally northward in the RGA toward the Ohio River, which is the local base level for the system.

Ecological Resources

Vegetation

Much of the Paducah Site has been impacted by human activity. Vegetation communities on the reservation are indicative of old field succession (e.g., grassy fields, field scrub-shrub, and upland mixed hardwoods). The open grassland areas, most of which are managed by WKWMA personnel, are periodically mowed or burned to maintain early successional vegetation, which is dominated by members of the Compositae family and various grasses. Management practices on the WKWMA encourage reestablishment of once common native grasses such as eastern gama grass and Indian grass. Other species commonly cultivated for wildlife forage are corn, millet, milo, and soybean (CH2M Hill 1992a).

Field scrub-shrub communities consist of sun-tolerant wooded species such as persimmon, maples, black locust, sumac, and oaks (CH2M Hill 1991a). The undergrowth may vary depending on the location of the woodlands. Wooded areas near maintained grasslands may have an undergrowth dominated by grasses; other communities may contain a thick undergrowth of shrubs, including sumac, pokeweed, honeysuckle, blackberry, and grape.

Upland mixed hardwoods contain a variety of upland and transitional species. Dominant species include oaks, shagbark and shellbark hickory, and sugarberry (CH2M Hill 1991a). Undergrowth may vary from open, with limited vegetation for more mature stands of trees, to dense undergrowth similar to that described for a scrub-shrub community.

Wildlife

Wildlife species indigenous to hardwood forests, scrub-shrub, and open grassland communities are present at the Paducah Site. Grassy fields are frequented by rabbits, mice, songbirds, and a variety of other small mammals and birds. Redwing blackbirds, killdeer, cardinals, mourning doves, bobwhite quail, meadowlarks, warblers, sparrows, and red-tailed hawks have been observed in such areas. Scrub-shrub communities support a variety of wildlife including opossums, voles, moles, raccoons, gray squirrels, killdeer, bluejays, redwing blackbirds, bluebirds, cardinals, mourning doves, shrike, warblers, turkeys, and meadowlarks. Deer, squirrels, raccoons, turkeys, songbirds, and great horned owls are found within the mature woodlands of the DOE reservation (CH2M Hill 1991a). In addition, the Ohio River serves as a major flyway for migratory birds, which are occasionally seen on the Paducah Site (DOE 1995).

Amphibians and reptiles are common throughout the Paducah Site. Amphibians likely to inhabit the area include the American and Woodhouse's toads. Reptiles include the Eastern box turtle and several species of snakes. Also, fish populations in Bayou and Little Bayou creeks are numerically dominated by various species of sunfish (DOE 1995).

Threatened and Endangered Species

A threatened and endangered species investigation identified federally listed, proposed, or candidate species potentially occurring at or near the Paducah Site (COE 1994). Updated information is obtained on a regular basis from federal and state sources. Currently, potential habitat for nine species of federal concern exists in the study area (Section 2, Table 2.2). Six of these species are listed as endangered under the Endangered Species Act of 1973, one is listed as threatened, and two are candidate species that may later be proposed for listing. All are animal species, eight of which are associated with the Ohio River. Of note, significant potential summer habitat exists at the Paducah Site for the Indiana bat, a federally listed endangered species. However, no federally listed or candidate species have been found on DOE property at the Paducah Site. Also, no property at the Paducah Site has been designated as critical habitat in accordance with the Endangered Species Act of 1973.

Cultural Resources

In a study area of about 4860 ha (12,000 acres) in and around the Paducah Site, there are 35 sites of cultural significance recorded with the State Historic Preservation Officer (SHPO) and several more unrecorded sites (COE 1994). Most of these sites are prehistoric and located in the Ohio River floodplain. Six of the sites are on DOE property at PGDP. None of the sites are included in, or have been nominated to, the National Register of Historic Places, although some are potentially eligible. Additional discussion is included in Section 2.

Site Program Missions

The following four major programs are operated by the DOE at the Paducah Site: (1) Environmental Restoration, (2) Waste Operations, (3) Facilities Management, and (4) D&D/DMSA (Figure 1.5). The mission of the Environmental Restoration Program is to ensure that releases from past operations and waste management at the Paducah Site are investigated and that appropriate remedial action is taken for protection of human health and the environment in accordance with the Federal Facility Agreement (FFA) (DOE 1998). The mission of the Waste Operations Program is to characterize and dispose of the legacy waste stored on-site in compliance with various Federal Facility Compliance Agreements (FFCAs). The primary mission of the Facilities Management Program is to maintain safe, compliant storage of the DOE depleted UF_6 inventory, pending final disposition of the material, and to manage facilities and grounds not leased to USEC. The primary mission of the D&D/DMSA programs is to manage and characterize the areas or facilities in the programs and prepare materials or waste for disposition. The environmental monitoring summarized in this report supports all four programs.

Figure 1.5 Paducah Site programs.

2 Environmental Compliance

Abstract

The policy of DOE and its contractors and subcontractors at the Paducah Site is to conduct operations safely and minimize the impact of operations on the environment. Protection of the environment is considered a responsibility of paramount importance. The Paducah Site maintains an environmental compliance program aimed at meeting all applicable requirements and minimizing impacts.

Introduction

Local, state, and federal agencies, including DOE, are responsible for enforcing environmental regulations at the Paducah Site. Principal regulating agencies are the U.S. Environmental Protection Agency (EPA) Region IV and the Kentucky Department for Environmental Protection (KDEP). These agencies issue permits, review compliance reports, participate in joint monitoring programs, inspect facilities and operations, and oversee compliance with applicable laws and regulations.

The EPA develops, promulgates, and enforces environmental protection regulations and technology-based standards as directed by statutes passed by the U.S. Congress. In some instances, the EPA has delegated regulatory authority to KDEP when the Kentucky program meets or exceeds EPA requirements. Where regulatory authority is not delegated, EPA Region IV is responsible for reviewing and evaluating compliance with EPA regulations which pertain to the Paducah Site. Table 2.1 provides a summary of the Paducah Site environmental permits maintained by DOE in 2001. Figure 2.1 shows the major environmental laws and requirements applicable to the Paducah Site. Each is discussed in this section.

Table 2.1 Environmental permit summary

Permit Type	Issued By	Expiration Date	Permit Number	Issued To
Water				
KPDES	KDOW	3/31/2003	KY0004049	DOE
Stormwater Point Sources	KDOW	9/30/2002	KYR100000	DOE
Solid Waste				
Residential Landfill (closed)	KDWM	11/1/2003	073-00014	DOE
Inert Landfill (closed)	KDWM	6/11/2003	073-00015	DOE
Solid Waste Contained Landfill (construction/operation)	KDWM	11/4/2006	073-00045	DOE
RCRA/TSCA				
State Hazardous Waste Management Permit	KDWM	8/19/2001*	KY8890008982	DOE/BJC
EPA Hazardous & Solid Waste Amendments Permit	EPA	8/19/2001*	KY8890008982	DOE/BJC
Toxicity Characteristic Leaching Procedure, Federal Facility Compliance Agreement	EPA	NA	NA	DOE
Federal Facility Compliance Act Site Treatment Plan: Agreed Order	EPA	NA	NA	DOE
Federal Facility Agreement	EPA KDWM	NA	NA	DOE
TSCA FFCA	EPA		NA	DOE
Air				
Cylinder Refurbishment – Permit Terminated				
Vortec – Permit Expired Not Renewed				

NA - Not Applicable
KDOW – Kentucky Division of Water
KDWM – Kentucky Division of Waste Management
KDAQ – Kentucky Division of Air Quality
* - New permits have been applied for.

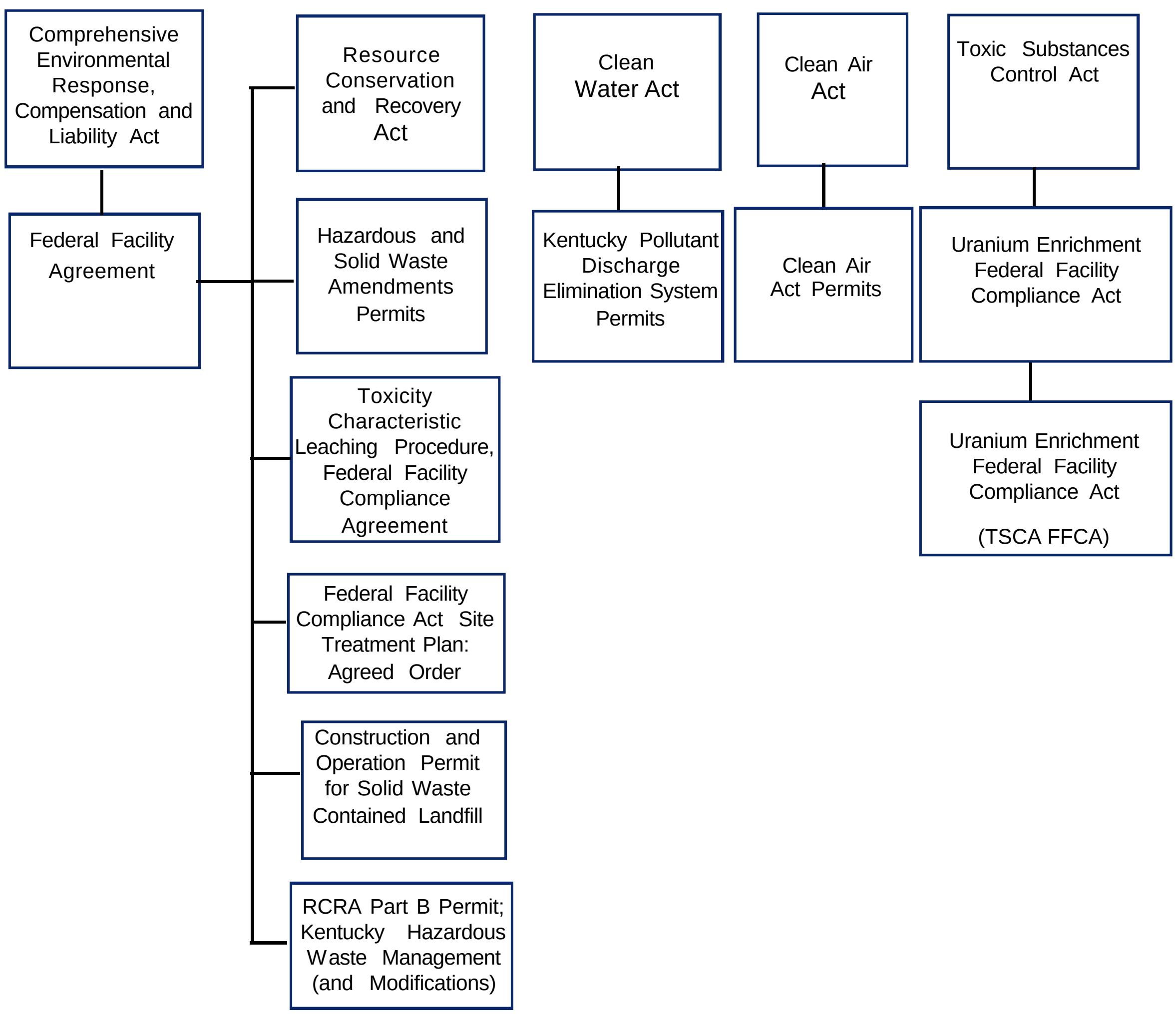

Figure 2.1 Regulatory Drivers at the Paducah Site.

Compliance Activities

Resource Conservation and Recovery Act

Regulatory standards for the identification, treatment, storage, and disposal of solid and hazardous waste are established by RCRA. Waste generators must follow specific requirements outlined in RCRA regulations for handling solid and hazardous wastes. Owners and operators of solid and hazardous waste treatment, storage, disposal, and recycle facilities are required to obtain operating and closure permits for waste treatment, storage, disposal, and recycle activities. Paducah generates solid, hazardous waste, and mixed waste (i.e., hazardous waste mixed with radionuclides) and operates four permitted hazardous waste storage and treatment facilities.

Resource Conservation and Recovery Act Hazardous Waste Permit

Part A and Part B permit applications of RCRA for storage and treatment of hazardous wastes were initially submitted for the Paducah Site in the late 1980s. At that time, the EPA had authorized the Commonwealth of Kentucky to exclusively administer the RCRA-base program for treatment, storage, and disposal units, but had not given the authorization to administer the 1984 Hazardous and Solid Waste Amendments (HSWA) provisions. Therefore, a permit application was submitted to the EPA and the Kentucky Division of Waste Management (KDWM) for treatment and storage of hazardous wastes.

On July 16, 1991, a 10-year RCRA permit (No. KY8890008982) was issued by KDWM and EPA to DOE as owner and operator and DOE's prime contractor (currently BJC) as cooperator. This RCRA permit consists of the following two individual permits: (1) a hazardous waste management permit administered by the Commonwealth of Kentucky and (2) a HSWA permit administered by the EPA. The hazardous waste management permit contains regulatory provisions for treatment, storage, and disposal activities at PGDP, authorized under the RCRA-base program (pre-HSWA), as well as HSWA provisions. The HSWA permit addresses only the provisions of the HSWA, which include corrective actions for solid waste management units (SWMUs), air emissions, and the land disposal restrictions. In 1996, Kentucky received authorization to administer the HSWA provisions in lieu of EPA. Even though the state is authorized, the EPA's portion of the RCRA permit will remain in effect until a new permit is issued. Therefore, the Paducah Site still has dual requirements for corrective actions under state and federal authority.

The Hazardous Waste Permit Application was submitted to the KDWM on February 21, 2001. This application was a renewal application to the original permit that was issued August 19, 1991 and expires on August 19, 2001. On September 28, 2001, KDWM requested additional information. A revised permit application was submitted in February 2002. DOE is awaiting the issuance of a new permit and continues to operate under the expired permit.

As part of the corrective action requirements, the RCRA permit's schedule of compliance requires DOE to develop and implement a RCRA facility investigation (RFI) work plan for SWMUs and areas of concern (AOCs). DOE has submitted RFI work plans to the EPA and the KDWM in accordance with the time frames specified in the schedule of compliance. These RFI work plans are described in further detail in the section on Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) activities.

Modifications to the Resource Conservation and Recovery Act Hazardous Waste Permit

Since issuance of the KDWM Hazardous Waste Management portion of the RCRA permit in

1991, 15 permit modifications have been approved. Modification 15 was approved in 1999. This major modification allows the Paducah Site to perform treatment in containers utilizing neutralization, oxidation/reduction, and stabilization techniques. There were no modifications to this permit in 2001.

Resource Conservation and Recovery Act Hazardous Waste Facilities Closure Activities

DOE has submitted closure plans to KDWM for hazardous waste discovered in the following DMSAs: C400-04, C-331-10, C-335-05, C-331-10, and C-331-15.

Resource Conservation and Recovery Act Notices of Violation

DOE received three notices of violations (NOVs) during 2001 from the KDWM. On July 30, 2001, KDWM issued an NOV for "Failure to Comply with Permit Condition II.J.1 of the PGDP Hazardous Waste Management Permit." KDWM submitted a letter to DOE on March 26, 2001, requiring that a well abandonment and replacement workplan be submitted for several compliance monitoring wells within 45 days following DOE's receipt of the letter. KDWM determined that these wells were corroded and no longer suitable for use as monitoring wells. One of the corroded wells was Monitoring Well (MW) 87, a C-404 landfill compliance well. A downhole well video of MW 87 identified a potential hole in the well stainless steel casing. DOE submitted a letter on May 14, 2001, proposing to redevelop MW 87 and perform another camera survey of the well. KDWM stated in the NOV that DOE failed to submit a well abandonment and replacement workplan for MW 87 as originally required.

An NOV dated July 31, 2001, was received from KDWM for "Failure to Comply with 401 Kentucky Administrative Regulation (KAR) 32:030, Section 5, 401 KAR 38:010, Section 4, Kentucky Revised Statute (KRS) 224.46-520 and Part II of the Facility's Hazardous Waste Management Permit." An investigation and characterization of DMSA C-331-10 (SWMU 244) identified hazardous waste that had been stored greater than 90 days without a permit. Actions taken in response to this NOV included submittal of an amended SWMU Assessment Report (SAR), a revised Part A Application, which included SWMU 244, and a closure plan to address SWMU 244.

On October 9, 2001, KDWM issued an NOV as a result of DOE's identification of hazardous waste stored in DMSAs. The violation stated that there was a "Failure to Comply with 401 KAR 32:030, Section 5, 401 KAR 38:010, Section 4, KRS 224.46-520 and Part II of the facility's Hazardous Waste Management Permit." DMSAs C-331-15, C-335-05, and C-333-31 were identified as containing hazardous waste for greater than 90 days without a permit. The following actions were taken as a result of the NOV: amended SARs for SWMUs 249, 287, and 301; revised the Part A Application; and submitted closure plans to address the aforementioned DMSAs. See Section 3 page 15 for more information about DMSAs.

Land Disposal Restrictions

Hazardous waste is subject to land disposal restrictions storage prohibitions which permits storage only for accumulation of sufficient quantities of hazardous waste to facilitate proper treatment, recycling, or disposal. Hazardous wastes are not to be stored for more than one year. The Paducah Site generates mostly mixed waste, which is a combination of hazardous waste and radioactive waste. Nationally, there are very limited opportunities for treatment and disposal of mixed waste. Therefore, the Paducah Site stores most of the mixed waste that is generated for longer than one year. Storage of waste without treatment and disposal options does not comply with land disposal restriction regulations. If not for the radioactive constituents, this waste would not pose a compliance problem for the site, as there would be treatment and disposal options readily available. On June 30, 1992, DOE entered into an FFCA with EPA Region IV to regulate the treatment and storage of land disposal restriction mixed waste at the Paducah Site. On April 13, 1998, EPA Region IV released DOE from the FFCA, and allowed KDWM to regulate mixed waste under the Federal Facilities Compliance (FFC) Act.

Federal Facilities Compliance Act

The FFC Act was enacted in October 1992. This act waived the immunity from fines and penalties that had existed for federal facilities for violations of hazardous waste management as defined by RCRA. As a result of the complex issues and problems associated with mixed chemical hazardous and radioactive waste (mixed waste) as well as the lack of treatment and disposal capacity, the FFC Act allowed a three-year extension for DOE facilities to prepare schedules and plans. These addressed how the facilities would manage their mixed waste in compliance with applicable RCRA regulations. The three-year waiver can be extended under the following conditions: (1) a mixed waste treatment plan and compliance schedule are approved by the appropriate agency, (2) an implementing order with that agency is signed, and (3) adherence to the plan and implementing order are maintained by the facility.

To facilitate compliance with the FFC Act and address the myriad of complex issues involved, the Paducah Site, along with 48 other DOE sites, began a four-phase approach. The first phase consisted of gathering required information and submitting to the EPA and state agencies an inventory of mixed wastes (mixed waste inventory report), including information pertaining to characterization and waste generation volumes.

The second phase of the approach involved the development of a Conceptual Site Treatment Plan (CSTP). The plan included investigation of the existing treatment capacity for facility wastes and, where there was no existing capacity, procurement of information on potential treatment technologies or options that could be employed to meet operation requirements. The Paducah Site submitted the CSTP in October 1993.

The third phase of the approach expanded on the information in the CSTP to identify treatment options that are preferred both environmentally and economically. The information gathered by the ongoing waste characterization program and the technology evaluation and development program outlined in the CSTP formed the basis for the Draft Site Treatment Plan (DSTP), which was submitted to the regulators in August 1994.

The fourth phase of the approach combined the preferred treatment options from the DSTP with regulator and stakeholder comments and the overall DOE complex picture to formulate a Proposed Site Treatment Plan (PSTP). This PSTP was submitted to the regulators March 31, 1995, and provides details on how and where Paducah Site mixed waste is to be treated. On October 5, 1995, KDWM issued a Unilateral Order and the Site Treatment Plan for the Paducah Site. DOE requested a hearing, which resulted in the Agreed Order dated September 10, 1997. The Paducah Site has complied since issuance of the Agreed Order.

Toxicity Characteristic Leaching Procedure Federal Facility Compliance Agreement

The Paducah Site has generated a significant volume of waste materials that are stored on-site. A large quantity of this waste was generated, characterized, and placed in storage before September 25, 1990. At that time, characterization required utilizing the Extraction Procedure for toxicity. On September 25, 1990, a new regulation became effective replacing the Extraction Procedure for toxicity with the Toxicity Characteristic Leaching Procedure (TCLP). Since the accumulated wastes had not been characterized under the new toxicity characteristic regulations, DOE needed revised characterization data for these wastes by the new protocol.

On March 26, 1992, EPA Region IV and DOE entered into a TCLP FFCA concerning the regulatory status of these wastes. The TCLP FFCA requires the Paducah Site to identify those solid wastes that are not being managed in RCRA-regulated units and that have not been characterized under the TCLP test method. Additionally, the FFCA requires the Paducah Site to provide a schedule for TCLP characterization of the identified waste.

In response to the FFCA, the Paducah Site submitted an implementation plan that established a general framework for compliance with the requirements of the FFCA. The implementation plan established priorities for the characterization program and the nature of the data to be collected, and included a schedule for TCLP characterization of the identified waste. The primary characterization objective was the acquisition of sufficient data to safely handle the waste and provide for determination of its status under RCRA. Characterization of the waste with respect to polychlorinated biphenyls (PCB) and radionuclide concentrations was the second objective. The final characterization objective was the collection of data related to treatment and/or disposal of the waste.

A three-phase program for accomplishing the goals of the plan was developed. Phase I activities consisted of data compilation and waste prioritization. Phase II involved identification of discrete waste streams and development of characterization plans. The final phase of the program included the development of sampling and analysis plans, field sampling, and data reporting. All three phases of the program have been completed. Characterization was completed by December 2000. DOE continues to manage the program.

RCRA Solid Waste Management

The Paducah Site disposes of a portion of its solid waste at its on-site contained landfill facility, C-746-U. Construction of the C-746-U Landfill began in 1995 and was completed in 1996. The operation permit was received from KDWM in November 1996. Disposal of waste at the landfill began in February 1997. The C-746-U Landfill operated from February 1997 through October 1999 and disposed of approximately 16,000 tons of solid waste. In November 1999, the landfill suspended waste acceptance activities for all waste streams with the exception of wastes classified as “no rad added.” An Environmental Assessment (EA) was initiated by BJC with disposal operations placed on hold until the EA is approved. The draft EA has been publicly reviewed and comments incorporated. The final EA was being reviewed by DOE at the end of CY 2001.

In December of 1999, waste generated at the landfill was placed in the landfill on a routine basis. This waste was generated away from the plant and lacked potential for contamination by radioactive materials. On June 13, 2001, the landfill was opened for disposal of cylinder yard construction waste. Cylinder yard construction waste (2948 tons) was placed in the landfill from June 13, 2001, through July 25, 2001. On August 10, 2001, KDWM issued a letter ordering DOE to cease the placement of waste in the landfill until such time that the monitoring well network has been re-established due to potential corrosion of MWs discovered in late 2000. In addition, two sampling events must be conducted at an interval of no less than thirty days prior to re-opening the landfill. No further waste has been placed in the landfill. Interim cover was placed on the landfill beginning in September 2001.

The potential corrosion in the landfill MWs was a result of an electrochemical reaction. The electrochemical reaction discovered in 2000 was caused by the difference in electrical potential between the two types of steel used in the wells. This caused a small electric current to flow through the well. This current degraded the steel, which was then further broken down by the action of microbes “eating” the metals. The replacement wells will be constructed of polyvinyl chloride, which should prevent this from re-occurring. Activities were initiated to replace MWs at the landfill in late 2001.

In lieu of disposing of office waste at the C-746-U Landfill, office waste generated by DOE and its contractors generated at the plant site is taken off-site for disposal. Off-site disposal of the office waste is provided by Commercial Waste Incorporated at Mayfield, Kentucky. A recycling program exists for office waste that is generated off the plant site. Section 3 provides more detail concerning this program.

No NOVs were received by DOE that cited violations of solid waste regulations.

Underground Storage Tanks

Underground storage tank systems (USTs) at the Paducah Site have been used to store petroleum products, such as gasoline, diesel fuel, and waste oil. These USTs are regulated under RCRA Subtitle I [40 Code of Federal Regulations (CFR) Part 280] and Kentucky UST regulations (401 KAR Chapter 42), or are exempt from specific UST regulations.

In August 2001, a previously unknown UST was discovered during refurbishment of cylinder storage yard C-745-K. KDWM was notified of the discovery. The UST was removed and clean closure for the site was obtained.

DOE is responsible for 15 of the 17 site USTs that have been reported to KDWM in accordance with regulatory notification requirements. Of DOE's 15 USTs, none are currently in use. Four have been removed from the ground, eight have been filled in place with inert material, one (C-611-1) was "clean closed in place", and two were determined not to exist. Table 2.2 provides a current listing of DOE UST's and their status.

At of the end of 2001, four of DOE's USTs had not met all regulatory requirements necessary to achieve permanent ("clean") closure. Other UST activities in 2001 included submittal to KDWM of additional information requested related to previously submitted Closure Assessment Reports. Closure activities for USTs continued into 2002.

Comprehensive Environmental Response, Compensation, and Liability Act

An Administrative Consent Order (ACO) was entered into by DOE and EPA Region IV in August 1988 under Section 104 and 106 of CERCLA. The ACO was in response to the off-site groundwater contamination detected in July 1988.

On May 31, 1994, the Paducah Site was placed on the EPA National Priorities List (NPL), which is a list of sites across the nation designated by EPA as a high priority for site remediation. The EPA uses the Hazard Ranking System to determine which sites should be included on the NPL. A site is eligible for the NPL if it ranks 28.5 on the system; the Paducah Site ranked 56.9. Being placed on the NPL means DOE must follow the cleanup requirements of CERCLA.

Section 120 of CERCLA requires federal facilities on the NPL to enter into a FFA, also referred to as an interagency agreement, with the appropriate regulatory agencies. The FFA, which was signed February 13, 1998, establishes a process for decision making for remediation of the Paducah Site and coordinates CERCLA remedial action requirements with RCRA corrective action requirements specified in the RCRA permits. Upon signature of the FFA, the parties agreed to terminate the CERCLA ACO because those activities can be continued under the FFA. According to the FFA, DOE is required to submit an annual Site Management Plan (SMP) to EPA and KDEP. The plan summarizes the remediation work completed to date, outlines remedial priorities, and contains schedules for completing future work. The SMP is submitted to the regulators annually in November to update the enforceable milestones and to include any new strategic approaches.

The Agency for Toxic Substances and Disease Registry (ATSDR), based in Atlanta, Georgia, is part of the U.S. Public Health Service. As required by CERCLA, this agency conducts public health assessments (PHA) of hazardous waste sites listed or

Table 2.2 Summary of USTs

UST	State ID	Date Installed	Operational Status	Regulatory Status
C-750-A	0001	1955	Removed from ground 3/91	Closure complete per KDWM letter of 3/25/99
C-750-B	0002	1955	Removed from ground 3/91	Closure complete per KDWM letter of 3/25/99
C-750-C	0003	1957 (Estimated)	Removed from ground 10/93	Clean closed under RCRA Subtitle C
C-750-D	0004	1957	Rinsed with TCE and emptied 6/79; filled with cement 10/97	Closure complete per KDWM letter of 11/23/99
C-746-A1	0005	1960	Emptied 9/88; filled with cement 10/97	Final closure awaits remediation of contaminated soils
C-710-B	0006	1956 (Estimated)	Emptied 7/85; filled with cement 10/97	Awaiting final closure approval from KDWM
C-200-A	0007	1956 (Estimated)	Filled with grout in 1977	Closure complete per KDWM letter of 11/23/99
C-746-A2	0008	- -	Determined during WAG 15 site investigation not to exist	Documented during WAG 15 site investigation not to exist
C-751-W	0009	1992	In use by USEC	In use by USEC
C-751-E	0010	1992	In use by USEC	In use by USEC
C-611-1	0011	1943 (Estimated)	Last used before 1975	Clean closed in place per KDWM letter of 12/6/96
C-611-3	0012	1953	Last used before 1975; filled with cement 9/97	Clean closed per KDWM letter of 12/6/96
C-611-2	0013	- -	Determined not to exist	No further action required per state correspondence of 12/6/96
C-611-4	0014	1943 (Estimated)	Last used before 1975; filled with sand	Clean closed per KDWM letter of 12/6/96
C-611-5	0015	Unknown	Filled with grout before 1975	Clean closed per KDWM letter of 12/6/96
C-200-B	0016	1967	Filled with concrete in 1981	Awaiting final closure approval from KDWM
C-745-K	0017	1951	Removed from ground 2/02	Awaiting final closure approval from KDWM

proposed for listing on the NPL. Representatives from the ATSDR made their initial site visit to Paducah in May 1994 to assign a ranking to the site for priority in scheduling the health assessment. A "B" ranking was assigned to Paducah, which is the second highest priority. The ranking was based on groundwater contamination associated with the plant that had affected several off-site wells. The ATSDR is aware of the actions the site has taken since 1988 to address the risks from the potential use of contaminated water.

In 1995, the ATSDR visited the Paducah Site to initiate a PHA. The PHA report was issued in March 2001 for public comment. This document is available on-line at http://www.atsdr.cdc.gov/HAC/PHA/paducah/pad_toc.html

The following text was copied from the conclusion section of the above mentioned PHA report.

According to the information evaluated by ATSDR, under normal operating conditions, the Paducah Gaseous Diffusion Plant currently poses no apparent public health hazard for the surrounding community from exposure to groundwater, surface water, soil and sediment, biota, or air. "No apparent public health hazard" means that people may be exposed to contaminated media near the site, but that exposure to the contamination is not expected to cause any adverse health effects. We define "current" as ranging from 1990 to the present. This conclusion assumes the effectiveness of access restrictions to Little Bayou Creek, the outfalls, and the North-South Diversion Ditch; the fish advisories issued for Little Bayou Creek and some of the ponds in the Western Kentucky Wildlife Management Area; and existing regulation of discharges to air and surface water.

ATSDR representatives reviewed available health outcome data, such as cancer registries and vital statistics. We evaluated the data using age-adjusted rates, concentrating mostly on nine general types of cancer. The health outcome data reviewed do not apply specifically to small groups of people who have been, or could be, exposed to PGDP contaminants. The data are recorded for larger areas (area development districts or counties) which include many people with no exposures to contaminants from the site (approximately 63,000 in McCracken County, 8,000 in Ballard County, and 15,000 in Massac County). The population of concern for the exposure pathways in the PDGP area (approximately 15 to 90 persons) is small. The associations between exposure from this site and any adverse health effects would be obscured or distorted by the presence of the much larger unexposed population.

Our specific conclusions about chemical and radioactive contaminants in completed and potential human exposure pathways are as follows:

1. PGDP *currently poses no apparent public health hazard* to the off-site community during normal operating conditions, because exposure is not taking place at levels that would likely cause adverse human health effects. However, off-site monitoring should continue since other on-site activities could impact the surrounding community.

2. *Past exposure to TCE and lead was a public health hazard for children routinely drinking water from four residential wells*, because it increased the likelihood of adverse effects on their nervous systems. Residential wells that contained TCE may also have been contaminated with vinyl chloride, a breakdown product of TCE in groundwater. The detection limits in most analyses of samples from tested residential wells were well above the levels of concern, and not all residential wells in or near the plumes were tested for vinyl chloride. Because ATSDR scientists do not know with certainty whether (or at what levels) TCE-contaminated wells contained vinyl chloride, we cannot assess the level of potential health hazard associated with potential past exposure to vinyl chloride.

3. *Future exposures to the maximum concentrations of contaminants in the groundwater plumes will pose a public health hazard to adults and children* if new wells are drilled into the contaminated groundwater plumes, or if old wells are used by new land owners. We base this conclusion on the increased contaminant concentrations in the plumes since residential wells were taken out of service, but it does not consider the potential reduction of concentrations in the groundwater from future remediation activities.

4. *A transportation accident involving fire and the rupture of full depleted uranium cylinders would pose an urgent public health hazard to people near the accident*. Such an accident is very unlikely, according to historical transport records. Weather conditions and duration of exposure would affect the distance from an accident at which a hazard would exist, but anyone within 100 feet (30 meters) or less of the accident could experience serious or lethal harm.

5. For *other accident scenarios* such as a plane crash, severe weather, or natural disasters involving the on-site depleted uranium cylinders at PGDP, *a temporary public health hazard* could exist off site from hydrogen fluoride exposure, but the exposure would not cause permanent harm and would not be fatal. Such an accident is very unlikely.

6. *Past accidental airborne releases of uranium hexafluoride and the resulting exposures are indeterminate*, because total release quantities and completed exposure pathways are uncertain. The worst of the reported accidents occurred in the early morning hours on November 17, 1960, when it is uncertain if any residents were exposed. If people were exposed at the modeled uranium and hydrogen fluoride concentrations, adverse health effects may have resulted. Currently, we have no reports of health effects related to this accident; however, if data become available suggesting adverse health effects did occur, we will re-evaluate the need for followup activities. Hazardous air concentrations probably did not reach off-site areas during other, smaller accidental releases. A better spatially and statistically consistent soil sampling program in residential areas would have assisted in determining potential past exposures.

Comprehensive Environmental Response, Compensation, and Liability Act Reportable Quantities

There were no spills of materials above a CERCLA reportable quantity at the Paducah Site in 2001.

National Environmental Policy Act

An evaluation of the potential environmental impact of proposed federal activities is required by the National Environmental Policy Act (NEPA), as well as requires an examination of alternatives to those actions. Compliance with NEPA, as administered by DOE's NEPA Implementing Procedures (10 CFR 1021) and Council on Environmental Quality Regulations (40 CFR 1500–1508), ensures that consideration is given to environmental values and factors in federal planning and decision making. In accordance with 10 CFR 1021, the Paducah Site conducts NEPA reviews for proposed actions and determines if any proposal requires preparation of an environmental impact statement (EIS), an EA, or is categorically excluded (CX) from preparation of either an EIS or an EA. The Paducah Site maintains records of all NEPA reviews.

In 2001, DOE continued preparation of two EAs. An EA addresses Waste Disposition. A second EA addresses the process and criteria for accepting Paducah Site waste at the C-746-U Landfill. In addition, numerous minor activities were within the scope of the previously approved CXs for routine maintenance, small-scale facility modifications, and site characterization. The

Table 2.3 Federally listed, proposed, and candidate species potentially occurring within the Paducah Site Study Area in 2001[a]

Common Name	Scientific Name	Endangered Species Act Status
Indiana Bat[b]	*Myotis sodalis*	Listed Endangered
Interior Least Tern	*Sterna antillarum athalassos*	Listed Endangered
Pink Mucket	*Lampsilis abrupta*	Listed Endangered
Ring Pink	*Obovaria retusa*	Listed Endangered
Orangefoot Pimpleback	*Plethobasus cooperianus*	Listed Endangered
Fat Pocketbook	*Potamilus capax*	Listed Endangered
Bald Eagle	*Haliaeetus leucocephalus*	Listed Threatened
Sturgeon Chub	*Macrhybopsis gelida*	Candidate
Sicklefin Chub	*Macrhybopsis meeki*	Candidate

[a] All of the above species are discussed in *Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area, McCracken County, Kentucky, Volume III*, U. S. Army Corps of Engineers Nashville District, May 1994. Note that the study area encompasses 11,719 acres and extends to include the Ohio River, which is over three miles north of the DOE reservation. None of these species have been reported as sighted on the DOE reservation although potential summer habitat exists there for the Indiana bat. No critical habitat for any of these species has been designated anywhere in the study area.

[b] Specimens of the Indiana bat were collected at the WKWMA in 1991 and 1999.

Paducah DOE Site Office and the DOE Oak Ridge Operations Office NEPA compliance officer approve and monitor the internal applications of previously approved CX determinations.

In accordance with the 1994 DOE Secretarial Policy Statement on NEPA, preparation of separate NEPA documents for environmental restoration activities conducted under CERCLA is no longer required. Instead, DOE CERCLA documents incorporate a consideration of environmental impacts resulting from the activity, or “NEPA values,” to the extent practical. NEPA values are environmental issues that affect the quality of the human environment. Incorporation of NEPA values into CERCLA documents ensure that the decisionmakers consider the potential effects of proposed actions on the human environment. Actions conducted under CERCLA are discussed in Section 3 of this report.

National Historic Preservation Act

The NHPA of 1966 is the primary law governing federal agencies’ responsibility for identifying and protecting historic properties (cultural resources included in, or eligible for inclusion in, the National Register of Historic Places). There are currently no historic properties at the Paducah Site in the National Register of Historic Places, although there is a potential for eligible historic properties. Therefore, each proposed project is assessed to determine if there are any historic properties present and whether they may be affected. In making these determinations, DOE consults with the SHPO as required by Section 106 of the NHPA.

In accordance with 36 CFR 800.13, DOE is in the process of developing an optional NHPA compliance strategy based on a programmatic agreement between DOE, the Advisory Council on Historic Preservation, and the SHPO. In April 1997, a draft programmatic agreement was submitted to the SHPO for approval. The draft programmatic agreement provides for a more comprehensive cultural resources program and requires a survey to identify significant historical properties and development of a Cultural Resources Management Plan. The draft programmatic agreement is still in the process of being finalized. In 2001, additional discussions took place between DOE and the SHPO in order to reach an agreement on the final details of the programmatic agreement.

Endangered Species Act

The Endangered Species Act of 1973, as amended, provides for the designation and protection of endangered and threatened animals and plants. The act also serves to protect ecosystems on which such species depend. At the Paducah Site, proposed projects are reviewed, in conjunction with NEPA project reviews, to determine if activities have the potential to impact these species. If necessary, project-specific field surveys are performed to identify threatened and endangered species and their habitats, and mitigating measures are designed as needed. When appropriate, DOE initiates consultation with the U.S. Fish and Wildlife Service prior to implementing a proposed project.

Table 2.3 includes nine federally-listed, proposed, or candidate species that have been identified as potentially occurring at or near the Paducah Site. Project NEPA reviews and associated field surveys indicated that in 2001, DOE projects at the Paducah Site did not directly impact any of these nine species. Potential habitats of these species were also not significantly impacted.

Floodplain/Wetlands Environmental Review Requirements

Title 10 CFR, Part 1022 establishes procedures for compliance with Executive Order 11988, “Floodplain Management,” and Executive Order 11990, “Protection of Wetlands.” Activities, other than routine maintenance, proposed within 100-year floodplains or in wetlands first require that a notice of involvement be published in the Federal Register. A floodplain or wetlands assessment must then be prepared by DOE that evaluates potential impacts on the floodplains or wetlands and considers alternatives to avoid or lessen impacts. For floodplains, a floodplain statement of findings summarizing the floodplain assessment must be published in the Federal Register for public comment at least 15 days before beginning the project. Activities of DOE in "waters of the United States," which include wetlands, are likely to be subject to additional Clean Water Act (CWA) permit requirements administered by the U.S. Army Corps of Engineers (COE) and may require water quality certification from KDEP.

In 2001, no floodplain or wetlands assessments were prepared or approved. Also, no floodplain or wetlands notices of involvement were published in the Federal Register for the Paducah Site. In addition, DOE did not apply for any individual permits from COE or for any water quality certifications from the state. Some DOE projects were authorized through the COE nationwide permit program for activities involving waters of the United States.

DOE activities did not result in significant impacts to floodplains or wetlands at the Paducah Site in 2001.

Clean Water Act

The CWA was established primarily through the passage of the Federal Water Pollution Control Act Amendments of 1972. The CWA established the following four major programs for control of water pollution: (1) a permit program regulating point-source discharges into waters of the United States, (2) a program to control and prevent spills of oil and hazardous substances, (3) a program to regulate discharges of dredge and fill materials into "waters of the U.S.," and (4) a program to provide financial assistance for construction of publicly owned sewage treatment works. The Paducah Site is primarily affected by the regulations for discharges of dredge and fill materials (see previous subsection on Floodplain/Wetlands Environmental Review Requirements) and for point-source discharges regulated under the KPDES Permit.

Clean Water Act NOVs

DOE received a NOV dated February 28, 2001 by KDOW for failure to submit sampling data for Outfall 017 in the November 2000 Discharge Monitoring Report. The November samples for toxicity were not collected. DOE implemented contract modifications to ensure future toxicity samples will be collected and extended toxicity sampling through May 2001.

Kentucky Pollutant Discharge Elimination System Permits

During 2001, the CWA applied to all nonradiological DOE discharges to waters of the United States. At the Paducah Site, the regulations are applied through issuance of a KPDES permit for effluent discharges to Bayou and Little Bayou creeks. The Kentucky Division of Water issued KPDES Permit No. KY0004049 to the Paducah Site. This permit became effective April 1, 1998, and is enforced by the KDOW. The KPDES permit calls for biological monitoring as an indicator of discharge-related effects in the receiving stream.

KPDES Permit No. KY0004049 applies to the following four DOE outfalls: 001, 015, 017, and 019. Outfall 001 had one permit exceedence during 2001 for chronic toxicity; however, the re-test showed no toxicity. No exceedences of effluent limits occurred at Outfall 015, which is an intermittent rainfall-dependent outfall. Four permit exceedences occurred at Outfall 017, which contains runoff from DOE depleted uranium hexafluoride (DUF_6) cylinder storage yards. The exceedences were due to acute toxicity, most likely related to zinc from paint associated with recently painted DUF_6

cylinders. The toxicity problems associated with Outfall 017 are discussed in detail in the following subsection. No exceedences of effluent permit limits occurred at C-746-U Landfill Outfall 019.

Toxicity at Outfall 017

On August 30, 2000, DOE, BJC, and KDOW representatives met to discuss the path forward concerning the intermittent acute toxicity permit exceedences over the past two years at Outfall 017. It was agreed that DOE would continue the TRE investigation to identify the dynamics of the intermittent toxicity exceedences. The TRE investigation resumed in December 2000 and continued through May 2001. A report was issued in July 2001. Due to intermittent toxicity failures during February and March 2001, DOE continued the TRE for an additional period of July through December 2001 to further study the dynamics of the contaminant causing the toxicity failures. Failures for toxicity in 2001 occurred in February (2.1 acute toxicity unit [TUa]), March (2.46 TUa), June (1.33 TUa), and December (1.6 TUa). No NOVs associated with toxicity at Outfall 017 were issued in 2001. KDOW requested that the TRE occur during the winter months due to the history of exceedences occurring in those months. Therefore, the TRE will continue until May 2002 and a report will be issued in the summer of 2002.

Toxic Substances Control Act

In 1976, the Toxic Substances Control Act (TSCA) was enacted with a twofold purpose: (1) to ensure that information on the production, use, and environmental and health effects of chemical substances or mixtures are obtained by the EPA, and (2) to provide the means by which the EPA regulates chemical substances/ mixtures.

Polychlorinated Biphenyls

The Paducah Site undertakes activities to comply with PCB regulations (40 CFR 761) and the Uranium Enrichment (UE) TSCA FFCA promulgated under TSCA. The major activities performed in 2001 to ensure compliance included the following: maintaining compliant storage of PCB waste and PCB-contaminated wastewater, shipping PCB waste for treatment and disposal, treatment and discharge of PCB-contaminated wastewater, maintenance to the troughing system, and reporting and record keeping.

The UE TSCA FFCA between EPA and DOE was signed in February 1992. To meet the compliance goals at the Paducah Site, the UE TSCA FFCA is frequently revised and updated. Under this agreement, action plans have been developed and implemented for removal and disposal of large volumes of PCB material at the Paducah Site. As part of this program during 2001, four capacitors were removed from service. Table 2.4 shows progress of removal of capacitors in service during the year. Table 2.5 is a summary of PCB items in service at the Paducah Site at the end of 2001.

Nine boxes containing 262 capacitors were shipped off-site for disposal in 2001. The contents of the boxes were shipped on January 25, 2001, and January 31, 2001, by DOE to an offsite disposal facility.

The annual PCB document, due July 1, provides details of facility activities associated with the management of PCB materials. The annual report provides details from the previous year on all PCB items that are in use, stored for reuse, generated as waste, stored for disposal, or shipped off-site for disposal. All Paducah Site UE TSCA FFCA milestones for 2001 were completed.

The facility operates equipment that contains PCB capacitors as well as transformers, electrical equipment, and other miscellaneous PCB equipment. Both radioactive and nonradioactive PCB wastes are stored on-site in storage units that meet TSCA and/or UE TSCA FFCA compliance requirements. Upon approval, nonradioactive PCBs are transported off-site to EPA-approved facilities for disposal.

Radioactive contaminated PCB wastes are authorized by the UE TSCA FFCA for on-site storage at Paducah beyond two years. Technology for the treatment and/or disposal of radioactively contaminated PCB wastes is being evaluated.

Table 2.4 Status of large, high-voltage PCB capacitors in 2001

Building Location	Beginning Balance (1/1/01)	Capacitors Removed	New Balance (12/31/01)
C-331	69	0	69
C-333	413	4	409
C-335	46	0	46
C-337	255	0	255
Total	783	4	779

Table 2.5 Summary of PCBs and PCB items in service at the end of 2001

Type	Number in Service	Volume (gal)	PCBs (kg)
PCB transformers	66	95,256	277,152
PCB-contaminated transformers	9	2,299	0.95
PCB-contaminated electrical equipment	7	2,094	1.13
PCB capacitors	779	--	--
PCB open systems[a]	3	235	10.90

[a] PCB open systems are addressed in the UE TSCA FFCA. In addition, ventilation gaskets used in various buildings throughout the Paducah Site have been determined to contain PCBs. The average PCB concentration is estimated to be 20% by weight. The total PCB content is estimated at 3840 kg in the 19,200 kg of gaskets.

Emergency Planning and Community Right-To-Know Act

Also referred to as Title III of the Superfund Amendments and Reauthorization Act (SARA), Emergency Planning and Community Right-to-Know Act (EPCRA) requires reporting of emergency planning information, hazardous chemical inventories, and releases to the environment. Reports under EPCRA are submitted to federal, state, and local authorities. Executive Order 12856, signed in August 1993, subjects all federal agencies to EPCRA. The applicable requirements of EPCRA are contained in Sections 304, 311, 312, and 313.

- Section 304 requires reporting of off-site reportable quantity releases to state and local authorities. Reportable quantities for various chemical releases are defined in regulations implemented by EPA.

- Section 311 requires that either material safety data sheets (MSDSs) or lists of the hazardous chemicals for which an MSDS is required be provided to state and local authorities for emergency planning purposes.

- Section 312 requires that a hazardous chemical inventory for chemicals stored at the Paducah Site be submitted to state and local authorities for emergency planning.

- Section 313 requires annual reporting of releases of toxic chemicals to the EPA and the state.

The Paducah Site did not have any releases that were subject to Section 304 notification requirements during 2001. No Section 311 notifications were required in 2001. The Section 312 Tier II report of inventories for 2001 included UF_6, uranium tetrafluoride (UF_4), iron filings, diesel fuel, activated carbon pellets, magnesium fluoride, and PCBs associated with DOE activities. The Paducah Site reported PCBs on the Section 313 report, based on the disposal of electrical equipment.

Clean Air Act

Authority for enforcing compliance with the Clean Air Act (CAA) and subsequent amendments resides with EPA Region IV and the Kentucky Division for Air Quality (KDAQ). The Paducah Site maintains compliance with federal and state rules implementing the CAA and its amendments.

Clean Air Act Compliance Status

The Paducah Site had two air emissions point sources in 2001. The Northwest Plume Groundwater System and the Northeast Plume Containment System are interim remedial actions (IRAs) under CERCLA for the containment of groundwater contamination at the Paducah Site. These separate facilities remove trichloroethene (TCE) contamination from the groundwater by air stripping. At the Northwest Plume Groundwater System, the TCE-laden air passes through carbon filtration which removes much of the TCE. At the Northwest Plume Groundwater System, the TCE-laden air passes through carbon filtration which removes much of the TCE. At the Northeast Plume Containment System, a cooling tower system acts as an air stripper for TCE. The air streams for both systems are then released to the atmosphere where the remaining TCE naturally breaks down.

Asbestos Program

Numerous facilities at the Paducah Site contain asbestos materials. Compliance programs for asbestos management include identification of asbestos materials, monitoring, abatement, and disposal. Procedures and program plans are maintained that delineate scope, roles, and responsibilities for maintaining compliance with EPA Region IV, Occupational Safety and Health Administration, and Kentucky regulatory requirements. Noncompliances with environmental protection standards were not identified in 2001.

Radionuclide National Emissions Standards for Hazardous Air Pollutants Program

Kentucky and EPA Region IV regulate airborne emissions of radionuclides from DOE facilities under 40 CFR 61 Subpart H, the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations. Potential radionuclide sources at the Paducah Site in 2001 resulted from the crushing of concrete rubble, the Northwest Plume Groundwater System, and from fugitive source emissions. The fugitive source emissions include piles of contaminated scrap metal, roads, and building roofs. DOE utilized ambient air monitoring data to verify insignificant levels of radionuclides in off-site ambient air. The Radiation/Environmental Monitoring Section of the Radiation Health and Toxic Agents Branch of the Department for Public Health of the Kentucky Cabinet for Health Services conducted ambient air monitoring during 2001. Ambient air data were collected at eleven sites surrounding the plant in order to measure radionuclides emitted from Paducah Site sources, including fugitive emissions.

Pollutants and Sources Subject to Regulation

Any stationary source emitting more than 10 tons/year of any hazardous air pollutant (HAP) or 25 tons/year of any combination of HAPs is considered a major source and is subject to regulation. EPA Region IV must examine other sources for regulation under an “area source” program. The Paducah Site is not a major source by virtue of its individual or total hazardous air pollutant emissions.

Stratospheric Ozone Protection

DOE refrigeration units contain less than 50 pounds of ozone depleting substances; therefore, the only part of Title VI of the Clean Air Act that applies to the Paducah Site is the requirement to control refrigerants from leaking systems and maintain records of systems disposed. DOE has implemented these controls and has an established record keeping system.

Clean Air Act NOVs

There were no violations of the CAA during 2001 and no NOVs were received for Clean Air Act violations.

Kentucky/Department of Energy Agreement in Principle

The Kentucky/DOE Agreement in Principle (AIP) reflects the understanding and commitments between DOE and the Commonwealth of Kentucky regarding DOE's provision of technical and financial support to Kentucky for environmental oversight, surveillance, remediation, and emergency response activities. The goal of the AIP is to maintain an independent, impartial, and qualified assessment of the potential environmental impacts from present and future DOE activities at the Paducah Site. The AIP is intended to support non-regulatory activities whereas the FFA covers regulatory authority. The AIP includes a grant to support the commonwealth of Kentucky in conducting independent monitoring and sampling, both on-site and off-site, and to provide support in a number of emergency response planning initiatives including cooperative planning, conducting joint training exercises, and developing public information regarding preparedness activities. The AIP is negotiated on a five-year interval. The AIP's second five-year agreement became effective January 1, 1997.

Regulatory Inspections

Paducah Site environmental management programs are overseen by several organizations, both inside and outside the DOE complex. Each year, numerous appraisals, audits, and surveillances of various aspects of the environmental compliance program are conducted. Table 2.6 summarizes the state and federal regulatory inspections conducted in 2001.

Table 2.6 State and federal regulatory inspections at the Paducah Site in 2001

Date	Auditor	Description
January 2001	KDOW	Inspection of the sanitary water spill at C-420
January 2001	KDAQ	Inspection of DOE Material Storage Areas
February 2001	KDAQ	Inspection of DOE Material Storage Areas
February 2001	KDOW	Collect effluent sample from Outfall 001
February 2001	KDWM	Inspection of C-746-U Landfill operations
March 2001	KDWM/EPA Region IV	RCRA inspection
March 2001	KDWM/EPA Region IV	Multi-media audit (review of Clean Water, Clean Air, EPCRA, TSCA/PCBs, WM/PP Programs)
April 2001	KDWM/EPA Region IV	Inspection of Safe Drinking Water and Underground Storage Tanks programs
May 2001	KDAQ	Inspection of C-409 facility for shut down air emission sources
May 2001	KDAQ	Inspection of new proposed ambient air monitor locations to support PGDP NESHAP ambient air monitoring program
July 2001	KDWM	Inspection of C-404 Landfill and associated groundwater program, and split groundwater samples on two wells
August 2001	KDWM	Inspection of C-746-U Landfill
October 2001	KDWM	Inspection of C-746-U Landfill
December 2001	KDOW	Inspection of DOE KPDES outfalls

3 Environmental Program Information

Abstract

Environmental monitoring, environmental restoration, waste operations, facilities management, UF_6 cylinder management activities, and D&D/DMSA management occur at the Paducah Site. Several programs are conducted; therefore, they are presented in this section to inform the public about these activities.

Environmental Monitoring Program

The Environmental Monitoring Program at the Paducah Site consists of effluent monitoring and environmental surveillance. Requirements for routine environmental monitoring programs were established to measure and monitor effluents from DOE operations and maintain surveillance on the effects of those operations on the environment and public health through measurement, monitoring, and calculation. This program is intended to demonstrate that DOE operations at the Paducah Site comply with DOE orders and applicable federal, state, and local regulations. The Environmental Monitoring Program is documented in the *Paducah Site Environmental Monitoring Plan* (BJC 2000) in accordance with DOE Order 5400.1, *General Environmental Protection Program.* The results of this program are discussed in detail in subsequent sections of this ASER.

Before the DOE/USEC transition (described in Section 1), DOE's primary mission at the Paducah Site consisted of enriching uranium. However, since the transition on July 1, 1993, DOE's mission at the site has been focused on environmental restoration, DUF_6 cylinder management, waste management, and D&D. This change in mission has also changed the direction and emphasis of the Environmental Monitoring Program. In November 1995, the site Environmental Monitoring Plan was reissued to address DOE operations exclusively. The Environmental Monitoring Plan is reviewed annually and updated at least every three years. The December 2000 version of the *Paducah Site Environmental Monitoring Plan* (BJC 2000) addresses the sampling events in 2001 that are reported in this ASER. Data Quality Objective (DQO) sessions were held during June and August of 2000 in order to determine if additional monitoring or changes to the environmental monitoring program were needed for 2001. As a result, locations and parameters were added for surface water, sediment, and groundwater monitoring in 2001.

Environmental Restoration Program

The goal of the Environmental Restoration Program is to ensure that releases from past operations and waste management activities are investigated and that appropriate remedial action is taken for the protection of human health and the environment. In May 1994, the PGDP was added to EPA's NPL of hazardous waste sites that require the most cleanup. Two federal laws, RCRA and CERCLA, are the dominant regulatory drivers for environmental restoration activities at the Paducah Site. RCRA sets the standards for managing hazardous waste and requires permits to be obtained for DOE facilities that treat, store, or dispose of hazardous waste and requires assessment and cleanup of hazardous waste releases at facilities. CERCLA addresses uncontrolled releases of hazardous substances and requires cleanup of inactive waste sites.

The Environmental Restoration Program supports remedial investigations (RIs) and response actions, D&D of facilities no longer in use, projects designed to demonstrate advancements in remedial technologies, and other projects related to remedial action for the protection of human health and the environment.

Background

In July 1988, the Kentucky Radiation Control Branch, in conjunction with the Purchase District Health Department, sampled several residential groundwater wells north of the plant in response to concerns from a local citizen regarding the quality of water in a private well. Subsequent analyses of these samples revealed elevated gross beta levels, indicative of possible radionuclide contamination. On August 9, 1988, these results were reported to the Paducah Site, which responded by sampling several private groundwater wells adjacent to the site on August 10, 1988. Upon analysis, some of the samples collected contained elevated levels of both TCE and ^{99}Tc. In response, DOE immediately instituted the following actions:

- provided a temporary alternate water supply to affected residences,
- sampled surrounding residential wells to assess the extent of contamination,
- began extension of the municipal water line to affected residences as a long-term source of water, and
- began routine sampling of residential wells around the Paducah Site.

Following the initial response actions, DOE and EPA entered into an ACO in August 1988 under sections 104 and 106 of CERCLA. The major requirements of the ACO include monitoring of residential wells potentially affected by contamination, providing alternative drinking water supplies to residents with contaminated wells, and investigation of the nature and extent of off-site contamination.

Pursuant to the ACO, DOE continued routine sampling of residential wells and initiated a two-phase site investigation to identify the nature and extent of off-site contamination at the Paducah Site. Phase I of the site investigation, from summer 1989 to March 1991, evaluated the extent of off-site contamination at the Paducah Site through extensive groundwater monitoring and surface-water sampling. Results of these activities are reported in *Results of the Site Investigation, Phase I, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (CH2M Hill 1991b). Phase II of the site investigation, from November 1990 to October 1991, focused on identification and characterization of on-site sources contributing to off-site contamination, determined the level of risk to human health and the environment from exposure to contaminated media and biota, and developed an initial list of remedial alternatives. Results are reported in *Results of the Site Investigation, Phase II, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (CH2M Hill 1992a). The principal findings of the site investigation are as follows:

- TCE and ^{99}Tc were identified as the primary contaminants in off-site groundwater at the Paducah Site,

- A northwest and a northeast groundwater plume extending off-site were delineated,
- PCBs and radionuclides were identified as the primary contaminants detected in surface water and sediment in outfalls, ditches, and creeks around the Paducah Site, and
- Several on-site sources were identified as potential contributors to off-site contamination.

Risks to human health and the environment from exposure to contamination originating at the Paducah Site were reported in *Results of the Public Health and Ecological Assessment, Phase II at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (CH2M Hill 1992b). This report used data collected during the site investigation to quantitatively assess risks to human health and to qualitatively assess risks to the environment.

A range of preliminary alternatives that could be used to address the contamination was also developed as part of the ACO activities. This information was presented in *Summary of Alternatives for Remediation of Off-Site Contamination at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (Draft) (SAIC 1991). Upon completion of the Phase II activities and in response to the risks identified in the public health and ecological assessment, the Paducah Site developed and implemented several IRAs designed to prevent further migration of contaminants and reduce risks to human health and the environment. The actions targeted certain on-site sources and the off-site contamination associated with groundwater and surface water.

As part of the routine residential well sampling that began when off-site contamination was discovered, DOE established a water policy. This policy states that in the event contamination originating from the Paducah Site is detected above plant-action levels, which are established at the analytical laboratory detection limits of 25 picoCuries per liter (pCi/L) for ^{99}Tc and 1 part per billion (ppb) for TCE, a response would be initiated by the Paducah Site. Accordingly, residents would be notified immediately as would state and EPA officials. Alternative water supplies would be provided through connection to the municipal water system, or in the event of a time lapse between discovery and the ability to complete connections, bottled water would be made available. DOE pays the cost of installation of water systems and the monthly charges for water service to residents with contaminated wells.

DOE modified this water policy to include provisions to extend a municipal water line to the entire area potentially affected by groundwater contamination originating from the Paducah Site. All residents within a defined area, regardless of whether or not their wells were contaminated, were given the option to receive municipal water at DOE's expense. Of the 83 eligible property owners, 73 signed agreements to accept the water provision and not to use or dig wells for human consumption on their property. DOE also provides municipal water to new residents and some new businesses. A five-year review of the water policy was issued in 1999.

Because of the extension of the municipal water line, the water policy allows reduction in the number and frequency of residential wells sampled routinely. This modification provides for a more cost-effective allocation of well-sampling resources. Through the strategic placement of additional MWs, the modification also allows more accurate data on location and movement of contaminated groundwater.

The most significant interim action taken under the ACO, documented in *Technical Memorandum for Interim Remedial Action of the Northwest Plume* (DOE/OR/1031&D2), included groundwater extraction and treatment to reduce the spread of contamination from the source and high concentration areas of the Northwest Plume. The *Proposed Plan for Interim Remedial Action of the Northwest Plume* (DOE/OR/06-1127&D2), which summarizes the interim alternatives, was approved by EPA on April 15, 1993. The *Record of Decision for Interim Remedial Action of the Northwest Plume* (DOE/OR/06-1143&D2) was signed by DOE on July 15, 1993, and by EPA on July 22, 1993. Construction of the interim action (the C-612 Northwest Plume Groundwater System) was completed and operational on August 28, 1995.

A second groundwater remediation action, the *Record of Decision (ROD) for Interim Remedial Action at the Northeast Plume* (DOE/OR/06-1356&D2), was signed by DOE on June 13, 1995, and the EPA on June 1, 1995. The ROD called for the hydraulic containment and treatment of high concentrations of off-site TCE contamination in the Northeast Plume.

Other interim actions completed to date include the North-South Diversion Ditch, institutional controls for surface water/ditches and scrapyards, enhancement of the existing cap for Waste Area Group (WAG) 7 (C-746-K Landfill), and a removal action at WAG 17 (AOC 124) , and a PCB removal action for surface soils at WAG 23 sites. The North-South Diversion Ditch Interim Action called for treating certain plant effluents and controlling the migration of contaminated sediment associated with the ditch. The installation of fencing/posting restricted recreational use of surface water, outfalls, and lagoons. The installation of sediment controls to mitigate surface-water/sediment runoff from scrapyards has been completed and is inspected on a monthly basis. The existing cap for the C-746-K Landfill was enhanced to reduce leachate migration from surface infiltration.

Operable Units

PGDP has numerous SWMUs and AOCs that require further investigation and potential remediation. Complex sites with multiple environmental releases, such as PGDP, may choose to divide the site into smaller areas and conduct separate RI feasibility studies (FSs), as opposed to conducting a single, site-wide RI/FS. These smaller, individual study areas, referred to as operable units (OUs) implying an area for action to be taken or WAGs under the FFA, typically contain a limited number of SWMUs/AOCs grouped together based on certain criteria.

The SWMUs and AOCs requiring an RI/FS were initially segregated into 30 WAGs based on the following characteristics, and then prioritized for cleanup according to their contributions to off-site contamination:

- Common Remedial Technologies,
- Common Contaminant Sites,
- Common Geographic Locations,
- Common Operational Processes,
- Common Release Mechanisms,
- Common Surface-Water Drainage,
- Common Media Type,
- Hydraulically-Connected Areas,
- Operating Units, and
- Suspected Sources of Off-site Contamination.

As a better understanding of site conditions was gained through the various WAG investigations, the DOE, EPA, and the state of Kentucky concluded it would be more effective if the existing WAGs were grouped more broadly, thereby providing the framework to more effectively integrate, focus, and prioritize response actions across the site. These data and other process knowledge were used to develop site conceptual models for each of the source areas to support the further consolidation of the WAGs into larger operable units. Source areas that were suspected as primary contributors of contamination to a specific environmental media and/or exposure pathway were grouped under the same OU. This effort resulted in identification of the following five potential OUs:

(1) Groundwater OU,

(2) Surface Water OU,

(3) Burial Grounds OU,

(4) Soils OU, and

(5) D&D OU.

The OUs include a number of SWMUs and AOCs that require an RI/FS. The scopes of these OUs are intended to include both the contributing source area and the affected media, which is a significant change from the previous WAG strategy where sources were addressed separately from the contamination that had already migrated to groundwater and surface water. Combining the source areas and affected media under the OU approach is intended to enhance the agencies' ability to develop integrated remedial solutions that will account for interactions between source areas and affected media.

While the source areas have been grouped into OUs based on suspected releases to a common media and/or exposure pathway, this does not mean the strategies or response actions for a given OU will not evaluate impacts to other media or exposure pathways. For example, the intent of the soils OU is to help focus data collection and decision-making on a group of source areas where the probable site conditions, based on existing data and process knowledge, suggest the contamination may primarily be limited to the shallow soil horizons, thereby providing a primary route of exposure to plant workers through direct contact. However, it is not unrealistic for some sources within this OU to also be a contributor to surface water or groundwater via contaminant transport. In comparison, sources in the groundwater and surface water OUs may also contain contamination at locations where plant workers could experience direct contact exposure with contaminated soils or sediments. Therefore, the strategies and corresponding response actions will contain adequate flexibility to manage uncertainties and address impacts to other media and secondary routes of exposure when appropriate.

Also, it should be noted that some OUs contain operating SWMUs. Since some of these units may not be able to be fully characterized or remediated until they cease operation, the scope of the RI/FS may be focused in nature, with emphasis on the migration pathways to determine whether there is an on-going release that poses a current risk, which warrants an immediate action. However, the extent of investigation and remedial action for OUs will be determined on a case-by-case basis after consideration of site-specific conditions. In some cases, if the investigation determines there is no immediate risk or potential for off-site migration, additional characterization and/or remediation may be deferred to the D&D OU when these units cease operation.

Once the five OU actions are complete, a comprehensive site-wide OU (CSOU) will be conducted. The scope of the CSOU will include a comprehensive site-wide baseline risk assessment to evaluate any residual risk remaining at the site after completion of the five OUs, and the cumulative effects from all media. If the CSOU risk assessment concludes the actions taken to date collectively provide adequate protection to human health and the environment, a final CSOU Proposed Plan and ROD will be issued. The ROD will be followed by a final remediation report declaring site remediation complete. In the event the CSOU risk assessment determines additional actions are needed, an FS will be developed with the preferred alternative documented in a proposed plan and ROD, followed by the necessary remedial actions prior to issuing the final remediation report.

Site Priorities

The prioritization process for implementing the OU strategy incorporates the general principles of the CERCLA National Contingency Plan, which emphasizes the use of early actions to address and reduce further migration of imminent threats (both on- and off-site) and contamination (Figure 3.1). Consistent with those principles, a series of interim actions were implemented under the ACO during the earlier phases of the cleanup program. These actions focused exclusively on mitigating current threats of that nature, including, for example, alternate drinking supplies to affected residents, construction and operation of groundwater treatment systems for the northwest and northeast plumes, and surface water actions in the North-South Diversion Ditch and Bayou and Little Bayou creeks. With regard to potential on-site exposure, current threats, in general, have been mitigated through access restrictions and institutional controls. However, data generated from implementation of the OU strategy will be continuously reviewed to identify the need, should current threats be discovered, for additional expedited action.

Assuming imminent threats have been adequately addressed through previous actions, groundwater and surface water have been identified as the highest priority since those media serve as migration pathways to off-site receptors. The soils and burial grounds OUs are the next priority followed by the D&D facilities. However,

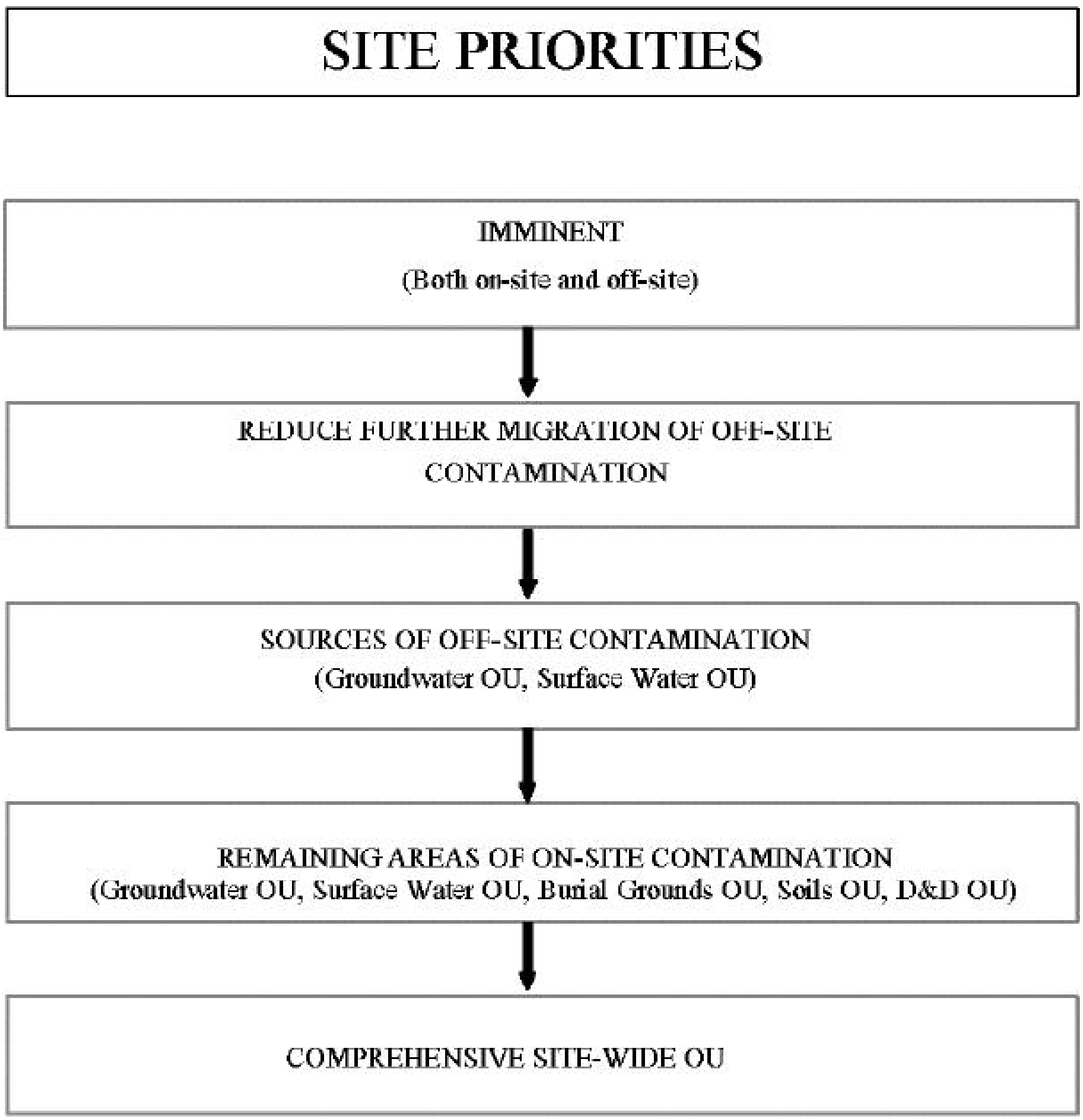

Figure 3.1 Site management plan priorities and corresponding operable units.

it should be noted that while the RI/FSs for the five OUs have been sequenced in accordance with the previous priorities, a key strategy of implementing the OU approach is early evaluation of existing data to help identify opportunities to implement early actions prior to, or in conjunction with, the RI/FSs for each OU. While a series of early actions have already been identified for several of the OUs (e.g., Scrap Metal, North-South Diversion Ditch, C-340/C-410 D&D, etc.), this revised strategy formalizes a process to further facilitate identification and implementation of early actions.

2001 Remedial Activities

The significant accomplishments for the environmental restoration program conducted in 2001 include the following:

- Continued operation of the Lasagna™ technology as the selected remedial alternative for reducing the concentration of TCE in SWMU 91.
- Continued operation of the Northwest and Northeast Plume Groundwater treatment systems.
- Prepared major regulatory documents for North-South Diversion Ditch, C-720 Groundwater, and Scrap Metal Removal, which will allow projects to proceed in 2002.
- Initiated CERCLA Waste Disposition Field Work project.
- Initiated construction of the sediment basin for Scrap Yards Removal Project in November 2001.
- Continued management of the D&D Program for the Paducah Site.

Lasagna™

In July 1998, DOE issued the *Record of Decision for Remedial Action at Solid Waste Management Unit 91 of Waste Area Group 27 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 1998). The ROD designated Lasagna™ as the selected remedial alternative for reducing the concentration of TCE in SWMU 91 to levels that would decrease the potential groundwater risk to human health and the environment at the point-of-exposure (POE).

Lasagna™ was selected as the preferred remedial alternative for the reduction of TCE in the soil at SWMU 91. The ROD states, "The primary objective of this remedial action is to reduce the level of TCE-contaminated soil, thereby reducing the potential future concentrations in groundwater that could pose a threat to human health and the environment at the POE (i.e., the DOE property boundary)." The Lasagna™ system will be operated for two years in an attempt to reduce the concentration of TCE in SWMU 91 soil from an average of 84 milligrams/kilogram (mg/kg) to an average of less than 5.6 mg/kg. Preliminary sampling results indicate that the cleanup objective will have been met within the two years of operation.

Lasagna™ uses an applied direct current electric field to drive TCE-contaminated groundwater through treatment zones installed in the contaminated soil. This induced groundwater flow is called electro-osmosis. The groundwater flow induced by the direct current travels from the anode electrodes to the cathode electrode. Groundwater containing TCE is driven away from anode electrodes toward the cathode electrode and passes through a series of iron particle treatment zones installed between them. The TCE is broken down into nonhazardous compounds as it comes in contact with the iron particles in the treatment zones. Figure 3.2 shows a cross section of the treatment process. Additional information about the Lasagna™ technology and its development can be found in the *Final Soil Characterization Work Plan for the Paducah Gaseous Diffusion Plant Lasagna Pilot Test in the Cylinder Drop Test Area* (MMES 1994) and the *DNAPL Site Characterization And Lasagna™ Technology Demonstration at Solid Waste Management Unit 91 of the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (LMES 1996).

Installation of the Lasagna™ technology was completed in September 1999. The system was in operation during 2000 and 2001. During 2001, the second progress sampling event was conducted as scheduled in accordance with project plans. The report from this event was submitted to regulatory agencies in early 2002 with sampling verification planned during 2002 as well.

Northwest Plume Groundwater System

The IRA of the Northwest Plume Groundwater System is documented in a ROD signed by DOE and EPA in July 1993. KDEP also concurred with the ROD. The IRA began operation on August 28, 1995. The IRA consists of two extraction well fields with two wells each, transfer pipelines, a treatment system, and appurtenant equipment. The interim action is designed to contain the migration of the high-concentration zone of the groundwater contaminant plume. Plume contaminants are TCE and ^{99}Tc.

TCE is removed by an air stripping process. The TCE is volatilized by a large volume of air that comes into contact with the contaminated groundwater during the treatment process. Activated carbon filtration beds are then used to remove the TCE, which is entrained in the air stream, before the air is released to the atmosphere. ^{99}Tc is removed by an ion-exchange process.

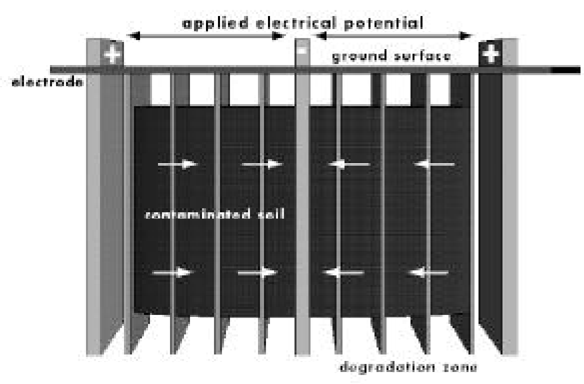

Figure 3.2 Lasagna™ Treatment System Cross Section.

The treatment system has extracted and treated approximately 650 million gallons of contaminated groundwater from start up through the end of 2001. The treatment system has been on-line approximately 98% of the time since startup, exceeding the goal of 85%. The IRA has consistently met the treatment goals documented in the ROD of 5 ppb TCE and 900 pCi/L of ^{99}Tc. The groundwater, after treatment, is released through a KPDES permitted outfall 001. Radiological emissions from this facility are discussed in Section 4.

Northeast Plume Containment System

The IRA of the Northeast Plume was documented in a ROD signed by DOE and the EPA in June 1995. The KDEP accepted the ROD with the issuance of Hazardous Waste Permit Modification 8 dated June 26, 1995. The IRA system consists of an extraction well field, equalization tank, transfer pump, transfer piping and required instrumentation, electrical power and appurtenances, and use of the existing C-637-2A Cooling Tower at the PGDP for stripping of TCE. Characterization and construction activities were completed during December 1996. System startup and operational testing were conducted in February 1997 with the system fully operational by February 28, 1997.

System operation includes pumping groundwater contaminated with TCE from two extraction wells to an equalization tank. A transfer pump is used to pump the contaminated water from the equalization tank through a transfer line (greater than 6,000 linear feet) to the top of the C-637-2A Cooling Tower. The cooling tower acts as an air stripper and removes the TCE from the groundwater.

Through the end of 2001, approximately 360 million gallons of contaminated groundwater have been extracted. The system has been operational approximately 95% of the time since startup with the exception of July through September 1999 when the facility was taken off-line due to cooling tower maintenance.

Regulatory Document Preparation

During 2001, regulatory documents were prepared for several projects to allow implementation of cleanup. A summary of these documents is listed below. Approval of these decision documents will allow field work to be initiated in CY 2002.

- The Proposed Plan and ROD was prepared for the North-South Diversion Ditch. The project will clean-up a two-mile long contaminated ditch at PGDP (See Figure 3.3).
- The Proposed Plan and ROD was prepared for the Groundwater OU C-720 area.
- The Engineering Evaluation/Cost Analysis (EE/CA) and the Action Memorandum was prepared for the Scrap Metal Removal Project.
- The EE/CA was prepared for the Site-Wide Sediment Controls Project.

Figure 3.3 North-South Diversion Ditch.

CERCLA Waste Disposition

A field investigation was conducted to evaluate seismic conditions the Paducah Site for the siting of a potential on-site CERCLA waste disposal facility. DOE worked with KDWM to plan the investigation, which began in late August 2001. The investigation consisted of four parts: 1) a Paleoliquefaction Study 2) a Site-Specific Fault Study 3) a Regional Fault Study; and 4) a Site-Specific Geotechnical Study. The Paleoliquefaction Study included visual surveys of several regional streams and the Ohio River to identify possible paleoliquefaction features in the area surrounding the Paducah Site. The Site-Specific Fault Study included a seismic reflection survey (P-wave), a horizontal shear (S) wave survey, direct push technology (DPT) sampling, and Carbon-14 dating of organic samples. The Regional Fault Study included similar activities at an off-site location in southern Illinois plus a detailed study of exposed faults in a large creek system. The Site-Specific Geotechnical Study included several seismic cone penetrometer tests (SCPTs) and shallow boreholes covering the potential disposal site, two deep boreholes that were drilled to bedrock (approximately 400 ft deep), and analyses of samples for geotechnical properties. Nationally-recognized experts were consulted on this important project. The results will be presented to the EPA and KDWM in mid-2002.

Scrap Metal Removal

The Paducah Site has approximately 53,000 tons of scrap metal in ten scrap yards located on the northwestern portion of the fenced area of the plant, most of which are located adjacent to each other. An *Engineering Evaluation/Cost Analysis for Scrap Metal Disposition at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/OR/07-1880&D2/R1) was completed and approved by EPA and the Commonwealth of Kentucky in March 2001, which analyzed alternatives for handling the scrap. A public comment period followed, and the alternative known as “Scrap Removal and Disposition with Nickel Ingot Storage and Enhanced Sediment Control Measures” was selected. All documents leading to this selection including those addressing public comments can be found at the DOE Environmental Information Center (EIC). The proposed activities, which will be included in the removal action, are:

- Construct staging areas to provide the scrap metal disposition with water,

- septic systems, electricity and communications;
- Control surface water and sediment runoff by constructing a storm water collection basin;
- Remove all of the scrap materials down to the level of surface soil;
- Characterize, process, and package scrap materials to meet RCRA, TSCA, appropriate disposal facility waste acceptance criteria, and U.S. Department of Transportation shipping requirements; and
- Transport and dispose of the materials removed.

The work will be completed in a phased approach. Construction of the storm water collection basin is the first phase of the work and began in November 2001 (Figure 3.4). Scrap metal removal will begin once the infrastructure is in place to support the disposition project. Actual handling of the scrap metal is expected to begin in the summer of 2002 and be completed in the spring of 2006.

Figure 3.4 Sediment basin construction for Scrap Yard controls.

Waste Operations Program

The Paducah Site Waste Operations Program directs the safe treatment, storage, and disposal of waste generated before July 1, 1993 (i.e., legacy wastes), and waste from current DOE activities. The primary objective of the program is to ensure that waste materials do not migrate into the environment. Waste managed under the program is divided into the following seven categories:

- *Low-level radioactive waste* - radioactive waste not classified as high-level or transuranic and does not contain any components regulated by RCRA or TSCA.
- *Hazardous waste* - waste that contains one or more of the wastes listed under RCRA or that exhibits one or more of the four RCRA hazardous characteristics: ignitability, corrosivity, reactivity, and toxicity.
- *Mixed waste* - waste containing both hazardous and radioactive components. Mixed waste is subject to RCRA, which governs the hazardous components, and is subject to additional regulations that govern the radioactive components.
- *Transuranic waste* - waste that contains more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years.
- *PCB and PCB-contaminated waste* - waste containing or contaminated with PCBs, a class of synthetic organic chemicals including 209 known isomers, each with 1 to 10 chlorine atoms on a biphenyl ring. Under TSCA regulations, PCB manufacturing was prohibited after 1978. However, continued use of PCBs is allowed provided that the use does not pose a risk to human health or the environment. Disposal of all PCB materials is regulated.

- *Asbestos waste* - asbestos-containing materials from renovation and demolition activities.
- *Solid* - waste that is neither radioactive nor hazardous. Solid sanitary/industrial waste is basically refuse or industrial/ construction debris and is disposed in landfills.
- *PCB/Radioactive Waste* - PCB waste or PCB items mixed with radioactive materials and managed as radioactive waste. PCB/radioactive/RCRA shall mean PCB/radioactive waste that may also be hazardous waste under RCRA.

Requirements for meeting waste management regulatory objectives are varied and complex because of the variety of waste streams generated by DOE activities. The goal, however, is to comply with all current regulations while planning actions to comply with anticipated future regulations.

Compliance for waste management activities involves meeting EPA and state regulations and DOE orders. In addition to compliance with these regulations, supplemental policies are enacted for management of radioactive, hazardous, PCB, PCB/ radioactive, and mixed wastes. These policies include reducing the amount of wastes generated; characterizing and certifying waste before it is stored, processed, treated, or disposed; and pursuing volume reduction and use of on-site storage, when safe and cost effective, until a final disposal option is identified. Table 3.1 summarizes the waste shipments during 2001.

Pollution Prevention / Waste Minimization

The Pollution Prevention/Waste Minimization (PP/WM) Program at the Paducah Site provides guidance and objectives for minimizing waste generation. Guidance for the program comes from regulations promulgated under RCRA and the Pollution Prevention Act, as well as applicable state and EPA rules, DOE Orders, and Executive Orders.

The program is striving to meet its goals with the following strategies:

- source reduction,
- segregation,
- reuse of materials,
- recycling, and
- procurement of recycled-content products.

The PP/WM Program has the following objectives:

- identify waste reduction opportunities,
- establish site-specific goals,
- establish employee awareness of PP/WM principles,
- integrate PP/WM technologies into ongoing projects,
- coordinate recycling programs,

Table 3.1 Waste shipments during 2001

- Shipped 1320 cubic feet of contaminated soil to the Nevada Test Site.
- Shipped 128 cubic feet of treated uranium chips and empty drums to Envirocare of Utah for disposal
- Shipped 783 cubic feet of PCB Capacitors to Clean Harbors for disposal
- Shipped 7.4 cubic feet of mixed low level waste to Waste Control Specialist for treatment

- identify PP/WM responsibilities and resource requirements, and
- track and report results.

Recycling efforts in 2001 included 4.82 metric tons (mt) (10,600 pounds) of office paper, 0.11 mt (240 pounds) of aluminum cans, 0.07 mt (150 pounds) of telephone books, dozens of printer and fax toner cartridges, carbon used in the Northwest Plume Groundwater Treatment Facility, and reuse of gravel generated from reconstruction of cylinder storage yards. Additional accomplishments of the PP/WM Program included incorporating micropurging techniques into groundwater sampling resulting in wastewater reductions; transferring unused chemicals and materials to other programs for re-use; and obtaining surplus equipment from the Weldon Springs Site for reuse at the Paducah Site.

Depleted Uranium Hexafluoride Cylinder Program

DUF_6 is a product of the uranium enrichment process. A solid at ambient temperatures, DUF_6 is stored in large metal cylinders. At the end of 2001, the Paducah Site managed an inventory of 37,895 cylinders containing approximately 448,000 metric tons of UF_6 (most containing DUF_6) stored in outdoor facilities commonly referred to as cylinder storage yards. Additional cylinders are added to the DOE inventory annually as a result of formal agreements with the United States Enrichment Corporation.

The mission of the DUF_6 Cylinder Program is to safely store the DOE-owned DUF_6 inventory until its ultimate disposition. DOE has an active cylinder management program that includes cylinder and cylinder yard maintenance, routine inspections, improve cylinder yard construction, and other programmatic activities such as cylinder corrosion studies. The Program maintains a cylinder inventory database, which serves as a systematic repository for all cylinder inspection data.

The DUF_6 is stored as a crystalline solid at less than atmospheric pressure. When DUF_6 is exposed to the atmosphere, hydrogen fluoride and uranium reaction products form. The uranium by-products form a hard crystalline solid, which acts as a self-sealant within the storage cylinder. The hazard potential of DUF_6 is primarily chemical toxicity from any released hydrogen fluoride, rather than a radiological hazard.

After visiting the Paducah, Portsmouth, and K-25 (currently identified as East Tennessee Technology Park) sites in 1994 and 1995, the Defense Nuclear Facilities Safety Board (DNFSB) issued Recommendation 95-1 and a supporting technical report. That report addressed the improved safety of cylinders containing DUF_6. Recommendation 95-1 on DUF_6 stated the following:

- Start an early program to renew the protective coating of cylinders containing DUF_6 from the historical production of enriched uranium.
- Explore the possibility of additional measures to protect these cylinders from the damaging effects of exposure to the elements, as well as any additional handling that may occur.
- Institute a study to determine whether a more suitable chemical form should be selected for long-term storage of the depleted uranium.

On June 29, 1995, DOE formally accepted Recommendation 95-1 and emphasized the following five focus areas for DOE response:

- Removing cylinders from ground contact and keeping cylinders from further ground contact;
- Relocating all cylinders into an adequate inspection configuration (this effort continued as new storage yards were constructed or as existing yards were refurbished);

- Repainting cylinders as needed due to excessive corrosion (cylinder painting was suspended in 1999);
- Updating handling and inspection procedures and site-specific safety analysis reports; and
- Completing an ongoing study that includes an analysis of alternative chemical forms for the material (on April 15, 1999, DOE issued the *Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride*).

DNFSB Recommendation 95-1 was closed in December, 1999.

DOE is upgrading the quality of the cylinder yards to maintain the integrity of the cylinders. Fewer cylinders are stored in the refurbished yards resulting in easier access for inspections to detect corrosion or leaks. To accommodate the resulting space needs, DOE initiated construction of a new 470,000 ft^2 cylinder yard (C-745-T), which was completed during the spring of 1998. The C-745-L (south) cylinder yard was reconstructed in 2000 and covers 108,000 square feet. The design for refurbishment of more existing storage yards is complete and the reconstruction is planned for fiscal year 2002-2004 pending funding. Figure 3.5 shows the cylinder storage yards.

In May 1997, the DOE communicated to the DNFSB that two cylinder populations needed to be painted to remain compliant with National Board Inspection Code (NBIC) “in service” pressure vessel standards. At Paducah, a population of approximately 3870 cylinders (former C-746-G yard bottom-row cylinders) were identified as requiring painting by 2010. Because it was not logical to separate the cylinders on the bottom row from the top row, it was determined that a total of approximately 7800 cylinders at Paducah would be painted. During fiscal years 1996, 1997, and 1998, a total of 3368 cylinders were painted. Cylinder painting activities at Paducah were terminated after 1998 in light of DOE’s near-term plans to begin conversion of the depleted UF_6 in 2005. If conversion begins in 2005, the remaining worst case cylinders can be converted by 2010. If conversion does not become operational in 2005, alternative mitigating actions, such as restarting cylinder painting operations, will need to be implemented.

In December 1998, toxicity test results at KPDES Outfall 017 exceeded the KPDES limit for toxicity (see Section 2). Subsequent tests confirmed the toxicity exceedance; a TRE Plan was established. Zinc from cylinder painting operations was suspected as the primary cause of the toxicity. Additional sampling and monitoring at Outfall 017 is scheduled to continue through at least May 2002. Any future cylinder painting operations at Paducah will consider the use of non-zinc based paints.

Figure 3.5 DUF$_6$ cylinder storage yard.

Decontamination and Decommissioning/DOE Material Storage Areas

D&D is conducted for facilities and other structures contaminated with radiological and hazardous material. Facilities are accepted for D&D when they are no longer required to fulfill a site mission. Legacy contamination on the structure, floors, walls, and equipment constitutes a potential for release to the environment if not appropriately managed in the near term and ultimately removed. Two major facilities comprising approximately 46,450 m^2 (500,000 ft^2) have been accepted for D&D. These facilities are the C-340 Metal Reduction Plant complex, where UF_6 was converted to uranium metal and hydrogen fluoride, and the C-410 Feed Plant complex, where uranium trioxide (UO_3) was converted to UF_6. Contaminants at these facilities include depleted uranium, natural uranium and transuranic radionuclides, UF_4, PCBs, asbestos, and lead paint.

Development of CERCLA documentation for a non-time critical removal action for removal and disposal of piping, process equipment, and stored materials from the C-410 complex (Figure 3.6) was initiated in 2001. An EE/CA) was developed, approved by the regulatory agencies, and made available for public comment. Also development of the Action Memorandum and Removal Action Work Plan began and will be finalized in 2002. Preparations for implementing the removal action, including initiation of utility isolation, lighting improvements, relocation of stored materials, and radiological and chemical characterization of the building were performed, as well as routine surveillance and maintenance activities. Activities performed during the year at the C-340 complex were limited to surveillance and maintenance of the structures to ensure containment of residual materials.

Figure 3.6 C-410 building.

The DMSA project is managing 160 DMSAs located throughout the Paducah Site. These areas store DOE materials throughout the site within buildings and also in outside designated areas. The project is undergoing a characterization process to comply with Nuclear Criticality Safety (NCS), RCRA, TSCA, and solid waste concerns. During this process, the material is segregated in several categories to ensure appropriate waste management. It is anticipated that most of the material in the DMSAs will be considered low-level waste after characterization is complete. Most of the low-level waste will remain in-place until D&D of each area. Figure 3.7 shows a DMSA. See Section 2 page 4 for more information on NOVs at DMSAs.

Figure 3.7 DOE Material Storage Area.

Public Awareness Program

A comprehensive community relations and public participation program on DOE activities exists at the Paducah Site. The purpose of the program is to provide the public with opportunities to become involved in decisions affecting environmental issues at the site. The program uses proactive public involvement to foster a spirit of openness and credibility among local citizens and various segments of the public.

Community/Educational Outreach

DOE and BJC Public Affairs supported several educational and community outreach activities during 2001. The DOE Site Manager spoke with civic groups, business leaders, and residents at pre-arranged events. In addition, DOE relocated its EIC from Kevil, Kentucky, to a more convenient, accessible location in Paducah, near Interstate 24 and Paducah Community College.

Site Specific Advisory Board

The PGDP Citizens Advisory Board (CAB), a Site Specific Advisory Board chartered by DOE under the Federal Advisory Committees Act, completed its fifth full year of operation in September 2001. During the year, the CAB held 11 regular meetings, one retreat, and an average of three subcommittee meetings each year. All meetings are open to the public and publicly advertised. The CAB advised and made recommendations to DOE on three projects. In 2001, the CAB had 18 voting members, five *ex-officio* members, a Deputy Designated Federal Official, and a Federal Coordinator. The Paducah CAB consists of individuals with diverse backgrounds and interests. It meets monthly to focus on early citizen participation in environmental cleanup priorities and related issues at the DOE facility. The Paducah CAB participates only in activities that are governed by DOE.

Environmental Information Center

The public has access to Administrative Records and programmatic documents at the DOE EIC in the Barkley Centre, 115 Memorial Drive, Paducah, Kentucky. The EIC (Figure 3.8) is open Monday through Friday from 9 a.m. to 5 p.m. and by appointment. The phone number is (270) 554-6979.

Documents for public comment are also placed in the McCracken County Public Library (formerly the Paducah Public Library), 555 Washington Street, Paducah, Kentucky. The library is open Monday through Thursday from 9 a.m. to 9 p.m., Friday and Saturday from 9 a.m. to 6 p.m., and Sunday from 1 to 6 p.m.

The EIC, and other public web pages related to DOE work at the Paducah Site, can be accessed at www.bechteljacobs.com/p_eic/p_eic.htm.

Figure 3.8 Environmental Information Center.

4 Radiological Effluent Monitoring

Abstract

Environmental Monitoring at the Paducah Site, as required by DOE Order 5400.1, consists of two components: 1) effluent monitoring and 2) environmental surveillance monitoring. Effluent monitoring is initiated to demonstrate compliance with one or more federal or state regulations. Radiological liquid effluent monitoring was performed at the four outfalls under the jurisdiction of DOE at the Paducah Site during 2001. Three of the four outfalls retained by DOE contain only rainfall runoff. A fourth outfall is a continuous flow outfall. The outfalls were monitored for radionuclides historically present at the site. Surface water runoff from landfills at the Paducah Site was also monitored. Concentrations of the radionuclides measured (uranium and ^{99}Tc) for DOE outfalls were within acceptable limits set by DOE and by state and federal standards. The DOE-operated point sources for radionuclides in airborne effluents during 2001 were the Northwest Plume Groundwater System and the Wildlife Area Rubble Pile Removal Project.

Introduction

Effluents are monitored for radionuclides known to be emitted or to have been present at the site. Monitoring of radioactivity in liquid and airborne effluents is described fully in the *Paducah Site Environmental Monitoring Plan* (BJC 2000). Dose calculations are provided in Section 6.

Airborne Effluents

Effluent monitoring is to be conducted to meet the requirements of DOE Order 5400.1, *General Environmental Protection Program*, at all DOE sites. DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, sets annual dose standards for members of the public at 10 millirems (mrem) per year from airborne releases and at 100 mrem/year through all exposure pathways resulting from routine DOE operations.

Radiological airborne releases are also regulated by EPA and KDAQ under 40 CFR 61, Subpart H, which covers radionuclide emissions, other than radon, from DOE facilities. This regulation was amended in 1989 to include specific sampling requirements for each emission point with the potential to emit radionuclides resulting in an effective dose equivalent of 0.1 mrem to the most affected off-site resident. When determining potential emissions, it is assumed that air pollution abatement devices do not exist, but that the facility is otherwise operating normally.

Per 40 CFR 61 Subpart H, DOE must report annual radionuclide emissions, covering emissions during the previous calendar year, by June 30 of each year to EPA via a NESHAP report. The EPA-approved methodologies for sampling and calculating must be used to address emissions. DOE had two sources of airborne radionuclides in 2001. These sources were the Northwest Plume Groundwater System and the Wildlife Area Rubble Pile Removal Project.

Northwest Plume Groundwater System

The CERCLA ROD signed July 22, 1993, established the Northwest Plume Groundwater System. Although administrative requirements of environmental regulations do not apply to projects conducted under CERCLA, DOE has continued to supply all permit-related documentation to regulators. The Operations and Maintenance Plan approved by the EPA in March 1995 (and since revised), describes sampling and methodologies to be used at the Northwest Plume Groundwater System. The air emissions methodology is to sample the water stream before and after the air stripper. The change in contaminant concentration is used to calculate air emissions. The analysis of the water before and after the air stripper stack provides a much more accurate measure of airborne discharges than actual stack measurements due to the low, practically immeasurable radionuclide airborne effluents associated with the facility.

On August 28, 1995, DOE began operation of the Northwest Plume Groundwater System. The facility is located just outside of the northwest corner of the PGDP security area. The facility consists of an air stripper to remove volatile organics from water and an ion-exchange unit for the removal of ^{99}Tc. The air stripper is located upstream of the ion-exchange unit. The ^{99}Tc concentration in the influent and effluent of the air stripper and the quantity of the water passing through the air stripper were used to calculate the total quantity of ^{99}Tc emitted from the facility in 2001. This calculation is used to calculate dose as a result of these operations.

Wildlife Area Rubble Pile Removal Project

Ambient air was monitored during the crushing operations associated with the Wildlife Area Rubble Pile Removal Project. In July 2001, workers began removing rubble from seven areas around the plant. More than 80 truck-loads of debris were hauled inside the plant. Sampling, crushing and staging of the material followed. The last of the debris was crushed the last week of August. Most of the debris was concrete and came from the removal and renovation of roads and structures in the plant. Concrete rubble was sometimes used by the WKWMA as construction materials, backfill or for erosion control. During the rubble pile project, workers removed about 4,000 cubic yards of material. The crushed material will either be used for construction projects inside the plant or disposed. During the crushing small amounts of airborne radionuclides were detected. The amount of airborne radionuclides detected were all less than state and EPA standards (Appendix E, Table 2 of 40 CFR 61). Figure 4.1 shows the removal operation.

Airborne Effluent Results

In 2001, releases to the atmosphere from the Northwest Plume Groundwater System were calculated to be 0.0185 curies of ^{99}Tc. Estimates of airborne radionuclide emissions from the Wildlife

Figure 4.1 Wildlife Area Rubble Pile Removal.

Area Rubble Pile Removal Project were made based on sampling data and emission factors. The estimated emissions from the project were 0.000042 curies of various radionuclides. The actual emissions were much less as shown by the ambient air monitoring data. The ambient air data collected at the Wildlife Area Rubble Pile Removal Project showed that the amount of airborne radionuclides detected were all less than state and EPA standards (Appendix E, Table 2 of 40 CFR 61). Dose to the public from airborne radionuclides is discussed in Section 6.

Liquid Effluents

The CWA for the Paducah site is administered by KDOW through the KPDES Wastewater Discharge Permitting Program. The site-wide KPDES permit (KY0004049) became effective April 1, 1998, and expires March 31, 2003. This permit contains discharge limits based on water quality criteria for a zero-flow receiving stream.

In addition to nonradiological parameters on the KPDES permit, specific radionuclide analyses and indicator gross activity analyses are conducted on liquid effluent samples. Grab samples and composite samples at various frequencies are used to measure discharges.

The EPA safe drinking water limits for groundwater do not apply to Paducah Site surface water sampling as effluent ditches and Bayou and Little Bayou creeks are not drinking water supply sources for public or private use. However, DOE orders 5400.1 and 5400.5 establish effluent monitoring requirements to provide confidence that radiation exposure limits are not exceeded. Although no specific effluent limits for radiological parameters are included on the KPDES permit, DOE Order 5400.5 sets guidelines for allowable concentrations of radionuclides in various effluents and requires radiological monitoring to protect public health. This protection is achieved at the Paducah Site by meeting the DOE Order 5400.5 derived concentration guidelines (DCGs), which are the concentrations of given radionuclides that would result in an effective dose equivalent of 100 mrem/year. The DCGs are based on the assumption that a member of the public has continuous, direct access to the liquid effluents, which is a conservative exposure scenario not likely to exist. Since exposure is not continuous, this results in conservatively low concentration for the DCGs. Further information on DCGs is provided in Appendix B.

For monitoring purposes, the Paducah Site uses estimates of DCG levels and outfall flow characteristics (rainfall dependent) to determine sampling frequencies. Neither continuous monitoring nor continuous sampling are required by DOE Order 5400.5. Uranium and ^{99}Tc are the primary radionuclides of concern. Analyses are also routinely performed for dissolved alpha, suspended alpha, dissolved beta, suspended beta. The KPDES Permit also intermittently requires additional sampling for priority pollutants at the DOE outfalls. This sampling was conducted in 2001, which adds a larger list of analyses to the data set.

Other effluent monitoring is required by KDWM landfill permits 073-00014, 073-00015, and 073-00045. Surface runoff is to be analyzed to ensure that landfill constituents are not discharging into nearby receiving streams.

DOE Outfalls

DOE was responsible for a total of four outfalls in 2001 (Figure 4.2). Under KPDES permit number KY0004049, Outfall 001 is a continuous flow outfall that received discharges from USEC's Phosphate Reduction Facility, USEC's once-through cooling water, DOE's Northwest Plume Groundwater System, and DOE's Northeast Plume Containment System. In addition, surface water runoff from the northeast side of the plant also discharges into Outfall 001. Outfall 015 receives surface water runoff from the east central sections of the plant. Outfall 017 receives surface water runoff from the southeast section of the plant (primarily the cylinder storage yards). Outfall 019 receives surface water runoff from C-746-U (DOE's operational landfill). Data are presented in Section 1 of the *Environmental Monitoring Results Annual Site Environmental Report for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* (BJC/PAD-319 Volume II).

Landfill Surface Runoff

Surface runoff from the closed C-746-S Residential Landfill and the C-746-T Inert Landfill is monitored quarterly. Due to their close proximity, they are monitored as one landfill ("L" locations shown in Figure 4.2). Also, surface runoff is monitored from the Operating C-746-U Contained Landfill. Surface runoff from these landfills is monitored for gross alpha and gross beta. Grab samples are taken from the landfill runoff, the receiving ditch upstream of the runoff discharge point, and the receiving ditch downstream of the runoff discharge point. Sampling is performed to comply with KDWM permit requirements for landfill operations. The landfills will continue to be monitored for at least 30 years from the date of closure. Data are presented in Section 1 of the *Environmental Monitoring Results Annual Site Environmental Report for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* (BJC/PAD-319 Volume II).

Liquid Effluent Monitoring Results

Tables 4.1 and 4.2 include the yearly minimum, maximum, and average concentrations of uranium and ^{99}Tc, respectively, at each outfall monitoring location. Each radionuclide is compared with the corresponding DCG and is presented as a percentage. The average concentrations at all outfalls were small percentages of the corresponding DCG. The average concentration of uranium being discharged to Outfall 015 was 20% of the DCG. The average concentration of uranium being discharged to Outfalls 001, 017, and 019 was less than 2% of the DCG. Outfall 015 received runoff from the uranium burial ground with small quantities of surface contamination from uranium compounds. Runoff from the burial ground is suspected as responsible for the elevated uranium concentrations associated with Outfall 015. ^{99}Tc averages for 2001 for all four outfalls were well below 0.1% of the DCG.

Data for 2001 do not show a significant change in relation to DCG levels for any radionuclide compared to data for the past five years. Figures 4.3 and 4.4 show a five-year summary of average concentrations of uranium and ^{99}Tc concentrations.

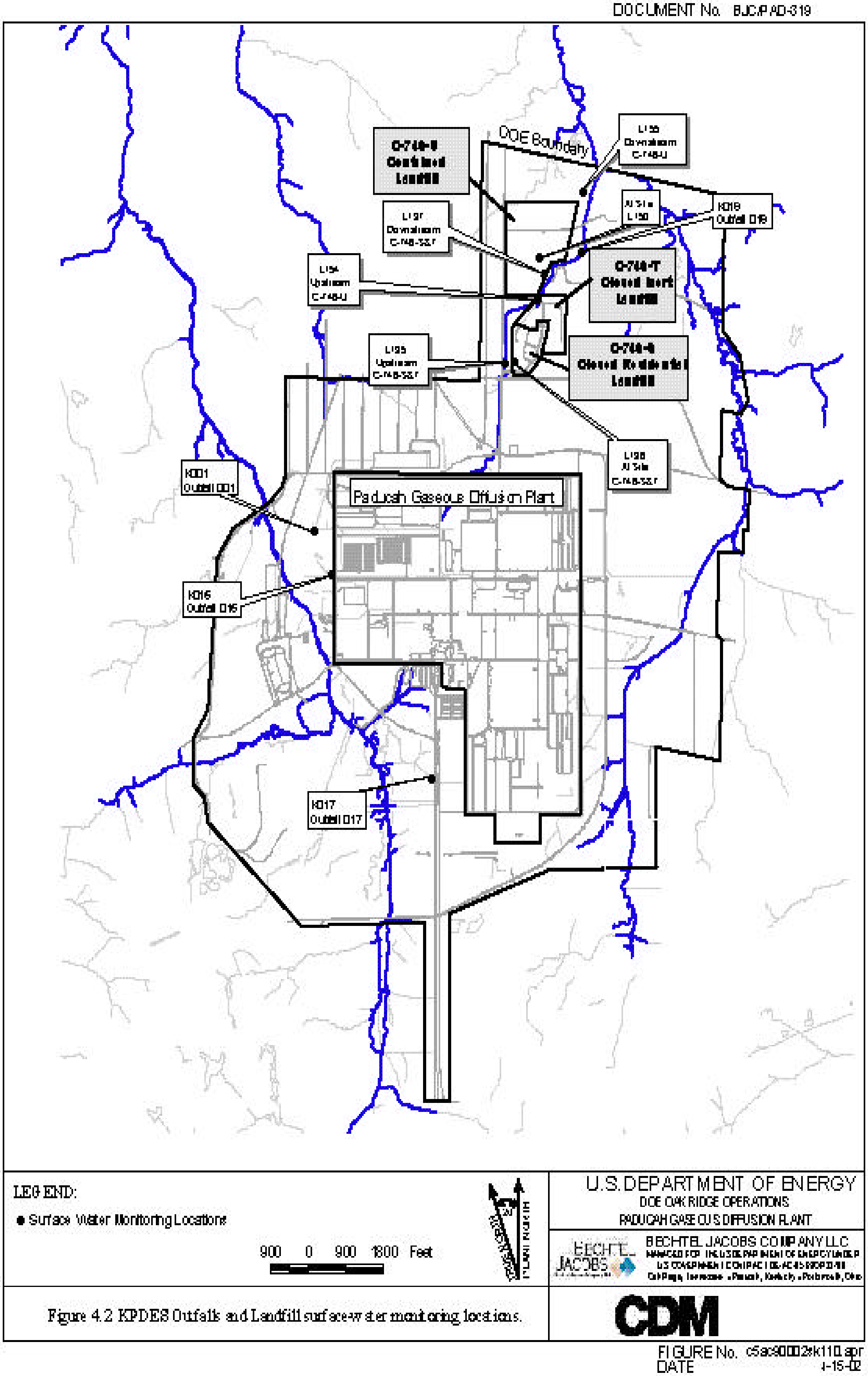

Figure 4.2 KPDES Outfalls and Landfill surface-water monitoring locations.

Table 4.1 Total uranium concentration in DOE outfalls for 2001.

Outfall	Number of Samples	Minimum (mg/L)	Maximum (mg/L)	Average (mg/L)	Average (pCi/L)	% ^{235}U	% of DCG[a]
001	5	0.002	0.046	0.02	9.5	0.4[b]	1.6
015	4	0.014	0.58	0.2	121	0.3	20
017	5	<0.001	0.006	<0.002	0.9	0.6[b]	0.15
019	3	<0.001	<0.001	<0.001	0.7	0.08[c]	0.12

[a] Derived Concentration Guide (DCG) for uranium is 600 pCi/L

[b] Insufficient uranium quantities to analyze for assay, assay based on past data

[c] Insufficient uranium quantities to analyze for assay, natural uranium used as assay

Table 4.2 Technetium-99 concentration in DOE outfalls for 2001.

Outfall	Number of Samples	Minimum (pCi/L)[a]	Maximum (pCi/L)[a]	Average (pCi/L)	% of DCG[a]
001	5	-0.33	5.3	3.7	0.0037
015	4	14.3	50	28	0.028
017	5	-12	8.8	-3.2	0
019	3	1.4	22	8.9	0.0089

[a] DCG for ^{99}Tc is 100,000 pCi/L.

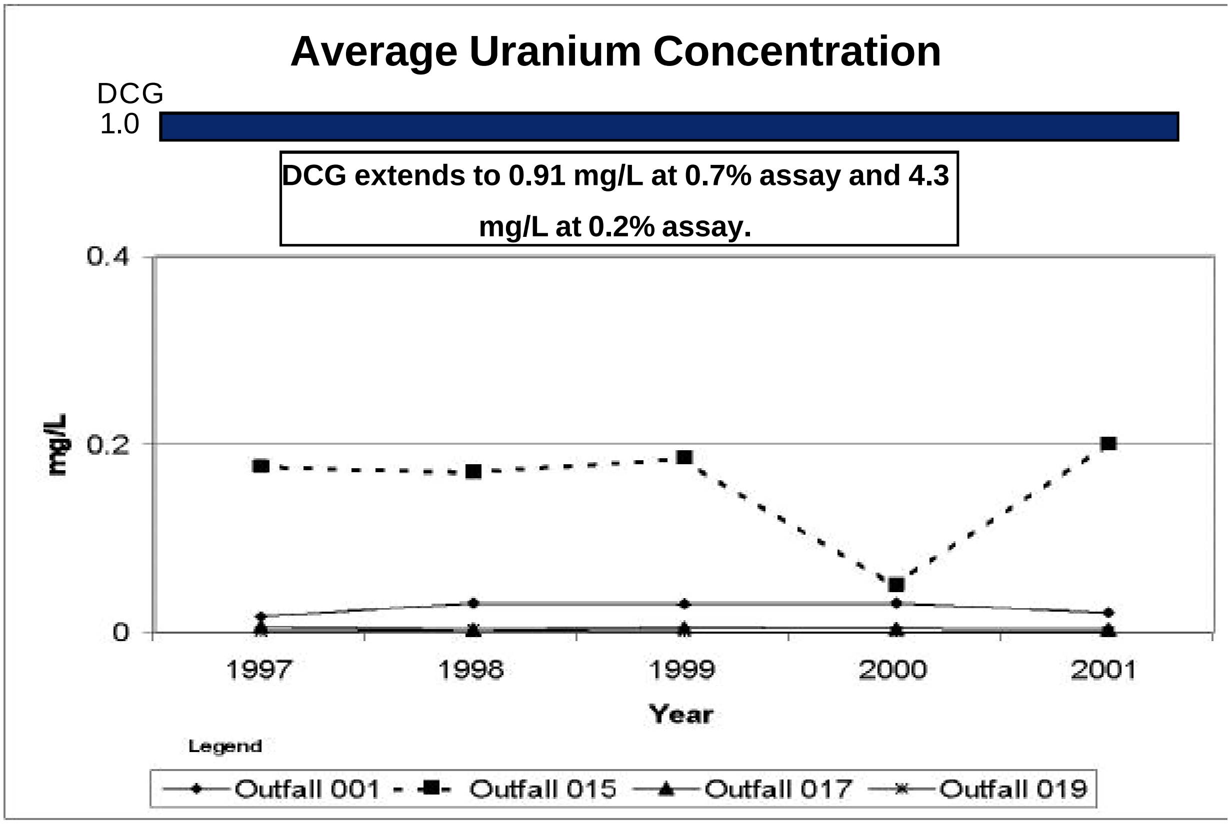

Figure 4.3 Uranium Concentrations discharged to surface water, 1997-2001.

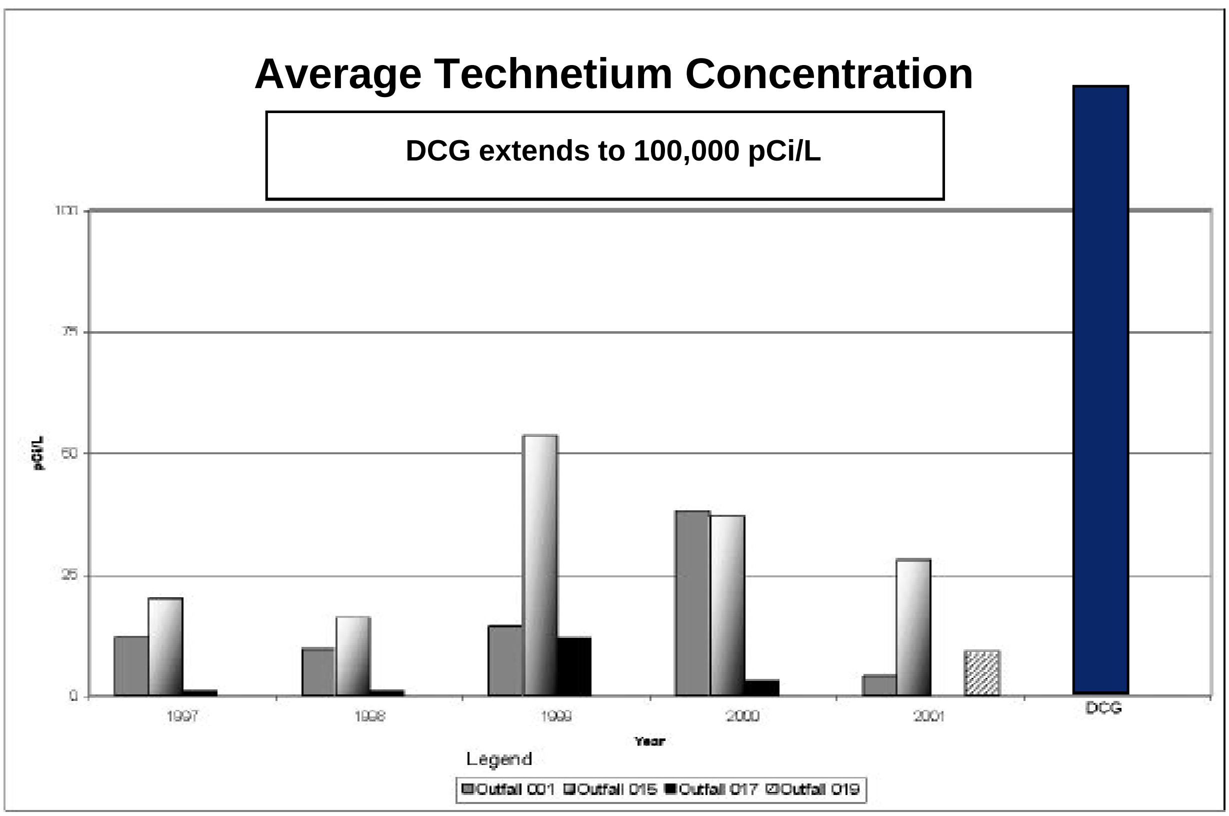

Figure 4.4 Technetium-99 concentrations discharged to surface water, 1997-2001.

5 Radiological Environmental Surveillance

Abstract

The radiological environmental surveillance program assesses the effects of DOE activities on the surrounding population and environment. Surveillance includes analyses of surface water, groundwater (Section 9), sediment, terrestrial wildlife, direct radiation, and ambient air. Surveillance results indicate that radionuclide concentrations in sampled media were within applicable DOE standards in 2001.

Introduction

The Radiological Environmental Surveillance Program at the Paducah Site is based on DOE Orders 5400.1, *General Environmental Protection Program*, and 5400.5, *Radiation Protection of the Public and the Environment*, which require that an environmental surveillance program be established at all DOE sites to monitor the radiological effects, if any, of DOE activities on the surrounding population and environment. Surveillance includes analyses of surface water, groundwater (Section 9), sediment, terrestrial wildlife, direct radiation, and ambient air.

Ambient Air

Per the 1993 DOE/USEC agreement, USEC is responsible for the existing radionuclide airborne point-source discharges at PGDP, with the exception of DOE's Northwest Plume Groundwater System. DOE monitors fugitive emission sources including building roof tops, piles of contaminated scrap metal, roads, and concrete rubble piles. A potential fugitive or diffuse source of radionuclides also results from the decontamination of machinery and equipment used in remediation activities, such as well drilling. The equipment is washed with high-power sprayers to remove any contaminants picked up from soil and groundwater. The concentrations of radionuclides on the equipment are so small that, under most circumstances, contamination cannot be distinguished from background.

DOE utilized ambient air monitoring data to verify insignificant levels of radionuclides in off-site ambient air. Ambient air data are collected at eleven sites surrounding the plant (See Figure 5.1) in order to measure radionuclides emitted from Paducah Site sources including fugitive emissions. The Radiation/Environmental Monitoring Section of the Radiation Health and Toxic Agents Branch of the Department for Public Health of the Kentucky Cabinet for Health Services (KCHS) conducted the ambient air monitoring during 2001. ^{99}Tc was analyzed but not detected in the quarterly composites. Lead-210

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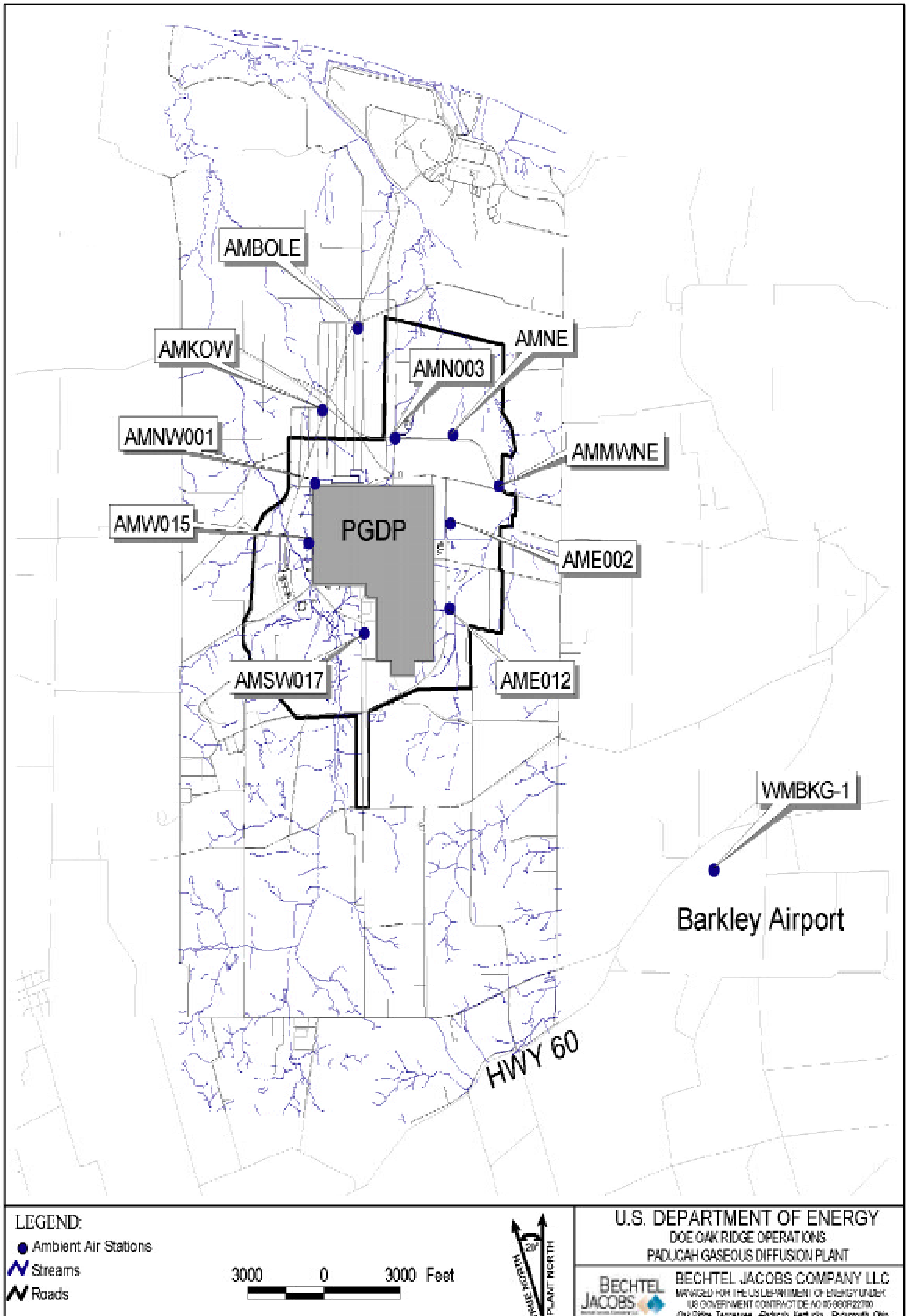

Figure 5.1 Paducah Site ambient air monitoring stations.

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(^{210}Pb) and Potassium-40 (^{40}K) were detected on sampling material, which accounts for the presence of the gross alpha and beta activities. Based on observations for CY 2001, plant derived radionuclides were not detected by the Radiation Health and Toxic Agents Branch's air monitoring network. The monitoring results for 2001 are listed in Section 2 of the *Environmental Monitoring Results Annual Site Environmental Report for Calendar Year 2001*, *Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (BJC/PAD-319 Volume II). Based on these results, airborne radionuclides emitted from the Paducah Site (including both DOE and USEC emissions) were at or below background at the ambient air monitors (KCHS 2002).

Meteorological Monitoring

DOE Order 5400.1 requires that DOE facilities collect representative meteorological data in support of environmental monitoring activities. This information is essential to characterize atmospheric transport and diffusion conditions in the vicinity of the Paducah Site.

On-site meteorological data is used as input to calculate radiation dose to the public (see Section 6). Additional meteorological data from Barkley Regional Airport are used by some groups. For example, the Environmental Restoration Program uses these data to correlate precipitation with groundwater flow.

Computer-aided atmospheric dispersion modeling uses emission and meteorological data to determine the impacts of plant operations. Modeling is used to simulate the transport of air contaminants and predict the effects of abnormal airborne emissions from a given source. In addition, a multitude of emergency scenarios can be developed to estimate the effects of unplanned releases on employees and population centers downwind of the source.

Surface Water

All Paducah Site surface water runoff is released via plant outfalls either to the west to Bayou Creek or to the east to Little Bayou Creek. Bayou and Little Bayou Creeks merge north of the site and discharge into the Ohio River. The net impact of the Paducah Site on surface waters can be evaluated by comparing data from samples collected upstream of the site with data from samples collected downstream of the site or from background waterways. Bayou and Little Bayou Creeks are considered to be waters of the Commonwealth of Kentucky and designated for all uses by the Commonwealth. However, because these creeks are not used as drinking water supplies, EPA safe drinking water standards do not apply. Radioactive effluents are managed in accordance with DOE Order 5400.5.

Figure 5.2 shows surveillance surface-water sampling locations. Table 5.1 shows the radiological analytical parameters. Radiological sampling is conducted at upstream Bayou Creek (L1), downstream Bayou Creek (L5 and L6), downstream Little Bayou Creek (L12, L11, L241, and LBCN1), the convergence of both creeks (L8), upstream Ohio River (L29), downstream Ohio River (L30), downstream in the Ohio River at the confluence with the Mississippi River (L306) which is the closest public drinking water supply source downstream of the plant, and background stream Massac Creek (L64). Locations were also collected near the plant on Bayou Creek (C612, C616, K004, K006, K008, K009, K016, and L291), Little Bayou Creek (K002, K010, K011, K012, K013, L10, L55, L56, and L194) and at the C-746-K Landfill (C746KUP, C746TB1, C746TB2). No sample point exists for upstream Little Bayou Creek, as the watershed is insufficient to develop adequate flow to monitor. Nearly all water in Little Bayou Creek is comprised of discharges from plant outfalls. Therefore, background water quality for Little Bayou Creek is based on L1 (upstream Bayou Creek). L29 and L64 are background waterways

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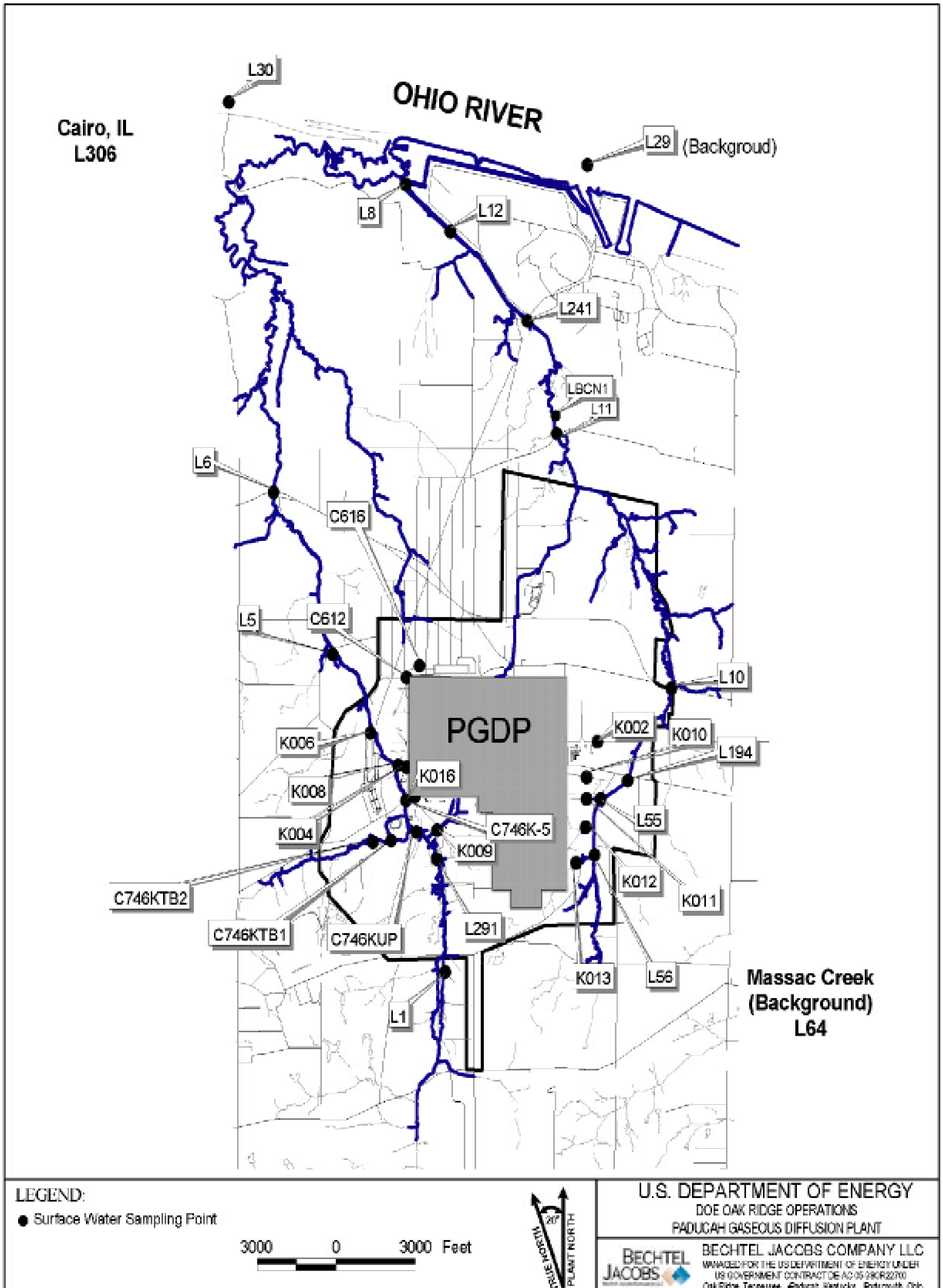

Figure 5.2 Surface-water monitoring locations.

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Table 5.1 Radiological parameters for surface-water samples.

Parameter
Americium-241
Cesium-134
Cesium-137
Cobalt-60
Dissolved Alpha
Dissolved Beta
Neptunium-237
Plutonium-238
Plutonium-239/240
Potassium-40
Suspended Alpha
Suspended Beta
Technetium-99
Thorium-228
Thorium-230
Thorium-232
Uranium
Uranium-234
Uranium-235
Uranium-238

also used for comparison with data from Little Bayou Creek.

New sampling locations added in 2001, as recommended by state agencies, are as follows: C-612, C-616, C746KTB1, C746KTB2, C746KUP, K002, K004, K006, K008, K009, K010, K011, K012, K013, and K016 (Figure 5.2).

Surface Water Surveillance Results

Table 5.2 provides the average concentrations of radionuclides upstream and downstream of plant effluents in Bayou Creek and downstream of plant effluents in Little Bayou Creek. Comparisons of downstream data with upstream data and background waterways can be made to determine the influence of plant effluents on these waterways.

The downstream Bayou and Little Bayou Creek locations show no increase in the average total uranium or uranium isotopes, although concentrations are very small both upstream and downstream. In 2000, L12, which had extremely high analytical results for uranium isotopes, had lower analytical results for uranium isotopes in 2001. Additional locations added in 2001 near PGDP on Bayou Creek and near the C-746-K Landfill on the unnamed tributary showed detectable results of uranium isotopes.

^{99}Tc concentrations were elevated in downstream creek locations with the highest concentrations found downstream in Little Bayou Creek. However, these concentrations are well below the plant release criteria of 900 pCi/L. Cesium-137 (^{137}Cs), Cobalt-60 (^{60}Co), ^{237}Np, ^{239}Pu, ^{230}Th, and Uranium-235(^{235}U), were not found in significant concentrations at any sampled location in 2001 when compared with DCGs. DCGs are provided in Appendix B.

^{241}Am, Uranium-234 (^{234}U), Uranium-238 (^{238}U), and total uranium were elevated compared to 10% DCGs near the plant site on Bayou Creek, at the C-746-K Landfill, and downstream on Little Bayou Creek. ^{241}Am was also elevated upstream on the Ohio River, at L8, and on Little Bayou Creek near the plant. All other concentrations of radionuclides in effluents at the Paducah Site were far below DCGs and do not pose a health risk.

L135, L136, L137, L150, L154, L155, are surface water runoff sampling locations from the C-746-S, T, and U landfills (See Section 4, Figure 4.2). Additional surface water data are presented in Tables 2.2 through 2.34 of Section 2 of the *Environmental Monitoring Results Annual Site Environmental Report for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (BJC/PAD-319 Volume II).

Table 5.2 Average radiological parameter concentrations for surface-water surveillance samples.

Parameter	Upstream Bayou[1]	Bayou Near Site[2]	Downstream Bayou[3]	Little Bayou Near Site[4]	Downstream Little Bayou[5]	Creek Convergence[6]	C-746-K Landfill Area[7]	Upstream Ohio River[8]	Downstream Ohio River[9]	Massac Creek[10]	Cairo[11]
^{241}Am (pCi/L)	-5.6	**13**	0.72	**8.5**	**8.9**	**8.2**	-3.0	**6.1**	-3.0	-20	-2.6
^{134}Cs (pCi/L)	-8.2	-0.19	1.5	5.8	-2.5	-3.5	0.17	-6.2	-3.1	-4.4	-6.0
^{137}Cs (pCi/L)	0.023	3.2	2.0	3.9	9.7	2.3	9.5	0.36	1.6	-0.24	6.3
^{60}Co (pCi/L)	-1.3	0.6	0.33	2.1	4.4	-0.24	1.4	-0.60	-2.3	-2.5	-3.3
Dissolved Alpha	-0.21	8.5	1.6	20	3.4	3.0	0.82	-1.6	-0.97	-3.1	-0.77
Dissolved Beta	4.7	44	9.1	16	15	16	10	2.9	3.7	1.4	2.0
Suspended Alpha	-1.4	1.1	-0.38	1.9	-0.44	17	2.3	-1.7	0.27	0.21	-1.2
Suspended Beta	0.32	11	1.4	5.6	4.4	49	2.1	-1.0	0.95	-1.9	1.3
^{237}Np (pCi/L)	0.037	0.40	1.7	0.64	0.48	0.18	0.15	-0.11	0.080	0.29	-0.16
^{239}Pu (pCi/L)	-0.0011	3.1	6.2	3.3	-0.0069	-0.040	0.023	-0.020	-0.030	-0.060	-0.020
^{238}Pu (pCi/L)	-0.0049	0.018	-0.010	0.017	0.038	-0.010	-0.0050	-0.010	-0.010	0.017	-0.010
^{40}K (pCi/L)	-79	710	1.4	160	41	160	240	-130	-1.1	-2.0	-57
^{99}Tc (pCi/L)	-1.7	4.2	9.6	7.2	28	12	3.0	-3.2	-2.1	3.4	5.0
^{228}Th (pCi/L)	0.010	0.055	-0.02	0.027	0.063	0.060	0.056	0.020	0.0040	0.00019	0.003
^{230}Th (pCi/L)	-0.010	0.0578	0.0010	0.069	0.14	0.033	0.056	-0.030	-0.030	-0.031	-0.010
^{232}Th (pCi/L)	0.029	1.17	8.4	7.5	0.061	0.087	0.026	-0.020	-0.010	0.016	-0.010
Uranium (mg/L)	0.001	0.014	0.0068	0.012	0.0056	a	ND	ND	0.001	0.09	ND
Uranium (pCi/L)	26	**630**	a	a	**1200**	a	**1820**	a	a	a	a
^{234}U (pCi/L)	8.7	**330**	a	a	**690**	a	**560**	a	a	a	a
^{235}U (pCi/L)	4.3	28	0	4.2	7.9	-2.8	7.9	0	0	-1.6	-1.2
^{238}U (pCi/L)	0	**270**	a	a	**230**	a	**920**	a	a	a	a

a = Quantities of total uranium were found to be quite small or not detected; individual isotopes of uranium were not analyzed.
ND = Not Detected
[Bold] = Exceeds DCGs
1 = L1
2 = C612, C616, K004, K006, K008, K009, K016, and L291
3 = L5, L6
4 = K002, K010, K011, K012, K013, L10, L55, L56, L194
5 = L11, L12, L241, LBCN1
6 = L8
7 = C746KUP, C746KTB1, C746KTB2
8 = L29
9 = L30
10 = L64
11 = L306

Sediment

Sediment is an important constituent of the aquatic environment. If a pollutant is a suspended solid or attached to suspended sediment, it can either settle to the bottom (thus creating the need for sediment sampling), be taken up by certain organisms, or become attached to plant surfaces. Pollutants transported by water -can adsorb on suspended organic and inorganic solids or be assimilated by plants and animals. Suspended solids, dead biota, and excreta settle to the bottom and become part of the organic substrata that support the bottom-dwelling community of organisms. Sediments play a significant role in aquatic ecology by serving as a repository for radioactive or chemical substances that pass via bottom-feeding biota to the higher trophic levels.

Sediment Surveillance Program

As a result of DOE's retaining responsibility for historic environmental issues and problems, ditch sediments are sampled semiannually through a radiological environmental surveillance program. Table 5.3 shows the radiological analytical parameters. Sediment samples were taken from 20 locations (Figure 5.3).

New locations added in 2001, as recommended by state agencies, were C612, C616, C746KTB2, C746KUP, K001, K006, K010, K012, and LBCN1 (Figure 5.3).

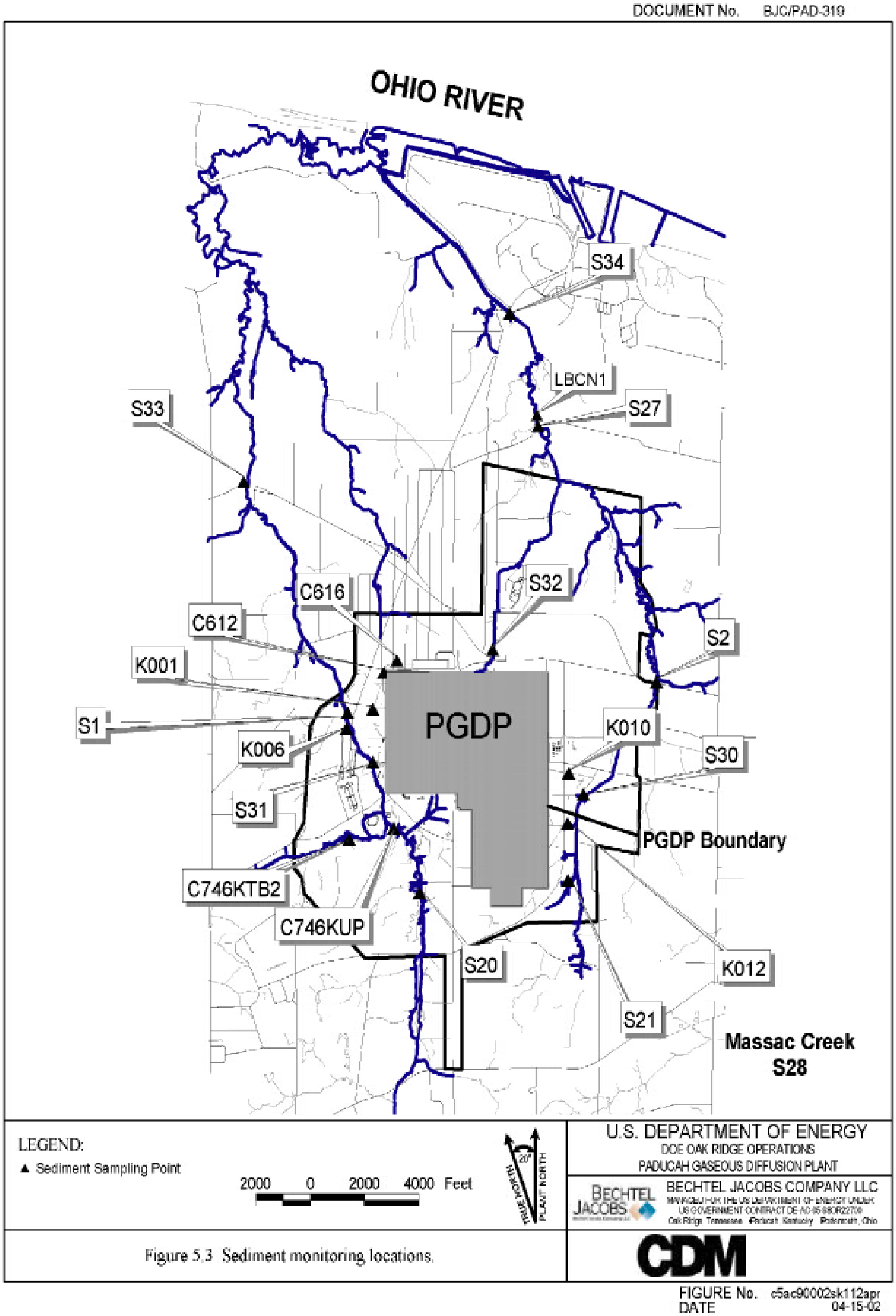

Figure 5.3 Sediment monitoring locations.

Table 5.3 Radiological parameters for sediment samples.

Parameter
Alpha activity
Americium-241
Beta activity
Cesium-137
Cobalt-60
Neptunium-237
Potassium-40
Pu-239/240
Technetium-99
Thorium-230
Uranium
Uranium-234
Uranium-235
Uranium-238

Sediment Surveillance Results

Table 5.4 shows the upstream concentrations of radionuclides in the sediments compared with concentrations downstream of all DOE outfalls for 2001. Locations S27, S33, S34, and LBCN1 are downstream of plant effluents. Locations S20, S21, and S28 are considered reference, or background sites, and can be compared with downstream data. S20 and S21, located at Bayou and Little Bayou creeks, respectively, are upstream of plant discharges, whereas S28 is located in a similar, off-site stream (Massac Creek) providing a regional reference site. S30, S1, S2, S31, S32, K006, K001, C616, C612, K010, and K012 (Figure 5.3) are below certain discharges of the plant, but not below all discharges. The uranium concentration increase near plant site is attributed to historical plant operations. Concentrations downstream both Bayou and Little Bayou Creeks show levels that are similar to upstream concentrations. C746KUP and C746KTB2 are areas on the unnamed tributary near the C-746-K Landfill.

Upstream sampling near the C-746-K and Massac Creek showed uranium isotopes were not analyzed because not enough total uranium was found present to warrant analysis of individual isotopes. Therefore, the Bayou and Little Bayou Creek near the plant site and downstream concentrations are higher than the background and upstream concentrations for all uranium isotopes. Figure 5.4 shows no significant change in uranium concentrations in sediment over the past five years. New locations, in 2001, have been added to Figure 5.4. No bars are present for the new locations for years 1997-2000. New locations sampled near plant site on both Bayou and Little Bayou Creeks indicate higher amounts of uranium. The new locations on Bayou near the plant site show an elevated level of ^{99}Tc, similar to amounts seen downstream Little Bayou Creek.

Table 5.4 Average[b] radiological parameter concentrations for sediment surveillance samples.

Parameter	Upstream Bayou[1]	Bayou Near Site[2]	Downstream Bayou[3]	Upstream Little Bayou[4]	Little Bayou Near Site[5]	Downstream Little Bayou[6]	C-746-K Area[7]	NS Ditch[8]	Massac Creek[9]
^{241}Am (pCi/g)	0.00067	0.14	0.028	0.024	0.050	0.041	0.0080	0.52	0.0054
^{137}Cs (pCi/g)	0.0080	0.11	0.044	0.018	0.074	0.017	0.017	0.80	0.024
^{60}Co (pCi/g)	-0.0013	0.0022	-0.0012	0.00060	.0010	0.0012	0.0029	0.0033	0.00080
Alpha Activity (pCi/g)	1.9	31	3.9	3.1	35	9.02	2.3	100	2.5
Beta Activity (pCi/g)	1.2	120	4.5	2.5	41	23	2.1	86	1.8
^{237}Np (pCi/g)	-0.0020	0.21	0.011	0.0024	0.10	0.046	0.0025	0.701	-0.0072
^{40}K (pCi/g)	2.5	5.4	3.35	4.5	5.5	2.7	2.5	6.07	3.5
^{239}Pu (pCi/g)	-0.0011	0.28	0.014	0.00061	0.066	0.16	0.0043	2.8	0.0012
^{99}Tc (pCi/g)	0	17	0.30	0.065	0.20	9.9	0.073	17	0
^{230}Th (pCi/g)	0.15	2.4	0.30	0.34	0.38	2.6	0.23	74	0.14
Uranium (ug/g)	ND	<42	<3.2	<.1	<18	<.91	ND	<7.4	ND
^{234}U (pCi/g)	0.018	2.8	0.097	0.023	0.32	0.067	a	1.6	a
^{235}U (pCi/g)	0.001	0.17	0.005	0.001	0.061	0.0056	a	0.089	a
^{238}U (pCi/g)	0.019	6.4	0.16	0.033	5.3	0.305	a	2.5	a

NS Ditch – North-South Diversion Ditch
ND – Non Detect
a = Quantities of total uranium were found to be quite small or not detected; individual isotopes of uranium were not analyzed.
b= The maximum site average within each group of locations.
1 = S20
2 = S1, S31, K006, K001, C616, C612
3 = S33
4 = S21
5 = S30, S2, K010, K0126
6 = LBCN1, S27, S34
7 = C746KUP, C746KTB2
8 = S32
9 = S28

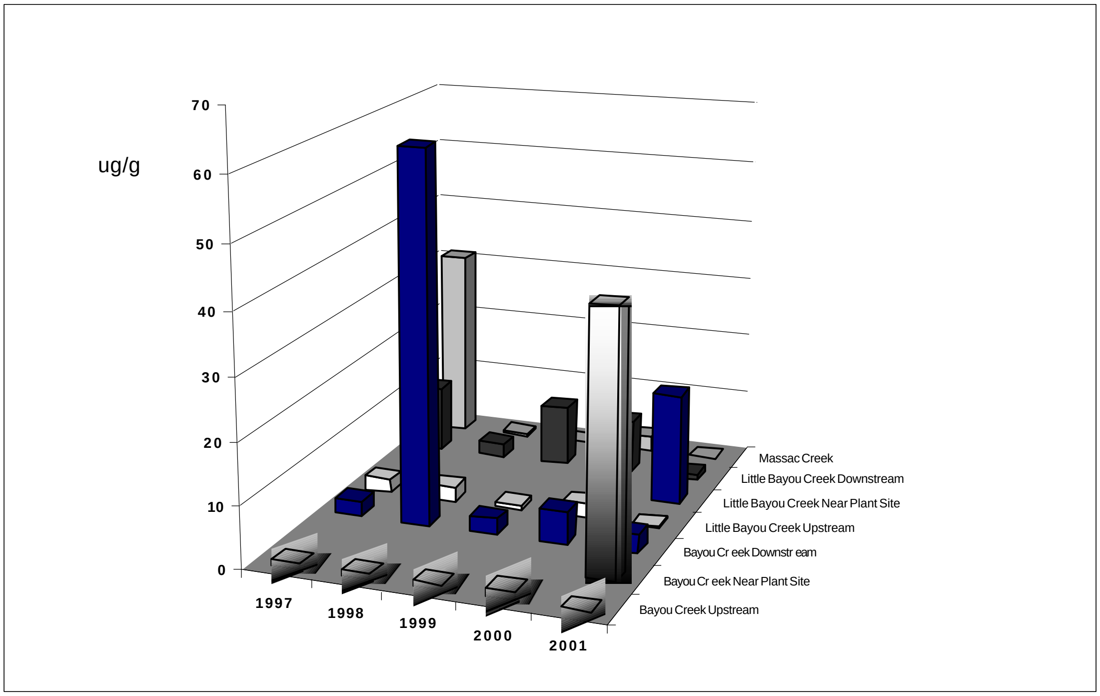

Figure 5.4 Five year uranium concentration in sediment.

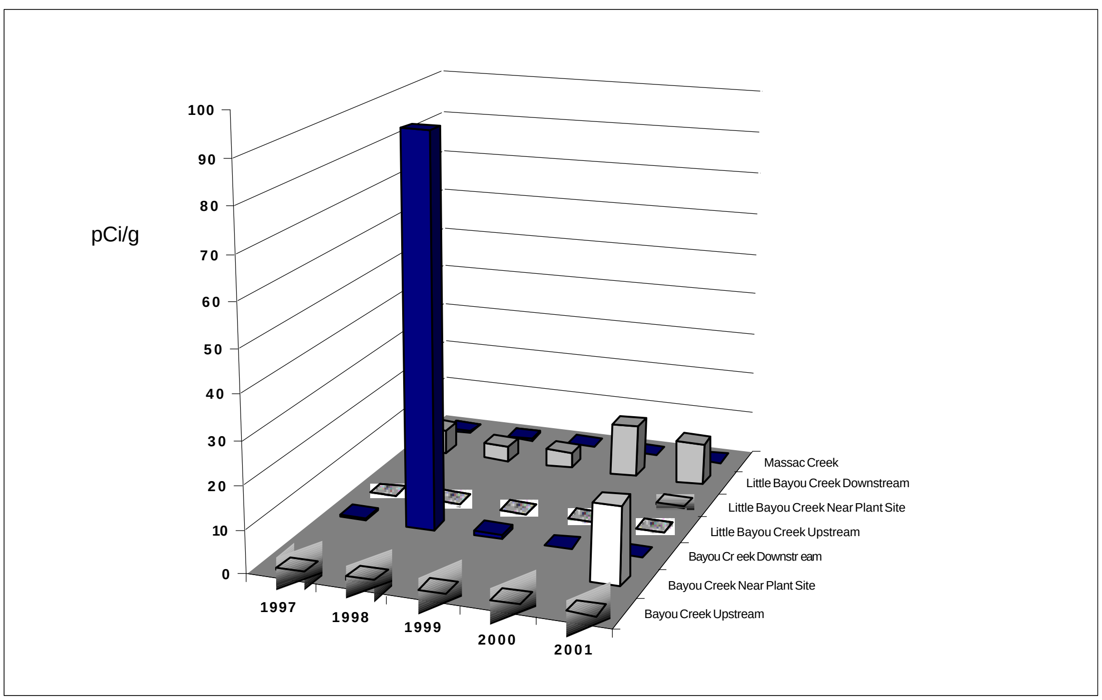

Figure 5.5 Five year technetium-99 concentration in sediment.

The Bayou and Little Bayou creeks concentrations near the plant site were generally higher than the background upstream concentrations and downstream concentrations. The highest concentrations of radionuclides were found at Bayou Creek near the plant site and the North-South Diversion Ditch (S32). Figure 5.5 shows no significant change in ^{99}Tc concentrations in sediment over the past five years. New locations are also shown as previously noted, which do not contain bars for years 1997-2000. Other radionuclides, although present, are not significantly above background values. Additional sediment data are presented in Tables 2.35 through 2.54 of Section 2 of the *Environmental Monitoring Results.*

Terrestrial Wildlife

Annual Deer Harvest

In 2001, a total of six deer were harvested in the WKWMA as part of DOE's ongoing effort to monitor the effects of the Paducah Site on the ecology of the surrounding area. Two deer obtained as background samples from the Ballard Wildlife Management Area (BWMA) were used for reference. Liver, muscle, and bone samples were analyzed for several radionuclides [^{137}Cs, ^{237}Np, ^{239}Pu, ^{99}Tc, ^{230}Th, ^{234}U, ^{235}U, ^{238}U, and ^{90}Sr (bone samples only)]. In addition, thyroid samples were analyzed for ^{99}Tc. Because the liver and muscle tissue are considered consumable by hunters, these tissues can be evaluated for radiological risks (dose) if analyses reveal detectable levels above background, or reference, deer. Bone and thyroid samples are used only as indicators of contamination.

In deer muscle, which is normally considered to be edible to humans, concentrations of ^{230}Th were detected at low levels in both WKWMA and background deer. ^{234}Th was detected in WKWMA deer. In deer bone, ^{230}Th, ^{234}U, and ^{40}K isotopes were found at or above detectable levels in WKWMA deer. In deer liver, ^{234}U was detected in WKWMA deer at a concentration of 0.09 pCi/g and ^{238}U was detected in WKWMA deer at a concentration of 0.044 pCi/g. No uranium was detected in background deer. Table 5.5 lists the average deer concentration of radionuclides detected in deer tissue for 2001. Dose assessments indicate that deer are acceptable for consumption and levels are consistent with previous years data.

The thyroid and bone are not considered edible portions of deer, but an indicator of the presence of target radionuclides. Specifically, Strontium-90 (^{90}Sr) accumulates in the bone and ^{99}Tc accumulates to some lesser degree in the thyroid. In 2001, all results were non-detect for ^{90}Sr in the bone and ^{99}Tc in the thyroid for both WKWMA deer and background deer.

Table 5.5 Radiological parameters detected in deer tissue.

Parameter (pCi/g)	Bone	Liver	Liver Background	Muscle	Muscle Background
^{228}Ac	ND	ND	ND	5.7	ND
^{210}Pb	ND	ND	ND	6.3	ND
^{40}K	65	6.4	8.7	28	ND
^{230}Th	0.15	ND	ND	0.14	0.079
^{234}Th	ND	ND	ND	7.2	ND
^{234}U	0.079	0.09	ND	ND	ND
^{238}U	ND	0.044	ND	ND	ND

ND - Not Detected

Additional deer data are presented in Tables 2.56 through 2.63 of Section 2 of the *Environmental Monitoring Results Annual Site Environmental Report for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (BJC/PAD-319 Volume II). Chapter 6 discusses dose calculations associated with eating deer from WKWMA.

Direct Radiation

A primary pathway of concern for DOE's operations at the Paducah Site is direct external radiation exposure. External radiation exposure is defined as exposure attributed to radioactive sources outside the body (e.g., cosmic gamma radiation). Sources of external radiation exposure from the Paducah Site include cylinder storage yards, the cascade system, and small sources such as instrument check locations. Cylinder storage yards have the largest potential for a dose to the public because of their proximity to the PGDP security fence.

The *Paducah Site Environmental Monitoring Plan* (BJC 2000) establishes DOE's program for monitoring external gamma radiation at areas accessible to members of the public. The External Radiation Exposure Monitoring Program has the following three objectives:

- to establish the potential radiation dose received by a member of the public from direct exposure to DOE operations at the boundary of the DOE perimeter fence,
- to establish the potential dose a member of the public may receive visiting or passing through accessible portions of the DOE reservation, and
- to calculate the radiation dose equivalent to the maximally exposed individual member of the public.

In 2001, monitoring consisted of quarterly placement, collection, and analysis of environmental thermoluminescent dosimeters (TLDs). TLD locations are shown in Figure 5.6. Monitoring results indicate that nine locations out of 46 were consistently above background levels (BJC 2002a). These locations were all at or near the PGDP security fence in the vicinity of UF_6 cylinder storage yards (Figure 5.6).

Annual dose rates for the background locations and the nine locations above background were calculated. The mean annual background exposure was determined to be 114 milliRoentgen (mR), based on the analysis of TLDs placed away from DOE property, see *Annual Report on External Gamma Radiation Monitoring for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, (BJC/PAD-357)*. For each location, the mean background exposure was subtracted from the annualized total exposure to obtain a net annual exposure. The net annual exposure represents the total exposure at that location, for the entire calendar year 2001, attributed to the Paducah Site (Table 5.6). The net annual exposure is a conservative calculation due to limited access to the Paducah Site since September 11, 2001. Exposure measured at

Table 5.6 Net annual exposure from direct radiation attributed to the Paducah Site for 2001 (mR).

Location	TLD-1	TLD-2	TLD-3	TLD-47	TLD-48	TLD-50	TLD-51	TLD-52	TLD-53
total annual exposure	505	815	434	234	145	171	164	130	298
background[a]	114	114	114	114	114	114	114	114	114
net annual exposure	391	701	320	120	31	57	50	16	184

a based on the analysis of TLDs placed away from DOE property, see *Annual Report on External Gamma Radiation Monitoring for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky (BJC/PAD-357)*.

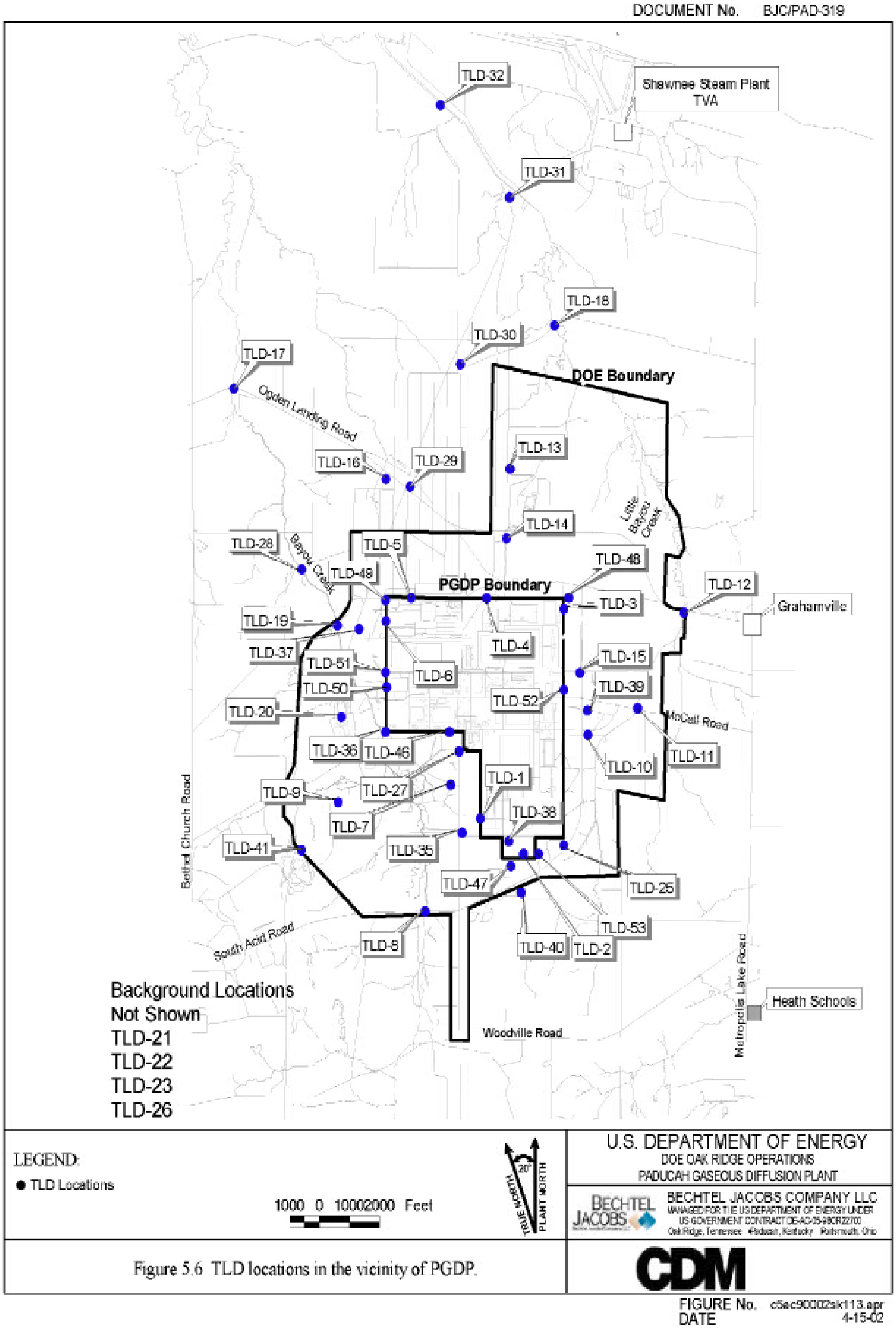

Figure 5.6 TLD locations in the vicinity of PGDP.

these locations is assumed to result from DOE operations. Dose from direct radiation exposure is discussed in Section 6. Additional data are presented in Section 2 of the *Environmental Monitoring Results Annual Site Environmental Report for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, (BJC/PAD-319 Volume II)*. Chapter 6 discusses dose calculations associated with direct radiation exposure.

6 Dose

Abstract

For 2001, exposure pathways potentially contributing to dose were determined to include ingestion of surface water, ingestion of sediments, ingestion of deer meat, direct radiation, and atmospheric releases. The highest estimated dose a maximally exposed individual might have received from all combined DOE exposure pathways (worst-case scenario) was 3.73 mrem. This dose is less than 5% of the applicable federal standard of 100 mrem/year.

Introduction

This section presents the calculated doses to individuals and the surrounding population from atmospheric and liquid releases from the Paducah Site, as well as direct radiation (sections 4 and 5). In addition, potential doses from special case exposure scenarios, such as deer meat consumption, were calculated based upon deer sample analyses. Doses from naturally occurring sources are discussed in Appendix A.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, limits the dose to members of the public to less than 100 mrem/year total effective dose equivalent from all pathways resulting from operation of a DOE facility. Information on the demography and land use of the area surrounding the plant and identification of on-site sources have indicated radionuclides and exposure pathways of concern.

For the Phase I Remedial Action Site Investigation, a preliminary assessment of risk to the health of the public from contaminants at the Paducah Site was conducted. This study identified the following four primary pathways that each could contribute greater than 1% to the total off-site dose: (1) groundwater ingestion, (2) sediment ingestion, (3) wildlife ingestion, and (4) exposure to direct radiation. Since that preliminary assessment, groundwater wells that supplied drinking water in the downgradient direction from the PGDP have been sealed to prevent use, resulting in a loss of that pathway. Surface water is now considered to be the primary pathway for water ingestion. In addition, the Northwest Plume Groundwater System began operation in 1995, resulting in an airborne pathway now included in the dose calculations. In 2001, the Wildlife Area Rubble Pile Removal Project also added to the airborne dose. Furthermore, in 1999, a drinking water pathway was added for consumption of surface water at the nearest public drinking water source (Ohio River at Cairo, Illinois).

To fully assess the potential dose to the public, a hypothetical group of extreme characteristics was used to postulate an upper limit to the dose of any real group. This is referred to as the worst-case scenario. Actual dose received is likely to be considerably less than the dose calculated for the worst-case scenario.

Terminology and Internal Dose Factors

Most consequences associated with radionuclides released to the environment are caused by interactions between human tissue and various types of radiation emitted by the radionuclides. These interactions involve the transfer of energy from radiation to tissue, possibly resulting in tissue damage. Radiation may come from radionuclides outside the body or from radionuclides deposited inside the body (by inhalation, ingestion, and, in a few cases, absorption through the skin). Exposures to radiation from radionuclides outside the body are called external exposures; exposures to radiation from radionuclides inside the body are called internal exposures. This distinction is important because external exposure occurs only as long as a person is near the external radionuclide; simply leaving the area of the source will stop the exposure. Internal exposure continues as long as the radionuclide remains inside the body.

A number of specialized terms or quantities have been defined for characterizing exposures to radiation as defined in Appendix A. Because the damage associated with such exposures results primarily from the deposition of radiant energy in tissue, the units are defined in terms of the amount of incident radiant energy absorbed by tissue and of the biological consequences of that absorbed energy. These terms or quantities include the following:

- *Committed effective dose equivalent (CEDE)* — the total internal dose (measured in mrem) received over a 50-year period resulting from the intake of radionuclides in a one-year period. The CEDE is the product of the annual intake (pCi) and the dose conversion factor for each radionuclide (mrem/pCi).
- *Effective dose equivalent* — includes the CEDE from internal deposition of radionuclides and the dose from penetrating radiation from sources external to the body. This is a risk-equivalent value and can be used to estimate the health-effects risk to the exposed individual.
- *Total effective dose equivalent* — includes the sum of the effective dose equivalent (for external exposures) and the CEDE (for internal exposures). For purposes of compliance, dose equivalent to the whole body may be used as the effective dose equivalent for external exposures.

Internal dose factors for several radionuclides of interest at the Paducah Site are included in Appendix A.

Direct Radiation

In 2001, DOE conducted continuous monitoring for direct external radiation exposure (Section 5). The monitoring results indicate that, due to limited access of the public to radioactive source areas, the dose to the maximally exposed individual member of the public (i.e., the neighbor living closest to the PGDP security fence) from DOE operations did not vary statistically from background (i.e., essentially zero) (BJC 2002).

For purposes of this ASER, an additional potential receptor was considered. In a very conservative exposure scenario, this receptor is assumed to be exposed to the location at TLD-48 for 8.3 hours for the year. TLD-48 represents the closest location with results above background that would be accessible to the public in 2001 (Figure 5.5). The 8.3 hours per year assumption is based on an individual driving past this location twice per day at 1 minutes per trip, five days per week, 50 weeks per year. The mean dose rate for location TLD-48, attributable to the Paducah Site, was determined to be 0.0034 mrem/hour (BJC 2002). Therefore, the dose to this receptor was calculated to be 0.03 mrem for 2001. It is likely that actual occupancy at this location is probably much less than assumed since any shielding from the receptor's vehicle is not considered. Additionally, access is further limited to this location due to the increased security boundary implemented in September 2001.

Surface Water

The most common surface-water pathway for exposure is through drinking water containing radionuclides. Surface-water pathway dose was calculated for an individual assumed to consume water from the public drinking water supply at Cairo, Illinois. Cairo is the closest drinking water system that uses water downstream of PGDP effluents. The maximum concentrations of radionuclides that were detected in Cairo were used to calculate the exposure resulting from consumption of surface water. The radionuclides that were detected in Cairo were ^{137}Cs, ^{99}Tc, and ^{228}Th. The maximally exposed receptor was assumed to consume all of their daily required water, 8 glasses each containing 8 ounces (approximately 2 L), 365 days a year from the public drinking water supply. The maximum dose to an individual, without subtracting the background dose, was determined to be 0.24 mrem in 2001. The background dose, taken at Massac Creek, was determined to be 1.02 mrem in 2001. Therefore, the resulting net exposure to the maximally exposed receptor from the Paducah Site was zero.

Contaminated Sediment

Exposure to contaminated sediment in Bayou and Little Bayou creeks could occur during fishing, hunting, or other recreational activities. Exposure is possible through incidental ingestion of contaminated sediment. The worst-case ingestion assumption is that an individual would splash around in one of the creeks every other day during the hunting season and ingest a small amount of sediment each visit (50 mg/day). A dose is then calculated based on the radionuclide concentrations and amount of exposure via ingestion. Massac Creek samples are assumed to be background and are subtracted from downstream sample results to arrive at a dose associated with site releases. The downstream location with the maximum dose is assumed to represent the dose received from this pathway by the maximally exposed individual.

Doses are calculated for ingestion of sediments for both Bayou and Little Bayou creeks. The worst-case dose was calculated to be at S32, the north-south diversion ditch (Figure 5.3). The estimated worst-case dose above background from sediment ingestion was 0.30 mrem in 2001. Sediment sample locations are shown in Figure 5.4. Dose results are provided at the end of this section in Table 6.1.

Ingestion of Deer

The effect of an intake of a radionuclide by ingestion depends on the concentration of the radionuclide in food and drinking water and on the individual's consumption patterns. The estimated intake of a radionuclide is multiplied by the appropriate ingestion dose factor to provide the estimate of CEDE resulting from the intake.

Terrestrial wildlife, such as deer, can come into contact with contaminated soil, ingest plants that have taken up contaminants, or ingest contaminated water. Hunting is permitted in the WKWMA surrounding the Paducah Site, and the limit for deer harvest is two deer per person per season. Approximately 100 deer are harvested per year from WKWMA. The Paducah Site dose calculations assume that an individual kills two average-weight deer and consumes the edible portions of those deer during the year (approximately 100 pounds of meat and five pounds of liver). The dose is calculated for each deer.

In 2001, six deer from the Paducah Site were sampled along with two reference deer from the BWMA (Section 5). As a worst-case scenario for site dose contribution, it is assumed that a person kills and eats the two deer with the largest dose potential. The worst-case dose was calculated to be 7.5 mrem, which is 3.4 mrem above the average dose from the background deer (Hampshire 2001). Therefore, 3.4 mrem is used in the worst case scenario calculations. The detection limits for the two background deer were significantly lower than those for all site deer. This was the principal reason for the rise in the calculated difference in doses from calendar year 2000 (1.7 mrem) to 2001.

Airborne Radionuclides

DOE's radionuclide airborne point-sources that contributed to the public dose in 2001 included two sources. These sources were the Northwest Plume Groundwater System and the Wildlife Area Rubble Pile Removal Project that consisted of crushing concrete. The two point sources are discussed in Section 4. These point-sources were monitored to determine the extent to which the general public could be exposed and to demonstrate compliance with EPA regulations that are based on International Commission on Radiological Protection (ICRP) publications (ICRP 1980).

The 50-year CEDE (internal) from DOE air sources to the maximally exposed individual, who under most circumstances is the person living closest to the plant in the predominant wind direction, is calculated each year. EPA-supplied CAP-88 software was used to calculate the off-site dose from PGDP air emissions. CAP-88 provides a framework for developing dose and risk assessments for the purpose of demonstrating compliance with 40 CFR 61.93(a). CAP-88 assesses both collective populations and maximally-exposed individuals. The dose from the two projects to the maximally exposed individual from radioactive emissions was calculated to be 3.7×10^{-3} mrem from the Northwest Plume Groundwater System and 0.016×10^{-3} mrem from the Wildlife Area Rubble Pile Removal Project. If an individual were to receive the maximum dose from each of these sources, it would add up to approximately 3.7×10^{-3} (0.0037) mrem which is well below the 10 mrem limit of 40 CFR Part 61, Subpart H. The maximally exposed individual for both of the projects would be located 1220 m (4000 ft) north of the plant.

Conclusions

Table 6.2 provides a summary of the dose for 2001 from the Paducah Site that could be received by a member of the public assuming worst-case exposure from all major pathways. The largest contributor to the calculated dose is from ingestion of deer meat. The groundwater pathway from DOE sources is assumed to contribute no dose to the population because all residents have been supplied with public water by DOE. The worst-case combined (internal and external) dose to an individual member of the public was calculated at 3.73 mrem. This level is well below the DOE annual dose limit of 100 mrem/year to members of the public and below the EPA limit of 10 mrem airborne dose to the public.

Estimates of radiation doses presented in this report were calculated using the dose factors provided by DOE and EPA guidance documents. These dose factors are based on International Commission on Radiological Protection Publication 30 (ICRP 1980). Figure 6.1 shows the potential (worst-case) annual dose as calculated for the past five years.

Table 6.1 Annual dose estimates for 2001 incidental ingestion of sediment from Bayou and Little Bayou creeks.

Location	Committed Effective Dose Equivalent (mrem)						Total (mrem)
	^{237}Np	^{99}Tc	^{230}Th	^{234}U	^{235}U	^{238}U	
S1	3.3E-04	1.4E-05	1.1E-03	2.2E-04	1.2E-05	3.6E-04	2.0E-03
S2	1.4E-04	1.6E-07	9.1E-04	4.4E-05	3.0E-06	1.3E-04	1.2E-03
S20	2.7E-05	0	3.0E-04	2.5E-05	1.3E-06	2.3E-05	3.8E-04
S21	5.1E-06	4.9E-07	8.3E-04	3.2E-05	1.3E-06	4.0E-05	9.1E-04
S27	1.3E-04	7.6E-06	1.9E-03	6.3E-05	4.9E-06	2.4E-04	2.3E-03
S28 (background)	0	0	3.2E-04	---	---	---	**3.2E-04**
S30	6.0E-04	1.3E-06	7.5E-04	4.4E-04	8.1E-05	6.5E-03	8.3E-03
S31	2.5E-04	1.4E-06	1.6E-03	1.7E-04	8.0E-06	1.9E-04	2.3E-03
S32 (maximum)	1.5E-02	1.6E-04	2.8E-01	2.3E-03	1.2E-04	3.0E-03	**3.0E-01**
S33	2.9E-04	2.3E-06	9.2E-04	1.3E-04	6.6E-06	2.0E-04	1.5E-03
S34	2.9E-04	6.3E-06	3.4E-03	9.2E-05	7.4E-06	3.7E-04	4.2E-03
C612	4.2E-04	1.4E-06	1.3E-03	1.7E-04	1.1E-05	4.1E-04	2.3E-03
C616	4.5E-03	9.0E-05	7.3E-03	1.4E-03	7.0E-05	1.7E-03	1.5E-02
C746KTB2	3.3E-05	0	4.7E-04	---	---	---	5.1E-04
C746KUP	0	0	8.2E-04	---	---	---	8.2E-04
K001	1.4E-03	3.3E-05	1.6E-03	5.5E-04	3.2E-05	9.9E-04	4.6E-03
K006	1.4E-04	2.7E-07	1.0E-03	4.3E-05	2.7E-06	4.0E-05	1.2E-03
K010	3.9E-05	1.2E-06	1.2E-03	1.2E-04	6.6E-06	1.6E-04	1.5E-03
K012	2.8E-03	3.1E-06	1.0E-03	1.5E-04	9.3E-06	3.7E-04	4.4E-03
LBCN1	2.7E-04	1.6E-05	6.9E-04	2.6E-05	1.3E-06	2.4E-05	1.0E-03
Net exposure from Paducah Site to maximally exposed individual (S32-S28) =							**3.0E-01**

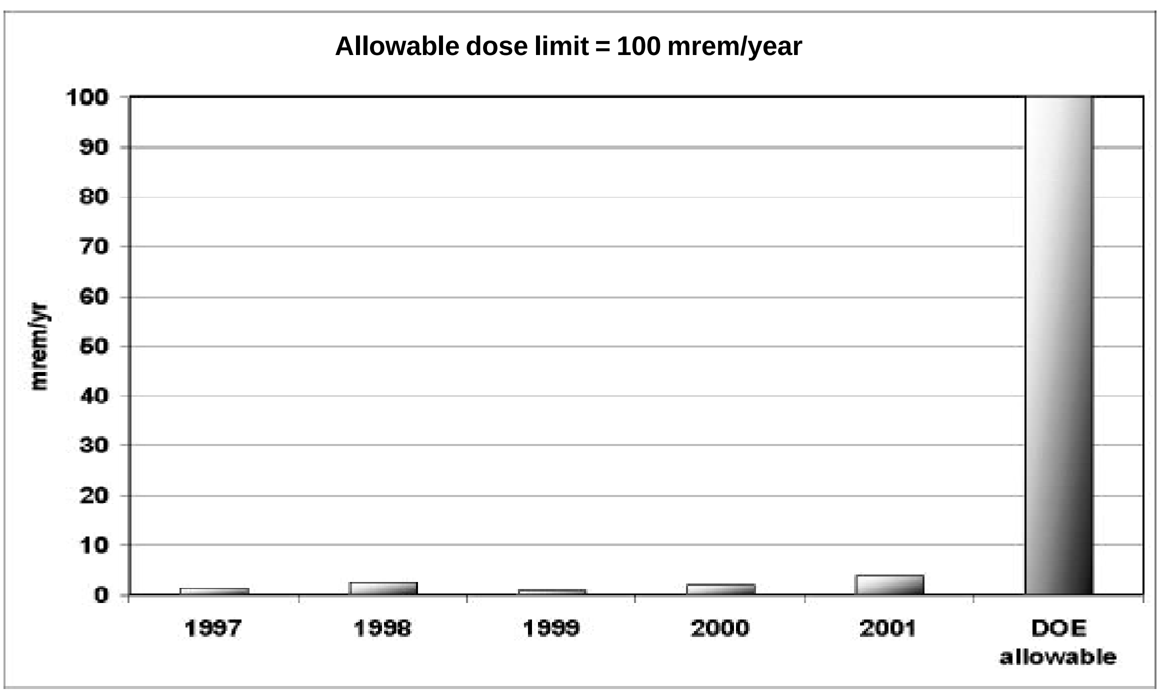

Figure 6.1 Potential radiological dose from the Paducah Site, 1997 through 2001.

Table 6.2 Summary of potential radiological dose from the Paducah Site for 2001.
(worst-case combined exposure pathways)

	Dose[a] (mrem/year)	Percent of total
Ingestion of surface water	0	0
Ingestion of sediments	0.30	8
Ingestion of deer meat	3.4	91.2
Direct radiation	0.03	0.8
Atmospheric releases[1]	0.0037	0
Total annual dose above background (all pathways)	**3.73**	**100**

[a] – Maximum allowable exposure is 100 mrem/year (DOE Order 5400.5).
[1]DOE source emissions were from the Northwest Plume and Concrete Crushing

7 Nonradiological Effluent Monitoring

Abstract

In 2001, there were two KPDES outfalls at the Paducah Site that experienced exceedences for toxicity. Outfalls 001 and 017 exceeded reportable KPDES effluent discharge permit limits for acute toxicity and chronic toxicity, respectively. No NOVs were issued in 2001 for exceedences.

In 2001, DOE had two point sources and several fugitive sources for nonradiological air emissions. The combined emissions from these DOE sources were small; therefore, the Paducah Site is considered a minor source in accordance with the CAA.

Introduction

Responsibility for nearly all nonradioactive airborne emission sources at the PGDP was turned over to USEC as a result of the 1993 lease agreement between USEC and DOE. Only a few fugitive sources such as gravel roads, spoil piles (resulting from construction excavation), metal scrap pile windage, and two point sources remained the responsibility of DOE in 2001. The small amount of emissions from DOE sources results in CAA classification of the Paducah Site as a minor air emissions source.

Monitoring of nonradiological parameters in liquid effluents is summarized in the *Paducah Site Environmental Monitoring Plan* (BJC 2000) and is based on KPDES Permit KY0004049, and KDWM landfill permits 073-00014, 073-00015, and 073-00045. Effluents are monitored for nonradiological parameters listed on the permit governing the discharge.

Airborne Effluents

Airborne Effluent Applicable Regulations

The CAA at the Paducah Site is administered by KDAQ. DOE has responsibility only for air emission sources under DOE program control; therefore, this report does not address emissions from the PGDP sources leased to USEC.

Airborne Effluent Monitoring Program

The point sources of air emissions other than radionuclides (Section 4) for the Paducah Site in 2001 were the Northwest Plume Groundwater System and the Northeast Plume Containment System. These systems combined removed 1939 pounds (0.97 tons) of TCE, which is a volatile organic compound (VOC), from 178,183,000 gallons of groundwater. These facilities remove TCE contamination from the groundwater by air stripping. At the Northwest Plume Groundwater System, TCE-laden air passes through carbon filtration removing TCE. The air stream is then released to the atmosphere where any remaining TCE naturally breaks down.

The CAA defines VOC emissions as criteria pollutants. A minor source is limited to 100 tons per year of each criteria pollutant. If greater quantities of criteria pollutants are emitted, then the source is classified as a major source. A minor source has less stringent permit requirements because of the reduced potential for health effects from the smaller amount of emissions.

The CAA also limits the emissions from a minor source of HAPs to 10 tons/year for each individual pollutant and 25 tons/year for all HAPs combined. TCE is a HAP. The amount of TCE emitted in 2001 was less than the 1939 pounds (0.97 tons) of TCE removed from the 178,183,000 gallons of groundwater from the combination of the Northwest Plume Groundwater System and the Northeast Plume Containment System.

Liquid Effluents

Liquid Effluent Applicable Regulations

The CWA for the Paducah site is administered by KDOW through the KPDES Wastewater Discharge Permitting Program. The sitewide KPDES permit (KY0004049) became effective April 1, 1998, and expires March 31, 2003. This permit contains discharge limits based on water quality criteria for a zero-flow receiving stream.

KDWM specifies in landfill permits 073-00014, 073-00015, and 073-00045 that surface runoff be analyzed to ensure that landfill constituents are not discharging into nearby receiving streams.

Liquid Effluent Monitoring Program

DOE conducts nonradiological effluent monitoring for outfalls under its jurisdiction (Section 4, Figure 4.2). Outfalls 001, 015, 017, and 019 were monitored for KPDES permit parameters. The specific sample collection, preservation, and analytical methods acceptable for the types of pollutants analyzed are listed in 40 CFR 136. Preservation in the field is conducted per 40 CFR 136, and chain-of-custody procedures are followed after collection and during transport to the analytical laboratory. The samples are then accepted by the laboratory and analyzed per 40 CFR 136 procedures for the parameters required by the KPDES permit. The KPDES permit also intermittently requires additional sampling (two events in five years) for priority pollutants at the DOE outfalls. This sampling was conducted in 2001, which adds a larger list of analyses to the data set.

Surface runoff from the closed C-746-S Residential Landfill, the closed C-746-T Inert Landfill, and the operating C-746-U Landfill was monitored quarterly. Grab samples were monitored for chemical oxygen demand, chloride, conductivity, dissolved oxygen, dissolved solids, flow rate, iron, pH, sodium, sulfate, suspended solids, temperature, total organic carbon, and total solids. The samples taken include landfill runoff, the receiving ditch upstream of the runoff discharge point, and the receiving ditch downstream of the runoff discharge point (Section 4, Figure 4.2). Sampling was performed to comply with KDWM requirements for operation of the contained landfill.

Liquid Effluent Monitoring Results

Analytical results are reported to KDOW in monthly and quarterly discharge monitoring reports. Five exceedences of permit limits were reported in 2001 for DOE Outfalls 001 and 017 (Table 7.1 and Section 2). Table 7.2 summarizes the maximum detected nonradiological analyses for samples collected as part of the required KPDES permit sampling. During 2001, the priority pollutant monitoring results were also reported to KDOW. Table 7.3 summarizes the nonradiological detected analyses for this event. None of these detects resulted in KPDES permit violations.

Data for the KPDES samples and the surface runoff samples from the landfills are presented in Section 3 of the *Environmental Monitoring Results Annual Site Environmental Report for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, (BJC/PAD-319 Volume II).*

Table 7.1 KPDES permit exceedence summary for 2001.

Outfall	Noncompliance Parameter	Date Sampled	Result	KPDES Limit
017	Acute Toxicity	February	2.1 TUa	1.0 TUa
017	Acute Toxicity	March	2.46 TUa	1.0 TUa
001	Chronic Toxicity	June	1.5 TUc	1.0 TUc
017	Acute Toxicity	June	1.33 TUa	1.0 TUa
017	Acute Toxicity	December	1.6 TUa	1.0 TUa

Table 7.2 KPDES permit sampling nonradiological maximum detected analyses.

Parameter	K001	K015	K017	K019
Chlorine, Total Residual (mg/L)	0.08	0.03	ND	ND
Hardness - Total as CaCO3 (mg/L)	421	368	527	79
Iron (mg/L)	0.497	1.59	2.88	2.03
Oil and Grease (mg/L)	6.2	ND	ND	ND
PCB-1242 (ug/L)	ND	ND	0.234	ND
PCB-1248 (ug/L)	ND	ND	0.181	ND
PCB, Total (ug/L)	ND	ND	0.415	ND
Phosphorous (mg/L)	0.48	ND	ND	ND
Phosphorous, Dissolved (mg/L)	0.18	ND	ND	ND
Suspended Solids (mg/L)	ND	ND	177	ND
Zinc, Total (mg/L)	ND	ND	4.12	ND
Zinc, Dissolved (mg/L)	ND	ND	4.04	ND

ND - Non Detect

Table 7.3 KPDES Priority Pollutant sampling nonradiological detected analyses.

Parameter	K001[1]	K015	K017	K019
Aluminum (mg/L)	1.38	ND	0.398	0.672
Ammonia (mg/L)	ND	ND	ND	0.53
Barium (mg/L)	0.043	0.031	0.034	0.039
Bromide (mg/L)	ND	ND	1.1	ND
Chemical Oxygen Demand (mg/L)	ND	35	ND	ND
Chloride (mg/L)	48.9	14.1	2.1	4.6
Fecal Coliform (col/100ml)	230	6500	26000	ND
Fluoride (mg/L)	0.36	0.31	0.24	0.3
Hardness - Total as CaCO3 (mg/L)	99	92	116	78
Iron (mg/L)	1.11	0.215	0.356	0.523
Kjeldahl Nitrogen (mg/L)	20	2.8	ND	ND
Magnesium (mg/L)	6.86	3.9	3.53	4.04
Manganese (mg/L)	0.078	ND	ND	ND
Nitrate/Nitrite as Nitrogen (mg/L)	0.58	0.6	1.65	0.03
Phosphorous (mg/L)	0.37	0.56	0.21	0.18
Sulfate (mg/L)	98.7	127.8	39	7.5
Total Organic Carbon (mg/L)	8.6	15	6.6	6.1
Trichloroethene (ug/L)	ND	2	ND	ND

ND - Non Detect

1 - Duplicate sample collected at Outfall 001

8 Nonradiological Environmental Surveillance

Abstract

The nonradiological environmental surveillance program at the Paducah Site assesses the effects of DOE operations on the site and the surrounding environment. Surveillance includes analyses of air, surface water, groundwater (Section 9), sediment, soil, vegetation, terrestrial wildlife, and fish and other aquatic life. Surveillance results for 2001 were similar to results reported in previous ASERs.

Introduction

Nonradiological surveillance at the Paducah Site involves sampling and analysis of surface water, groundwater (see Section 9 for groundwater surveillance results), sediment, soil, terrestrial wildlife, and fish and other aquatic life. This section discusses the results of surveillance activities.

Ambient Air

As a result of the transfer of the production part of the plant to USEC in 1993, major air emission sources were transferred to USEC. Therefore, the Paducah Site is not required to conduct ambient air monitoring for nonradiological parameters.

Surface Water

Surface-water monitoring downstream of KPDES outfalls is not required by the KPDES permit. However, it is performed at the Paducah Site as part of the Environmental Surveillance Program. Nonradiological sampling is conducted at upstream Bayou Creek (L1), downstream Bayou Creek (L5 and L6), downstream Little Bayou Creek (L12, L11, L241, and LBCN1), the convergence of both creeks (L8), upstream Ohio River (L29), downstream Ohio River (L30), downstream in the Ohio River at the confluence with the Mississippi River (L306), and background stream Massac Creek (L64). Locations were also collected near the plant on the Bayou Creek (C612, C616, K004, K006, K008, K009, K016, and L291) and Little Bayou Creek (K002, K010, K011, K012, K013, L10, L55, L56, and L194). Samples were also collected near the C-746-K Landfill (C746KUP, C746KTB1, C746KTB2, and C-746K-5). No sample point exists for upstream Little Bayou

Creek, as the watershed is insufficient to develop adequate flow to monitor. Nearly all water in Little Bayou Creek is comprised of discharges from the plant outfalls. Therefore, background water quality for Little Bayou Creek is based on L1 (upstream Bayou Creek). L29 and L64 are background waterways also used for comparison with data from Little Bayou Creek. Figure 5.2 shows surveillance surface-water sampling locations. Table 8.1 shows the analytical parameters that are analyzed on a quarterly basis or semiannual basis.

Surface Water Surveillance Results

Table 8.2 shows a water chemistry comparison between upstream and downstream locations associated with the plant. The only result of significance compared to background data was the trichloroethene identified downstream of Little Bayou Creek at an average concentration of 20 µg/L at location L241.

Additional data are presented in Section 4 of the *Environmental Monitoring Results Annual Site Environmental Report for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (BJC/PAD-319 Volume II).

Table 8.1 Nonradiological parameters for surface-water samples.

Parameter
Chloride
Sulfate
Conductivity
Dissolved Oxygen
Flow Rate
pH
Temperature
Aluminum
Cadmium
Chromium
Copper
Iron
Lead
Nickel
Phosphorous
Zinc
Dissolved Oxygen
Flow Rate
pH
Temperature
PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260
PCB-1268
Polychlorinated biphenyl
2-Propanol
Acetone
Trichloroethene
Ammonia as Nitrogen
Biochemical Oxygen Demand
Carbonaceous Biochemical Oxygen Demand
Conductivity
Cyanide
Hardness - Total as CaCO3
Nitrate/Nitrite as Nitrogen
Suspended Solids
Turbidity

[redacted]

Sediment

Sediment is an important constituent of the aquatic environment. If a pollutant is a suspended solid or is attached to suspended sediment, it can either settle to the bottom (thus creating the need for sediment sampling), be taken up by certain organisms, or become attached to plant surfaces. Pollutants transported by water can either adsorb on organic and inorganic solids or be assimilated by plants and animals. Suspended solids, dead biota, and excreta settle to the bottom and become part of the organic substrata that support the bottom-dwelling community of organisms. Sediments play a significant role in aquatic ecology by serving as a repository for radioactive or chemical substances that pass via bottom-feeding biota to the higher trophic levels.

Sediment Surveillance Program

Ditch sediments are sampled semiannually as part of a nonradiological environmental surveillance program. Sediment samples were taken from twenty locations in 2001 (Figure 5.3). Sediments were sampled for the parameters listed in Table 8.3.

Table 8.3 Semiannual nonradiological parameters for sediment samples.

Parameter
Moisture
Percent Moisture
Total Organic Carbon
Grain Size Analysis
Metals
Semivolatiles
Pesticides
Herbicides
PCB

Sediment Surveillance Results

Table 8.4 shows maximum average value for locations within the area group for specific parameters. Parameters shown are those that whose differences between upstream (or background) and downstream and have potential impacts on the receiving streams. Chromium, arsenic, and zinc, showed the most variation between sites for metals. Chromium was identified in the North-South Diversion Ditch at 40 mg/kg and near the plant site on Bayou Creek at 53 mg/kg. Chromium was also found near the plant site on Little Bayou Creek at 49 mg/kg. Arsenic was found near the C-746-K Landfill and in Little Bayou Creek near the plant site. Zinc was found at all locations; however the highest was found in Little Bayou Creek near the plant site.

PCBs were found in the North-South Diversion Ditch, Little Bayou Creek near the plant site and downstream, and in Bayou Creek. PCB-1248 and PCB-1260 were the most abundant aroclors. This is consistent with PCBs used historically on plant site.

DOE included sampling for pesticides, herbicides, and semivolatiles in 2001 as an addition to the Environmental Monitoring Plan.

Additional sediment data are presented in Tables 4.34 through 4.53 of Section 4 of the *Environmental Monitoring Results Annual Site Environmental Report for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (BJC/PAD-319 Volume II).

Table 8.4 Selected routine nonradiological sediment surveillance results (average concentrations)

Parameter (mg/kg)	Upstream Bayou[1]	Bayou Near Site[2]	Down-stream Bayou[3]	Upstream Little Bayou[4]	Little Bayou Near Site[5]	Down-stream Little Bayou[6]	C-746-K Landfill[7]	NS Ditch[8]	Massac Creek[9]
2,4'-DDD (µg/kg)	ND	ND	ND	ND	ND	ND	ND	11	ND
2,4'-DDE (µg/kg)	ND	0.86	ND	ND	ND	ND	ND	ND	ND
2,4'-DDT (µg/kg)	ND	0.82	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD (µg/kg)	2.3	7.6	ND	ND	6.1	4.7	14	72	2.5
4,4'-DDE (µg/kg)	3.3	ND	3.1	ND	8.6	2.9	34	20	3.3
4,4'-DDT (µg/kg)	ND	3.4	ND	ND	ND	ND	ND	ND	9
Acenaphthene (µg/kg)	ND	ND	130	ND	170	150	ND	ND	ND
alpha-Chlordane (µg/kg)	ND	9	ND	ND	7.3	ND	ND	ND	ND
Anthracene (µg/kg)	ND	ND	130	ND	180	190	ND	140	ND
Arsenic (mg/kg)	ND	ND	ND	ND	4.2	ND	6.9	ND	ND
Barium (mg/kg)	30	64	31	59	76	23	32	54	44
Benzo(a)anthracene (µg/kg)	140	220	160	ND	780	230	140	190	130
Benzo(a)pyrene (µg/kg)	ND	170	140	ND	590	240	130	170	130
Benzo(b)fluoranthene (µg/kg)	140	270	160	ND	420	220	140	220	130
Benzo(e)pyrene (µg/kg)	ND	79	55	ND	870	25	40	120	22
Benzo(ghi)perylene (µg/kg)	ND	180	130	ND	250	170	130	140	ND
Benzo(k)fluoranthene (µg/kg)	ND	160	150	ND	550	240	140	190	ND
Benzoic acid (µg/kg)	ND	380	ND	ND	ND	ND	ND	ND	ND
Beryllium (mg/kg)	ND	0.44	ND	ND	0.51	ND	ND	ND	ND
Chromium (mg/kg)	6.8	53	9	14	49	35	9.4	40	6.4
Iron (mg/kg)	5800	8600	5700	9800	8800	3600	8200	9200	6700
Magnesium (mg/kg)	290	710	400	720	570	220	320	900	460
Manganese (mg/kg)	160	98	200	150	83	64	200	170	400
Nickel (mg/kg)	ND	7.8	4.4	6.9	9	ND	4.5	27	4.7
PCB, Total (µg/kg)	ND	70	ND	ND	8800	5600	ND	26000	ND
PCB-1242 (µg/kg)	ND	ND	ND	ND	120	ND	ND	ND	ND
PCB-1248 (µg/kg)	ND	ND	ND	ND	4500	5600	ND	21000	ND
PCB-1254 (µg/kg)	ND	120	ND	ND	90	ND	ND	140	ND
PCB-1260 (µg/kg)	ND	68	ND	ND	98	ND	ND	5600	ND
Vanadium (mg/kg)	12	27	11	19	26	7.5	15	18	12
Zinc (mg/kg)	11	66	21	16	70	17	20	56	11

Note: The result presented in the table is the maximum average value for the locations within the area grouping

ND – Not Detected

NS Ditch – North-South Diversion Ditch

1 = S20

2 = C612, C616, S1, S31, K001, K006

3 = S33

4 = S1

5 = S30, S2, K010, K012

6 = LBCN1, S27, S34

7 = C746KUP, C746KTB2

8 = S32

9 = S28

Soil

The major source of soil contamination is from air pathways. Because DOE no longer controls any major air emissions sources, routine soil surveillance is not performed. However, surface-soil contamination is being addressed by the Surface Soils Operable Unit (see Environmental Restoration Program discussion in Section 3).

Vegetation

Because DOE no longer operates any major air emissions sources, routine vegetation surveillance activities are not performed.

Terrestrial Wildlife

Annual Deer Harvest

The deer population in WKWMA is sampled annually to determine levels of radionuclides (Section 5), PCBs, and inorganic elements that might be attributed to past plant practices. There were six deer harvested from WKWMA and two deer harvested from the BWMA to serve as reference samples.

PCBs tend to accumulate in fat tissue. PCBs were found at an average concentration of 57 ppb in the fat tissue of seven of the eight deer harvested in 2001. All six deer harvested at WKWMA had measurable PCB-1260 present and both of the reference BWMA deer had measurable PCB-1260 present. No other forms of PCBs were detectable. All measurable PCBs were well below the Food and Drug Administration (FDA) standard of 3 ppm for red meat.

A risk assessment was conducted using the concentrations of PCB found in deer, assuming 20% fat content and that a hunter would eat the two deer with the highest quantities of PCBs found. The risk assessment concluded that the risk to the hunter who eats 100 pounds of the two worst-case deer (50 pounds/deer) would have an average increased cancer risk of 0.000005, or approximately five chances of cancer development per one million people who eat the deer.

There were no unusual findings in metal analysis of deer. Metals were not elevated in the WKWMA deer when compared to the BWMA deer.

Additional deer data are presented in Tables 4.54 through 4.61 of Section 4 of the *Environmental Monitoring Results Annual Site Environmental Report for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (BJC/PAD-319 Volume II).

Fish and Other Aquatic Life

Watershed (biological) monitoring was conducted, as required, by DOE Order 5400.1 and KPDES Permit KY0004049. The KPDES permit also requires toxicity monitoring of one continuous outfall and of three intermediate outfalls on a quarterly basis. Watershed or biological monitoring of Bayou and Little Bayou creeks has been conducted since 1987.

The objectives of the Watershed Monitoring Program are as follows:

- determine whether discharges from the Paducah Site and its associated SWMUs associated with the Paducah Site are adversely affecting instream fauna;
- assess the ecological health of Bayou and Little Bayou creeks;

- assess the degree to which abatement actions ecologically benefit Bayou and Little Bayou creeks;

- provide guidance for remediation;

- provide an evaluation of changes in potential human health concerns; and

- provide data that could be used to assess the impact of inadvertent spills or fish kills.

The 2001 sampling effort was conducted in accordance with the *Bayou Creek and Little Bayou Creek Watershed Monitoring Program* (ORNL 1998), otherwise known as the PGDP Watershed Monitoring Program Plan. The report was submitted to the KDOW as required by the KPDES permit. In June 2001, a spring watershed monitoring event was conducted in accordance with the Paducah Site Environmental Monitoring Plan. During planning sessions for the 2001 monitoring, it was recommended that this additional monitoring occur at two locations on Little Bayou Creek (LBCN, L56) and two locations on the unnamed tributary near the C-746-K Landfill (C746KUP, C746KTB2). Benthic macroinvertebrate sampling and fish community samples were conducted utilizing the same procedures outlined in this plan for the routine fall sampling events.

Study Area and Methods

In June 2001, benthic macroinvertebrate and fish communities were sampled at two locations on Little Bayou Creek (LBCN, L56) and two locations on the unnamed tributary near the C-746-K Landfill (C746KUP, C746KTB2). In September and October of 2001, the fish and benthic macroinvertebrate communities were sampled following locations: Bayou Creek (BBK 12.5, BBK 10.0, and BBK 9.1), Little Bayou Creek (LUK 7.2), and Massac Creek (MAK 13.8). Sampling locations are shown in Figure 8.1. The bioaccumulation of PCBs in fish was monitored by collecting longear sunfish at three locations in Little Bayou Creek (LUK 9.0, LUK 7.2, and LUK 4.3). Spotted bass could not be obtained because there were no bass present for collection at the designated location on Bayou Creek (BBK 10.0). Massac Creek serves as the source of background fish (MAK 13.8) and is not shown in Figure 8.1.

Benthic macroninvertebrate samples were collected with a square-foot bottom sampler from randomly selected locations within each of the five sites. Organisms were identified to the lowest practical classification. Instream habitats located on the bank of the watercourse, and water quality, were assessed at each site following standard procedures outlined by EPA. An analysis of the data includes general descriptive information to evaluate trends in sequential and spatial changes that could be associated with decreasing activities or remedial actions. Metrics of the benthic macroinvertebrate community, such as total density, total taxonomic richness, taxonomic richness of the pollution-sensitive Ephemeroptera, Plecoptera, and Trichoptera (EPT), percent community similarity index, and dominants in common, are included in the analysis of the data.

Quantitative samplings of the fish communities at the five sites (BBK 12.5, BBK 10.0, BBK 9.1, LUK 7.2, MAK 13.8) in the Paducah Site area were conducted by electrofishing. Areas ranging from eight to 120 meters at individual sampling sites were sampled by electrofishing methods using a three-pass removal estimate. Block nets were placed surrounding each area prior to commencement of sampling. Data from these samples were used to estimate species richness, population size (numbers and biomass per unit area), and annual production. Data were adapted to create an Index of Biotic Integrity that is consistent with KDOW 1986 guidelines. All fish sampling sites overlap sites used in the benthic macroinvertebrate community task.

The concentration of PCBs in fish was determined in longear sunfish (*Lepomis megalotis*) from the Little Bayou Creek sites and spotted bass (*Micropterus punctulatus*) from

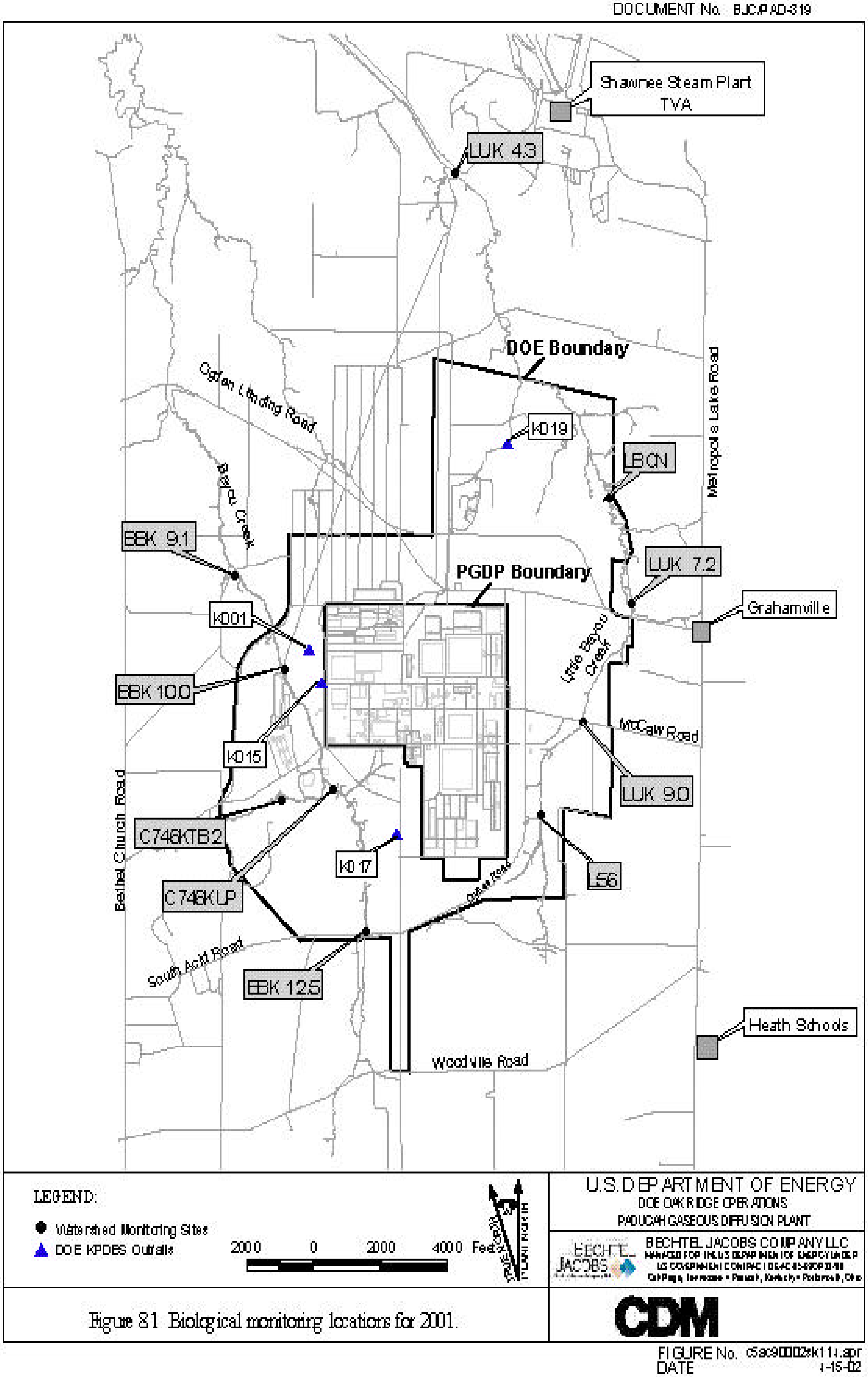

Figure 8.1 Biological monitoring locations for 2001.

Bayou Creek. Filets of individual sunfish and composite filet samples of the spotted bass were analyzed for PCBs and lipids. Fish from background reference sites were also to establish background levels.

Watershed Monitoring

Results of watershed monitoring are reported annually. Reports for 2001 monitoring are reported in the *Watershed Monitoring Report for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky KPDES Permit No. KY0004049*, BJC/PAD-363. Additional analysis of the data can be seen in this report. The report conclusions are presented as follows.

Macroinvertebrates are an important part of the food chain, and their well-being is reflected in higher forms such as fish. Some macroinvertebrates such as mosquitoes, black flies, biting midges, leeches, Asiatic clams, and zebra mussels are of considerable public health significance or are considered pests (USEPA 1990). Using Hilsenhoff's Family-level Biotic Index, the water quality of each sample site was evaluated. This index provides an overall rating measured by the types and number of species observed at the site. The background MAK 13.8 site was in excellent condition, BBK 9.1 was in good condition, BBK 10.0 and LUK 7.2 were in fair condition, and BBK 12.5 was in fairly poor condition.

The fish communities examined in 2001 show little change in species diversity when compared to previous years. However, the biomass at all localities and the densities at several sites are improved over the previous year. The decline in density and biomass has been reversed. Given the previous general decline in biomass in all species, it was hypothesized that this was due to an ecological phenomenon such as the El Nino/La Nina flooding and drought events that occurred during 1997-1998.

PCB concentrations are detectable in fish tissue from the Bayou Creek and Little Bayou Creek. The mean concentrations of PCBs have varied over the past five years and have consistently been elevated above the background level. PCBs are highly lipophilic and are rapidly accumulated by aquatic organisms and bioaccumulated through the aquatic food chain. Concentrations of PCBs in aquatic organisms may be 2,000 to more than a million times higher than the concentration found in the surrounding waters (EPA 1999).

All mean PCB concentrations of sites sampled were under 0.3 µg/g (ppm) wet weight. Based on the EPA default values for risk assessment parameters, consumption of fish with 0.3 µg/g (ppm) PCB concentrations would be restricted to 0.5 meals/month. A meal is defined as 8 oz of fish. Pregnant or nursing women and children under 15 years should not eat any of the fish.

Two main conclusions can be drawn from the spatial patterns previously observed in Little Bayou Creek: (1) elevated PCB concentrations in fish remain localized in the upper 2 to 3 km of Little Bayou Creek, and (2) the flattening of the downstream profile in recent years suggests decreased PCB sources from the Paducah Site KPDES outfalls. Overall, there is a general downward trend with a flattening profile for the locations monitored on Little Bayou Creek (Figure 8.2).

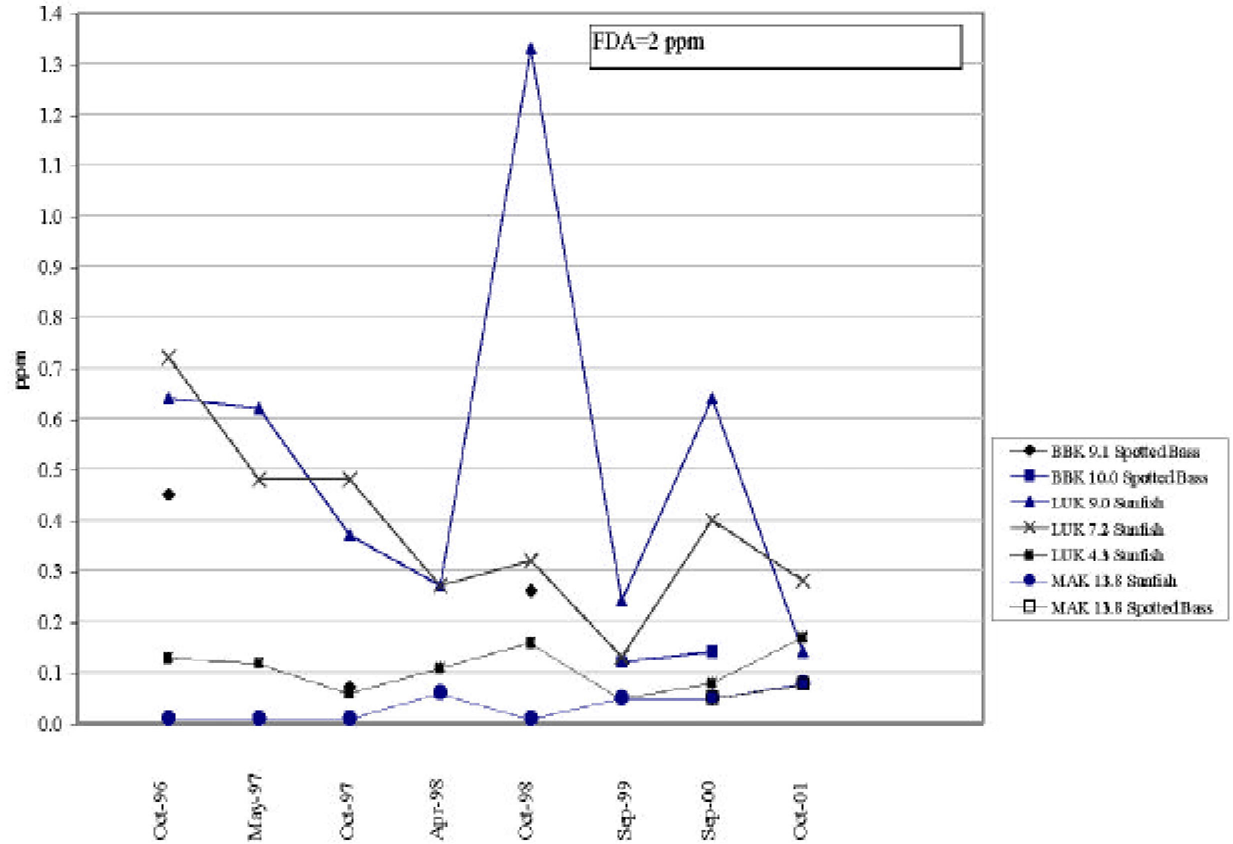

Figure 8.2 Average concentration of PCBs in fish tissue from 1996 through 2001.

9 Groundwater

Abstract

The primary objectives of groundwater monitoring at the Paducah Site are to detect contamination and provide the basis for groundwater quality assessments if contamination is detected. Monitoring includes the exit pathways at the perimeter of the plant and off-site water wells. Primary off-site contaminants continue to be TCE, which is an industrial degreasing solvent, and ^{99}Tc, which is a fission by-product. Evidence suggests the presence of dense nonaqueous phase liquids (DNAPL) in groundwater beneath the site.

Introduction

Monitoring and protection of groundwater resources at the Paducah Site are required by federal and state regulations and by DOE orders. Federal groundwater regulations generally are enacted and enforced by EPA. The Paducah Site lies within EPA Region IV jurisdiction. EPA Region IV encompasses the southeastern United States and maintains headquarters in Atlanta, Georgia. Many state groundwater regulations are enacted and enforced by KDWM located in Frankfort, Kentucky. A KDWM field office for western Kentucky is located in Paducah.

When off-site contamination from the Paducah Site was discovered in 1988, the EPA Region IV and DOE entered into an ACO. DOE provided an alternate water supply to affected residences. Under CERCLA, DOE is also required to determine the nature and extent of off-site contamination through sampling of potentially affected wells and a comprehensive site investigation.

A CERCLA/ACO site investigation, completed in 1991, determined off-site contaminants in the RGA to be TCE, used as an industrial degreasing solvent, and ^{99}Tc, a fission byproduct contained in nuclear power reactor returns that were brought on-site several years ago for reenrichment. Such reactor returns are no longer enriched. Known or suspected sources of TCE and ^{99}Tc include burial grounds, former test areas and other facilities, spills, leaks, and leachate derived from contaminated scrap metal.

Investigations of the on-site source areas of TCE at the Paducah Site are ongoing. A common degreasing agent, TCE is considered a DNAPL with typically low solubility in water. DNAPLs either sink to the bottom of aquifers or come to rest on a less-permeable layer within an aquifer, forming pools. These DNAPL pools form a continuous source for dissolved-phase contamination (plumes) that are migrating off-site toward the Ohio River (Figure 9.1). Pools of DNAPL are extremely difficult to clean up. Currently, only the highest concentrations of dissolved TCE are controlled by pump-and-treat systems at Paducah. The pump-and-treat system installed northwest of the plant also controls the highest concentrations of dissolved ^{99}Tc that would otherwise migrate off-site. Continued groundwater monitoring serves to identify the extent of contamination, predict the possible fate of the contaminants, and determine the movement of groundwater near the plant. This year's (CY 2001) plume map (Figure 9.1) continue the basic interpretation presented in the plume maps for CY 2000. Revisions for CY 2001 reflect the following: (1) increasing TCE trends in C-404 MWs, (2) the consideration of surface water discharge to Little Bayou Creek, and (3) an isolation of contaminants in the C-746-S&T Landfill area. Appendix C provides additional information about these plumes.

Groundwater monitoring at Paducah complies with one or more federal or state regulations and permit conditions and includes perimeter exit pathway monitoring and off-site water well monitoring. (See Groundwater Monitoring Program.) Figures 9.2 and 9.3 show the locations of all wells sampled during 2001.

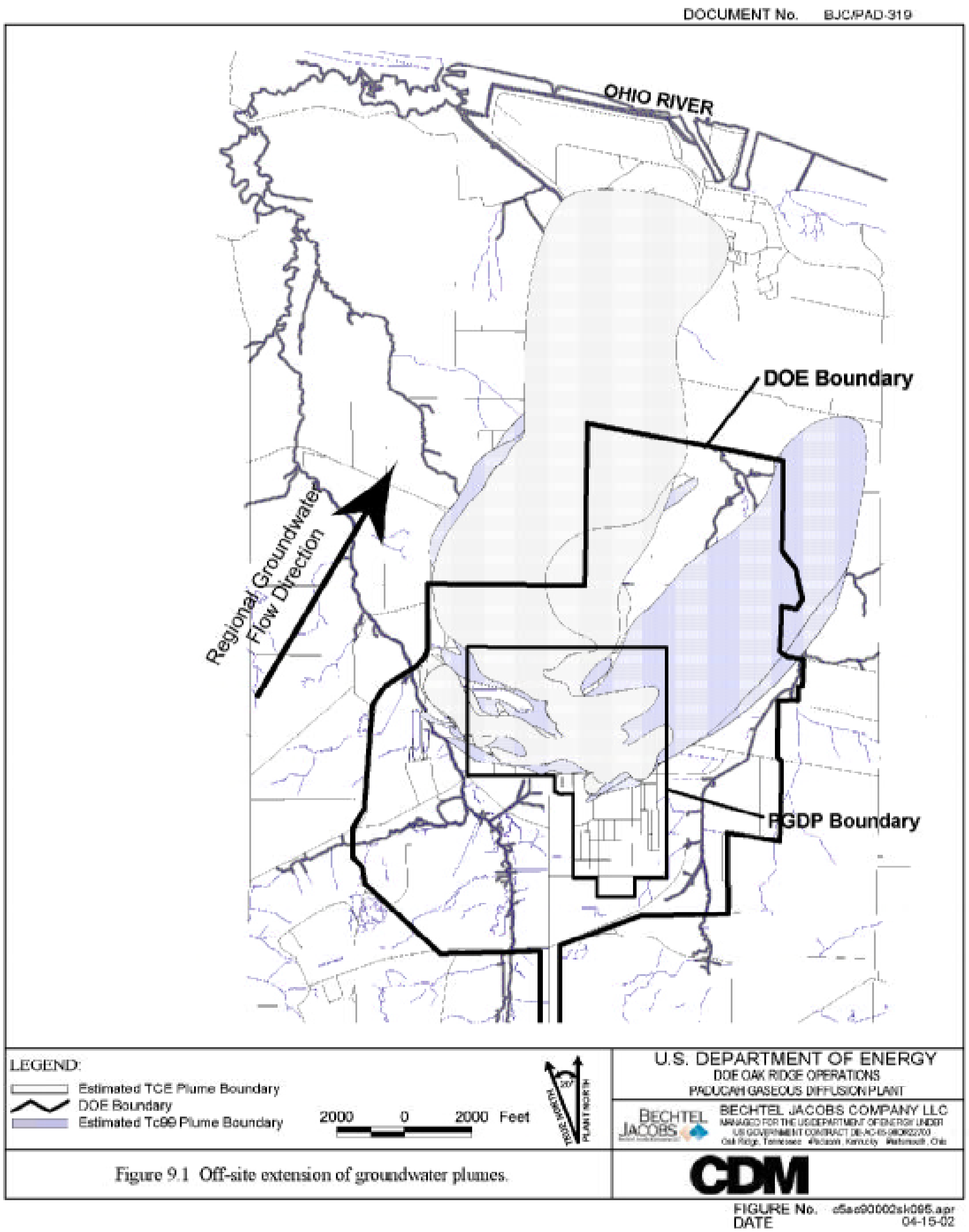

Figure 9.1 Off-site extension of groundwater plumes.

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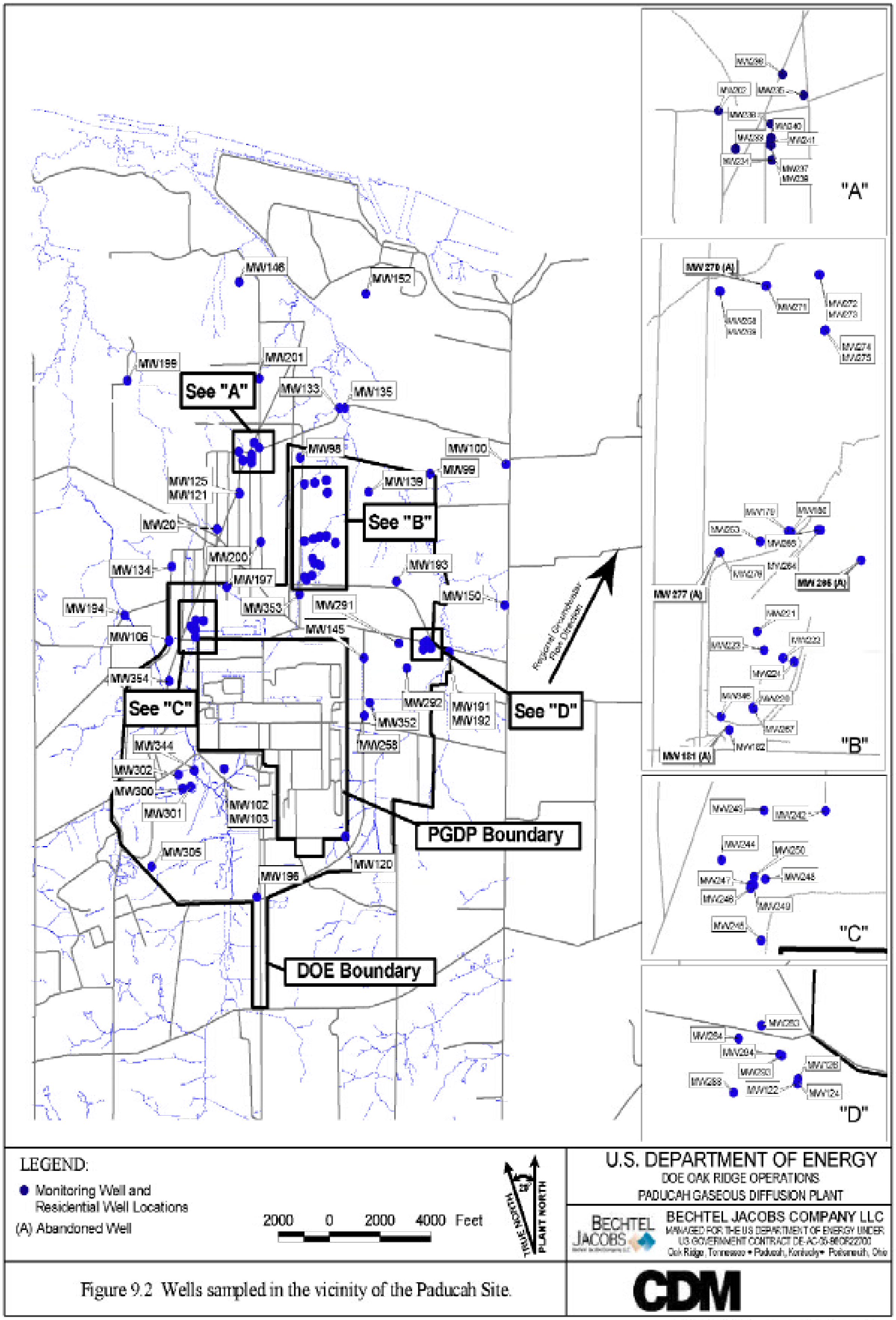

Figure 9.2 Wells sampled in the vicinity of the Paducah Site.

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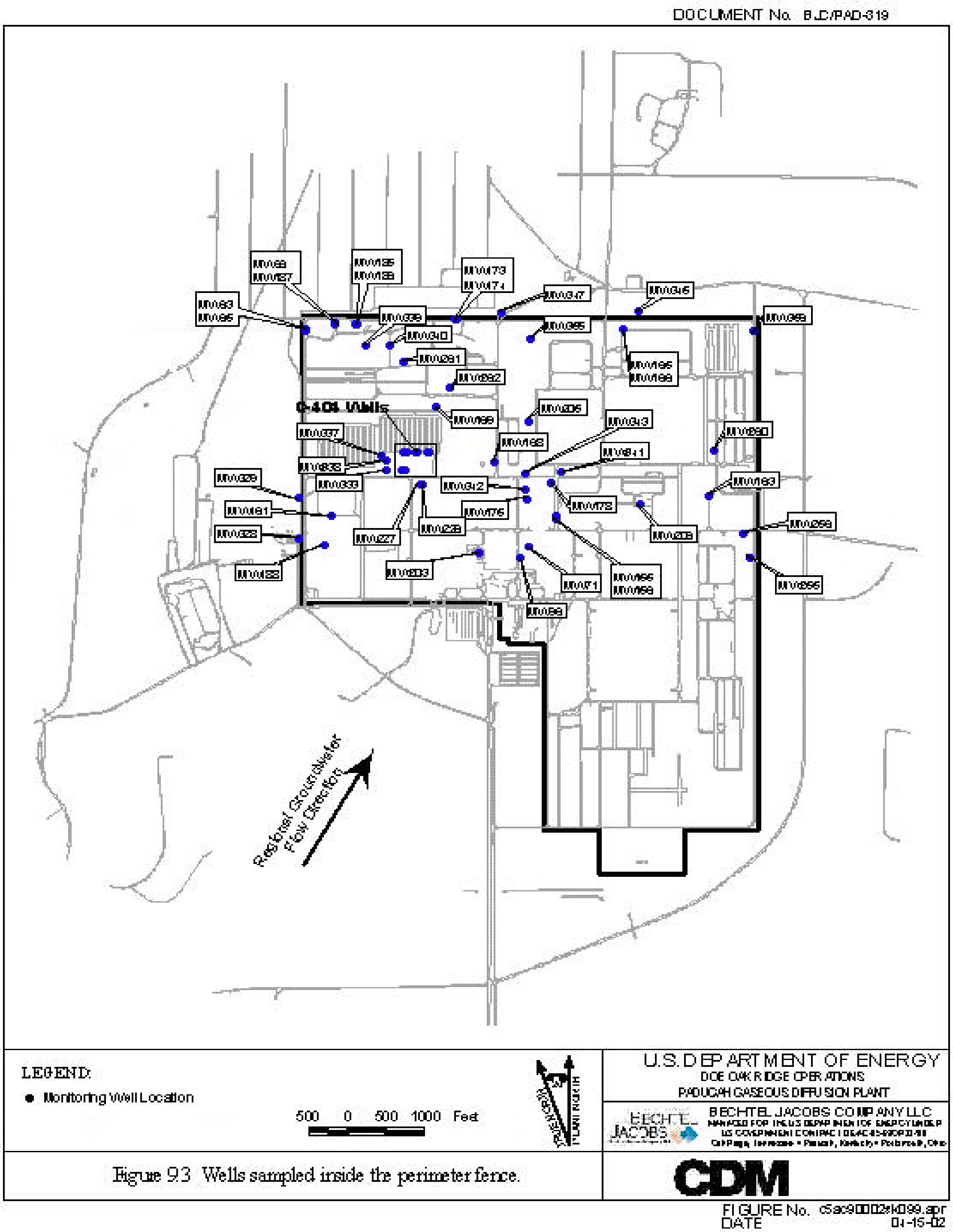


Figure 9.3 Wells sampled inside the perimeter fence.

Groundwater Hydrology

When rain falls to the ground, the water does not stop moving. Some of it flows along the surface in streams or lakes, some of it is used by plants, some evaporates and returns to the atmosphere, and some sinks into the ground. The water moves into the spaces between the particles of sand, infiltrating porous soil and rock. Groundwater is water that is found underground in cracks and spaces in soil, sand, and rock. Groundwater is stored in, and moves slowly through an aquifer, which is a source of useable water. Aquifers typically consist of layers of gravel, sand, sandstone, or fractured rock. The

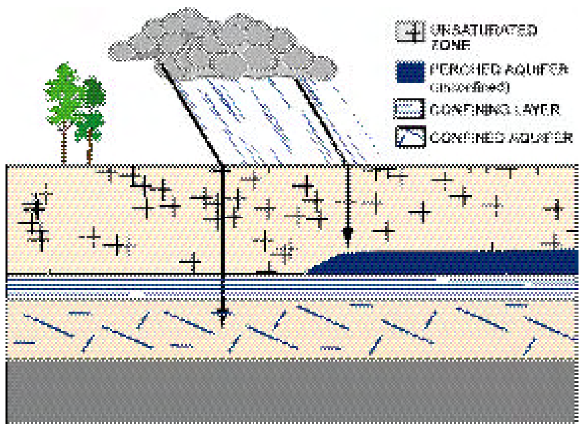


Figure 9.4 Typical path for rainwater accumulation as groundwater.

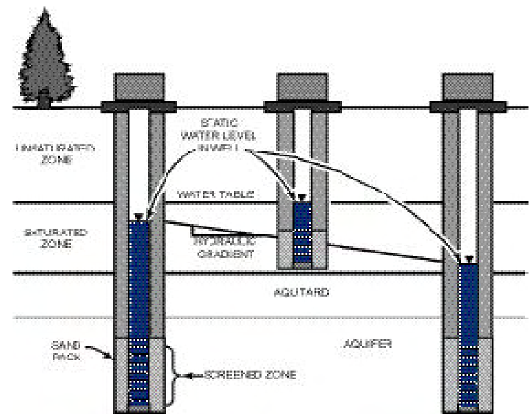


Figure 9.5 Monitoring well construction showing relationship between screened zone and water level in wells where limited flow in the aquifer is to the right.

speed at which groundwater flows depends on the size of the spaces in the soil or rock and how well the spaces are connected. These materials are permeable because they have large connected spaces that allow water to flow through. Permeability, or hydraulic conductivity, is the physical property that describes the ease with which water can move through the pore spaces and fractures in soil, gravel, sand, and rock.

The area where water fills these spaces is called the saturated zone (Figure 9.4). The top of the saturated zone is the water table, which is the boundary between the unsaturated and saturated zones. This boundary usually, but not always, gently mirrors the surface topography, rising above natural exits such as springs, swamps, and beds of streams and rivers. However groundwater is brought to the surface, either naturally through a spring or discharged into lakes and streams. This water can also be extracted through a well drilled into the aquifer. A well is a pipe in the ground that fills with groundwater, which can then be brought to the surface by a pump.

Groundwater movement is determined by differences in the energy associated with the water's elevation above sea level and the pressures exerted on it by surrounding water. This is called the hydraulic head. Hydraulic head is considered the total energy in any water mass resulting from three components: pressure, velocity, and elevation.

Water will rise in a well casing in response to the pressure of the water surrounding the well's screened zone. The depth to water in the well is measured and the elevation calculated to determine the hydraulic head of the water in the monitored zone (Figure 9.5). The hydraulic gradient measures the difference in hydraulic head over a specified distance. By comparing the water levels in adjacent wells screened in the same zone, a horizontal hydraulic gradient can be determined and the lateral direction of groundwater flow can be predicted. Only wells screened in the same zones are considered when determining the horizontal gradient. Wells screened above and below an aquitard (a geologic unit which inhibits groundwater flow) can also have different hydraulic heads, thus defining a vertical gradient. If the water levels in deeper wells are lower than those in shallower wells, vertical flow is primarily downward.

Groundwater aquifers are one of the primary pathways by which potentially hazardous substances can spread through the environment. Substances placed in the soil may migrate downward due to gravity or be dissolved in rainwater, which moves them downward through the unsaturated zone into the aquifer. The contaminated water then flows downgradient toward the discharge point. MWs are used extensively at the Paducah Site to assess the effect of plant operations on groundwater quality. Wells positioned to sample groundwater flowing away from a site are called downgradient wells, and wells placed to sample groundwater before it flows under a site are called upgradient wells. Any contamination of the downgradient wells not present in the upgradient wells at a site may be assumed to be a product of that site. Wells can be drilled to various depths in the saturated zone and be screened to monitor the recharge area above the aquifer, different horizons within the aquifer, or water-bearing zones below the aquifer. Vertical and horizontal groundwater flow directions are determined by the permeability and continuity of geologic strata, in addition to hydraulic head. To effectively monitor the movement of groundwater and any hazardous constituents it may contain, hydrogeologists at the Paducah Site have undertaken many detailed studies of the geology of strata beneath the site.

Geologic and Hydrogeologic Setting

The Paducah Site, located in the Jackson Purchase region of western Kentucky, lies within the northern tip of the Mississippi Embayment portion of the Gulf Coastal Plain Province (Figure 9.6). The Mississippi Embayment is a large sedimentary trough oriented nearly north-south that received sediments during the Cretaceous and Tertiary geologic time periods.

During the Cretaceous Period, sediments deposited in a coastal marine environment, creating the McNairy/Clayton Formation. For the most part, the McNairy/Clayton Formation is sandy at the bottom and silty at the top. There are areas of the

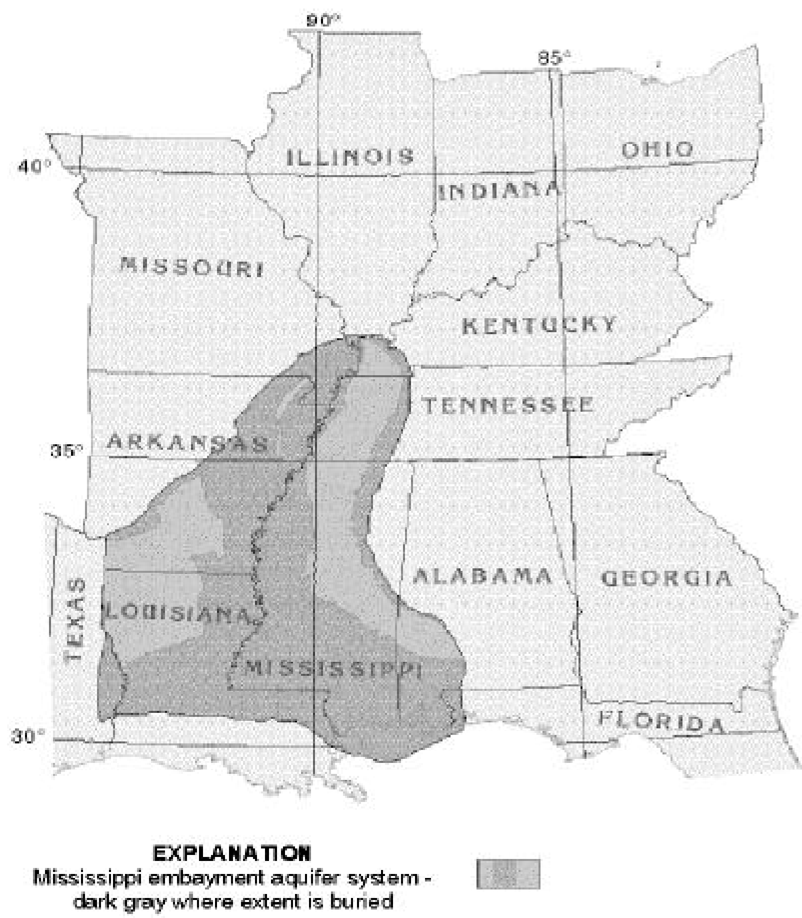


Figure 9.6 The Mississippi embayment aquifer system. (source: USGS website, http://sr6capp.er.usgs.gov/aquiferBasics/ext_embay.html)

McNairy/Clayton Formation that vary such as lenses of clay and at least one fairly continuous string of gravel.

The Clayton Formation is above the McNairy. The Clayton Formation was deposited during the early Paleocene geologic epoch in an environment so similar to that of the McNairy that the Clayton and upper portion of the McNairy are indistinguishable in lithologic samples. Later in the Paleocene, the Porters Creek Clay was deposited in marine and brackish water environments in a sea that occupied most of the Mississippi Embayment. The McNairy/Clayton and the Porters Creek Clay formations, dip 9 to 10.5 m [30 to 35 ft] per mile to the south-southwest.

The next feature in the geologic history at the Paducah Site is a Pleistocene-age river valley occupying approximately the same position as the present-day Ohio and Tennessee river valleys. In forming the valley, braided stream channels of the ancestral Tennessee River, and possibly several “feeder” streams, eroded any sediments deposited after the Paleocene Porters Creek Clay and before the Pleistocene. The river system also eroded portions of the Porters Creek Clay and the McNairy formation and cut a prominent terrace in the Porters Creek Clay at the south end of the plant. The sediments deposited on this erosional surface are termed continental deposits. The lower portion of the continental deposits consists of approximately 9 m (30 ft) of stream gravel and sand.

Over time, sediments from the retreating glaciers dammed the river valley, causing the formation of a lake. Silts and clays with thin zones of sand and occasional gravel were deposited in the lake, forming the upper portion of the continental deposits. These deposits range from approximately 1.5 to 17 m (5 to 55 ft) thick.

Finally, loess, a wind-blown silt, overlies the continental deposits throughout the site. Thickness of loess deposits varies from approximately 1.5 to 8 m (5 to 25 ft), averaging approximately 4.6 m (15 ft).

The local groundwater flow system at the Paducah Site contains the following four major components (listed from shallowest to deepest): (1) the terrace gravels, (2) UCRS, (3) RGA, and (4) the McNairy flow system. The terrace gravels consist of shallow Pliocene gravel deposits in the southern portion of the plant site. These deposits usually lack sufficient thickness and saturation to constitute an aquifer, but may be an important source of groundwater recharge to the RGA.

The UCRS consists mainly of clay silt with interbedded sand and gravel in the upper continental deposits. The system is so named because of its characteristic recharge to the RGA.

The RGA consists of sand and gravel facies in the lower continental deposits, gravel and coarse sand portions of the upper McNairy that are directly adjacent to the lower continental deposits, coarse-grained sediments at the base of the upper continental deposits, and alluvium adjacent to the Ohio River. These deposits have an average thickness of 9 m (30 ft) and can be more than 21 m (70 ft) thick along an axis that trends east-west through the site. The RGA is the uppermost and primary aquifer, formerly used by private residences north of the Paducah Site.

The McNairy flow system consists of interbedded and interlensing sand, silt, and clay of the McNairy Formation. Sand facies account for 40 to 50% of the total formation thickness of approximately 69 m (225 ft).

Uses of Groundwater in the Vicinity

The WKWMA and some lightly populated farmlands are in the immediate vicinity of the Paducah Site. Homes are sparsely located along rural roads in the vicinity of the site. The following three communities lie within 3.2 km (2 miles) of the plant: Magruder Village to the southwest and Grahamville and Heath to the east.

Both groundwater and surface water (Cairo, Il.) sources have been used for water supply to residents and industries in the plant area. Wells in the area are screened at depths ranging from 4.6 to 75 m (15 to 245 ft). The majority of these wells are believed to be screened in the RGA. The Paducah Site continues to provide municipal water to all residents within the area of groundwater contamination from the site. These residents' out-of-service wells are utilized by DOE for sampling as a result of written agreements. Residential wells that are no longer sampled have been capped and locked.

Groundwater Monitoring Program

The primary objectives of groundwater monitoring at the Paducah Site are early detection of any contamination resulting from past and present land disposal of wastes and provision of the basis for developing groundwater quality assessments if contamination is detected. Additional objectives outlined in DOE Order 5400.1, *General Environmental Protection Program*, require that groundwater monitoring at all DOE facilities "...determine and document the effects of operations on groundwater quality and quantity." The order specifically requires groundwater monitoring to be conducted on-site and in the vicinity of DOE facilities to accomplish the following:

- obtain data to determine baseline conditions of groundwater quality and quantity;
- demonstrate compliance with, and implementation of, all applicable regulations and DOE orders;
- provide data to permit early detection of groundwater pollution or contamination;
- provide a reporting mechanism for detected groundwater pollution or contamination;
- identify existing and potential groundwater contamination sources and maintain surveillance of these sources; and
- provide data for making decisions about land disposal practices and the management and protection of groundwater resources.

These objectives are outlined in the following three documents related to groundwater monitoring: *Paducah Gaseous Diffusion Plant Groundwater Protection Program Management Plan* (BJC 2000b), *Groundwater Protection Plan* (BJC 2001), and the *Paducah Site Environmental Monitoring Plan* (BJC 2000a). Scheduled sampling continues for more than 150 MWs and residential wells in accordance with DOE orders and federal, state, and local requirements. Well sampling is included in several different monitoring programs, which are described below.

Resource Conservation Recovery Act Permit Monitoring Programs

Presently, the only hazardous waste facility at the Paducah Site that requires groundwater monitoring is the C-404 Landfill (Figure 9.7). The C-404 Low-Level Radioactive Waste Burial Ground was used for the disposal of uranium-contaminated solid wastes until 1986 when it was determined that, of the wastes disposed there, gold dissolver precipitate was considered a hazardous waste under RCRA. The landfill was covered with a RCRA-compliant clay cap and was certified closed as a hazardous waste landfill in 1987. The landfill is now monitored under post-closure monitoring requirements. According to the Kentucky C-404 Post Closure Permit, 14 wells (MWs 84–95, 226, and 227) monitor groundwater quality of the UCRS (four wells) and the underlying RGA (ten wells) during the required post-closure care on a semiannual basis.

During 2001, MWs at the C-404 Landfill were sampled and analyzed for total and dissolved arsenic, cadmium, chromium, lead, mercury, selenium, TCE, ^{99}Tc, and uranium. TCE exceeded the Maximum Contaminant Level (MCL) in four upgradient RGA wells and two downgradient RGA

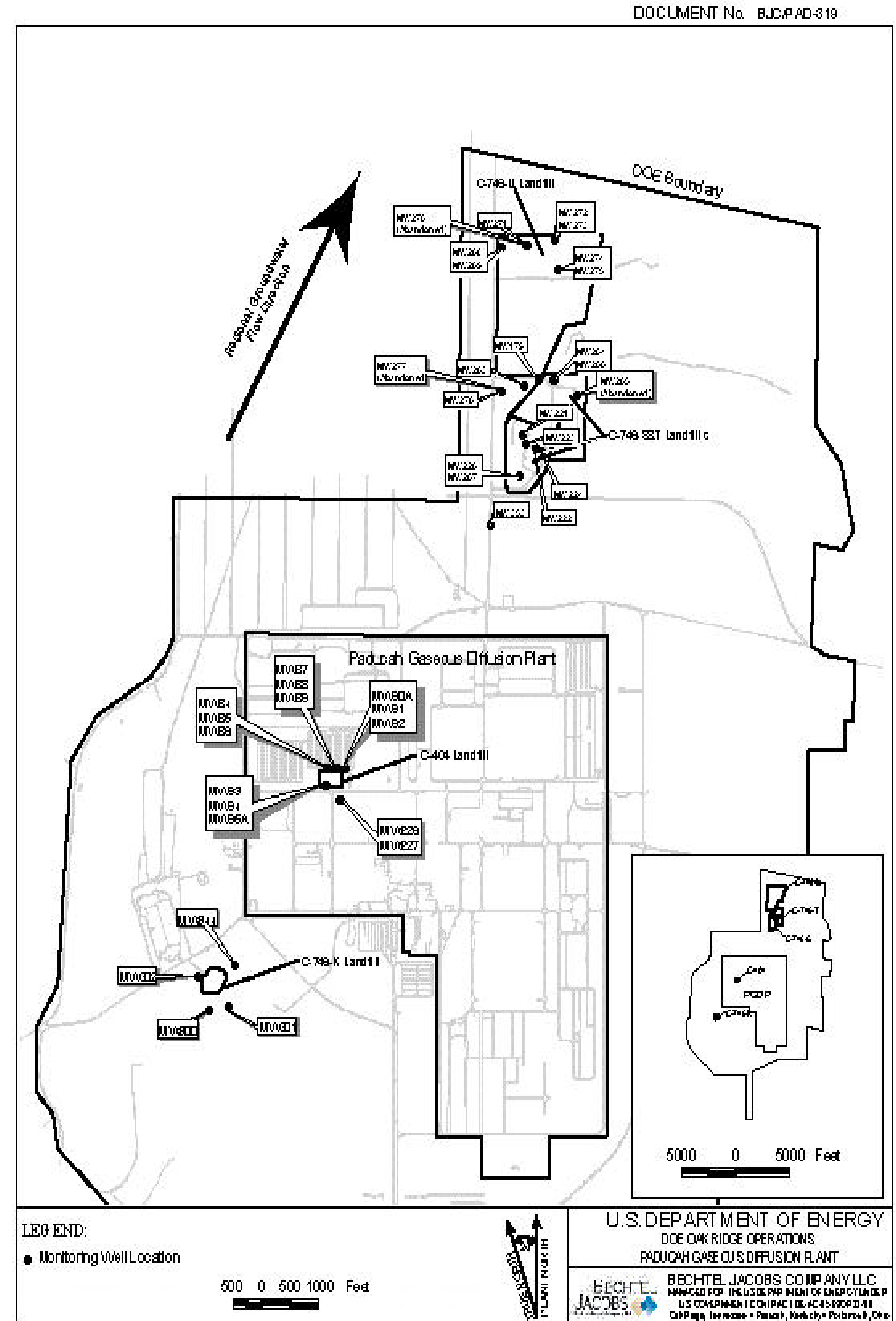


Figure 9.7 Monitoring well locations near the landfills

wells. Chromium also exceeded MCLs in one upgradient RGA well. Results are reported to KDWM semiannually. A summary of the maximum results for each of the wells is provided in Table 9.1.

In response to a NOV received regarding well integrity of MW 87 (Section 2), DOE initiated a well rehabilitation project for three C-404 wells in 2001. The wells were MW 87, MW 90 and MW 95. A chemical rehabilitation (cleaning) process was completed and camera surveys were performed on the wells. As a result, corrosion was suspected in MW 90 and MW 95 and both wells were subsequently abandoned and replaced. Figure 9.8 shows a monitoring well installation.

Figure 9.8 Monitoring well installation.

State Solid Waste Disposal Regulations

Post-closure groundwater monitoring continues for the C-746-S Residential Landfill. The landfill stopped receiving solid waste before July 1, 1995, and was certified closed on October 31, 1995, by an independent engineering firm. The groundwater monitoring system for the C-746-S Residential Landfill also encompasses the C-746-T Inert Landfill, which was certified closed in November 1992. The C-746-T Inert Landfill has fulfilled its two years of post-closure environmental monitoring and maintenance requirements and is awaiting final closure approval from KDWM.

The groundwater monitoring system for C-746-S and C-746-T consists of three upgradient and nine downgradient wells (Figure 9.7). The monitoring system is designed to monitor both the upper portion of the RGA (URGA) and lower portion of the RGA (LRGA). Upgradient wells are recognized as MW 220, MW 267, and MW 353 while downgradient wells are recognized as MW

Table 9.1 Summary of maximum groundwater results from the RGA at C-404 Landfill.

	Upgradient Wells				Downgradient Wells							
Parameter	MW 226	MW 227	MW 93	MW 95	MW 84	MW 86	MW 87	MW 89	MW 90	MW 92	Criteria Reference	
Arsenic (mg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	MCL
Arsenic, Dissolved (mg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Chromium, Total (mg/L)	**0.34**	0.026	ND	ND	ND	ND	ND	ND	ND	ND	0.1	MCL
Chromium, Dissolved (mg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
^{99}Tc (pCi/L)	150	ND	ND	24	ND	ND	ND	ND	ND	ND	900	MCL
Trichloroethene (µg/L)	81	7	65	19	41	18	5	ND	5	ND	5	MCL

ND - Non Detect

MCL - Maximum Contaminant Level

[Bold] = Exceeds Criteria

179, MW 221 through MW 224, and MW 263, MW 264, MW 265 (abandoned), and MW 266. An additional well, MW 225, is monitored for static water level only.

At the request of KDWM, MWs are being abandoned and replaced due to questionable integrity. A revised groundwater monitoring plan for the landfills was submitted in late 2001. DOE responded to KDWM comments on the plan. The revised plan was submitted and preparations are underway to implement the abandonment and replacement project in 2002.

The MWs are sampled quarterly and in accordance with 401 KAR 48:300. The analytes are dictated by a KDWM approved solid waste landfill permit modification. Evaluation of the groundwater monitoring data collected at the C-746-S and C-746-T landfills requires immediate reporting to KDWM of results exceeding Kentucky MCLs (401 KAR 47:030 Section 6) and statistical analysis of the results for constituents that do not have an MCL.

During 2001, aluminum, chromium, iron, and manganese exceeded contaminant levels in both upgradient and downgradient wells. TCE exceeded contaminant levels in four downgradient wells. Beta activity and ^{99}Tc exceeded contaminant levels in one downgradient well. Dissolved solids and turbidity contaminant level exceedences were seen in some upgradient and downgradient wells. KDWM was notified of the exceedences, as required by the permit. Results were reported to KDWM on a quarterly basis. A summary of the maximum results for each of the wells is provided in Table 9.2.

Table 9.2 Summary of maximum groundwater results at C-746-S&T Landfill.

		Upgradient Wells			Downgradient Wells								Criteria Reference
	Parameter	220	267	353	179	221	222	223	224	263	264	266	
Metal (mg/L)	Aluminum	ND	ND	5.3	ND	ND	15	6.1	ND	ND	ND	ND	0.2 SMCL
	Arsenic	ND	ND	0.031	ND	ND	ND	ND	ND	ND	ND	ND	0.1 MCL
	Barium	0.23	0.24	0.17	0.028	0.26	0.34	0.35	0.27	0.075	0.15	0.055	2 MCL
	Barium, Dissolved	0.22	0.22	0.095	0.036	0.24	0.25	0.2	0.24	0.065	0.14	0.057	2 MCL
	Calcium	25	21	49	74	25	22	22	33	37	46	44	
	Chromium, Total	0.06	0.86	0.54	ND	0.1	0.089	1.4	ND	0.47	ND	0.78	0.1 MCL
	Chromium, Dissolved	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1 MCL
	Cobalt	ND	ND	ND	ND	ND	ND	0.083	ND	ND	ND	ND	
	Copper	ND	ND	ND	ND	ND	ND	0.064	ND	ND	ND	0.041	1.3 SMCL
	Iron	0.26	3.4	16	0.25	0.71	49	25	ND	5.1	0.43	9.6	0.3 SMCL
	Magnesium	10	8.5	11	21	11	9.2	9	13	15	15	17	
	Manganese	0.12	ND	0.12	ND	ND	0.46	2.3	ND	ND	0.089	0.059	0.1 SMCL
	Molybdenum	ND	0.12	ND	ND	ND	ND	0.084	ND	ND	ND	ND	
	Nickel	1	0.22	0.44	ND	0.28	0.18	1.1	ND	ND	ND	0.33	
	Potassium	4.2	2.5	2.2	2	3.2	2.5	11	2	2.6	ND	6.9	
	Sodium	41	42	130	71	46	49	44	66	50	45	44	
	Uranium	ND	ND	0.001	ND	ND	0.001	ND	ND	ND	ND	ND	0 MCL
	Vanadium	ND	ND	ND	ND	ND	0.033	ND	ND	ND	ND	ND	
Rads	Alpha activity	3.9	ND	ND	ND	ND	ND	ND	ND	ND	6.9	ND	15 MCL
(pCi/L)	Beta activity	15	12	64	390	7.6	5.4	12	ND	26	8	13	50 MCL
	^{40}K	ND	ND	ND	ND	ND	47	ND	ND	ND	ND	ND	
	^{99}Tc	20	17	82	510	ND	ND	19	ND	32	ND	19	900 MCL
VOC (µg/L)	Trichloroethene	ND	ND	ND	9	2	ND	ND	2	23	8	16	5 MCL
Other	Chloride (mg/L)	44	53	78	41	48	32	43	37	54	42	61	250 SMCL
	Fluoride (mg/L)	0.23	0.13	0.21	0.18	0.2	0.29	0.27	0.27	0.19	0.16	0.15	4 MCL
	Nitrate as Nitrogen (mg/L)	1.5	2	ND	1.5	1.8	ND	2	1.3	ND	ND	1.4	10 MCL
	Sulfate (mg/L)	12	10	21	200	12	10	10	13	47	69	77	
	Dissolved Solids (mg/L)	260	240	620	640	260	270	290	320	320	320	350	500 SMCL
	Total Organic Carbon (mg/L)	1	ND	2.1	1.2	ND	ND	ND	1.1	1	ND	ND	
	Turbidity (NTU)	3.8	12	160	2.5	7.6	500	260	ND	37	4.4	50	5 MCL

SMCL - Secondary MCL
MCL - Maximum Contaminant Level
ND - Non Detect
[Bold] – Exceeds Criteria

The C-746-U Contained Landfill, solid waste landfill at the Paducah Site, was completed in 1996. Operation was initiated in 1997. Solid waste regulations require groundwater monitoring. Clusters of wells are installed which are made up of one well in the URGA and one well in the LRGA. One well cluster (MW 276 and MW 277 [abandoned]) is located upgradient of the facility and four well clusters are downgradient (Figure 9.7).

At the request of KDWM, MWs are being abandoned and replaced due to questionable integrity. A revised groundwater monitoring plan for the landfill was submitted in late 2001. DOE responded to KDWM comments on the plan. The revised plan was submitted and preparations are underway to implement the abandonment and replacement project in 2002.

Evaluation of the groundwater monitoring data collected at the C-746-U Landfill included, for permitted wells, immediate reporting to KDWM of results exceeding Kentucky MCLs (401 KAR 47:030, Section 6) and statistical analysis of the results for constituents that do not have an MCL. During 2001, TCE exceeded contaminant levels in one upgradient well. Aluminum, chromium, iron, and manganese exceeded contaminant levels in some upgradient and downgradient wells. Beta activity exceeded contaminant levels in four downgradient wells. Turbidity exceeded contaminant levels in one upgradient and four downgradient wells. KDWM was notified of the exceedences and results were reported to KDWM on a quarterly basis. A summary of the maximum results for each parameter for the wells is provided in Table 9.3.

Table 9.3 Summary of maximum groundwater results at C-746-U Landfill.

		Upgradient Well	Downgradient Wells							
	Parameter	276	268	269	271	272	273	274	275	Criteria Reference
Metal (mg/L)	Aluminum	**0.23**	ND	ND	ND	ND	ND	**1.3**	ND	0.2 SMCL
	Barium	0.27	0.19	0.065	0.12	0.2	0.21	0.24	0.22	2 MCL
	Barium, Dissolved	0.24	0.2	0.058	0.12	0.19	0.19	0.22	0.23	
	Calcium	31	22	39	29	26	27	27	26	
	Chromium	**2.1**	0.054	0.078	0.065	0.076	0.048	**0.34**	**0.29**	0.1 MCL
	Copper	0.073	ND	ND	ND	ND	ND	ND	ND	1.3 SMCL
	Iron	**9.9**	**1.7**	0.20	**0.33**	**1.7**	**0.63**	**2.5**	**1.5**	0.3 SMCL
	Magnesium	12	8.7	16	12	11	9.7	11	11	
	Manganese	0.056	0.018	ND	ND	**0.65**	ND	ND	ND	0.1 SMCL
	Molybdenum	0.096	ND	ND	ND	ND	ND	ND	ND	
	Nickel	0.36	0.32	ND	ND	ND	ND	ND	ND	
	Potassium	ND	ND	ND	2.5	3.8	ND	2.3	2.9	
	Sodium	38	40	54	43	54	38	42	40	
Rads (pCi/L)	Alpha activity	4.4	4.3	ND	ND	ND	4.3	10	ND	15 MCL
	Beta activity	39	32	**56**	27	47	**67**	**77**	**150**	50 MCL
	^{234}Pa	ND	210	ND	ND	ND	ND	220	ND	
	^{226}Ra	2.7	ND	3.6	2.8	4.3	ND	ND	ND	20 SDWA
	^{99}Tc	69	59	120	48	79	130	120	230	900 MCL
VOC (µg/L)	Trichloroethene	**16**	2	4	ND	ND	ND	3	1	5 MCL
Other	Chloride (mg/L)	53	21	31	26	53	38	41	39	250 SMCL
	Fluoride (mg/L)	0.16	0.17	0.17	0.16	0.18	0.16	0.18	0.18	4 MCL
	Nitrate as Nitrogen (mg/L)	1.4	ND	ND	1.3	1.1	1.1	1.1	1.3	10 MCL
	Sulfate (mg/L)	12	53	100	69	28	22	28	18	
	Dissolved Solids (mg/L)	280	250	350	290	290	280	260	230	500 SMCL
	Turbidity (NTU)	**30**	**9.4**	1.4	1.5	**12**	3.3	**21**	**11**	5 MCL

SMCL - Secondary MCL
MCL - Kentucky Maximum Contaminant Level
ND - Non Detect
[Bold] – Exceeds Criteria

Table 9.4 Summary of maximum groundwater results at C-746-K Landfill.

	Parameter	MW300	MW301	MW302	MW344	Criteria Reference	
Metal (mg/L)	Aluminum	**16**	**1.9**	ND	**16**	0.2	SMCL
	Barium	ND	0.063	0.078	0.076	2	MCL
	Barium, Dissolved	ND	0.067	0.074	0.058	2	MCL
	Beryllium	**0.017**	ND	ND	**0.016**	0.004	MCL
	Beryllium, Dissolved	**0.016**	ND	ND	**0.016**	0.004	MCL
	Cadmium	**0.04**	**0.036**	**0.047**	**0.036**	0.005	MCL
	Cadmium, Dissolved	**0.032**	**0.035**	**0.047**	**0.04**	0.005	MCL
	Iron	340	140	ND	**320**	0.3	SMCL
	Magnesium	94	41	27	93		
	Manganese	29	14	0.21	28	0.05	SMCL
	Nickel	0.26	ND	ND	0.25		
	Potassium	16	22	ND	16		
	Sodium	30	21	87	37		
	Strontium	1.6	1	0.42	1.5		
	Uranium	0.004	0.003	0.001	0.004	0.02	MCL
	Uranium, Dissolved	0.004	0.003	ND	0.004	0.02	MCL
Rads (pCi/L)	Beta activity	34	**54**	ND	10	50	MCL
	^{40}K	ND	ND	360	ND		
VOC (µg/L)	1,1-Dichloroethane	64	ND	ND	59		
	1,1-Dichloroethene	**100**	ND	ND	**100**	7	MCL
	cis-1,2-Dichloroethene	**980**	14	ND	**980**	70	SMCL
	Trichloroethene	**44**	ND	ND	**46**	5	MCL
	Vinyl chloride	**8**	ND	ND	ND	2	MCL
Other (mg/L)	Hexavalent Chromium	0.01	ND	ND	ND		
	Silica	44	29	50	42		
	Suspended Solids	ND	110	ND	53		

SMCL - Secondary MCL

MCL - Kentucky Maximum Contaminant Level

ND - Non Detect

[Bold] = Exceeds Criteria

C-746-K Sanitary Landfill Groundwater Monitoring

The C-746-K Sanitary Landfill was used at PGDP between 1951 and 1981 primarily for the disposal of fly ash. Post-closure groundwater monitoring continues for the C-746-K Landfill on a quarterly basis. The UCRS and RGA are not present at the C-746-K site. Wells at the landfill are installed to monitor groundwater in the terrace gravels (Figure 9.7). A summary of the maximum results for each of the wells is provided in Table 9.4. TCE and degradation compounds, above the MCL, were identified in wells around the C-746-K site. Aluminum, beryllium, and cadmium were also found above MCLs.

Residential (Federal Facility Agreement) Monitoring

The FFA requires sampling of residential wells potentially affected by the contaminant plume (DOE 1998). Currently, only three residential wells (R2, R294, and R302) are sampled monthly. Eighteen other residential wells are monitored semiannually per the FFA. Additionally, MW 66 (located on site at the northwest corner of the plant) is required to be sampled on a monthly basis. All monthly sampled wells were analyzed for alpha and beta activity, TCE, and ^{99}Tc. MW 66 is sampled annually for additional radionuclides. As stated previously, the hydrologic unit in which residential wells are screened is uncertain; however, most are believed to be RGA wells. Table 9.5 provides a summary of the maximum detected results for the monthly monitoring programs. The eighteen residential wells, sampled semiannually, showed no detections of alpha, beta, TCE, or ^{99}Tc, these results are not listed in the Table 9.5.

For one residential well, R424, DOE has provided the residents with a carbon filtering system to allow them to have safe drinking water. These filters are replaced semiannually and sampled before and after filter replacement. The groundwater in the well contains TCE below levels established by the EPA Safe Drinking Water Act; however, its location makes it highly improbable that the contaminants migrated from the Paducah Site. All residents were notified by mail of the results.

Environmental Surveillance Monitoring

Environmental surveillance monitoring is defined as perimeter exit pathway (off-site exposure) monitoring and off-site water well monitoring. Environmental surveillance monitoring is conducted in support of DOE orders and other laws and regulations as addressed in the *Paducah Site Environmental Monitoring Plan* (BJC 2000). Specific wells monitored for environmental surveillance are as follows:

• *Annual Monitoring Progra*m - UCRS MWs 96, 180, 182, 188, and 192; RGA MWs 71, 106, 134, 155, 156, 163, 168, 169, 175, 178, 188, 191, 193, 200, 201, 203, 205, and 206; McNairy MW 133;

• *Annual Background Monitoring Progra*m - Terrace Gravels MW196; Eocene Sand MW305; RGA MWs 103, 150, 194, and 199; McNairy MWs 102, 120, 121, and 122;

• *Quarterly Monitoring Progra*m - UCRS MWs 166, 174, 186, and 187; RGA MWs 20, 63, 65, 98, 99, 100, 125, 135, 139, 146, 152, 161, 165, 173, 185, 197, 202, 260, 261, 262, 328, 329, 333, 337, 338, 339, 340, 341, 342, 343, 352, 354, and 355; McNairy MW356; Rubble Zone MWs 345, 346, and 347.

During 2001, surveillance wells were sampled for VOCs, metals, chloride, radionuclides, alpha and beta activity, and hexavalent chromium. Table 9.6 provides a summary of the maximum detected results for each hydrogeologic unit sampled for the surveillance program. The maximum TCE value reported in the RGA is 180,000 µg/L from MW 156. The well is located at the southeast corner of C-400. This level of TCE is consistent with levels shown at this well in the past. TCE was also detected in the McNairy at 30 µg/L in MW 356. The well was first sampled in December 1999. Only one other well completed in the McNairy (MW 121) showed any TCE detections (2 µg/L).

Three wells, MW 345, MW 346, and MW 347, have been installed penetrating the Rubble Zone, which is the formation underlying the McNairy.

Table 9.5 Summary of maximum groundwater results from residential monthly monitoring.

Well Number	Alpha activity pCi/L	Beta activity pCi/L	^{99}Tc pCi/L	TCE µg/L
R2	3.7	**260**	330	**1500**
R294	3.5	5.2	ND	1
R302	3.8	7.2	ND	ND
MW 66	**16**	**770**	**1300**	**4700**
	MCL–15	MCL–50	MCL–900	MCL–5

ND - Non Detect

MCL - Kentucky Maximum Contaminant Level

[Bold] – Exceeds Criteria

Table 9.6 Summary of maximum groundwater results from environmental surveillance quarterly, annual, and background monitoring.

	Parameter	Eocene	McNairy	RGA	Rubble Zone	Terrace Gravel	UCRS	Criteria	Reference
VOC (µg/L)	1,1-Dichloroethane	ND	ND	8	ND	ND	ND		
	1,1-Dichloroethene	ND	ND	**28**	ND	ND	ND	7	MCL
	Carbon tetrachloride	ND	ND	**200**	ND	ND	ND	5	MCL
	cis-1,2-Dichloroethene	ND	ND	**270**	ND	ND	**580**	70	SMCL
	Tetrachloroethene	ND	ND	**79**	ND	ND	ND	5	SMCL
	Trichloroethene	3	**30**	**180000**	ND	**81**	**1500**	5	MCL
	Vinyl chloride	ND	ND	ND	ND	ND	**890**	2	MCL
Metal (mg/L)	Aluminum	ND	ND	**0.429**	ND	ND	ND	0.2	SMCL
	Aluminum, Dissolved	0.548	ND	**0.408**	ND	ND	**0.346**	0.2	SMCL
	Chromium	ND	ND	**0.154**	ND	ND	ND	0.1	MCL
	Chromium, Dissolved	ND	ND	**1.78**	ND	ND	ND	0.1	MCL
	Copper, Dissolved	ND	ND	0.04	ND	ND	ND		
	Iron	ND	ND	**12.7**	ND	ND	ND	0.3	SMCL
	Iron, Dissolved	**0.474**	**14**	**11.4**	ND	ND	**28.1**	0.3	SMCL
	Nickel	ND	ND	0.075	ND	ND	ND		
	Nickel, Dissolved	ND	ND	1.48	ND	ND	0.214		
	Phosphorous, Dissolved	1.8	0.46	0.31	ND	0.07	0.35		
	Uranium	0.003	0.002	**0.35**	0.001		**0.49**	0.02	MCL
	Uranium, Dissolved	0.002	ND	ND	ND	ND	**0.31**	0.02	MCL
Rads (pCi/L)	Alpha activity	**16.7**	**23.6**	**111**	14.2	ND	**266**	15	MCL
	Beta activity	10.3	**61.6**	**8140**	12.1	7.9	**166**	50	MCL
	Dissolved Alpha	ND	7.02	35.7	ND	ND	94.6		
	Dissolved Beta	ND	31.2	6520	ND	ND	74.2		
	^{237}Np	ND	ND	2.52	ND	ND	ND		
	^{40}K	ND	ND	377	ND	ND	ND		
	Suspended Alpha	ND	9.26	ND	ND	ND	ND		
	Suspended Beta	ND	11.6	14.1	ND	ND	4.16		
	^{99}Tc	ND	ND	**11700**	ND	ND	91.7	900	MCL
	^{228}Th	0.223	0.439	0.211	ND	ND	ND		
	^{230}Th	0.264	ND	0.698	ND	ND	ND		
	Uranium	ND	ND	1560	ND	ND	ND		
	Uranium, Dissolved	ND	ND	1380	ND	ND	ND		
	^{234}U	ND	ND	847	ND	ND	ND		
	^{235}U	ND	ND	39.7	ND	ND	ND		
	^{238}U	ND	ND	758	ND	ND	ND		
Other (mg/L)	Chloride	4.3	17.2	125.1	ND	106.8	91.7	250	MCL
	Carbonaceous Biochemical Oxygen Demand (CBOD)	ND	ND	19	ND	ND	ND		
	Chromium, hexavalent	ND	ND	ND	ND	ND	0.02		
	Hardness - Total as CaCO3	43	112	176	ND	59	190		
	Suspended Solids	217	25	37	ND		73		

SMCL - Secondary MCL

MCL - Maximum Contaminant Level

ND - Non Detect

[Bold] = Exceeds Criteria

Initial sampling of the wells indicated no contamination; however, in 2000 TCE was detected at 1 µg/L. This year, no TCE was detected in these wells. Beta activity was detected in all three wells: MW 345 at 11.1 pCi/L, MW 346 at 12.1 pCi/L, and MW 347 at 8.52 pCi/L. Alpha activity was detected in MW 346 at 14.2 pCi/L. ^{99}Tc was not detected in these wells.

Environmental Restoration Activities

Northwest Plume Monitoring

The EPA approved an IRA ROD to hydraulically contain off-site migration of the northwest plume. This was the first phase of remedial action for groundwater at the Paducah Site. Two extraction wells near a source of the northwest plume and two additional extraction wells farther north, near the centroid of the plume, were installed. Each set of extraction wells is surrounded by a MW network (Figure 9.9). The network is used for monitoring groundwater quality and water levels to determine the effectiveness of the interim action. Collectively, the system is known as the Northwest Plume Groundwater System.

Long-term monitoring has been conducted at the Northwest Plume. Data gathered from 1995 through 2001 suggest that the overall concentration of TCE and ^{99}Tc in the majority of the wells is decreasing. This indicates that the well fields are beginning to achieve containment of the core of the plume. Other analytical data are gathered to monitor the extraction system performance. A more detailed description of TCE and ^{99}Tc in the Northwest Plume is included in Appendix C. Summaries of the program's monitoring results are listed in Tables 9.7 and 9.8. The data for this program are reported in the FFA Semiannual Progress Report.

Northeast Plume Monitoring

A ROD was approved by the EPA in June of 1995. Implementation of the ROD was completed in 1996 and consisted of construction of two extraction wells, several MWs (Figure 9.10) and piezometers, and facilities required to transfer the TCE-contaminated water to the C-637 Cooling Tower for treatment. Groundwater quality and water level information obtained from the piezometers and MWs are used to evaluate the effectiveness of the remedial action. The upgradient MWs are used to detect possible ^{99}Tc contamination within the high-concentration area of the plume before it reaches the extraction wells.

Monitoring results from the Northeast Plume indicate TCE levels have dropped significantly since implementation of the remedial action (BJC 2001b). Other analytical data is also gathered to monitor the extraction system performance. A more detailed description of TCE and ^{99}Tc in the Northeast Plume is included in Appendix C. A summary of the program's monitoring results is listed in Table 9.9. The data for this program are reported in the FFA Semiannual Progress Report.

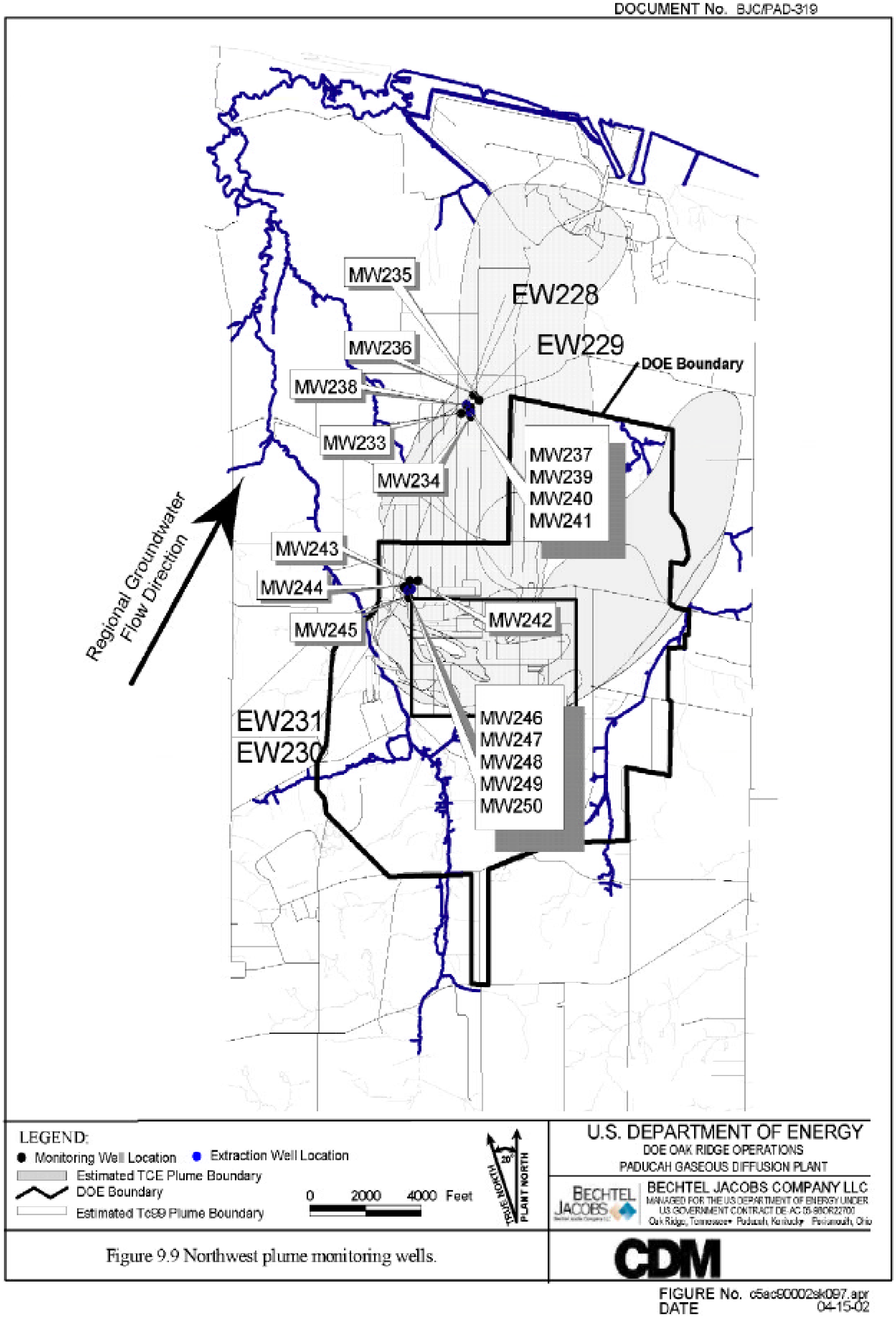


Figure 9.9 Northwest plume monitoring wells.

Table 9.7 Summary of maximum groundwater results from the Northwest Plume north field groundwater monitoring.

	Analysis	MW 233	MW 234	MW 235	MW 236	MW 237	MW 238	MW 239	MW 240	MW 241	Criteria	Reference
Metals (mg/L)	Aluminum	ND	ND	ND	ND	**0.42**	**0.37**	**0.2**	ND	**0.6**	0.2	SMCL
	Barium	0.12	0.15	0.16	0.14	0.21	0.13	0.041	0.12	0.12	2	MCL
	Barium, Dissolved	0.12	0.15	0.15	0.14	0.23	0.13	0.04	0.13	0.12	2	MCL
	Cadmium, Dissolved	ND	ND	ND	ND	0.026	ND	0.031	ND	ND		
	Calcium	19	25	28	24	22	21	5	21	22		
	Calcium, Dissolved	21	22	24	22	23	23	4.7	21	20		
	Chromium	ND	ND	ND	0.065	ND	ND	ND	ND	ND	0.1	MCL
	Copper	0.026	ND	ND	0.025	ND	ND	ND	ND	ND	1.3	SMCL
	Iron	ND	**0.37**	**2.3**	**1.5**	0.28	**0.46**	24	**0.32**	**0.87**	0.3	SMCL
	Iron, Dissolved	ND	ND	ND	ND	ND	ND	**26**	ND	**0.43**	0.3	SMCL
	Magnesium	7.8	9.9	11	9.6	8.8	8.7	3.3	8.5	8.7		
	Magnesium, Dissolved	8.3	9	10	8.9	9	9	3.2	8.5	8.2		
	Manganese	ND	0.03	0.069	ND	ND	ND	**0.58**	ND	ND	0.05	SMCL
	Manganese, Dissolved	ND	0.029	0.066	ND	ND	ND	**0.88**	ND	ND	0.05	SMCL
	Nickel	0.085	ND	ND	ND	ND	ND	ND	ND	ND		
	Nickel, Dissolved	0.08	ND	ND	ND	ND	ND	ND	ND	ND		
	Potassium	ND	ND	ND	ND	ND	ND	7.5	ND	ND		
	Potassium, Dissolved	ND	ND	ND	ND	ND	ND	8.3	ND	ND		
	Sodium	28	32	38	33	75	29	18	28	30		
	Sodium, Dissolved	32	29	34	29	78	30	18	29	29		
Rads (pCi/L)	Alpha activity	3.3	4.7	9.8	4.5	7.2	20	7.7	ND	7.3	15	MCL
	Beta activity	14	**390**	**380**	**320**	6.6	**250**	14	**96**	**53**	50	MCL
	^{99}Tc	ND	610	650	590	ND	350	ND	120	63	900	MCL
VOC (µg/L)	Trichloroethene	**34**	**1400**	**1300**	**1200**	ND	**840**	2	**300**	**150**	5	MCL
Other	Dissolved Solids (mg/L)	180	200	210	200	340	190	160	180	170	500	SMCL
	Chloride (mg/L)	26	31	38	30	8	27	23	26	25	250	SMCL
	Fluoride (mg/L)	0.16	0.15	0.16	0.15	0.54	0.17	0.33	0.16	0.15	4	MCL
	Nitrate as Nitrogen (mg/L)	2	2.4	2.3	2.3	1.1	2	ND	1.7	1.6	10	MCL
	Sulfate (mg/L)	13	21	20	22	55	21	18	17	16		
	Total Organic Carbon (mg/L)	ND	ND	ND	ND	1.3	ND	ND	ND	ND		
	Alkalinity (mg/L)	82	86	90	93	190	66	59	80	87		
	Silica (mg/L)	22	17	18	19	40	21	64	21	16		
	Turbidity (NTU)	1.7	5	15	7.9	5.4	8.6	18	2.2	10		

SMCL - Secondary MCL

MCL - Maximum Contaminant Level

ND - Non Detect

[Bold] – Exceeds Criteria

Table 9.8 Summary of maximum groundwater results from the Northwest Plume south field groundwater monitoring.

	Parameter	MW 242	MW 243	MW 244	MW 245	MW 246	MW 247	MW 248	MW 249	MW 250	Criteria Reference	
Metal (mg/L)	Aluminum	**2.2**	**0.2**	ND	**5.2**	**0.87**	ND	ND	**0.79**	**0.39**	0.2	SMCL
	Aluminum, Dissolved	ND	ND	ND	**0.58**	ND	ND	ND	ND	ND	0.2	SMCL
	Barium	0.25	0.12	0.094	0.15	0.085	0.16	0.12	0.16	0.094	2	MCL
	Barium, Dissolved	0.24	0.12	0.094	0.17	0.12	0.11	0.11	0.15	0.088	2	MCL
	Calcium	29	32	19	22	37	20	24	20	20		
	Calcium, Dissolved	31	30	19	22	33	19	25	20	20		
	Chromium	**0.11**	ND	ND	ND	ND	ND	ND	ND	ND	0.1	MCL
	Copper	ND	ND	0.026	ND	ND	ND	ND	ND	ND	1.3	SMCL
	Iron	**6**	**0.31**	**1**	**5.9**	**0.57**	**3**	ND	**0.86**	**0.63**	0.3	SMCL
	Iron, Dissolved	ND	ND	ND	**0.33**	ND	ND	ND	ND	ND	0.3	SMCL
	Magnesium	12	13	8.1	8.7	15	13	10	8.5	8.2		
	Magnesium, Dissolved	12	12	8	8.6	14	13	10	8.1	8.5		
	Manganese	**0.11**	**0.12**	ND	**1.6**	ND	**0.41**	**0.17**	**0.12**	ND	0.05	SMCL
	Manganese, Dissolved	**0.1**	**0.12**	ND	**1**	ND	**0.29**	ND	**0.1**	ND	0.05	SMCL
	Nickel	0.75	ND	ND	ND	ND	ND	ND	ND	ND		
	Nickel, Dissolved	0.72	ND	ND	ND	ND	ND	ND	ND	ND		
	Potassium	ND	ND	ND	ND	ND	7.1	ND	14	ND		
	Potassium, Dissolved	ND	ND	ND	ND	ND	6.6	ND	15	ND		
	Sodium	24	29	34	23	110	39	26	37	32		
	Sodium, Dissolved	25	29	32	22	110	38	26	39	31		
Rads (pCi/L)	Alpha activity	ND	6	ND	ND	ND	9.2	ND	ND	5.2	15	MCL
	Beta activity	**81**	**380**	13	28	ND	9.8	**400**	35	10	50	MCL
	Radium	ND	ND	ND	ND	ND	0.81	ND	ND	ND		
	^{99}Tc	120	640	17	64	ND	ND	590	56	21		
	^{237}Np	ND	ND	ND	ND	ND	ND	ND	ND	0.7		
VOC (ug/L)	Trichloroethene	**140**	**1700**	**6**	**130**	ND	ND	**2400**	**23**	**20**	5	MCL
Other	Dissolved Solids (mg/L)	230	210	180	160	450	190	210	250	180	500	SMCL
	Chloride (mg/L)	60	67	31	12	6.3	4.1	47	25	34	250	SMCL
	Fluoride (mg/L)	ND	0.11	0.15	0.2	0.33	0.15	0.12	0.18	0.15	4	MCL
	Nitrate as Nitrogen (mg/L)	1.2	1.7	1.4	ND	ND	ND	2	ND	1.6	10	MCL
	Sulfate (mg/L)	10	12	9.6	11	180	ND	9.5	20	9.6		
	Alkalinity (mg/L)	76	64	100	100	160	180	74	140	95		
	Silica (mg/L)	20	21	26	28	53	6.3	27	25	28		
	TOC (µg/L)	ND	1.2	ND	ND	1.1	ND	ND	1.1	ND		
	Turbidity (NTU)	**60**	**7**	**12**	**100**	**13**	**14**	2.5	**18**	**5.8**	5	MCL

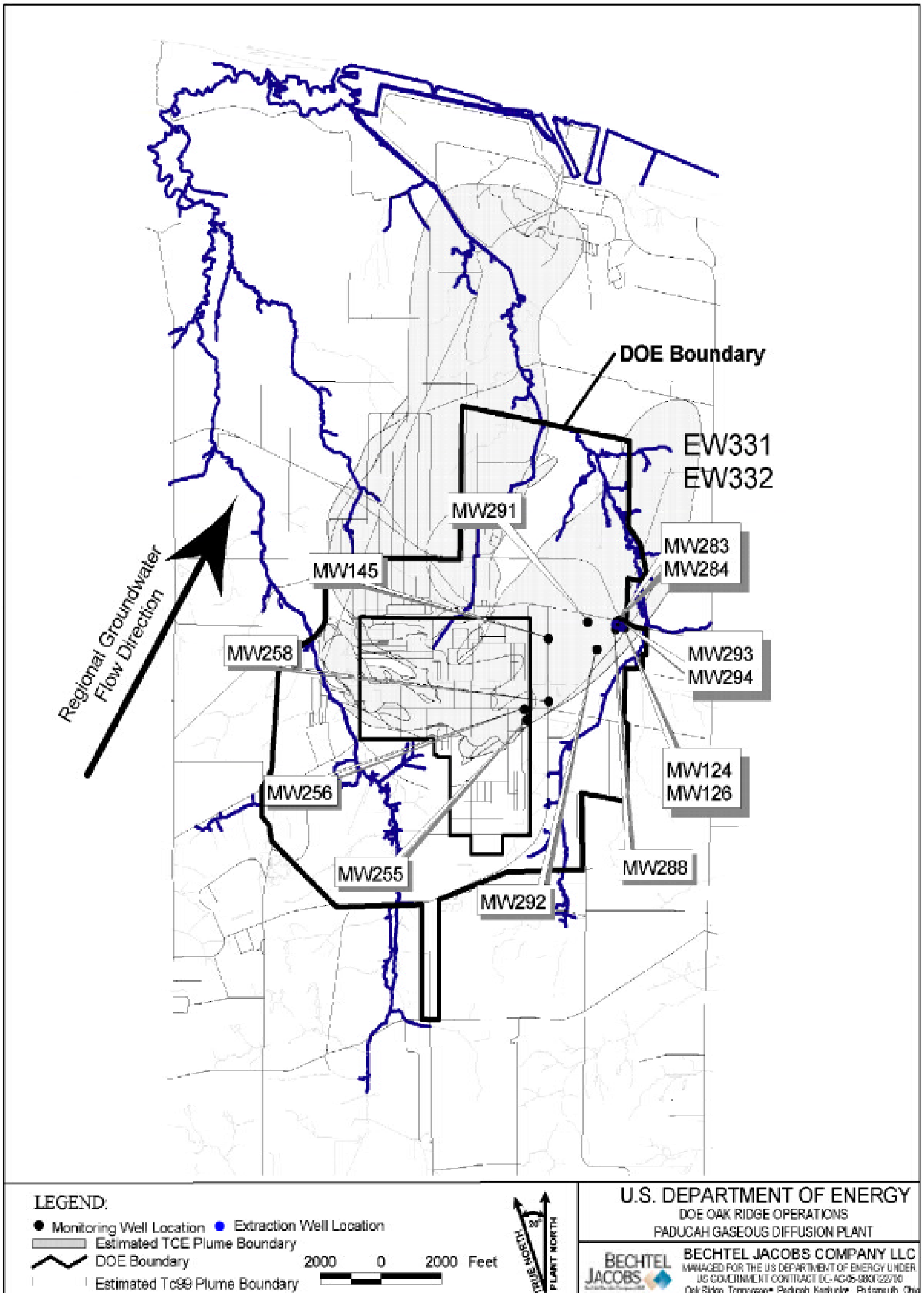
SMCL - Secondary MCL

MCL - Maximum Contaminant Level

ND - Non Detect

[Bold] – Exceeds Criteria

DOCUMENT No. BJC/PAD-319



U.S. DEPARTMENT OF ENERGY
DOE OAK RIDGE OPERATIONS
PADUCAH GASEOUS DIFFUSION PLANT

BECHTEL JACOBS COMPANY LLC
MANAGED FOR THE US DEPARTMENT OF ENERGY UNDER US GOVERNMENT CONTRACT DE-AC05-98OR22700
Oak Ridge, Tennessee • Paducah, Kentucky • Portsmouth, Ohio

Figure 9.10 Northeast plume monitoring wells.

CDM

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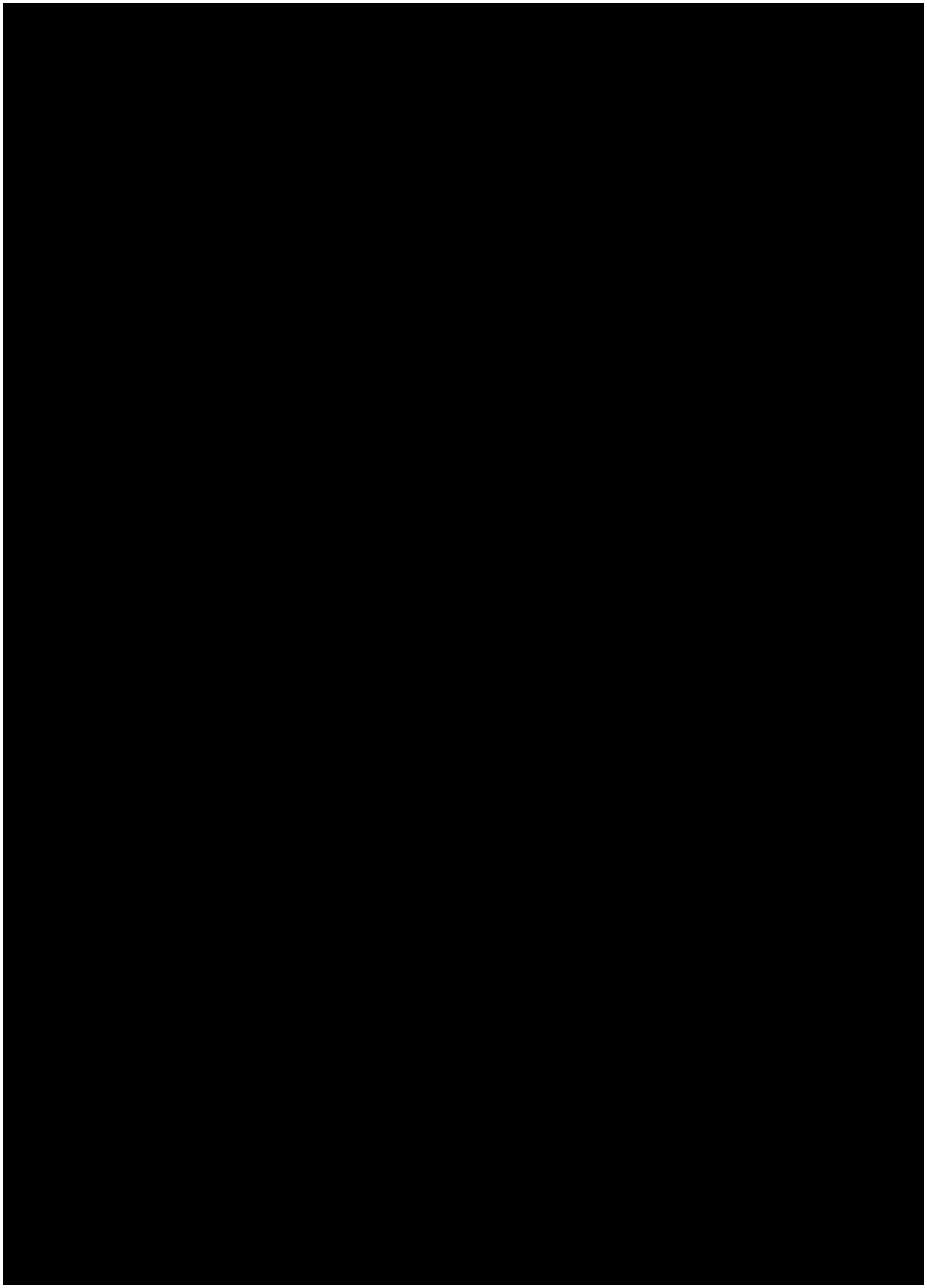

Groundwater Monitoring Results

The primary objectives of groundwater monitoring at the Paducah Site are being met by the monitoring programs. Contamination has been detected in groundwater off-site. Through the monitoring program, in conjunction with RIs, a footprint of the groundwater contamination has been mapped and is regularly updated. The program continues to expand each year to further delineate the boundaries of the footprint over time and to identify source locations for contaminants. Monitoring wells upgradient and downgradient from individual underground waste disposal facilities are sampled and analyzed for contaminants of concern (COCs). Contaminants identified by the monitoring program are evaluated by technical assessment and statistical analysis to determine if the source of the contaminants could be the disposal site being monitored. Beta activity, TCE, and ^{99}Tc are found in the off-site and on-site contamination plumes. Chromium and dissolved solids are also present in some wells, although these contaminants are thought to be natural in origin and not a result of past practices. Groundwater monitoring results from all sampling efforts conducted by the Paducah Site are compiled in the Paducah Oak Ridge Environmental Information System (OREIS) database. A complete listing of analytical results is available upon request from the BJC Public Affairs Department.

Appendix C contains a more detailed interpretation of the TCE and ^{99}Tc groundwater contamination and plumes within the RGA based upon an annual update of the plumes. Detailed plume figures included in *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2001 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2002) have been omitted from this report due to space limitations. However, Figure 9.1 shows offsite groundwater plumes. The complete report is available from the DOE EIC.

10 Quality Assurance

Abstract

The Paducah Site maintains a Quality Assurance/Quality Control (QA/QC) Program to verify the integrity of data generated within the environmental monitoring program. Monitoring and sampling organizations at Paducah select sampling methods, instruments, locations, schedules, and other sampling and monitoring criteria based on applicable guidelines from various established authorities.

Introduction

The Paducah Site maintains a QA/QC Program to verify the integrity of data generated within the Environmental Monitoring Program. Each aspect of the monitoring program, from sample collection to data reporting, must address quality requirements and assessment standards. Requirements and guidelines for the QA/QC Program at the Paducah Site are established by DOE Order 414.1, *Quality Assurance*; state and federal regulations; and documentation from EPA, the American National Standards Institute, the American Society of Mechanical Engineers, the American Society of Testing and Materials (ASTM), and the American Society for Quality Control. The QA/QC Program specifies organizational and programmatic elements to control equipment, design, documents, data, nonconformances, and records. Emphasis is placed on planning, implementing, and assessing activities.

The *Environmental Services Subcontract Quality Assurance and Data Management Plan* (CDM 2000) [EQADMP] defines the relationship of each element of the Environmental Monitoring Program to key quality and data management requirements. Training requirements, sample custody, procedures, instrument calibration and maintenance, and data review are a few of the subjects discussed in the EQADMP. In 2001, a variety of functions were performed for the Environmental Monitoring Program, such as developing DQOs, conducting surveillances, reporting problems, reviewing data, reviewing procedures, and revising the EQADMP.

Field Sampling Quality Control

Data Quality Objectives and Sample Planning

From the point of conception of any sampling program, DQOs play an important role. The number of samples, location of sampling sites, sampling methods, sampling schedules, and coordination of sampling and analytical resources to meet critical completion times are part of a DQO process and are documented in the *Paducah Site Environmental Monitoring Plan* (BJC 2000a).

Each sample location and sample collected is assigned a unique identification number, which consists of an alpha numeric sequence. Each segment of the sequence is used to designate information concerning the location from which a sample is collected. In order to progress from planning to implementing the DQOs, an analytical statement of work (SOW) for the analytical laboratory is generated from a system within the Paducah Integrated Data System. From this system, the Project Environmental Measurements System (PEMS), an electronic database used for managing and streamlining field-generated and laboratory-generated data, is populated with sample identification numbers, sampling locations, sampling methods, analytical parameters, analytical methods, and container and preservative requirements. This information is used to produce sample bottle labels and chain-of-custody forms for each sampling event.

Field Measurements

Field measurements for the groundwater and surface water monitoring program are collected real-time in the field and include water level measurements, pH, conductivity, flow rate, turbidity, temperature, dissolved oxygen, total residual chlorine, and barometric pressure. Environmental conditions such as ambient temperature and weather are also recorded. Field measurements are collected and either downloaded electronically, recorded on appropriate field forms, or recorded in logbooks, and input into PEMS.

Sampling Procedures

Samples are collected using media-specific procedures, which are written according to EPA-approved sampling methods. Sample media consists of surface water, groundwater, sediment, and biota, such as fish or deer. Sample information collected during a sample event consists of the following: sample identification number, station (or location), date collected, time collected, person who performed the sampling, etc. This information is recorded in the logbooks and on the chain-of-custody form and sample container label, and input directly into PEMS on a weekly or other appropriate basis. Chain-of-custody forms are maintained from the point of sampling, and samples are properly protected until they are placed in the custody of an analytical laboratory.

Field Quality Control Samples

The QC program for both groundwater and environmental monitoring activities specify a minimum target rate of 5%, or one per 20 environmental samples, on field QC samples. Table 10.1 shows the types of field QC samples collected and analyzed. Analytical results of field QC samples are evaluated to determine if the sampling event had, in some way, affected the sample results.

Analytical Laboratory Quality Control

Analytical Procedures

When available and appropriate for the sample matrix, EPA-approved SW-846 methods are used for sample analysis. When SW-846 methods are not available, other nationally recognized methods such as those developed by DOE and ASTM are used.

Table 10.1 Types of Quality Control (QC) Samples.

Field QC Samples	Laboratory QC Samples
Field blanks[a]	Laboratory duplicates
Field duplicates	Reagent blanks
Trip blanks[a]	Matrix spikes[b]
Equipment rinseates	Matrix spike duplicates
	Surrogates
	Performance evaluations
	Laboratory control samples

a blank – samples of deionized water used to assess potential contamination from a source other than the medial being sampled

b spikes – samples that have been mixed with a known quantity of a chemical to measure instrument effectiveness during the analysis process

Analytical methods are identified in an analytical SOW. Using guidance from EPA, the laboratories document the steps in handling, analysis, and approval of results. Chain-of-custody procedures are followed until a sample is analyzed.

Laboratory Quality Control Samples

Laboratory QC samples are prepared and analyzed as required by the analytical methods used. Typical laboratory QC samples are identified in Table 10.1. If acceptance criteria are not met for the QC samples, then appropriate action, as denoted by the analytical method, is taken or appropriate qualification of the data occurs.

Independent Quality Control

The Paducah Site is directed by DOE and EPA to participate in independent QC programs. The site also participates in voluntary independent programs to improve analytical QC. These programs generate data that are readily recognizable as objective measures, allowing participating laboratories and government agencies a periodic review of their performance. Results that exceed acceptable limits are investigated and documented according to formal procedures. Although participation in certain programs is mandated, the degree of participation is voluntary so that each laboratory can select parameters of particular interest to that facility. These programs are conducted by EPA, DOE, and commercial laboratories.

Laboratory Audits/Sample Management Office

Laboratory audits are performed periodically by the BJC Oak Ridge Sample Management Office (SMO) to ensure the laboratory is in compliance with regulations, procedures, and the contract between the laboratory and the SMO. Findings are documented and addressed by the audited laboratory through corrective actions.

Data Management

Project Environmental Management System

The data generated are stored in PEMS, a consolidated site data system for tracking and managing data. The system is used to manage field-generated data; import laboratory-generated data; input data qualifiers identified during the data review process; and transfer data to the Paducah OREIS for reporting. PEMS uses a variety of references and code lists to ensure consistency and standardize the presentation of data for users.

Paducah OREIS

Paducah OREIS is the database used to consolidate data generated by the Environmental Management Program. Data consolidation consists of the activities necessary to prepare the evaluated data for the users. The PEMS files containing the assessed data are transferred from PEMS to Paducah OREIS for future use. The data manager is responsible for notifying project team and other data users of the data availability. Data used in reports distributed to external agencies (e.g., the quarterly landfill reports, the ASER, and the biological monitoring program reports) are obtained from Paducah OREIS and have been through the data review process.

Electronic Data Deliverables

A "results only" Electronic Data Deliverable (EDD) is requested for all samples analyzed by each laboratory. The results and qualifier information from the EDD are checked in addition to the format of all fields provided. Discrepancies are immediately reported to the laboratory so corrections can be made or new EDDs can be issued. A random sample, consisting of approximately 10% of the EDDs are checked to verify that the laboratory continues to provide adequate EDDs.

Data Packages

A "forms only" Level III data package is requested from the laboratory when data validation is to be performed on a specific sampling event or media. All data packages received from the fixed-base laboratory are tracked, reviewed, and maintained in a secure environment. The following information is tracked: sample delivery group number; date received; number of samples; sample analyses; receipt of the EDD, if applicable; and comments. The contents of the data package and the chain-of-custody forms are compared and discrepancies are identified. Discrepancies are immediately reported to the laboratory and data validators. All data packages are forwarded to the PGDP Environmental Management and Enrichment Facilities Document Management Center for permanent storage.

Laboratory Contractual Screening

Laboratory contractual screening is the process of evaluating a set of data against the requirements specified in the analytical SOW to ensure that all requested information is received. The contractual screening includes, but is not limited to, the chain-of-custody form, number of samples, analytes requested, total number of analyses, method used, QC samples analyzed, EDDs, units, holding times, and reporting limits achieved. The contractual screening is conducted electronically upon receipt of data from the analytical laboratory. Any exception to the SOW is identified and documented.

Data Verification, Validation, and Assessment

Data verification is the process for comparing a data set against a set standard or contractual requirement. Verification is performed electronically, manually, or by a combination of both. Data verification includes contractual screening and other criteria specific to the data. Data are flagged as necessary. Verification qualifiers are stored in PEMS and transferred with the data to Paducah OREIS.

Data validation is the process performed by a qualified individual for a data set, independent from sampling, laboratory, project management, or other decision-making personnel. Data validation evaluates the laboratory adherence to analytical method requirements. Validation qualifiers are stored in PEMS and transferred with the data to Paducah OREIS. Data from routine sampling events are validated programmatically at a frequency of 5% of the total data packages. Each of the selected data packages, which make up 5% of the total number of data packages, is validated 100%.

Data assessment is the process for assuring that the type, quality, and quantity of data are appropriate for their intended use. It allows for the determination that a decision (or estimate) can be made with the desired level of confidence, given the quality of the data set. Data assessment follows data verification and data validation (if applicable) and must be performed at a rate of 100% to ensure data are useable. The data assessment is conducted by trained technical personnel or their designee in conjunction with other project team members. Assessment qualifiers are stored in PEMS and transferred with the data to Paducah OREIS. Data are made available for reporting from Paducah OREIS upon completion of the data assessment, and associated documentation is filed with the project files.

References

AEC 1974. *Nuclear Terms A Glossary*, Office of Information Services, U.S. Atomic Energy Commission.

American Nuclear Society (ANS). 1986. *Glossary of Terms in Nuclear Science and Technology*, American Nuclear Society.

BEIR 1990. *Health Effects of Exposure to Low Levels of Ionizing Radiation*, Committee on the Biological Effects of Ionizing Radiation (BEIR V), National Research Council, National Academy of Sciences, National Academy Press, Washington, DC.

BJC 2002. *Annual Report on External Gamma Radiation Monitoring for Calendar Year 2001 for the Paducah Gaseous Diffusion Plant*, BJC/PAD-357, Bechtel Jacobs Company LLC, Paducah, KY.

BJC 2001b. *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifier for Calendar Year 2001 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, BJC/PAD-169/R2, Bechtel Jacobs Company LLC, Paducah, KY.

BJC 2000a. *Paducah Site Environmental Monitoring Plan*, BJC/PAD-201, Bechtel Jacobs Company LLC, Paducah, KY.

BJC 2000b. Correspondence from Gordon L. Dover to J. Dale Jackson dated February 18, 2000, “Completion of Replacement of Temporary Radiological Postings.” Bechtel Jacobs Company LLC, Paducah, KY.

BJC 1998. *Groundwater Protection Plan*, Bechtel Jacobs Company LLC, Paducah Gaseous Diffusion Plant, Paducah, KY.

CDM 2001. *Watershed Monitoring Report for Calendar Year 2000, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, BJC/PAD-238, CDM Federal Services, Inc., Paducah, KY.

CDM 2002. *Watershed Monitoring Report for Calendar Year 2001, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, BJC/PAD-363, CDM Federal Services, Inc., Paducah, KY.

CDM 2000. *Environmental Services Subcontract Quality Assurance and Data Management Plan*, CDM Federal Services, Inc., Paducah Gaseous Diffusion Plant, Paducah, KY.

CDM 1994. *Investigation of Sensitive Ecological Resources Inside the Paducah Gaseous Diffusion Plant*, 7916-003-FR-BBRY, CDM Federal Services, Inc., Paducah, KY.

CH2M Hill 1992a. *Results of the Site Investigation, Phase II, at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, KY/SUB/13B-97777C P-03/1991/1, CH2M Hill, Paducah, Kentucky.

CH2M Hill 1992b. *Results of the Public Health and Ecological Assessment, Phase II, at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, KY/SUB/13B-97777C P-03/1991/1, CH2M Hill, Paducah, Kentucky.

CH2M Hill 199la. *Results of the Public Health and Ecological Assessment, Phase II at the Paducah Gaseous Diffusion Plant* (Draft**)**, KY/

SUB/13B-97777C P-03/1991/1, CH2M Hill, Paducah, KY.

CH2M Hill 1991b. *Results of the Site Investigation, Phase I, at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*,. KY/ER-4, CH2M Hill, Paducah, KY.

CH2M Hill 1990. *Draft Results of the Site Investigation Phase I at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky.*, KY/ER-4, CH2M Hill, Paducah, KY.

COE 1994. *Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area McCracken County, Kentucky,* Five Volumes, U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

DOC 1994. *County Business Patterns 1992*, Economics and Statistics Administration, Bureau of the Census, U.S. Department of Commerce.

DOE 2001. *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2000 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, BJC/PAD-169, U.S. Department of Energy, Paducah, KY.

DOE 2000a. *Paducah Site Annual Site Environmental Report for 1999*, BJC/PAD-206, U.S. Department of Energy, Paducah, Kentucky.

DOE 2000b. *Remedial Investigation Report for Waste Area Grouping 28 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1846-V1&D1, U.S. Department of Energy, Paducah, KY.

DOE 2000c. *Site Evaluation Report for Waste Area Grouping 8 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1867&D0, U.S. Department of Energy, Paducah, KY.

DOE 2000d. *Remedial Investigation Report for Waste Area Grouping 3 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1895/V1&D1, U.S. Department of Energy, Paducah, KY.

DOE 2000e. *Data Report for the Sitewide Remedial Evaluation for Source Areas Contributing to Off-Site Groundwater Contamination at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1845&D1, U.S. Department of Energy, Paducah, KY.

DOE 2000f. *Work Plan for Maintenance and Upgrade of Scrap Yard Sediment Runoff Containment at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/OR/07-1865&D1), U.S. Department of Energy, Paducah, KY.

DOE 1999a. *1998 National Emission Standard for Hazardous Air Pollutant (NESHAP) Annual Report for the Paducah Gaseous Diffusion Plant*, Paducah, Kentucky, U.S. Department of Energy, Paducah, KY.

DOE 1999b. *Final Environmental Assessment, Proposed Demonstration of the Vortec Vitrification System for Treatment of Mixed Wastes at the Paducah Gaseous Diffusion Plant*, DOE/EA-1230, Oak Ridge Operations Office, Oak Ridge, TN.

DOE 1998. *Record of Decision for Remedial Action at Solid Waste Management Unit 91 of Waste Area Group 27 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*. U.S. Department of Energy, Paducah, KY.

DOE 1998. *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant*, DOE/OR/07-1707, EPA Region IV, U.S. Department of Energy, and Kentucky Natural Resources and Environmental Protection Cabinet.

DOE 1997. *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1586&D2, U.S. Department of Energy, Paducah, KY.

DOE 1997. *Numerical Ground-Water Recalibration and Evaluation of the Northwest Plume Interim Remedial Action Report for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*. U.S. Department of Energy, Paducah, KY.

DOE 1996a. *Environment, Safety and Health Reporting*, DOE Order DOE O 231.1 Chg 2, Office of Environment, Safety and Health, U.S. Department of Energy, Washington, DC.

DOE 1996b. *Background Concentrations and Human Health Risk-Based Screening Criteria for Metals in Soil at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1417&D2, U.S. Department of Energy, Paducah, KY.

DOE 1995. *Environmental Assessment for the Construction, Operation, and Closure of the Solid Waste Landfill at the Paducah Gaseous Diffusion Plant Paducah, Kentucky*, DOE/EA-1046, U.S. Department of Energy, Oak Ridge, TN.

DOE 1993. *Radiation Protection of the Public and the Environment*, DOE Order 5400.5, U.S. Department of Energy.

DOE 1988. *Internal Dose Conversion Factors for Calculations of Dose to the Public*, DOE/EH-00071, U.S. Department of Energy.

EPA 1989. *Exposure Factors Handbook*, EPA 600/8-89-043, U.S. Environmental Protection Agency.

EPA 1984. *Occupational Exposure to Ionizing Radiation in the United States: A Comprehensive Review for the Year 1980 and a Summary of Trends for the Years 1960-1985*, EPA/520/1-8-005, U.S. Government Printing Office, U.S. Environmental Protection Agency, Washington, D.C.

Hampshire. 2000. Electronic mail message from G.J. Hampshire to D. R. Guminski, dated September 14, 2000, "Deer doses."

ICRP 1980. *Annals of the ICRP, Parts I and II, Limits for Intakes of Radionuclides by Workers*, International Commission on Radiological Protection Publication 30, Elmsford, NY.

Jinks and Eisenbud 1972. "Concentration Factors in Aquatic Environment," *Radia. Data Rep.* 13, 243, S.M. Jinks and M. Eisenbud.

KCHS 2001. Correspondence from E. Scott (Radiation Health and Toxic Agents Branch) to D. R. Guminski dated February 23, 2001, "Year 2000 Air Monitoring Data."

LMES 1997. *Paducah Gaseous Diffusion Plant Groundwater Protection Program Management Plan*, Lockheed Martin Energy Systems, Inc., Paducah Gaseous Diffusion Plant, Paducah, KY.

McGraw-Hill. 1994. *McGraw-Hill Dictionary of Scientific and Technical Terms*, Fifth Edition, McGraw-Hill, Inc.

MMES 1992. *Report of the Paducah Gaseous Diffusion Plant Groundwater Investigation Phase III*, KY/E-150, Martin Marietta Energy Systems, Inc., Paducah, KY.

NCRP 1987. "Ionizing Radiation Exposure of the Population of the United States," *NCRP Report No. 93*, National Council on Radiation Protection and Measurements, Washington, D.C.

NCRP 1989. "Exposure of the U.S. Population from Diagnostic Medical Radiation," *NCRP Report No. 100,* National Council on Radiation Protection and Measurements, Bethesda Md.

ORNL 1999. *Report on the Watershed Monitoring Program at the Paducah Site, January–December 1998*, ORNL/TM-13743, Oak Ridge National Laboratory, Oak Ridge, TN.

ORNL 1998. *Report on the Biological Monitoring Program at Paducah Gaseous Diffusion Plant January–December 1997*, ORNL/TM-13592, Oak Ridge National Laboratory, Oak Ridge, TN.

ORNL 1997. *Report on the Biological Monitoring Program at Paducah Gaseous Diffusion Plant January–December 1996*, ORNL/TM-13377, Oak Ridge National Laboratory, Oak Ridge, TN.

ORNL 1997b. *Bioavailability Study for the Paducah Gaseous Diffusion Plant*, ORNL/TM-13258, Oak Ridge National Laboratory, Oak Ridge, TN.

ORNL 1996a. *Report on the Biological Monitoring Program at Paducah Gaseous Diffusion Plant, December 1993 to December 1994*, ORNL/TM-12942, Oak Ridge National Laboratory, Oak Ridge, TN.

ORNL 1996b. *Report on the Biological Monitoring Program at Paducah Gaseous Diffusion Plant, January–December 1995*, ORNL/TM-13190, Oak Ridge National Laboratory, Oak Ridge, TN.

ORNL 1994a. *Report on the Biological Monitoring Program at the Paducah Gaseous Diffusion Plant, December 1990 to November 1992,* ORNL/TM-12338/R1, Oak Ridge National Laboratory, Oak Ridge, TN.

ORNL 1994b. *Report on the Biological Monitoring Program at the Paducah Gaseous Diffusion Plant, December 1992 to December 1999,* ORNL/TM/1276, Oak Ridge National Laboratory, Oak Ridge, TN.

SAIC 1991. *Summary of Alternatives for Remediation of Off-Site Contamination at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (Draft), Science Applications International Corporation, Paducah, KY.

SCS 1976. *Soil Survey of Ballard and McCracken Counties,* U. S. Department of Agriculture, Soil Conservation Service, in cooperation with the Kentucky Agricultural Experiment Station.

USEPA 1990. United States Environmental Protection Agency, Office of Research and Development, Nov. 1990. "Marcoinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters," EPA/600/4-90-030. Washington, D.C.

Glossary

absorption – The process by which the number and energy of particles or photons entering a body of matter is reduced by interaction with the matter.

activity – See radioactivity.

air stripping – The process of bubbling air through water to remove volatile organic compounds from the water.

alpha particle – A positively charged particle emitted from the nucleus of an atom having the same charge and mass as that of a helium nucleus (two protons and two neutrons).

ambient air – The atmosphere around people, plants, and structures.

analyte – A constituent or parameter being analyzed.

analytical detection limit – The lowest reasonably accurate concentration of an analyte that can be detected; this value varies depending on the method, instrument, and dilution used.

aquifer – A geologic formation, group of formations, or part of a formation capable of yielding a significant amount of groundwater to wells or springs.

aquitard – A geologic unit that inhibits the flow of water.

assimilate – To take up or absorb.

atom – Smallest particle of an element capable of entering into a chemical reaction.

beta particle – A negatively charged particle emitted from the nucleus of an atom. It has a mass and charge equal to those of an electron.

biota – The animal and plant life of a particular region considered as a total ecological entity.

CERCLA-reportable release – A release to the environment that exceeds reportable quantities as defined by the Comprehensive Environmental Response, Compensation, and Liability Act.

chain of custody form – A form that documents sample collection, transport, analysis, and disposal.

closure – Formal shutdown of a hazardous waste management facility under Resource Conservation and Recovery Act requirements.

compliance – Fulfillment of applicable requirements of a plan or schedule ordered or approved by government authority.

concentration – The amount of a substance contained in a unit volume or mass of a sample.

conductivity – A measure of a material's capacity to convey an electric current. For water, this property is related to the total concentration of the ionized substances in water and the temperature at which the measurement is made.

confluence – The point at which two or more streams meet; the point where a tributary joins the main stream.

congener – Any particular member of a class of chemical substances. A specific congener is denoted by a unique chemical structure.

contained landfill – A solid waste site or facility that accepts disposal of solid waste. The technical requirements for contained landfills are found in 401 KAR 47:080, 48:050, and 48:070 to 48:090.

contamination – Deposition of unwanted material on the surfaces of structures, areas, objects, or personnel.

cosmic radiation – Ionizing radiation with very high energies that originates outside the earth's atmosphere. Cosmic radiation is one contributor to natural background radiation.

curie (Ci) – A unit of radioactivity. One curie is defined as 3.7×10^{10} (37 billion) disintegrations per second. Several fractions and multiples of the curie are commonly used:

- **kilocurie (kCi)** – 10^{3} Ci, one thousand curies; 3.7×10^{13} disintegrations per second.
- **millicurie (mCi)** – 10^{-3} Ci, one-thousandth of a curie; 3.7×10^{7} disintegrations per second.
- **microcurie (µCi)** – 10^{-6} Ci, one-millionth of a curie; 3.7×10^{4} disintegrations per second.
- **picocurie (pCi)** – 10^{-12} Ci, one-trillionth of a curie; 3.7×10^{-2} disintegrations per second.

daughter – A nuclide formed by the radioactive decay of a parent nuclide.

decay, radioactive – The spontaneous transformation of one radionuclide into a different radioactive or nonradioactive nuclide or into a different energy state of the same radionuclide.

dense nonaqueous phase liquid (DNAPL) – The liquid phase of chlorinated organic solvents. These liquids are denser than water and include commonly used industrial compounds such as tetrachloroethylene and trichloroethylene.

derived concentration guide (DCG) – The concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (i.e., ingestion of water, submersion in air, or inhalation), would result in either an effective dose equivalent of 0.1 rem (1 mSv) or a dose equivalent of 5 rem (50 mSv) to any tissue, including skin and the lens of the eye. The guidelines for radionuclides in air and water are given in DOE Order 5400.5, *Radiation Protection of the Public and the Environment.*

disintegration, nuclear – A spontaneous nuclear transformation (radioactivity) characterized by the emission of energy and/or mass from the nucleus of an atom.

dose – The energy imparted to matter by ionizing radiation. The unit of absorbed dose is the rad, equal to 0.01 joules per kilogram in any medium.

- **absorbed dose** – The quantity of radiation energy absorbed by an organ divided by the organ's mass. Absorbed dose is expressed in units of rad (or gray) (1 rad = 0.01 Gy).
- **dose equivalent** – The product of the absorbed dose (rad) in tissue and a quality factor. Dose equivalent is expressed in units of rem (or sievert) (1 rem = 0.01 Sv).
- **committed dose equivalent** – The calculated total dose equivalent to a tissue or organ over a 50-year period after known intake of a radionuclide into the body. Contributions from external dose are not

included. Committed dose equivalent is expressed in units of rem (or sievert).

- **committed effective dose equivalent** – The sum of the committed dose equivalents to various tissues in the body, each multiplied by the appropriate weighting factor. Committed effective dose equivalent is expressed in units of rem (or sievert).
- **effective dose equivalent** – The sum of the dose equivalents received by all organs or tissues of the body after each one has been multiplied by an appropriate weighting factor. The effective dose equivalent includes the committed effective dose equivalent from internal deposition of radionuclides and the effective dose equivalent attributable to sources external to the body.
- **collective dose equivalent/collective effective dose equivalent** – The sums of the dose equivalents or effective dose equivalents of all individuals in an exposed population within a 50-mile (80-km) radius expressed in units of person-rem (or person-sievert). When the collective dose equivalent of interest is for a specific organ, the units would be organ-rem (or organ-sievert). The 50-mile distance is measured from a point located centrally with respect to major facilities or DOE program activities.

downgradient – In the direction of decreasing hydrostatic head.

downgradient well – A well that is installed hydraulically downgradient of a site and that may be capable of detecting migration of contaminants from a site.

drinking water standards (DWS) – Federal primary drinking water standards, both proposed and final, as set forth by the EPA in 40 CFR 141 and 40 CFR 143.

effluent – A liquid or gaseous waste discharge to the environment.

effluent monitoring – The collection and analysis of samples or measurements of liquid and gaseous effluents for purposes of characterizing and quantifying the release of contaminants, assessing radiation exposures to members of the public, and demonstrating compliance with applicable standards.

Environmental Restoration – A DOE program that directs the assessment and cleanup of its sites (remediation) and facilities (decontamination and decommissioning) contaminated with waste as a result of nuclear-related activities.

exposure (radiation) – The incidence of radiation on living or inanimate material by accident or intent. Background exposure is the exposure to natural background ionizing radiation. Occupational exposure is that exposure to ionizing radiation received at a person's workplace. Population exposure is the exposure to the total number of persons who inhabit an area.

external radiation – Exposure to ionizing radiation when the radiation source is located outside the body.

fauna – The population of animals in a given area, environment, formation, or time span.

flora – The population of plants in a given area, environment, formation, or time span.

formation – A mappable unit of consolidated or unconsolidated geologic material of a characteristic lithology or assemblage of lithologies.

gamma ray – High-energy, short-wavelength electromagnetic radiation emitted from the nucleus of an excited atom. Gamma rays are identical to X-rays except for the source of the emission.

Gaussian puff/plume model – A computer-simulated atmospheric dispersion of a release using a Gaussian (normal) statistical distribution to determine concentrations in air.

grab sample – A sample collected instantaneously with a glass or plastic bottle placed below the water surface to collect surface-water samples (also called dip samples).

groundwater, unconfined – Water that is in direct contact with the atmosphere through open spaces in permeable material.

half-life, radiological – The time required for half of a given number of atoms of a specific radionuclide to decay. Each nuclide has a unique half-life.

hardness – The amount of calcium carbonate dissolved in water, usually expressed as part of calcium carbonate per million parts of water.

hydrogeology – Hydraulic aspects of site geology.

hydrology – The science dealing with the properties, distribution, and circulation of natural water systems.

in situ – In its original place; field measurements taken without removing the sample from its origin; remediation performed while groundwater remains below the surface.

internal dose factor – A factor used to convert intakes of radionuclides to dose equivalents.

internal radiation – Occurs when natural radionuclides enter the body by ingestion of foods, milk, or water or by inhalation. Radon is the major contributor to the annual dose equivalent for internal radionuclides.

ion – An atom or compound that carries an electrical charge.

irradiation – Exposure to radiation.

isotopes – Forms of an element having the same number of protons but differing numbers of neutrons in their nuclei.

- **long-lived isotope** – A radionuclide that decays at such a slow rate that a quantity of it will exist for an extended period (half-life is greater than three years).
- **short-lived isotope** – A radionuclide that decays so rapidly that a given quantity is transformed almost completely into decay products within a short period (half-life is two days or less).

lower limit of detection – The smallest concentration or amount of analyte that can be reliably detected in a sample at a 95% confidence level.

maximally exposed individual – A hypothetical individual who remains in an uncontrolled area and would, when all potential routes of exposure from a facility's operations are considered, receive the greatest possible dose equivalent.

migration – The transfer or movement of a material through air, soil, or groundwater.

milliroentgen (mR) – A measure of X-ray or gamma radiation. The unit is one-thousandth of a roentgen.

minimum detectable concentration – The smallest amount or concentration of a radionuclide that can be distinguished in a sample by a given measurement system at a preselected counting time and at a given confidence level.

monitoring – Process whereby the quantity and quality of factors that can affect the environment or human health are measured periodically to regulate and control potential impacts.

mrem – The dose equivalent that is one-thousandth of a rem.

natural radiation – Radiation from cosmic and other naturally occurring radionuclide (such as radon) sources in the environment.

nuclide – An atom specified by its atomic weight, atomic number, and energy state. A radionuclide is a radioactive nuclide.

outfall – The point of conveyance (e.g., drain or pipe) of wastewater or other effluents into a ditch, pond, or river.

part per billion (ppb) – A unit measure of concentration equivalent to the weight/volume ratio expressed as µg/L or mg/mL.

part per million (ppm) – A unit measure of concentration equivalent to the weight/volume ratio expressed as mg/L.

pathogen – A disease-producing agent; usually refers to living organisms.

person-rem – Collective dose to a population group. For example, a dose of 1 rem to 10 individuals results in a collective dose of 10 person-rem.

pH – A measure of the hydrogen-ion concentration in an aqueous solution. Acidic solutions have a pH from 0 to 6, neutral solutions have a pH equal to 7, and basic solutions have a pH greater than 7.

piezometer - An instrument used to measure the hydraulic potential of groundwater at a given point; also, a well designed for this purpose.

polychlorinated biphenyl (PCB) - Any chemical substance that is limited to the biphenyl molecule and that has been chlorinated to varying degrees.

polynuclear aromatic hydrocarbon (PAH) - Any organic compound composed of more than one benzene ring.

process water - Water used within a system process.

purge - To remove water before sampling, generally by pumping or bailing.

quality assurance (QA) - Any action in environmental monitoring to ensure the reliability of monitoring and measurement data.

quality control (QC) - The routine application of procedures within environmental monitoring to obtain the required standards of performance in monitoring and measurement processes.

quality factor - The factor by which the absorbed dose (rad) is multiplied to obtain a quantity that expresses, on a common scale for all ionizing radiation, the biological damage to exposed persons. A quality factor is used because some types of radiation, such as alpha particles, are more biologically damaging than others.

rad - An acronym for Radiation Absorbed Dose. The rad is a basic unit of absorbed radiation dose. (This is being replaced by the 'gray,' which is equivalent to 100 rad.)

radiation detection instruments – Devices that detect and record the characteristics of ionizing radiation.

radioactivity – The spontaneous emission of radiation, generally alpha or beta particles or gamma rays, from the nucleus of an unstable isotope.

radioisotopes – Radioactive isotopes.

radionuclide – An unstable nuclide capable of spontaneous transformation into other nuclides by changing its nuclear configuration or energy level. This transformation is accompanied by the emission of photons or particles.

reference material – A material or substance with one or more properties that is sufficiently well established and used to calibrate an apparatus, to assess a measurement method, or to assign values to materials.

release – Any discharge to the environment. Environment is broadly defined as any water, land, or ambient air.

rem – The unit of dose equivalent (absorbed dose in rads multiplied by the radiation quality factor). Dose equivalent is frequently reported in units of millirem (mrem), which is one-thousandth of a rem.

remediation – The correction of a problem. See Environmental Restoration.

Resource Conservation and Recovery Act (RCRA) – Federal legislation that regulates the transport, treatment, and disposal of solid and hazardous wastes.

RFI Program – RCRA Facility Investigation Program; EPA-regulated investigation of a solid waste management unit with regard to its potential impact on the environment.

roentgen – A unit of exposure from X-rays or gamma rays. One roentgen equals 2.58 x 10^4 coulombs per kilogram of air.

screen zone – In well construction, the section of a formation that contains the screen, or perforated pipe, that allows water to enter the well.

semivolatile organic analyte (SVOA) – Any organic compound with a high boiling point which will volatilize upon heating.

sievert (Sv) – The SI (International System of Units) unit of dose equivalent; 1 Sv = 100 rem.

slurry – A suspension of solid particles (sludge) in water.

source – A point or object from which radiation or contamination emanates.

specific conductance – The ability of water to conduct electricity; this ability varies in proportion to the amount of ionized minerals in the water.

stable – Not radioactive or not easily decomposed or otherwise modified chemically.

storm water runoff – Surface streams that appear after precipitation.

strata – Beds, layers, or zones of rocks.

substrate – The substance, base, surface, or medium in which an organism lives and grows.

surface water – All water on the surface of the earth, as distinguished from groundwater.

suspended solids – Mixture of fine, nonsettling particles of any solid within a liquid or gas.

terrestrial radiation – Ionizing radiation emitted from radioactive materials, primarily ^{40}K, thorium, and uranium, in the earth's soils. Terrestrial radiation contributes to natural background radiation.

thermoluminescent dosimeter (TLD) – A device used to measure external gamma radiation.

total activity – The total quantity of radioactive decay particles that are emitted from a sample.

total solids – The sum of total dissolved solids and suspended solids.

total suspended particulates – Refers to the concentration of particulates in suspension in the air irrespective of the nature, source, or size of the particulates.

transuranic element (TRU) – An element above uranium in the Periodic Table, that is, with an atomic number greater than 92. All 11 TRUs are produced artificially and are radioactive. They are neptunium, plutonium, americium, curium, berkelium, californium, einsteinium, fermium, mendelevium, nobelium, and lawrencium.

troughing system – A collection and containment system designed to collect leaks of oil that have been contaminated with PCBs.

turbidity – A measure of the concentration of sediment or suspended particles in solution.

upgradient – In the direction of increasing hydrostatic head.

vadose zone – Soil zone located above the water table.

volatile organic compound (VOC) – Any organic compound which has a low boiling point and readily volatilizes into air (e.g., trichloroethane, tetrachloroethylene, and trichloroethylene).

watershed – The region draining into a river, river system, or body of water.

wetland – A lowland area, such as a marsh or swamp, inundated or saturated by surface or groundwater sufficiently to support hydrophytic vegetation typically adapted to life in saturated soils.

wind rose – A diagram in which statistical information concerning direction and speed of the wind at a location is summarized.

Appendix A: Radiation

This appendix gives basic information about radiation. This information is intended to be a basis for understanding normal radiation dose from sources unassociated with the Paducah Site. People are constantly exposed to radiation. For example, radon in air; potassium in food and water; and uranium, thorium, and radium in the earth's crust are all sources of radiation. The following discussion describes important aspects of radiation, including atoms and isotopes; types, sources, and pathways of radiation; radiation measurement; and dose information.

ATOMS AND ISOTOPES

All matter is made up of **atoms**. The atom is thought to consist of a dense central nucleus surrounded by a cloud of electrons. The nucleus is composed of protons and neutrons. **Table A.1** summarizes the basic components of an atom. In an electrically neutral atom, the number of protons equals the number of electrons. Atoms can lose or gain electrons through ionization. The number of protons in the nucleus determines an element's atomic number, or chemical identity. With the exception of hydrogen, the nucleus of each type of atom also contains at least one neutron. Unlike protons, the number of neutrons may vary among atoms of the same element. The number of neutrons and protons determine the atomic weight of the atom.

Atoms of the same element with a different number of neutrons are called **isotopes**. Isotopes have the same chemical properties but different atomic weights. **Figure A.1** depicts isotopes of the element hydrogen. Uranium, which has 92 protons, is another example of an element that has isotopes. All isotopes of uranium have 92 protons. However, each uranium isotope has a different number of neutrons. ^{234}U has 92 protons and 142 neutrons; ^{235}U has 92 protons and 143 neutrons; and ^{238}U has 92 protons and 146 neutrons.

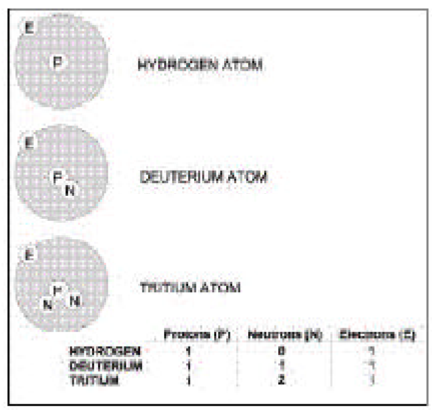

Figure A.1 Isotopes of the element hydrogen.

Table A.1 Summary of the basic parts of an atom.

Particle	Location	Charge	Comments
Protons	Nucleus	+ positive	The number of protons determines the element. If the number of protons changes, the element changes.
Neutrons	Nucleus	No charge	Atoms of the same element have the same number of protons, but can have a different number of neutrons. This is called an isotope.
Electrons	Orbit nucleus	– negative	This negative charge is equal in magnitude to the proton's positive charge.

Source: Bechtel Jacobs Company, LLC. *Radiological Worker I and II Academics Training*, Student Handbook, revision 2.

BASIC INFORMATION ABOUT RADIATION

Radioactivity was discovered in 1896 by the French physicist Antoine Henri Becquerel when he observed that the element uranium can blacken a photographic plate, even when separated from the plate by glass or black paper. In 1898 the French chemists Marie Curie and Pierre Curie concluded that radioactivity is a phenomenon associated with atoms, independent of their physical or chemical state. The Curies measured the heat associated with the decay of radium and established that 1 g (0.035 oz) of radium gives off about 100 cal of energy every hour. This release of energy continues hour after hour and year after year, whereas the complete combustion of a gram of coal results in the production of a total of only about 8000 cal of energy. Radioactivity attracted the attention of scientists throughout the world following these early discoveries. In the ensuing decades many aspects of the phenomenon were thoroughly investigated ("Radioactivity" 2002, Appendix A references).

Radiation is energy in the form of waves or particles moving through space. Radiation occurs because unstable atoms give off excess energy to become stable. **Ionization** is the process of removing electrons from neutral atoms. NOTE: Ionization should not be confused with radiation. Ionization is a result of the interaction of radiation with an atom, and is what allows the radiation to be detected. **Ionizing radiation** is energy (particles or rays) emitted from radioactive atoms that can cause ionization. Ionizing radiation is capable of displacing electrons and changing the chemical state of matter and subsequently causing biological damage. Therefore, ionizing radiation is potentially harmful to human health. Examples of ionizing radiation include alpha, beta, and gamma radiation. **Non-ionizing radiation** bounces off or passes through matter without displacing electrons. Non-ionizing radiation does not have enough energy to ionize an atom. It is unclear whether non-ionizing radiation is harmful to human health. Examples include visible light, radar waves, microwaves, and radio waves. **Radioactivity** is the process of unstable, or radioactive, atoms becoming stable by emitting radiant energy. Radioactivity that occurs over a period of time is called **radioactive decay**. The discovery that radium decays to produce radon proved conclusively that radioactive decay is accompanied by a change in the chemical nature of the decaying element. A **disintegration** is a single atom undergoing radioactive decay. **Radioactive half-life** is the time it takes for one half of the radioactive atoms present to decay (Bechtel Jacobs Company, LLC., Appendix A references).

TYPES, SOURCES, AND PATHWAYS OF RADIATION

Visible light, heat, radio waves, and alpha particles are examples of radiation. When people feel warmth from the sunlight, they are actually absorbing the radiant energy emitted by the sun. Electromagnetic radiation is radiation in the form of electromagnetic waves; examples include gamma rays, ultraviolet light, and radio waves. Particulate radiation is radiation in the form of particles; examples include alpha and beta particles. The spectrum of particle and electromagnetic radiations range from the extremely short wavelengths of cosmic rays and electrons to very long radio waves that are hundreds of kilometers in length. **Figure A.2** shows the difference between a longer wavelength and a shorter wavelength. **Figure A.3** illustrates the wavelengths of several types of radiation along with an example of something that is approximately the same dimension in length.

The Radiation's ability to penetrate material is an important consideration in protecting human health. Adequate shielding decreases the power of radiation by absorbing part or all of it. **Figure A.4** shows the different penetrating power of alpha, beta, and gamma rays. Alpha rays are stopped by the thickness of a few sheets of paper or a rubber glove. A few centimeters of wood or a thin sheet of copper stops beta rays. Gamma rays and X-rays require thick shielding of a heavy material such as iron, lead, or concrete ("Radiation" 2002, Appendix A references).

Radiation is everywhere. Most occurs naturally, but a small percentage is from human-made sources. Naturally occurring radiation is identical to the radiation resulting from human-made sources.

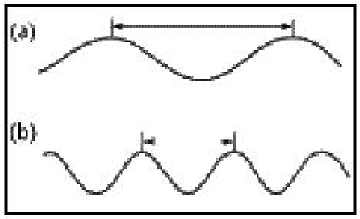

Figure A.2 Comparison between longer (a) and shorter (b) wavelengths.[a]

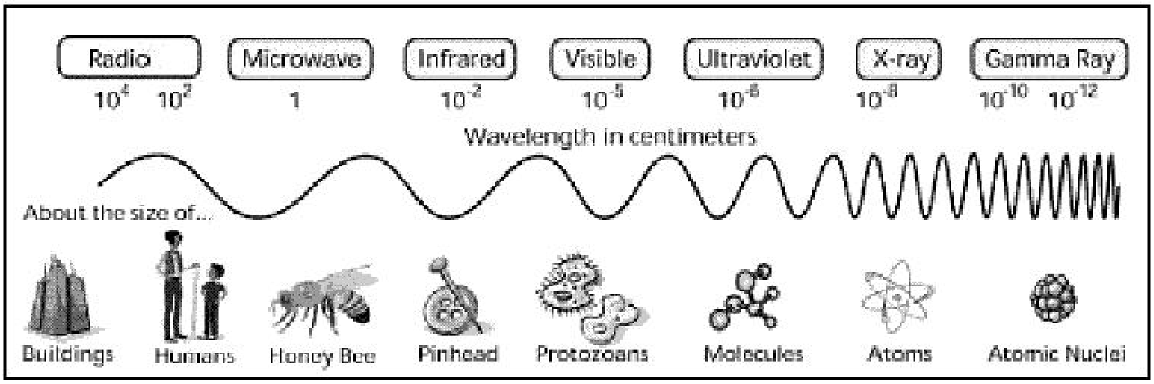

Figure A.3 The approximate wavelengths of the various regions of the electromagnetic spectrum and an example of something that is approximately the same size.[b]

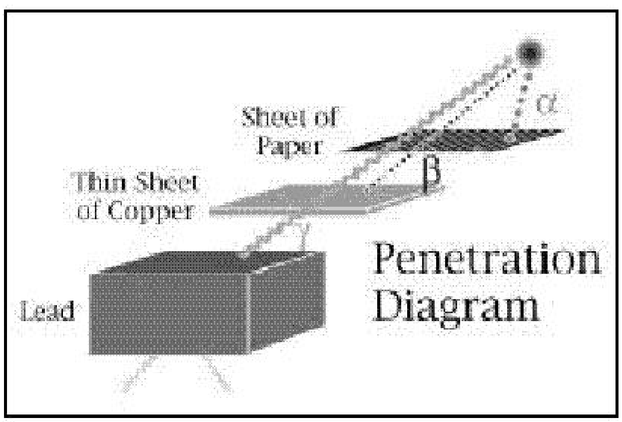

Figure A.4 The penetrating potential of the three types of ionizing radiation: alpha (•), beta (•), and gamma (?).[c]

[a] ("Electromagnetic…" 2002, Appendix A references)
[b] ("Exploring …" 2002, Appendix A references)
[c] ("Experiment…" 2002, Appendix A references)

Naturally occurring radiation is known as **background radiation**. In fact, this naturally occurring radiation is the major source of radiation in the environment. People have little control over the amount of background radiation to which they are exposed. Background radiation remains relatively constant over time. The amount of background radiation present in the environment today is much the same as it was hundreds of years ago. Sources of background radiation include uranium in the earth, radon in the air, and potassium in food. Depending on its origin, background radiation is categorized as cosmic, terrestrial, or internal. **Cosmic radiation** comes from the sun and outer space and is made up of energetically charged particles from that continuously hit the earth's atmosphere. Because the atmosphere provides some shielding against cosmic radiation, the intensity of cosmic radiation increases with altitude above sea level. Therefore, a person in Denver, Colorado, is exposed to more cosmic radiation than a person in Paducah, Kentucky. **Terrestrial radiation** refers to radiation emitted from radioactive materials in the earth's rocks, soils, and minerals. Radon (Rn); radon progeny, the relatively short-lived decay products of radium-235 (^{235}Ra); potassium (^{40}K); isotopes of thorium (Th); and isotopes of uranium (U) are the elements responsible for most terrestrial radiation. **Internal radiation** is radiation that is inside the body and is in close contact with body tissue. Internal radiation can deposit large amounts of energy in a small amount of tissue. Radioactive material in the environment enters the body through the air people breathe, the food they eat, and even through an open wound. Natural radionuclides in the body include isotopes of U, Th, Ra, Rn, Pu, bismuth (Bi), and lead in the ^{238}U and ^{212}Th decay series. In addition, the body contains isotopes of sodium-24 (^{24}Na), ^{40}K, rubidium (Rb), and carbon-14 (^{14}C). Most of our internal exposure comes from ^{40}K.

In addition to background radiation, there are human-made sources of radiation to which most people are exposed. Examples include consumer products, medical sources, and other sources. Some **consumer products** are sources of radiation. In some of these products, such as smoke detectors and airport X-ray baggage inspection systems, the radiation is essential to the performance of the device. In other products, such as televisions and tobacco products, the radiation occurs incidentally to the product function. **Medical sources** of radiation account for the majority of the exposure people receive from human-made radiation. Radiation is an important tool of diagnostic medicine and treatment. Exposure is deliberate and directly beneficial to the patients exposed. Generally, diagnostic or therapeutic medical exposures result from X-ray beams directed to specific areas of the body. Thus, all body organs generally are not irradiated uniformly. Radiation and radioactive materials are also used in a wide variety of pharmaceuticals and in the preparation of medical instruments, including the sterilization of heat-sensitive products such as plastic heart valves. Nuclear medical examinations and treatment involve the internal administration of radioactive compounds, or radiopharmaceuticals, by injection, inhalation, consumption, or insertion. Even then, radionuclides are not distributed uniformly throughout the body. **Other sources** of radiation include fallout from atmospheric atomic weapons tests; emissions of radioactive materials from nuclear facilities such as uranium mines, fuel processing plants, and nuclear power plants; emissions from mineral extraction facilities; and transportation of radioactive materials. Atmospheric testing of atomic weapons has been suspended. About one-half of 1% of the United States population performs work in which radiation in some form is present.

Radiation and radioactive material in the environment can reach people through many routes. Potential routes for radiation are referred to as **pathways**. Several radiation pathways are shown in **Figure A.5**. For example, radioactive material in the air could fall on a pasture. Cows could then eat the grass, and the radioactive material on the grass would show up in the cow's milk. People drinking the milk would thus be exposed to this radiation. Or, people could simply inhale the radioactive material in the air. The same events could occur with radioactive material in water. Fish living in the water would be exposed. People eating the fish would then be exposed to the radiation in the fish. Or, people swimming in the water would be exposed.

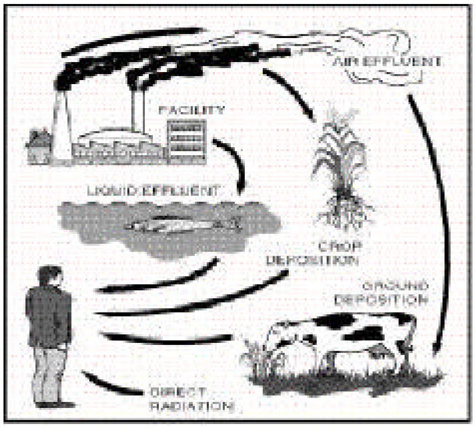

Figure A.5 Possible radiation pathways.

MEASURING RADIATION

To determine the possible effects of radiation on the environment and the health of people, the radiation must be measured. More precisely, its potential to cause damage must be determined. When measuring the amount of radiation in the environment, what is actually being measured is the rate of radioactive decay, or **activity**. The rate of decay varies widely among the various radioisotopes. For that reason, 1 g of one radioactive substance may contain the same amount of activity as several tons of another substance. Activity is measured by the number of disintegrations a radioactive material undergoes in a certain period of time. In the United States, activity is expressed in a unit of measure known as a **curie (Ci)**. In the international system of units, activity is expressed in a unit of measure known as a **Becquerel (Bq)**. One disintegration per second (dps) equals one Becquerel (Bq).

One curie equals:

· 37,000,000,000 atom disintegrations per second (3.7×10^{10} dps).

· 37,000,000,000 Becquerels (3.7×10^{10} Bq)

· 1,000,000 microcuries (1×10^{6} µCi)

DOSE INFORMATION

The total amount of energy absorbed per unit mass as a result of exposure to radiation is expressed in a unit of measure known as a **radiation absorbed dose (rad)**. In the international system of units, 100 rad = 1 gray. However, in terms of human health, it is the effect of the absorbed energy that is important because some forms of radiation are more harmful than others. The unit, rad, does not take into account the potential effects that different types of radiation have on the body. The measure of potential biological damage caused by exposure to and subsequent absorption of radiation is expressed in a unit of measure known as a **Roentgen equivalent man (rem)**. One rem of any type of radiation has the same total damaging effect and pertains to the human body. Dose is expressed in millirems (mrem), because a rem represents a fairly large dose. One millirem is equal to 1/1000 rem. The International System of Units uses the **Sievert (Sv)**, l00 rem = 1 Sievert (Sv), 100 mrem = 1 millisievert (mSv).

Many terms are used to report **dose**, as listed in **Table A.2**. Several factors are taken into account, including the amount of radiation absorbed, the organ absorbing the radiation, and the effect of the radiation over a 50-year period. The term "dose," in this report, includes the committed effective dose equivalent (EDE) and the effective dose equivalent attributable to penetrating radiation from sources external to the body.

Determining dose is an involved process using complex mathematical equations based on several factors, including the type of radiation, the rate of exposure, weather conditions, and typical diet. Basically, radiant energy is generated from radioactive decay, or activity. People absorb some of the energy to which they are exposed. This absorbed energy is calculated as part of an individual's dose. Whether radiation is natural or human made, its effects on people are the same.

A comparison of some dose levels is presented in **Table A.3**. Included is an example of the type of exposure that may cause such a dose or the special significance of such a dose. This information is intended to help the reader become familiar with the type of doses individuals may receive. The average annual dose received by residents of the United States from cosmic radiation is about 27 mrem (0.27 mSv) (NCRP 1987). The average annual dose from cosmic radiation received by residents in the Paducah area is about 45 mrem (0.45 mSv). The average annual dose received from terrestrial gamma radiation in the United States is about 28 mrem (0.28 mSv). The terrestrial dose varies geographically across the country (NCRP 1987); typical reported values are 16 mrem (0.16 mSv) at the Atlantic and Gulf coastal plains and 63 mrem (0.63 mSv) at the eastern slopes of the Rocky Mountains. In the Paducah area, background levels of radionuclides in soils are within typical levels indicating that the dose received from terrestrial gamma radiation is within the range of typical reported values (DOE 1997). The major contributors to the annual dose equivalent for internal radionuclides are the short-lived decay products of radon, mostly Rn-222. They contribute an average dose of about 200 mrem (2.00 mSv) per year. This dose estimate is based on an average radon concentration of about 1 pCi/L (0.037 Bq/L) (NCRP 1987). The average dose from other internal radionuclides is about 39 mrem (0.39 mSv) per year, most of which can be attributed to the naturally occurring isotope of potassium, K-40. The concentration of radioactive potassium in human tissues is similar in all parts of the world. **Table A.4** presents the internal dose factors for an adult. The United States average annual dose received by an individual from consumer products is about 10 mrem (0.10 mSv) (NCRP 1987). The dose from medical sources include nuclear medicine examinations, which involve the internal administration of radiopharmaceuticals, and generally account for the largest portion of the dose received from human-made sources. However, the radionuclides used in specific tests are not distributed uniformly throughout the body. In these cases, comparisons are made using the concept of EDE, which relates exposure of organs or body parts to one effective whole-body dose. The average annual EDE from medical examinations is 53 mrem (0.53 mSv), including 39 mrem (0.39 mSv) for diagnostic X- rays and 14mrem (0.14mSv) for nuclear medicine procedures (NCRP 1989). The actual doses received by individuals who complete such medical exams are much higher than these values, but not everyone receives such exams each year (NCRP 1989). The dose from other sources include small doses received by individuals that occur as a result of radioactive fallout from atmospheric atomic weapons tests, emissions of radioactive materials

Table A.2 Dose terminology.

Term	Description
absorbed dose	quantity of radiation energy absorbed by an organ divided by an organ's mass
dose equivalent	absorbed dose to an organ multiplied by a quality factor
effective dose equivalent	single weighted sum of combined dose equivalents received by all organs
committed dose equivalent	effective dose equivalent to an organ over a 50-year period following intake
committed effective dose equivalent	total effective dose equivalent to all organs in the human body over a 50-year period following intake
collective effective dose equivalent	sum of effective dose equivalents of all members of a given population
quality factor	a modifying factor used to adjust for the effect of the type of radiation, for example, alpha particles or gamma rays, on tissue
weighting factor	tissue-specific modifying factor representing the fraction of the total health risk from uniform, whole-body exposure

from nuclear facilities, emissions from certain mineral extraction facilities, and transportation of radioactive materials. The combination of these sources contributes less than 1 mrem (0.01 mSv) per year to the average dose to an individual (NCRP 1987). A comprehensive EPA report of 1984 projected the average occupational dose to monitored radiation workers in medicine, industry, the nuclear fuel cycle, government, and miscellaneous industries to be 105 mrem (1.05 mSv) per year for 1985, down slightly from 110 mrem (1.10 mSv) per year in 1980 (EPA 1984).

Table A.3 Comparison and description of various dose levels

Dose level	Description
1 mrem (0.01 mSv)	Approximate daily dose from natural background radiation, including radon.
2.5 mrem (0.025 mSv)	Cosmic dose to a person on a one way airplane flight from New York to Los Angeles.
10 mrem (0.10 mSv)	Annual exposure limit, set by the EPA for exposures from airborne emissions from operations of nuclear fuel cycle facilities, including power plants and uranium mines and mills.
45 mrem (0.45 mSv)	Average yearly dose from cosmic radiation received by people in the Paducah area.
46 mrem (0.46 mSv)	Estimate of the largest dose any off-site person could have received from the March 28, 1979, Three Mile Island nuclear power plant accident.
66 mrem (0.66 mSv)	Average yearly dose to people in the United States from human-made sources.
100 mrem (1.00 mSv)	Annual limit of dose from all DOE facilities to a member of the public who is not a radiation worker.
110 mrem (1.10 mSv)	Average occupational dose received by U.S. commercial radiation workers in 1980.
244 mrem (2.44 mSv)	Average dose from an upper gastrointestinal diagnostic X-ray series.
300 mrem (3.00 mSv)	Average yearly dose to people in the United States from all sources of natural background radiation.
1-5 rem (0.01-0.05 Sv)	EPA protective action guidelines state that public officials should take emergency action when the dose to a member of the public from a nuclear accident will likely reach this range.
5 rem (0.05 Sv)	Annual limit for occupational exposure of radiation workers set by NRC and DOE.
10 rem (0. 10 Sv)	The BEIR V report estimated that an acute dose at this level would result in a lifetime excess risk of death from cancer, caused by the radiation, of 0.8% (BEIR 1990).
25 rem (0.25 Sv)	EPA guideline for voluntary maximum dose to emergency workers for non-lifesaving work during an emergency.
75 rem (0.75 Sv)	EPA guideline for maximum dose to emergency workers volunteering for lifesaving work.
50-600 rem (0.50-6.00 Sv)	Doses in this range received over a short period of time will produce radiation sickness in varying degrees. At the lower end of this range, people are expected to recover completely, given proper medical attention. At the top of this range, most people would die within 60 days.

Adapted from *Savannah River Site Environmental Report for 1993, Summary Pamphlet*, WSRC-TR-94-076, Westinghouse Savannah River Company, 1994.

Table A.4 Internal dose factors for an adult.

		Intake[a] (mrem/pCi)			
Isotope	Half-life (years)	Inhalation (soluble)	Inhalation (slightly soluble)	Inhalation (insoluble)	Ingestion
^{237}Np	2,100,000	NA	0.49	NA	0.0039
^{239}Pu	24,000	NA	0.51	0.33	0.0043
^{99}Tc	210,000	0.00000084	0.0000075	0.12	0.0000013
^{230}Th	75,000	NA	0.32	0.26	0.00053
^{234}U	240,000	0.0027	0.0071	0.13	0.00026
^{235}U	710,000,000	0.0025	0.0067	0.12	0.00025
^{238}U	4,500,000,000	0.0024	0.0062	0.12	0.00023

[a] Source: U.S. DOE. July 1988. *Internal Dose Conversion Factors for Calculations of Dose to the Public*, DOE/EH-0071.
NA = not available in the above-referenced document

Appendix A References

Bechtel Jacobs Company, LLC. *Radiological Worker I and II Academics Training*, Student Handbook, revision 2.

"Electromagnetic Radiation." Accessed May 15, 2002.
http://www.lbl.gov/MicroWorlds/ALSTool/EMSpec/EMSpec.html

"Experiment #4:Penetrating Power" Accessed May 16, 2002.
http://www.lbl.gov/abc/experiments/Experiment4.html

"Exploring other Wavelengths," Imagine the Universe, NASA website. Accessed May 15, 2002.
http://imagine.gsfc.nasa.gov/docs/science/answers_l2/new_wavelengths.html

NCRP 1987. "Ionizing Radiation Exposure of the Population of the United States," *NCRP Report No. 93*, National Council on Radiation Protection and Measurements, Washington, D.C.

NCRP 1989. "Exposure of the U.S. Population from Diagnostic Medical Radiation," *NCRP Report No. 100*, National Council on Radiation Protection and Measurements, Bethesda Md.

"Radiation," Microsoft® Encarta® Online Encyclopedia 2002.
http://encarta.msn.com © 1997-2002 Microsoft Corporation. All Rights Reserved

"Radioactivity," Microsoft® Encarta® Online Encyclopedia 2002.
http://encarta.msn.com © 1997-2002 Microsoft Corporation.

"Regions of the Electromagnetic Spectrum," Imagine the Universe, NASA website. Accessed May 14, 2002.
http://imagine.gsfc.nasa.gov/docs/science/know_l1/spectrum_chart.html

Savannah River Site Environmental Report for 1993, *Summary Pamphlet*, WSRC-TR-94-076, Westinghouse Savannah River Company, 1994.

U. S. Department of Energy. *Internal Dose Conversion Factors for Calculations of Dose to the Public*, DOE/EH-0071.

Appendix B: Radionuclide and Chemical Nomenclature

Table B.1 Half-life and DCG for selected radionuclides.

Radionuclide	Symbol	Half-life	Ingested Water DCG (µCi/ml)
Americium-241	^{241}Am	432 years	3 E - 08
Bismuth-210	^{210}Bi	5.01 days	2 E - 05
Cesium-137	^{137}Cs	30.2 years	3 E - 06
Cobalt-60	^{60}Co	5.3 years	1E - 05
Lead-206	^{206}Pb	Stable	None
Lead-210	^{210}Pb	21 years	3 E - 08
Lead-214	^{214}Pb	26.8 minutes	2 E - 04
Neptunium-237	^{237}Np	2,140,000 years	3 E - 08
Plutonium-239	^{239}Pu	24,110 years	3 E - 08
Polonium-210	^{210}Po	138.9 days	8 E - 08
Polonium-214	^{214}Po	164 microseconds	None
Polonium-218	^{218}Po	3.05 minutes	None
Potassium-40	^{40}K	1,260,000,000 years	7 E - 06
Protactinium-234m	^{234m}Pa	1.17 minutes	None
Radium-226	^{226}Ra	1,602 years	1E - 07
Radon-222	^{222}Rn	3.821 days	None
Technetium-99	^{99}Tc	212,000 years	1E - 04
Thorium-230	^{230}Th	80,000 years	3 E - 07
Thorium-231	^{231}Th	25.5 hours	1E - 04
Thorium-234	^{234}Th	24.1 days	1E - 05
Uranium-234	^{234}U	247,000 years	5 E - 07
Uranium-235	^{235}U	710,000,000 years	6E - 07
Uranium-236	^{236}U	23,900,000 years	5 E - 07
Uranium-238	^{238}U	4,510,000,000 years	6E - 07

Derived Concentration Guide (DCG) is the concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (i.e., ingestion of water, submersion in air, or inhalation), would result in an effective dose equivalent of 100 mrem. DCGs do not consider decay products when the parent radionuclide is the cause of the exposure.

Table B.2 Nomenclature for elements and chemical compounds.

Constituent	Symbol	Constituent	Symbol
Aluminum	Al	Manganese	Mn
Ammonia	NH_3	Mercury	Hg
Antimony	Sb	Nickel	Ni
Arsenic	As	Nitrate	NO_3
Barium	Ba	Nitrite	NO_2
Beryllium	Be	Nitrogen	N
Cadmium	Cd	Oxygen	O
Calcium	Ca	Ozone	O_3
Calcium carbonate	$CaCO_3$	Phosphate	PO_4
Carbon	C	Phosphorus	P
Chlorine	Cl	Potassium	K
Chromium	Cr	Radium	Ra
Chromium, hexavalent	Cr^{6+}	Radon	Rn
Cobalt	Co	Selenium	Se
Copper	Cu	Silver	Ag
Fluorine	F	Sodium	Na
Hydrogen fluoride	HF	Sulfate	SO_4
Iron	Fe	Sulfur dioxide	SO_2
Lead	Pb	Thorium	Th
Lithium	Li	Uranium	U
Magnesium	Mg	Zinc	Zn

Appendix C: Groundwater Contamination Assessment

This appendix contains excerpts from the report, ***Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2001 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*** **(BJC/PAD-169/R2) issued by Bechtel Jacobs Company LLC in May 2002. The complete document is available through the U.S. Department of Energy Environmental Information Center in Kevil, Kentucky. Most of the information presented in the report is provided here; however, figures and maps are not reproduced in this publication. Where omissions from the original report occur, the text is bolded. Where Appendix A and Appendix B are referenced, these are appendices to the original report and are not included in this Annual Site Environmental Report.**

The remaining tables of data sets and graphs in the report, ***Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2001 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,*** **(BJC/PAD-169/R2), are available in the DOE Environmental Information Center.**

1. INTRODUCTION

This report is the third of a series of annual interpretations of groundwater data for the U.S. Department of Energy's (DOE's) Paducah Gaseous Diffusion Plant (PGDP), including revision of the site groundwater plume maps, to assess the extent of trichloroethene (TCE) and technetium-99 (^{99}Tc) in the shallow aquifer for the preceding year. The plume maps include data from the above referenced documents, taking into consideration the age of the data, in addition to routine groundwater monitoring data collected through the end of calendar year (CY) 2001. These maps are consistent with interpreted groundwater flow directions determined from potentiometric trends of the shallow aquifer and conceptual models of the influence of surface-water bodies. Significant revisions to the 2000 edition of the plume maps are discussed in Sect. 4. These reports provide a basis for timely incorporation of routine groundwater monitoring and characterization data for planned remedial actions. This report also includes potentiometric maps for each quarter of CY 2001.

The PGDP has been the subject of intense environmental monitoring over the last decade. Annual DOE reports present a summary of yearly monitoring results. These yearly monitoring results have been incorporated within the database of site-wide investigations, as they occurred. The previous site-wide investigations have included the following:

- *Results of the Site Investigation, Phase I, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (CH2M HILL 1991);
- *Results of the Site Investigation, Phase II, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (CH2M HILL 1992);
- *Report of the Paducah Gaseous Diffusion Plant Groundwater Investigation Phase III* (MMES 1992);
- *Northeast Plume Preliminary Characterization Summary Report, Paducah, Kentucky* (DOE 1995a);
- *Final Report on Drive-Point Profiling of the Northwest Plume and Analysis of Related Data* (DOE 1995b);
- *Remedial Investigation Report for the Waste Area Grouping 6 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 1999a);
- *Remedial Investigation Report for the Waste Area Grouping 27 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 1999b);
- *Remedial Investigation Report for the Waste Area Grouping 28 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2000a);
- *Data Report for the Sitewide Remedial Evaluation for Source Areas Contributing to Off-Site Groundwater Contamination at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2000b);
- *Site Evaluation Report for Waste Area Grouping 8 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2000c); and
- *Remedial Investigation Report for Waste Area Grouping 3 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2000d).

2. SETTING

The PGDP is located in the Jackson Purchase region of western Kentucky, approximately 16.1 km (10 miles) west of Paducah, Kentucky and 6.5 km (4 miles) south of the Ohio River. Cretaceous marine sediments of the Mississippi Embayment, resting upon a Mississippian-age carbonate bedrock, underlie the PGDP at depth. Buried fluvial deposits of the ancestral Tennessee River unconformably overlie the Cretaceous sediments directly beneath the PGDP. A thick gravel deposit at a general depth of 18.3 m (60 ft) below most of the PGDP forms the shallow aquifer, the Regional Gravel Aquifer (RGA). The RGA is found throughout the plant area and to the north, but pinches out to the south, southeast, and southwest along the slope of the Porters Creek Terrace. The RGA is the main conduit for groundwater flow to the north, where groundwater discharges into the Ohio River, and the main pathway for off-site contaminant plume migration. Fig. 2.1 **(not shown in this report)** presents a general cross-section of the site geology, while Fig. 2.2 **(not shown in this report)** illustrates the main features of the groundwater flow systems.

Trichloroethene, a common solvent, and ^{99}Tc, a man-made radioisotope, are the most widespread groundwater contaminants associated with the PGDP. Trichloroethene occurs as pure phase (free-product) dense nonaqueous-phase liquid (DNAPL) at multiple locations in the silts and clays overlying the RGA and, most probably, in the RGA itself at some locations. Technetium-99 is a widespread soil contaminant at the PGDP and a common contaminant in many PGDP burial grounds. Both dissolved TCE and ^{99}Tc migrate with downward percolating water to the RGA. In addition, pools of TCE, believed to exist within the RGA, are able to yield much higher dissolved levels in groundwater. These contaminants have resulted in large-scale dissolved-phase plumes that are migrating from the PGDP toward the Ohio River. Table 2.1 presents a summary of the PGDP groundwater plumes. Due to the lack of information at the plume's distal ends, off-site plume length is approximated, based on interpretation.

DOE has taken three discrete actions to contain the groundwater contamination and mitigate the risk to the public that is associated with groundwater. Two separate interim remedial actions installed pump-and-treat systems in the Northwest and Northeast Plumes. Both pump-and-treat systems consist of well fields in the high concentration core of the plumes. The Northwest Plume treatment system also includes a well field near the PGDP security fence. To minimize risks to residents and businesses north of the PGDP, DOE maintains a Water Policy, under which DOE provides municipal water to area residents and businesses.

3. REVISED PLUME MAPS

A primary component of the annual groundwater report is a revision of the site maps of TCE and ^{99}Tc levels in the RGA. These maps (presented in Appendix A) **(not shown in this report)** represent the contaminant extent during the preceding year based upon (1) analysis of groundwater samples collected during the previous year, (2) temporal trends in groundwater samples collected from monitoring wells (MWs), and (3) interpreted contaminant levels based on previous analyses and a conceptual model of contaminant trends. Appendix B **(not shown in this report)** includes plots of contaminant levels over time for trends cited in this report. The attached maps are based on the available TCE and ^{99}Tc analyses of groundwater found in the Paducah Oak Ridge Environmental Information System (OREIS) database at the end of CY 2001. These data include records for 115 RGA wells and piezometers and the maximum results from depth-discrete samples collected from 432 temporary soil borings in the RGA. The data set (Appendix B) **(not shown in this report)** incorporates analyses of the Remedial Investigations (RIs) of Waste Area Groupings (WAGs) 3 (DOE 2000d), 6 (DOE 1999a), 27 (DOE 1999b), and 28 (DOE 2000a), as well as the Sitewide Evaluation for Source Areas Contributing to Off-Site Groundwater Contamination (DOE 2000b) and the Site Evaluation Report for WAG 8 (DOE 2000c). These data have been age-adjusted

Table 2.1. PGDP groundwater plumes, CY 2001

Plume	Approximate maximum off-site contaminant levels	Off-site plume length
	Trichloroethene	
Northeast	1100 µg/L	3.4 km (2.1 miles)
Northwest	10,000 µg/L	4.4 km (2.7 miles)
Southwest	350 µg/L	0.4 km (0.3 miles)
	Technetium-99	
Northwest	3000 pCi/L	4.7 km (2.9 miles)
Southwest	1670 pCi/L	0.7 km (0.4 miles)

in order to take into consideration what the current concentration/activity likely might be. Age-adjusting was accomplished by comparing historical data in the boring to similar historical data in nearby MWs with a more recent value.

Maps of TCE and ^{99}Tc are presented at two scales to best present the greater available detail for the PGDP plant and to show the larger off-site area impacted by the PGDP. The plant map (1:4800 scale) covers the 303 hectares (748 acres) contained within the PGDP security fence. The larger area map (1:12,000 scale) addresses approximately 5950 hectares (14,700 acres) of the DOE reservation and other lands between the plant and the Ohio River. Metropolis Lake Road and Bethel Church Road conveniently define the east and west boundaries, respectively, of the potential area impacted by the PGDP groundwater contamination. Each map represents contaminant levels observed in or implied from trend plots of RGA MWs during CY 2001, plus data from temporary characterization borings. These maps are composites of three sets of working maps of the lower, middle, and upper RGA [elevations 76.2 to 89.9 m (250 to 295 ft), 89.9 to 93.0 m (295 to 305 ft), and 93.0 to 97.5 m (305 to 320 ft) amsl]. Figures 3.1 **(not shown in this report)** and 3.2 **(not shown in this report)** show the composite maps. Additional discussion of how the maps were developed is presented in Appendix B. **(not shown in this report)** The data set and trend plots for MWs used in the interpretation also are included in Appendix B. **(not shown in this report)** Figure 3.3 **(not shown in this report)** shows the areas of Solid Waste Management Units (SWMUs) and WAGs identified in the text. Also, Figs. 3.4 **(not shown in this report)** and 3.5 **(not shown in this report)** show the locations of borings and wells that are referenced in this report.

4. REVISIONS TO PREVIOUS PLUME MAPS

This year's (CY 2001) plume maps continue the basic interpretation presented in the plume maps for CY 2000. Revisions for CY 2001 reflect the following: (1) increasing TCE trends in C-404 MWs, (2) the consideration of surface water discharge to Little Bayou Creek, and (3) an isolation of contaminants in the C-746-S&T Landfill area.

The main revisions to the groundwater plume maps and contaminant trends for each plume are described in the following subsections.

4.1 NORTHEAST PLUME

4.1.1 Trichloroethene

Within the Northeast Plume, contaminant distributions have been interpreted similarly to those of the previous CY. In the upper RGA, an area of higher concentration previously existed within the plant boundary at boring P4-F5. That data, however, is unable to be age-adjusted as described in Sect. 3 and, subsequently, was not considered in this CY's interpretation.

Contaminant contours for the middle RGA this CY include MW99, whose TCE values have steadily risen since 1995 to an interpreted June 2001 value of 12 μg/L.

4.1.2 Technetium-99

Contaminant levels generally are less than 25 pCi/L offsite and are only greater than 100 pCi/L at a few discrete sources. No significant changes were made to this CY's maps.

4.2 NORTHWEST PLUME

4.2.1 Trichloroethene

Contaminant distributions in the Northwest Plume are also very similar to CY 2000's interpretation. The most notable change is in the interpretation of the distal end, which no longer appears bifurcated. It is believed that although TCE is upwelling into the surface water near monitoring points L241 and L12, TCE in the lower RGA is passing under Little Bayou Creek, as detected in MW152.

4.2.2 Technetium-99

Significant changes were made to the interpretation of ^{99}Tc distribution in the Northwest Plume. Previously, ^{99}Tc appeared as two separate plumes migrating from PGDP to near the Ohio River. The current interpretation is that these ^{99}Tc plumes are not separate plumes, but are part of the same plume. At the distal end, near the river, this CY's maps show the plume terminating at Little Bayou Creek, where upwelling into the surface water is occurring. In the middle and lower RGA horizons, ^{99}Tc is believed to be passing under Little Bayou Creek, as detected in MW152.

4.3 SOUTHWEST PLUME

4.3.1 Trichloroethene

Due to the age-adjusting of data collected from single boreholes, TCE in the middle RGA now has been connected with TCE from the C-720 area. Age-adjusting Boring 004-024 (from 48,000 μg/L to >300,000 μg/L) resulted in an area of higher concentration near SWMU 4. Additionally, the 100-1,000 μg/L contour has moved closer to the C-404 Landfill.

4.3.2 Technetium-99

There are no significant changes to the interpretation of ^{99}Tc distribution in the Southwest Plume.

4.4 C-746-S&T AREA

4.4.1 Trichloroethene

In the previous CY's maps, TCE in the C-746-S&T area was shown originating from within the plant. The CY's maps, however, show the TCE as isolated in the area for all three horizons.

4.4.2 Technetium-99

In the previous CY's maps, ^{99}Tc in the C-746-S&T area was shown originating from within the plant and from the C-616 Lagoons. The CY's maps, however, show the ^{99}Tc as isolated in the area for all three horizons.

5. TRENDS IN PGDP MONITORING WELLS

MW systems located at the PGDP provide a means to assess the groundwater quality in the RGA for distinct areas. Records of TCE and ^{99}Tc levels over time for 105 RGA wells document overall groundwater contaminant trends for the PGDP. For the primary contaminants of TCE and ^{99}Tc, the general trend has been a decline in contaminant levels. Approximately 37 wells, or about a third of the 105 RGA MWs, have shown an increase either in TCE, ^{99}Tc, or both over the past year; but, two-thirds show either a decline or no change in contaminant levels. This general decline in contaminant levels may be related to any of the following causes:

1) reduction in leachate generation from shallow contaminant source zones due to reduced area rainfall;

2) lowered hydraulic potential in the RGA, minimizing contact of groundwater with contaminant source zones and altering hydraulic gradients; or

3) depletion of the contaminant source volumes over time.

The following sections summarize the interpretation of groundwater trends at PGDP.

5.1 RAINFALL AND RGA HYDRAULIC POTENTIAL TRENDS

Figure 5.1 **(not shown in this report)** is a plot of cumulative rainfall for the PGDP area for the period 1990 through 2001. The actual rainfall is compared against the average cumulative rainfall for the same duration, based on 30-year monthly average rainfalls for the PGDP area (now available for the years 1970 through 2000). The plot demonstrates a sustained rainfall deficit for the PGDP area over the period 1992 through 2002. Figure 5.1 **(not shown in this report)** also presents the same data in another perspective that highlights the significance of the growing rainfall deficit. As the period of deficient rain continues, the amount of water in storage in surficial soils is depleted, and the amount of water infiltrating through deeper soils, potentially carrying groundwater contaminants, is reduced.

Figure 5.2 **(not shown in this report)** is a plot of RGA hydraulic potential for MW179, screened in the RGA and central to the area of the 105 wells represented in this assessment. The figure also compares the RGA hydraulic potential for MW179 to the net cumulative rainfall shown on Figure 5.1**(not shown in this report)**. All of the RGA water-level records exhibit identical trends (aside from rare outliers that appear to be measurement errors) with a similar magnitude of rise and fall (see Appendix B) **(not shown in this report)**. The data define an overall decline of approximately 6 ft for the period 1997 to 2002. Lowered RGA water levels may result in less contaminant source zone in contact with groundwater and may alter groundwater flow paths. The identical trends in hydraulic potential across the PGDP reservation suggest that any change in the groundwater flow path has been local only.

5.2 TRENDS IN CONTAMINANT LEVELS

Several groups of wells with records of increased TCE or ^{99}Tc levels occur among the 105 wells represented in this analysis. In nearly all well records, the number of water level measurements greatly exceeds the number of analyses for TCE and ^{99}Tc; thus, a strict comparison of contaminant levels versus water-level events is not possible. The data does, however, support an analysis of overall trends that may reflect cause-and-effect relationships.

5.2.1 C-400 Area

MW341 and MW343 are relatively recent monitoring stations for the northeast and northwest corners of the C-400 Building/source zone(s), respectively. Both are installed near the cores of groundwater contaminant plumes emanating from the C-400 area. In general, contaminant levels are continuously elevated in the C-400 area, illustrated in Figs. 5.3 **(not shown in this report)** and 5.4 **(not shown in this report),** reflecting the presence of secondary contaminant source zones within the RGA.

MW168 is located on the west side of the core of the Northwest Plume and west of the C-635 cooling tower complex. TCE levels have generally declined since early 1996, while ^{99}Tc levels have steadily increased over the period of record. The C-400 area contaminant source zones appear to be large and may have continuously supplied the Northwest Plume for a long period of time. Contaminant trends in MW168 appear to reflect a relocation of the core of the plume rather than a significant change in the contaminant source term. The PGDP cooling towers are suspected to be significant sources of induced recharge to the RGA. These contaminant trends probably indicate the increased impact of leakage from the cooling towers on the local groundwater flow path as the RGA hydraulic potential has declined.

5.2.2 On-Site Northwest Plume and Adjacent Areas

In the area immediately upgradient of the south extraction well field of the Northwest Plume, several trends are evident.

- The record of MW261 represents contaminant trends in the core of the Northwest Plume, upgradient of the south extraction well field. As shown in Figs. 5.5 **(not shown in this report)** and 5.6 **(not shown in this report)**, levels of both TCE and ^{99}Tc appear to be increasing. MW185 and MW245 exhibit similar trends of increasing contaminant levels (both TCE and ^{99}Tc). These wells are located on the east and west sides of the core of the Northwest Plume, respectively. The increasing trends suggest that the zone of higher contamination is expanding (consistent with increasing contaminant levels in the core of the plume). This increase in contaminant levels reflects past changes in the source zone, C-400 area, that are difficult to relate to the rainfall and water-level trends.

- Groundwater contaminant levels in the area of MW63 and MW65 (both far to the west of the core of the Northwest Plume) may be experiencing a similar trend. ^{99}Tc levels remain below typical laboratory detection limits (Figs.5.7 and 5.8) **(not shown in this report)**.

- MW66 contaminant levels (both TCE and ^{99}Tc) are clearly related to RGA hydraulic potential. Levels of both contaminants "spike" with high hydraulic potential events. The "base" contaminant levels significantly changed during 1997 when RGA hydraulic potential declined below 328.5 ft. This data suggests that the secondary contaminant source zone affecting groundwater in the MW66 area is at an elevation of approximately 328.5 ft. Whatever the cause-and-effect relationship, MW66 contaminant levels can be expected to rise significantly when the RGA hydraulic potential returns to 328.5 ft and above (Figs.5.7 and 5.8) **(not shown in this report)**.

- Contaminant trends for wells of the Northwest Plume south well field typically exhibit a sharp decline beginning in 1995, related to startup of pumping, and a continuing asymptotic reduction in contaminant levels. As illustrated in Fig. 5.5 **(not shown in this report)**, the ^{99}Tc record for MW249, however, suggests the beginning of a rebound (current level is approximately 35 pCi/L). This increase probably reflects an expanding zone of higher contamination as evidenced by the records for MW185 and MW245.

5.2.3 North Well Field

While all MWs downgradient of, or adjacent to, the extraction wells in the North Field exhibited decreasing TCE concentrations and ^{99}Tc activities initially, the contaminant levels in downgradient MW235 and MW236 began to increase in mid-1998 (Figures 5.9 and 5.10) **(not shown in this report)**. Since that time, both wells have continued to exhibit elevated levels of TCE and ^{99}Tc. The contaminant increase in MW125 and MW235 may be related to eastward migration of the core of the Northwest Plume with the decline in RGA hydraulic potential. TCE concentrations and ^{99}Tc activities in MW238, MW240, and MW241 have exhibited a fluctuating pattern since mid-1998. Figures 5.11 **(not shown in this report)** and 5.12 **(not shown in this report)** illustrate the contaminant trends in MWs at the North Well Field.

A review of the contaminant concentration curves exhibited by upgradient MW234 indicates that the contaminant concentration entering the North Field began to increase in mid-1998 (Figures 5.9 and 5.10) **(not shown in this report)**. The fact that these same higher levels of contamination also are observed in downgradient wells suggests that these higher levels of contamination have broken through the extraction field. The breakthrough possibly is due to biofouling and partial blockage of the extraction well screens, or a bypass of the system extraction wells due to changing hydraulic gradients.

5.2.4 Northwest Plume, Shawnee Steam Plant

RGA water levels likely are a strong influence on groundwater flow paths and contaminant levels in the vicinity of MW152, located near the Shawnee Steam Plant. During periods of high hydraulic potential in the RGA, groundwater of the Northwest Plume discharges to Little Bayou Creek, upgradient of MW152. In addition, large surface water withdrawals at the Shawnee Steam Plant have the impact of focusing groundwater flow from the Northwest Plume through the area of MW152. This impact would be heightened during periods of low hydraulic potential in the RGA. The recent increase in TCE concentrations in the groundwater of the MW152, shown in Fig. 5.13 **(not shown in this report)**, area likely are related to the lower hydraulic potential of the RGA.

5.2.5 South Well Field

During CY 2001, the TCE concentrations and ^{99}Tc activities exhibited by most MWs in the South Field were consistent with a documented six-year downward trend. Chemical concentration curves for MW242, MW244, MW249, and MW250 continued to appear asymptotic (Figs. 5.14 and 5.15) **(not shown in this report)**. As illustrated in Figs. 5.16 **(not shown in this report)** and 5.17 **(not shown in this report)**, MW245 continued to exhibit a gradual increase in TCE concentrations and ^{99}Tc activities that began in mid-1996. MW248, located between extraction wells, continued to exhibit fluctuating levels of TCE and ^{99}Tc, with contaminant levels decreasing in the first and second quarters of 2001 and increasing in the third and fourth quarters. Downgradient MW243 exhibited a slight increase in both TCE and ^{99}Tc during the first three quarters of 2001, and a slight decrease in both TCE and ^{99}Tc during the fourth quarter of 2001 (Figs. 5.16 and 5.17) **(not shown in this report)**.

While the increases observed at MW245 during this reporting period remain consistent with historical trends, the slow elevation of TCE and ^{99}Tc could indicate the continued movement of contaminants from the plant. The overall decline in concentrations exhibited by downgradient wells in the South Field continues to suggest that the extraction wells are meeting performance objectives.

5.2.6 North C-746-S&T Landfills Area

Four wells on the north side of the C-746-S&T Landfills (MW179, MW263, MW264, and MW266) have well records demonstrating an increase in area TCE levels as shown in Fig. 5.18 **(not shown in this report)**. This trend may be related to a nearby source zone in the C-746-S&T Landfills or may be due to changing groundwater flow paths related to the declining RGA hydraulic potential. An increase in ^{99}Tc levels to the south (upgradient) of the C-746-S&T Landfills, monitored in MW353 (Fig. 5.19) **(not shown in this report)**, is most easily explained by a shift in groundwater flow paths related to the lower RGA hydraulic potential.

5.2.7 North C-746-U Landfill Area

Increasing ^{99}Tc levels are documented in three wells (MW268, MW271, and MW272) and possibly a fourth well (MW273) located on the north side of the C-746-U Landfill. This contamination appears to be derived from an upgradient source(s). The trend of rising ^{99}Tc levels, as illustrated in Fig. 5.20 **(not shown in this report)**, reflects a shift in groundwater flow paths associated with the declining RGA hydraulic potential.

5.2.8 General North PGDP Reservation Area

Three widely separated wells in the north PGDP reservation monitor increasing TCE levels. The source of the TCE is undefined and the reason for rising TCE concentrations cannot be determined.

5.2.9 Northeast Plume Well Field

Four of the downgradient wells at the Northeast Plume (MW126, MW283, MW284, and MW291) continued to conform to a declining or asymptotic TCE concentration trend during CY 2001 as shown in Fig. 5.21 **(not shown in this report)**. Concentrations of TCE observed in MW124 (Fig. 5.22) **(not shown in this report)** during CY 2001 continued to reflect contaminant levels commensurate with pre-2000 trends. MW293 (screened in the RGA at 64 to 74 ft bgs) continued to show a moderate rise in TCE concentrations during the first through third quarters of CY 2001, but exhibited a slight decrease in TCE concentration in the fourth quarter of CY 2001. The associated "nested" well, MW294 (screened in the RGA at 80.5 to 90.5 ft bgs), also exhibited slight increases in TCE concentrations during 2001 (Fig. 5.22) **(not**

shown in this report). This increase in TCE concentrations may represent the movement of a “pocket” of groundwater with elevated TCE concentrations through the well field. The lack of complete capture of this “pocket” may be attributed to biofouling problems in the extraction wells and/or several extended periods of Northeast Plume Containment System downtime, which occurred from June 1999 through 2001. Elevated levels of TCE in the downgradient wells are expected to decrease when full and constant operation is resumed.

Upgradient MW145, MW255, and MW258 continued to exhibit TCE concentrations consistent with historical stable or downward trends. (Fig. 5.23.) **(not shown in this report)** MW256 and MW292 showed increased concentrations of TCE during the second half of 2001 and MW288 during the entire year, suggesting some continued movement of TCE from the plant. (Fig. 5.24.) **(not shown in this report)**

During CY 2001, all Northeast Plume Containment System MWs, except MW256, exhibited ^{99}Tc activities that were below the 25 pCi/L action level. Activities of ^{99}Tc observed at MW256 were 98.9, 101, 118, and 114 pCi/L, respectively, for each of the four quarters of CY 2001. Technetium-99 activities at other MWs upgradient of the Northeast Plume Containment System (MW258 and MW292) do not indicate that a plume of ^{99}Tc was moving offsite from the plant. (Fig. 5.25.) **(not shown in this report)**

5.2.10 East Side of the PGDP

Contaminant trends in groundwater of the MW256 area are thought to represent two source zones. The TCE is attributed to an upgradient DNAPL zone in the area of the C-333 process building. In general, TCE levels in this plume appear to be declining. The increase in TCE levels in MW256 appears to be related to a shift in the location of the core of the Northeast Plume, related to lowered RGA hydraulic potential. The ^{99}Tc contamination is ascribed to an adjacent materials storage site and increasing levels reflect the recent arrival of the dissolved phase plume into the RGA.

The MW260 well record exhibits a declining TCE concentration and an increasing ^{99}Tc level. Plume maps relate this contamination to the C-400 area, far upgradient of MW260. The contaminant trends observed in MW260, as shown in Fig. 5.19 **(not shown in this report)**, likely are related to shifting groundwater flow paths, due to the declining RGA hydraulic potential and the increasing impact of leakage from the nearby C-637 Cooling Tower complex.

5.2.11 Southwest Plume Area

Two wells of the upgradient Southwest Plume area exhibit increasing contaminant levels (MW71 and MW203, shown on Fig. 5.26) **(not shown in this report).** These trends may be related to the recent arrival of dissolved phase contamination to the RGA or changes in groundwater flow paths during the extended period of low RGA hydraulic potential.

MWs to the west and northwest of the C-404 Waste Burial Ground and wells at the C-749 Burial Ground have shown significantly increasing values of TCE. TCE levels in MW84, northwest of C-404, have increased from 9μg/L to 17 μg/L to 41 μg/L during the years 1999, 2000, and 2001, respectively. During the CY, TCE concentrations at MW337, monitoring C-749, have increased from 90 μg/L to 150 μg/L. Figure 5.27 **(not shown in this report)** illustrates these increasing trends. TCE values to the north and northeast of C-404 remain less than 5 μg/L. (Fig. 3.1.) **(not shown in this report)**

While ^{99}Tc activities in MW84 have been elevated in the past (as high as 1000 pCi/L in 1989), activities since 1996 have been less than the 25 pCi/L action limit. Technetium-99 activities in MW337 have been increasing and reached a high of 158 pCi/L this CY (Fig. 5.27.) **(not shown in this report)**.

5.2.12 C-404 Area

The well records of the C-404 area exhibit a consistent trend of increasing TCE levels on the west side of C-404, with greatest increase in wells screened in the upper RGA. This trend is strongly suggestive of a shallow contaminant source at C-404 with dissolved contaminant levels only recently migrating downward to the RGA (similar to the C-746-S&T area trend). A return to normal rainfall levels can be expected to result in an increase in TCE levels in the RGA.

5.3 SUMMARY

The typical trend of contaminant levels in RGA groundwater is a decline over time; however, several PGDP wells evidence increasing TCE or ^{99}Tc levels. In a few cases, these trends reflect recent arrival of dissolved phase plumes in the RGA. More often, rising contaminant levels may be due to locally altered groundwater flow paths in the RGA (leading to lateral migration of contaminant plumes), related to a period of declining RGA hydraulic potential.

6. POTENTIOMETRIC DATA

The potentiometric surface of the RGA was contoured for each quarter of CY 2001 using water level data collected during quarterly water level suites. In addition to depths to water, barometric pressure also is collected. Water level elevations were normalized using the average barometric pressure for the quarter. These maps are presented in Appendix A **(not shown in this report)**, following the plume maps (Figs. A.13 through A.20) **(not shown in this report)**. The area maps (Figs. A.13, A.15, A.17, and A.19) **(not shown in this report)** are contoured at 1 ft intervals, while the plant view maps (Figs. A.14, A.16, A.18, and A.20) **(not shown in this report)** are contoured to the ½ ft.

The potentiometric data is presented in Tables B.3 through B.6 **(not shown in this report)**. As a quality control check for each quarter's data, the water level elevations were contoured using the surface mapping system Surfer®. The computer-generated contours and surfaces are presented in Figures B.1 through B.8 **(not shown in this report)**. Some data values were excluded from the hand-contoured map, based on these checks. Reasons such as multiple data values available for the well and data points not matching surrounding wells are denoted in the tables in Appendix B **(not shown in this report)**.

In general, the contours follow the shape of the terrace slope and indicate flow toward the Ohio River. The influence of streams, lagoons, or other surficial features in the area are not obvious on these potentiometric maps. The apparent lack of influence may be related to the density of well coverage in these areas and the range of the contour interval.

Quarterly potentiometric surfaces on the area maps show a depression in the area of the Northeast Plume extraction wells for the first and second quarters. Additionally, a depression seems to exist in the Northeast Plume near the PGDP fence. This depression is depicted in three different wells in the first and fourth quarters. To a smaller scale, the depression also can be seen in the plant view maps in the second and third quarters. Another depression seems to exist at the northwest corner of the plant area. Potentiometric highs appear near the C-746-S &-T Landfills throughout most of the year, but especially during the third quarter.

7. USES OF THIS REPORT

This evaluation of groundwater contaminant trends for CY 2001 supports several goals of the PGDP environmental program. Foremost, the updated plume maps and definition of trends will be used as an input to remedial action decisions for the Groundwater Operable Unit to provide the following information:

- define additional areas contributing significant contamination to the RGA,
- scope the dimensions of potential remedial actions, and

- refine the extent of off-site areas that will be addressed by temporary or permanent institutional controls.

This same assessment will support the ongoing evaluation of the adequacy of DOE's Water Policy and effectiveness of the PGDP groundwater monitoring program. To this end, this report is being included as an appendix to the 2001 Annual Site Environmental Report. In addition, the trends and extent of contamination defined by this report will be used as an aid in data interpretation and project planning.

8. REFERENCES

CH2M HILL 1991. *Results of the Site Investigation, Phase I, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, KY/ER-4, CH2M HILL Southeast, Inc., Oak Ridge, TN.

CH2M HILL 1992. *Results of the Site Investigation, Phase II, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, KY/SUB/13B-97777C P-03/1991/1, CH2M HILL Southeast, Inc., Oak Ridge, TN, April.

DOE (U.S. Department of Energy) 1995a. Draft *Northeast Plume Preliminary Characterization Summary Report, Paducah, Kentucky*, DOE/OR/07-1339&D1, February 7.

DOE 1995b. *Final Report on Drive-Point Profiling of the Northwest Plume and Analysis of Related Data*, KY/ER-66, Paducah, KY, April.

DOE 1999a. *Remedial Investigation Report for Waste Area Grouping 6 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1727&D2, May.

DOE 1999b. *Remedial Investigation Report for Waste Area Grouping 27 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1777&D2, June.

DOE 2000a. *Remedial Investigation Report for Waste Area Grouping 28 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1846&D1, January.

DOE 2000b. *Data Report for the Sitewide Remedial Evaluation for Source Areas Contributing to Off-Site Groundwater Contamination at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1845/D1, January.

DOE 2000c. *Site Evaluation Report for Waste Area Grouping 8 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1867&D0, March.

DOE 2000d. *Remedial Investigation Report for Waste Area Grouping 3 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1895&D0, July.

MMES (Martin Marietta Energy Systems, Inc.) 1992. *Report of the Paducah Gaseous Diffusion Plant Groundwater Investigation Phase III*, KY/E-150, Martin Marietta Energy Systems, Inc., Paducah, KY, November.

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List of Tables

Notes:

1. Selected results are discussed in the appropriate sections of the text of this report.

2. "ND" means the parameter was not detected. Detection limits are available in the Paducah OREIS database. The count detects column represents the number of times the contaminant was detected when sampled during the year.

3. Monitoring programs often include measurement of extremely low concentrations of radionuclides, below the detection limit of the counting instruments. Less-than-detectable data will produce numerical measurements with values below the detection limit and sometimes negative values. All of the actual values, including those that are negative, are included in the statistical analyses in accordance with DOE's *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991).

4. For non-radiological data, average values are calculated using the actual result values from the OREIS database. Where analytical result values were below the detection level, half of the detection limit was used to calculate average concentration. For radiological data, the average concentration was calculated by using the actual result given for both detectable and non-detectable results.

1. RADIOLOGICAL EFFLUENT DATA

KPDES Radiological Data

Table 1.1 Radiological Effluent Data for Outfall 001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/L	0	20.9	12.4	2	3		
Beta activity	pCi/L	77.9	100	87.6	2	3		
Dissolved Alpha	pCi/L	-1.19	18.7	6.66	0	5		
Dissolved Beta	pCi/L	10.3	39.9	26.4	4	5		
Radium	pCi/L	0.513	0.899	0.706	1	2		
Suspended Alpha	pCi/L	-0.962	1.3	0.0038	0	5		
Suspended Beta	pCi/L	-0.979	2.85	1.02	0	5		
Technetium-99	pCi/L	-0.325	5.32	3.72	0	5	ActionLimit	900
Uranium	mg/L	0.002	0.046	0.0202	5	5	10%DCG	0.0901

Table 1.2 Radiological Effluent Data for Outfall 015

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/L	0	8.49	4.25	1	2		
Beta activity	pCi/L	27	40	33.5	1	2		
Dissolved Alpha	pCi/L	7.6	230	85.7	4	4		
Dissolved Beta	pCi/L	23.8	74.5	47.7	4	4		
Radium	pCi/L	0.612	0.612	0.612	1	1		
Suspended Alpha	pCi/L	0.634	4.71	2.54	1	4		
Suspended Beta	pCi/L	0.794	16	8.49	2	4		
Technetium-99	pCi/L	14.3	50.4	27.6	2	4	ActionLimit	900
Uranium	mg/L	0.014	0.58	0.195	4	4	10%DCG	0.0901

Table 1.3 Radiological Effluent Data for Outfall 017

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/L	-20	3.18	-8.41	1	2		
Beta activity	pCi/L	-20	0.95	-9.53	0	2		
Dissolved Alpha	pCi/L	-0.563	8.08	2.23	1	5		
Dissolved Beta	pCi/L	5.74	13.9	9.74	3	5		
Radium	pCi/L	0.4	0.4	0.4	0	1		
Suspended Alpha	pCi/L	0.217	2.73	1.39	0	5		
Suspended Beta	pCi/L	-2.95	8.94	4.03	2	5		
Technetium-99	pCi/L	-12	8.75	-3.18	0	5	ActionLimit	900
Uranium	mg/L	ND	0.006	0.0017	2	5	10%DCG	0.0901

KPDES Radiological Data

Table 1.4 Radiological Effluent Data for Outfall 019

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/L	-40	2.69	-18.7	0	2		
Beta activity	pCi/L	5.32	10	7.66	1	2		
Dissolved Alpha	pCi/L	0.494	3.07	2.17	0	3		
Dissolved Beta	pCi/L	0	8.72	4.58	1	3		
Radium	pCi/L	0.304	0.304	0.304	0	1		
Suspended Alpha	pCi/L	-1.09	0.618	-0.037	0	3		
Suspended Beta	pCi/L	0.196	1.43	0.61	0	3		
Technetium-99	pCi/L	1.39	22.1	8.92	1	3	ActionLimit	900
Uranium	mg/L	ND	ND	ND	0	3	10%DCG	0.0901

Surface Water Radiological Data

Table 1.5 Radiological Effluent Data for Landfill Surface Water Location L135

Upstream C-746 S&T Closed Landfills

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/L	2.3	4.46	3.31	0	4		
Beta activity	pCi/L	10.2	57	25.4	4	4		
Uranium	mg/L	0.002	0.008	0.005	4	4	10%DCG	0.0901

Table 1.6 Radiological Effluent Data for Landfill Surface Water Location L136

At the C-746 S&T Closed Landfills

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/L	0.454	8.98	4.93	1	5		
Beta activity	pCi/L	5.9	25.9	13.2	5	5		
Uranium	mg/L	ND	0.007	0.0031	4	5	10%DCG	0.0901

Table 1.7 Radiological Effluent Data for Landfill Surface Water Location L137

Downstream of the C-746 S&T Closed Landfills

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/L	1.51	8.55	5.06	2	4		
Beta activity	pCi/L	5.94	27.4	16.5	4	4		
Uranium	mg/L	0.001	0.009	0.0045	4	4	10%DCG	0.0901

Table 1.8 Radiological Effluent Data for Landfill Surface Water Location L150

At the C-746 U Landfill

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/L	1.39	3.47	2.28	0	5		
Beta activity	pCi/L	6.12	13.7	8.47	5	5		
Uranium	mg/L	ND	0.003	0.0012	3	5	10%DCG	0.0901

Table 1.9 Radiological Effluent Data for Landfill Surface Water Location L154

Upstream of the C-746 U Landfill

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/L	-1.63	8.22	1.57	1	4		
Beta activity	pCi/L	8.73	26.6	18	4	4		
Uranium	mg/L	ND	0.008	0.0033	3	4	10%DCG	0.0901

Surface Water Radiological Data

Table 1.10 Radiological Effluent Data for Landfill Surface Water Location L155

Downstream of the C-746 U Landfill

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/L	-0.419	3.81	2.34	1	4		
Beta activity	pCi/L	4.16	8.61	6.61	3	4		
Uranium	mg/L	0.004	0.011	0.007	4	4	10%DCG	0.0901

2. RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE DATA

Ambient Air Data

Table 2.1 Kentucky Radiation Health and Toxic Branch Air Monitoring

QUARTER 1

	AMSW017	AMW015	AMNW001	AMN003	AMNE	AME002	AME012	AMBKG2	AMBOLD	AMKOW	AMMWNE
Nuclide	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**
Am-241	-2.109E-16	-1.229E-16	-1.971E-16	4.506E-16	6.364E-16	5.945E-16	5.246E-16	-2.896E-16			
Np-237	2.63E-16	7.091E-17	-4.104E-16	-5.355E-19	7.757E-18	-7.26E-17	-6.211E-17	-3.238E-16			
Tc-99	1.44E-15	1.74E-15	1.64E-15	1.61E-15		2.09E-15	1.11E-15	2.11E-15			
U-238/Th-234	-3.17E-15	-1.678E-15	-3.303E-15	3.551E-15	8.84E-16	-2.674E-15	1.551E-16	8.351E-16			
Sum of ratios*	-0.26	-0.20	-0.83	0.68	0.45	-0.05	0.25	-0.31	0.00	0.00	0.00

QUARTER 2

	AMSW017	AMW015	AMNW001	AMN003	AMNE	AME002	AME012	AMBKG2	AMBOLD	AMKOW	AMMWNE
Nuclide	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**
Am-241	3.629E-17	-3.106E-16	-2.39E-16	7.329E-17	2.622E-16	8.325E-17	1.77E-16	5.912E-17			
Np-237	1.861E-16	1.698E-16	2.675E-16	-2.195E-17	-7.828E-17	-5.666E-17	-5.096E-17	-2.124E-16			
Tc-99	-7.0233E-17	-2.006E-16	1.8903E-16	1.4447E-15	3.8623E-17	-3.196E-16	8.4796E-17	2.5524E-16			
U-238/Th-234	2.104E-16	3.79E-15	2.774E-16	4.249E-15	-4.98E-16	-1.32E-15	-1.672E-15	-1.641E-15			
Sum of ratios	0.20	0.43	0.13	0.54	0.01	-0.16	-0.15	-0.34	0.00	0.00	0.00

QUARTER 3

	AMSW017	AMW015	AMNW001	AMN003	AMNE	AME002	AME012	AMBKG2	AMBOLD	AMKOW	AMMWNE
Nuclide	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**
Am-241	3.442E-16	5.001E-16	3.734E-16	5.475E-16	5.355E-16	4.049E-16	4.053E-16	-5.105E-16			
Np-237	7.45E-17	-1.012E-16	2.401E-16	2.496E-16	3.023E-16	-8.006E-17	-3.339E-16	3.072E-16			
Tc-99	1.9163E-16	-3.555E-17	2.5318E-16	2.8706E-16	1.7346E-16	4.3026E-16	4.3361E-16	3.5067E-16			
U-238/Th-234	-3.305E-15	-2.501E-15	-3.896E-15	-1.169E-15	-1.987E-15	-4.647E-16	5.826E-16	-1.046E-15			
Sum of ratios	-0.15	-0.12	-0.07	0.36	0.30	0.09	0.01	-0.14	0.00	0.00	0.00

QUARTER 4

	AMSW017	AMW015	AMNW001	AMN003	AMNE	AME002	AME012	AMBKG2	AMBOLD	AMKOW	AMMWNE
Nuclide	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**	**Ci/m3**
Am-241	3.794E-16	3.693E-16	-2.461E-16		-2.79E-16	6.437E-17	-6.428E-17	-2.564E-16	-1.476E-16	-1.395E-16	-3.706E-16
Np-237	7.686E-17	1.158E-16	2.767E-17		-3.05E-17	1.039E-17	-2.233E-16	7.727E-17	6.822E-17	-4.545E-17	7.837E-17
Tc-99	-2.5377E-16	-1.169E-16	3.4489E-17		9.0124E-17	2.667E-16	1.252E-16	1.1834E-16	1.1052E-16	2.3497E-16	4.3787E-17
U-238/Th-234	-1E-15	1.93E-15	-6.479E-15		-5.325E-15	-2.139E-15	-8.122E-16	-6.491E-15	6.063E-16	-3.099E-15	-2.69E-15
Sum of ratios	0.14	0.52	-0.89	0.00	-0.81	-0.21	-0.32	-0.85	0.05	-0.48	-0.45

*Sum of Ratios: The ratio of the measured concentration to the allowable concentration is added for all radionuclides for each quarter for each location. A value of less than one indicates regulatory compliance.

Surface Water Radiological Data

Table 2.2 Radiological Monitoring Data for Surface Water Location L1

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-17.1	8.02	-5.56	0	4	10%DCG	3
Cesium-134	pCi/L	-12.9	-4.02	-8.24	0	4		
Cesium-137	pCi/L	-7.01	6	0.0225	0	4	10%DCG	300
Cobalt-60	pCi/L	-3.56	2.44	-1.28	0	4	10%DCG	1000
Dissolved Alpha	pCi/L	-3.26	1.82	-0.218	0	4		
Dissolved Beta	pCi/L	3.32	5.51	4.68	0	4		
Neptunium-237	pCi/L	-0.162	0.308	0.0365	0	4	10%DCG	3
Plutonium-238	pCi/L	-0.0844	0.0596	-0.00112	0	4		
Plutonium-239/240	pCi/L	-0.0384	0.0211	-0.00491	0	4	10%DCG	3
Potassium-40	pCi/L	-205	56.9	-78.6	0	4		
Suspended Alpha	pCi/L	-2.56	0.18	-1.35	0	4		
Suspended Beta	pCi/L	-2.6	5.66	0.319	0	4		
Technetium-99	pCi/L	-16.9	7.57	-1.74	0	4	ActionLimit	900
Thorium-228	pCi/L	-0.0142	0.0405	0.0105	0	4		
Thorium-230	pCi/L	-0.0801	0.0626	-0.0114	0	4	10%DCG	30
Thorium-232	pCi/L	0.00279	0.0558	0.0298	0	4		
Uranium	mg/L	ND	0.05	0.005	1	6	10%DCG	0.0901
Uranium	pCi/L	25.8	25.8	25.8	0	1	10%DCG	60
Uranium-234	pCi/L	8.7	8.7	8.7	0	1	10%DCG	50
Uranium-235	pCi/L	0	17.1	4.28	1	4	10%DCG	60
Uranium-238	pCi/L	0	0	0	0	1	10%DCG	60

Table 2.3 Radiological Monitoring Data for Surface Water Location L5

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-25.9	13.2	-10.2	0	5	10%DCG	3
Cesium-134	pCi/L	-7.41	4.33	-1.85	0	5		
Cesium-137	pCi/L	-2.6	10.9	2.03	0	5	10%DCG	300
Cobalt-60	pCi/L	-4.56	4.31	0.326	0	5	10%DCG	1000
Dissolved Alpha	pCi/L	-0.72	3.63	1.61	0	5		
Dissolved Beta	pCi/L	3.28	20.7	9.09	1	5		
Neptunium-237	pCi/L	-0.0423	0.364	0.144	0	5	10%DCG	3
Plutonium-238	pCi/L	-0.139	0.0392	-0.00936	0	5		
Plutonium-239/240	pCi/L	-0.0415	0.0155	-0.0112	0	5	10%DCG	3
Potassium-40	pCi/L	-106	62.3	1.43	0	5		
Suspended Alpha	pCi/L	-3.17	1.44	-1.32	0	5		
Suspended Beta	pCi/L	-3.16	6.86	1.37	0	5		
Technetium-99	pCi/L	-6.19	12.4	3.03	0	5	ActionLimit	900
Thorium-228	pCi/L	-0.066	-0.00391	-0.0252	0	5		
Thorium-230	pCi/L	-0.0912	0.0306	-0.0379	0	5	10%DCG	30
Thorium-232	pCi/L	-0.065	0.0117	-0.02	0	5		
Uranium	mg/L	ND	0.05	0.00975	4	8	10%DCG	0.0901
Uranium-235	pCi/L	-2.96	0	-1.15	0	5	10%DCG	60

Surface Water Radiological Data

Table 2.4 Radiological Monitoring Data for Surface Water Location L6

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-6.31	8.88	0.723	0	3	10%DCG	3
Cesium-134	pCi/L	-1.4	3.95	1.49	0	3		
Cesium-137	pCi/L	-1.3	1.93	-0.0567	0	3	10%DCG	300
Cobalt-60	pCi/L	-6.94	-0.738	-3.4	0	3	10%DCG	1000
Dissolved Alpha	pCi/L	-8	3.56	-1.17	0	3		
Dissolved Beta	pCi/L	0.886	8.57	5.37	0	3		
Neptunium-237	pCi/L	-0.162	0.141	0.0165	0	3	10%DCG	3
Plutonium-238	pCi/L	-0.00139	0.1	0.0617	0	3		
Plutonium-239/240	pCi/L	-0.0363	0.00593	-0.0141	0	3	10%DCG	3
Potassium-40	pCi/L	-153	167	-20.2	0	3		
Suspended Alpha	pCi/L	-2.16	0.698	-0.384	0	3		
Suspended Beta	pCi/L	-2.81	0	-1.4	0	3		
Technetium-99	pCi/L	6.94	14.2	9.62	0	3	ActionLimit	900
Thorium-228	pCi/L	-0.00643	0	-0.00232	0	3		
Thorium-230	pCi/L	-0.032	0.0372	0.00128	0	3	10%DCG	30
Thorium-232	pCi/L	0.0023	0.0203	0.00844	0	3		
Uranium	mg/L	0.001	0.006	0.0035	2	2	10%DCG	0.0901
Uranium-235	pCi/L	0	0	0	0	3	10%DCG	60

Table 2.5 Radiological Monitoring Data for Surface Water Location C612

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-6.96	7.38	2.39	0	3	10%DCG	3
Cesium-134	pCi/L	-3.48	1.11	-0.62	0	3		
Cesium-137	pCi/L	-0.916	1.2	0.352	0	3	10%DCG	300
Cobalt-60	pCi/L	-8.63	-1.61	-4.68	0	3	10%DCG	1000
Dissolved Alpha	pCi/L	-0.874	4.65	1	0	3		
Dissolved Beta	pCi/L	-1.77	4.86	2.29	0	3		
Neptunium-237	pCi/L	0	0.0381	0.0127	0	3	10%DCG	3
Plutonium-238	pCi/L	-0.045	0.142	0.0312	0	3		
Plutonium-239/240	pCi/L	-0.0233	-0.00821	-0.0148	0	3	10%DCG	3
Potassium-40	pCi/L	-62.4	125	23.4	0	3		
Suspended Alpha	pCi/L	-1.96	1.94	-0.137	0	3		
Suspended Beta	pCi/L	0.426	2.55	1.57	0	3		
Technetium-99	pCi/L	-0.156	9.84	3.5	0	3	ActionLimit	900
Thorium-228	pCi/L	-0.0534	0.0763	0.00628	0	3		
Thorium-230	pCi/L	-0.156	-0.0371	-0.112	0	3	10%DCG	30
Thorium-232	pCi/L	-0.0521	0.0045	-0.0318	0	3		
Uranium	mg/L	ND	ND	ND	0	6	10%DCG	0.0901
Uranium-235	pCi/L	0	0	0	0	3	10%DCG	60

Surface Water Radiological Data

Table 2.6 Radiological Monitoring Data for Surface Water Location C616

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-25.8	15.5	-5.15	0	2	10%DCG	3
Cesium-134	pCi/L	-9.04	-1.63	-5.33	0	2		
Cesium-137	pCi/L	-6.9	0.642	-3.13	0	2	10%DCG	300
Cobalt-60	pCi/L	-3.78	1.56	-1.11	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	-6.05	-0.813	-3.43	0	2		
Dissolved Beta	pCi/L	38.1	49.5	43.8	2	2		
Neptunium-237	pCi/L	-0.019	0	-0.0095	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.0715	-0.0677	-0.0696	0	2		
Plutonium-239/240	pCi/L	0.00377	0.0128	0.00829	0	2	10%DCG	3
Potassium-40	pCi/L	-40.9	87.8	23.4	0	2		
Suspended Alpha	pCi/L	-1.2	-0.632	-0.916	0	2		
Suspended Beta	pCi/L	-0.198	0.448	0.125	0	2		
Technetium-99	pCi/L	2.44	5.97	4.2	0	2	ActionLimit	900
Thorium-228	pCi/L	-0.0259	-0.0184	-0.0221	0	2		
Thorium-230	pCi/L	-0.0724	0.0484	-0.012	0	2	10%DCG	30
Thorium-232	pCi/L	-0.021	-0.018	-0.0195	0	2		
Uranium	mg/L	ND	0.05	0.00762	2	4	10%DCG	0.0901
Uranium	pCi/L	37.9	1230	634	0	2	10%DCG	60
Uranium-234	pCi/L	12.8	647	330	0	2	10%DCG	50
Uranium-235	pCi/L	25.1	30.8	27.9	2	2	10%DCG	60
Uranium-238	pCi/L	0	556	278	1	2	10%DCG	60

Table 2.7 Radiological Monitoring Data for Surface Water Location K004

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-36.8	-24.1	-30.4	0	2	10%DCG	3
Cesium-134	pCi/L	-25.7	-6.8	-16.2	0	2		
Cesium-137	pCi/L	0	3.14	1.57	0	2	10%DCG	300
Cobalt-60	pCi/L	-7.5	8.7	0.6	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	-0.621	17.6	8.49	1	2		
Dissolved Beta	pCi/L	15.4	19.3	17.4	2	2		
Neptunium-237	pCi/L	-0.0745	0.254	0.0897	0	2	10%DCG	3
Plutonium-238	pCi/L	0.00218	0.0261	0.0141	0	2		
Plutonium-239/240	pCi/L	-0.0136	-0.00974	-0.0117	0	2	10%DCG	3
Potassium-40	pCi/L	-3.24	594	295	1	2		
Suspended Alpha	pCi/L	-1.25	-0.478	-0.864	0	2		
Suspended Beta	pCi/L	9.94	11.4	10.7	2	2		
Technetium-99	pCi/L	-5.7	3.04	-1.33	0	2	ActionLimit	900
Thorium-228	pCi/L	-0.0166	0.0955	0.0394	0	2		
Thorium-230	pCi/L	-0.164	0.0739	-0.045	0	2	10%DCG	30
Thorium-232	pCi/L	0.00385	0.0127	0.00827	0	2		
Uranium	mg/L	ND	0.05	0.017	3	4	10%DCG	0.0901
Uranium-235	pCi/L	0	0	0	0	2	10%DCG	60

Surface Water Radiological Data

Table 2.8 Radiological Monitoring Data for Surface Water Location K006

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-8.71	-8.71	-8.71	0	1	10%DCG	3
Cesium-134	pCi/L	-0.592	-0.592	-0.592	0	1		
Cesium-137	pCi/L	3.12	3.12	3.12	0	1	10%DCG	300
Cobalt-60	pCi/L	-10.1	-10.1	-10.1	0	1	10%DCG	1000
Dissolved Alpha	pCi/L	-1.35	-1.35	-1.35	0	1		
Dissolved Beta	pCi/L	2.5	2.5	2.5	0	1		
Neptunium-237	pCi/L	-0.149	-0.149	-0.149	0	1	10%DCG	3
Plutonium-238	pCi/L	-0.102	-0.102	-0.102	0	1		
Plutonium-239/240	pCi/L	0.0171	0.0171	0.0171	0	1	10%DCG	3
Potassium-40	pCi/L	712	712	712	1	1		
Suspended Alpha	pCi/L	-0.761	-0.761	-0.761	0	1		
Suspended Beta	pCi/L	1.08	1.08	1.08	0	1		
Technetium-99	pCi/L	2.66	2.66	2.66	0	1	ActionLimit	900
Thorium-228	pCi/L	0.00762	0.00762	0.00762	0	1		
Thorium-230	pCi/L	0.0579	0.0579	0.0579	0	1	10%DCG	30
Thorium-232	pCi/L	0.000454	0.000454	0.000454	0	1		
Uranium	mg/L	ND	ND	ND	0	2	10%DCG	0.0901
Uranium-235	pCi/L	0	0	0	0	1	10%DCG	60

Table 2.9 Radiological Monitoring Data for Surface Water Location K008

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-5.86	-3.61	-4.74	0	2	10%DCG	3
Cesium-134	pCi/L	-9.71	-3.23	-6.47	0	2		
Cesium-137	pCi/L	-5.06	3.45	-0.805	0	2	10%DCG	300
Cobalt-60	pCi/L	-2.83	0.145	-1.34	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	0.848	8.13	4.49	0	2		
Dissolved Beta	pCi/L	9.53	12.1	10.8	2	2		
Neptunium-237	pCi/L	-0.0847	0	-0.0423	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.05	0.0106	-0.0197	0	2		
Plutonium-239/240	pCi/L	-0.0303	-0.0163	-0.0233	0	2	10%DCG	3
Potassium-40	pCi/L	-96.9	60.6	-18.1	0	2		
Suspended Alpha	pCi/L	-2.54	-0.381	-1.46	0	2		
Suspended Beta	pCi/L	1.76	5.66	3.71	0	2		
Technetium-99	pCi/L	-3.7	2.93	-0.385	0	2	ActionLimit	900
Thorium-228	pCi/L	-0.0334	0.0181	-0.00765	0	2		
Thorium-230	pCi/L	-0.0481	0.0506	0.00125	0	2	10%DCG	30
Thorium-232	pCi/L	-0.0467	-0.0247	-0.0357	0	2		
Uranium	mg/L	ND	0.05	0.0115	3	4	10%DCG	0.0901
Uranium-235	pCi/L	-1.51	0	-0.755	0	2	10%DCG	60
Uranium-238	pCi/L	0	0	0	0	1	10%DCG	60

Surface Water Radiological Data

Table 2.10 Radiological Monitoring Data for Surface Water Location K009

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-23	5.88	-7.67	0	3	10%DCG	3
Cesium-134	pCi/L	-11.5	0.259	-5.17	0	3		
Cesium-137	pCi/L	-0.176	1.51	0.51	0	3	10%DCG	300
Cobalt-60	pCi/L	-5.48	1.34	-2.79	0	3	10%DCG	1000
Dissolved Alpha	pCi/L	2.31	5.97	3.86	0	3		
Dissolved Beta	pCi/L	6.35	11.6	8.32	1	3		
Neptunium-237	pCi/L	-0.152	0.55	0.158	0	3	10%DCG	3
Plutonium-238	pCi/L	-0.0461	0.00135	-0.0209	0	3		
Plutonium-239/240	pCi/L	-0.0317	0.0306	-0.00171	0	3	10%DCG	3
Potassium-40	pCi/L	-137	164	-17.1	0	3		
Suspended Alpha	pCi/L	-0.04	0.948	0.517	0	3		
Suspended Beta	pCi/L	0.98	2.84	1.86	0	3		
Technetium-99	pCi/L	-4.47	1.09	-1.13	0	3	ActionLimit	900
Thorium-228	pCi/L	-0.0249	0.205	0.0558	0	3		
Thorium-230	pCi/L	-0.185	-0.0457	-0.107	0	3	10%DCG	30
Thorium-232	pCi/L	0.00851	0.0146	0.0117	0	3		
Uranium	mg/L	ND	0.05	0.00575	2	6	10%DCG	0.0901
Uranium-235	pCi/L	0	0	0	0	3	10%DCG	60

Table 2.11 Radiological Monitoring Data for Surface Water Location K016

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-6.39	31.6	12.6	0	2	10%DCG	3
Cesium-134	pCi/L	-6.11	5.72	-0.195	0	2		
Cesium-137	pCi/L	-1.19	7.62	3.21	0	2	10%DCG	300
Cobalt-60	pCi/L	-3.98	0.0737	-1.95	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	2.99	3.76	3.37	0	2		
Dissolved Beta	pCi/L	0.718	4.25	2.48	0	2		
Neptunium-237	pCi/L	-0.238	-0.152	-0.195	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.0104	0.00706	-0.00167	0	2		
Plutonium-239/240	pCi/L	0.00212	0.0348	0.0185	0	2	10%DCG	3
Potassium-40	pCi/L	-37.3	-31.1	-34.2	0	2		
Suspended Alpha	pCi/L	0.965	1.33	1.15	0	2		
Suspended Beta	pCi/L	-2.86	1.52	-0.67	0	2		
Technetium-99	pCi/L	-3.11	6.34	1.61	0	2	ActionLimit	900
Thorium-228	pCi/L	0.0313	0.0341	0.0327	0	2		
Thorium-230	pCi/L	-0.165	0.000784	-0.0821	0	2	10%DCG	30
Thorium-232	pCi/L	0	0.0204	0.0102	0	2		
Uranium	mg/L	ND	0.05	0.00863	2	4	10%DCG	0.0901
Uranium-235	pCi/L	0	0	0	0	2	10%DCG	60

Surface Water Radiological Data

Table 2.12 Radiological Monitoring Data for Surface Water Location L291

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-35.7	6.85	-13.8	0	4	10%DCG	3
Cesium-134	pCi/L	-12.9	6.98	-7.11	0	4		
Cesium-137	pCi/L	-5.84	3.57	-1.55	0	4	10%DCG	300
Cobalt-60	pCi/L	-4.17	2.08	-0.388	0	4	10%DCG	1000
Dissolved Alpha	pCi/L	-1.58	0.553	-0.617	0	4		
Dissolved Beta	pCi/L	-1.96	10.2	4.71	1	4		
Neptunium-237	pCi/L	-0.0387	1.33	0.404	1	4	10%DCG	3
Plutonium-238	pCi/L	-0.0373	0.0845	0.00725	0	4		
Plutonium-239/240	pCi/L	-0.0276	0.0174	-0.00301	0	4	10%DCG	3
Potassium-40	pCi/L	-183	95.6	-32.8	0	4		
Suspended Alpha	pCi/L	-2.23	3.3	-0.107	0	4		
Suspended Beta	pCi/L	-6.18	5.39	-0.64	0	4		
Technetium-99	pCi/L	-13.8	15.5	-0.025	0	4	ActionLimit	900
Thorium-228	pCi/L	-0.034	0.0463	0.00333	0	4		
Thorium-230	pCi/L	-0.116	0.077	-0.023	0	4	10%DCG	30
Thorium-232	pCi/L	-0.00573	0.00249	-0.0019	0	4		
Uranium	mg/L	ND	ND	ND	0	6	10%DCG	0.0901
Uranium-235	pCi/L	-4.64	0	-1.79	0	4	10%DCG	60

Table 2.13 Radiological Monitoring Data for Surface Water Location K002

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-4.62	11.6	3.49	0	2	10%DCG	3
Cesium-134	pCi/L	-12.7	-4.69	-8.7	0	2		
Cesium-137	pCi/L	-2.45	7.3	2.42	0	2	10%DCG	300
Cobalt-60	pCi/L	-6.79	-4.43	-5.61	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	0.578	4.84	2.71	0	2		
Dissolved Beta	pCi/L	4.75	5.1	4.92	0	2		
Neptunium-237	pCi/L	0	0.228	0.114	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.0837	0.0904	0.00335	0	2		
Plutonium-239/240	pCi/L	0.0118	0.0226	0.0172	0	2	10%DCG	3
Potassium-40	pCi/L	30.1	85	57.5	0	2		
Suspended Alpha	pCi/L	-0.775	2.57	0.897	0	2		
Suspended Beta	pCi/L	-3.25	4.11	0.43	0	2		
Technetium-99	pCi/L	0	10.4	5.2	0	2	ActionLimit	900
Thorium-228	pCi/L	-0.0434	-0.0268	-0.0351	0	2		
Thorium-230	pCi/L	-0.0427	0.0873	0.0223	0	2	10%DCG	30
Thorium-232	pCi/L	-0.156	0.00255	-0.0767	0	2		
Uranium	mg/L	ND	0.05	0.00912	2	4	10%DCG	0.0901
Uranium-235	pCi/L	0	0	0	0	2	10%DCG	60

Surface Water Radiological Data

Table 2.14 Radiological Monitoring Data for Surface Water Location K010

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-9.68	1.64	-4.02	0	2	10%DCG	3
Cesium-134	pCi/L	-3.23	5.77	1.27	0	2		
Cesium-137	pCi/L	-4.63	5.06	0.215	0	2	10%DCG	300
Cobalt-60	pCi/L	1.03	1.72	1.37	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	-0.374	3.86	1.74	0	2		
Dissolved Beta	pCi/L	6.75	11.2	8.97	1	2		
Neptunium-237	pCi/L	-0.112	-0.0774	-0.0947	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.0733	-0.0623	-0.0678	0	2		
Plutonium-239/240	pCi/L	-0.066	-0.0332	-0.0496	0	2	10%DCG	3
Potassium-40	pCi/L	-48.6	153	52.2	0	2		
Suspended Alpha	pCi/L	-2.83	-1.17	-2	0	2		
Suspended Beta	pCi/L	-1.77	3.98	1.1	0	2		
Technetium-99	pCi/L	-2.76	4.47	0.855	0	2	ActionLimit	900
Thorium-228	pCi/L	-0.0227	-0.0199	-0.0213	0	2		
Thorium-230	pCi/L	-0.0377	-0.0134	-0.0255	0	2	10%DCG	30
Thorium-232	pCi/L	-0.0308	0.000509	-0.0151	0	2		
Uranium	mg/L	ND	0.05	0.0155	3	4	10%DCG	0.0901
Uranium-235	pCi/L	0	0	0	0	2	10%DCG	60

Table 2.15 Radiological Monitoring Data for Surface Water Location K011

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-16.5	-13.6	-15	0	2	10%DCG	3
Cesium-134	pCi/L	-11.5	-4.88	-8.19	0	2		
Cesium-137	pCi/L	-8.52	0.811	-3.85	0	2	10%DCG	300
Cobalt-60	pCi/L	-10.3	-6.98	-8.64	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	18.5	21.9	20.2	2	2		
Dissolved Beta	pCi/L	14.5	18	16.2	2	2		
Neptunium-237	pCi/L	-0.0381	0.106	0.0339	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.0244	-0.00983	-0.0171	0	2		
Plutonium-239/240	pCi/L	-0.0138	0.0453	0.0157	0	2	10%DCG	3
Potassium-40	pCi/L	-14.7	70.8	28	0	2		
Suspended Alpha	pCi/L	1.31	2.44	1.87	0	2		
Suspended Beta	pCi/L	5.36	5.78	5.57	0	2		
Technetium-99	pCi/L	-1.71	12.3	5.29	0	2	ActionLimit	900
Thorium-228	pCi/L	-0.00515	0.00413	-0.00051	0	2		
Thorium-230	pCi/L	-0.0852	-0.00722	-0.0462	0	2	10%DCG	30
Thorium-232	pCi/L	0.00589	0.0756	0.0407	0	2		
Uranium	mg/L	0.055	0.1	0.0766	4	4	10%DCG	0.0901
Uranium-235	pCi/L	-2.57	0	-1.28	0	2	10%DCG	60

Surface Water Radiological Data

Table 2.16 Radiological Monitoring Data for Surface Water Location K012

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-19.6	-9.86	-14.7	0	2	10%DCG	3
Cesium-134	pCi/L	5.53	5.97	5.75	0	2		
Cesium-137	pCi/L	2.39	4.18	3.29	0	2	10%DCG	300
Cobalt-60	pCi/L	-6.75	5.94	-0.405	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	-1.22	2.68	0.73	0	2		
Dissolved Beta	pCi/L	1.84	6.32	4.08	0	2		
Neptunium-237	pCi/L	-0.186	-0.0387	-0.112	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.0645	0.0648	0.00015	0	2		
Plutonium-239/240	pCi/L	-0.0336	-0.0181	-0.0259	0	2	10%DCG	3
Potassium-40	pCi/L	-1.53	293	146	1	2		
Suspended Alpha	pCi/L	-0.122	1.84	0.859	0	2		
Suspended Beta	pCi/L	-0.389	2.27	0.94	0	2		
Technetium-99	pCi/L	7.08	7.26	7.17	0	2	ActionLimit	900
Thorium-228	pCi/L	-0.000462	0.0162	0.00787	0	2		
Thorium-230	pCi/L	-0.0476	-0.0363	-0.0419	0	2	10%DCG	30
Thorium-232	pCi/L	-0.022	0.0235	0.00075	0	2		
Uranium	mg/L	ND	0.05	0.011	3	4	10%DCG	0.0901
Uranium-235	pCi/L	-7.7	-6.22	-6.96	0	2	10%DCG	60

Table 2.17 Radiological Monitoring Data for Surface Water Location K013

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-18.4	-17.6	-18	0	2	10%DCG	3
Cesium-134	pCi/L	-10.3	-5.72	-8.01	0	2		
Cesium-137	pCi/L	-9.48	1.21	-4.13	0	2	10%DCG	300
Cobalt-60	pCi/L	-5.51	9.64	2.06	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	-2.77	4.13	0.68	0	2		
Dissolved Beta	pCi/L	1.66	5.03	3.35	0	2		
Neptunium-237	pCi/L	-0.335	-0.0774	-0.206	0	2	10%DCG	3
Plutonium-238	pCi/L	0.0122	0.0868	0.0495	0	2		
Plutonium-239/240	pCi/L	-0.0774	-0.0264	-0.0519	0	2	10%DCG	3
Potassium-40	pCi/L	119	121	120	0	2		
Suspended Alpha	pCi/L	0.205	1.77	0.988	0	2		
Suspended Beta	pCi/L	1.16	4.17	2.66	0	2		
Technetium-99	pCi/L	1.22	9.11	5.16	0	2	ActionLimit	900
Thorium-228	pCi/L	-0.00787	-0.00185	-0.00486	0	2		
Thorium-230	pCi/L	0.0332	0.105	0.0691	0	2	10%DCG	30
Thorium-232	pCi/L	0.0198	0.0651	0.0424	0	2		
Uranium	mg/L	ND	0.05	0.0075	1	4	10%DCG	0.0901
Uranium-235	pCi/L	0	0	0	0	2	10%DCG	60

Surface Water Radiological Data

Table 2.18 Radiological Monitoring Data for Surface Water Location L10

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-46.6	17.5	-12.3	0	5	10%DCG	3
Cesium-134	pCi/L	-15.7	8.32	-6.53	0	5		
Cesium-137	pCi/L	0.143	7.28	3.93	0	5	10%DCG	300
Cobalt-60	pCi/L	-0.811	2.97	0.663	0	5	10%DCG	1000
Dissolved Alpha	pCi/L	-1.62	2.97	0.457	0	5		
Dissolved Beta	pCi/L	2.4	8.62	5.38	0	5		
Neptunium-237	pCi/L	-0.271	0	-0.131	0	5	10%DCG	3
Plutonium-238	pCi/L	-0.115	-0.00094	-0.053	0	5		
Plutonium-239/240	pCi/L	-0.0355	0.00419	-0.0171	0	5	10%DCG	3
Potassium-40	pCi/L	-189	62.1	-121	0	5		
Suspended Alpha	pCi/L	-2.92	-0.488	-1.68	0	5		
Suspended Beta	pCi/L	-4.77	6.6	-0.696	0	5		
Technetium-99	pCi/L	-7.64	14.2	0.7	0	5	ActionLimit	900
Thorium-228	pCi/L	-0.0124	0.0516	0.00876	0	5		
Thorium-230	pCi/L	-0.0453	0.00441	-0.0214	0	5	10%DCG	30
Thorium-232	pCi/L	-0.00809	0.0409	0.00887	0	5		
Uranium	mg/L	ND	0.05	0.0115	6	8	10%DCG	0.0901
Uranium-235	pCi/L	-3.24	0	-1.25	0	5	10%DCG	60

Table 2.19 Radiological Monitoring Data for Surface Water Location L194

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-26.8	16.4	-11.6	0	5	10%DCG	3
Cesium-134	pCi/L	-9.23	8.39	-2.75	0	5		
Cesium-137	pCi/L	-7.97	2.09	-1.99	0	5	10%DCG	300
Cobalt-60	pCi/L	-5.1	3.97	-0.995	0	5	10%DCG	1000
Dissolved Alpha	pCi/L	-6.64	4.17	-0.504	0	5		
Dissolved Beta	pCi/L	2.18	12.1	5.77	1	5		
Neptunium-237	pCi/L	-0.271	0.171	-0.0504	0	5	10%DCG	3
Plutonium-238	pCi/L	-0.0795	-0.0144	-0.0432	0	5		
Plutonium-239/240	pCi/L	-0.046	0.00871	-0.0243	0	5	10%DCG	3
Potassium-40	pCi/L	-260	616	17.5	1	5		
Suspended Alpha	pCi/L	-2.36	0.414	-1.1	0	5		
Suspended Beta	pCi/L	-3.39	0.792	-1.9	0	5		
Technetium-99	pCi/L	-3.4	5.47	0.535	0	5	ActionLimit	900
Thorium-228	pCi/L	-0.0104	0.103	0.0259	0	5		
Thorium-230	pCi/L	-0.0631	0.0386	-0.00786	0	5	10%DCG	30
Thorium-232	pCi/L	-0.024	0.0282	0.00848	0	5		
Uranium	mg/L	ND	0.05	0.0101	5	7	10%DCG	0.0901
Uranium-235	pCi/L	-4.2	25.4	4.24	0	5	10%DCG	60

Surface Water Radiological Data

Table 2.20 Radiological Monitoring Data for Surface Water Location L55

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-24.1	0.969	-11.6	0	2	10%DCG	3
Cesium-134	pCi/L	-6.31	3.81	-1.25	0	2		
Cesium-137	pCi/L	2.19	2.52	2.35	0	2	10%DCG	300
Cobalt-60	pCi/L	-0.463	1.8	0.668	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	2.79	3.92	3.35	0	2		
Dissolved Beta	pCi/L	-0.486	1.87	0.692	0	2		
Neptunium-237	pCi/L	-0.162	0.0684	-0.0468	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.0419	0.0248	-0.00855	0	2		
Plutonium-239/240	pCi/L	-0.0112	0.00901	-0.00109	0	2	10%DCG	3
Potassium-40	pCi/L	-49.8	-48.6	-49.2	0	2		
Suspended Alpha	pCi/L	-0.613	-0.502	-0.557	0	2		
Suspended Beta	pCi/L	-2.8	-0.788	-1.79	0	2		
Technetium-99	pCi/L	-7.03	7.89	0.43	0	2	ActionLimit	900
Thorium-228	pCi/L	0.0119	0.0432	0.0276	0	2		
Thorium-230	pCi/L	-0.0301	0.0143	-0.0079	0	2	10%DCG	30
Thorium-232	pCi/L	-0.0362	0.017	-0.0096	0	2		
Uranium	mg/L	0.002	0.018	0.01	2	2	10%DCG	0.0901
Uranium-235	pCi/L	-4.37	0	-2.19	0	2	10%DCG	60

Table 2.21 Radiological Monitoring Data for Surface Water Location L56

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-29.5	6.99	-11	0	4	10%DCG	3
Cesium-134	pCi/L	-10.6	7.58	-0.997	0	4		
Cesium-137	pCi/L	-5.7	-2.94	-4.08	0	4	10%DCG	300
Cobalt-60	pCi/L	-6.88	8.89	-0.915	0	4	10%DCG	1000
Dissolved Alpha	pCi/L	-1.17	6.67	1.44	0	4		
Dissolved Beta	pCi/L	-2.08	5.46	1.73	0	4		
Neptunium-237	pCi/L	-0.149	2.51	0.636	1	4	10%DCG	3
Plutonium-238	pCi/L	-0.00996	0.145	0.0725	0	4		
Plutonium-239/240	pCi/L	-0.0533	0.0348	-0.00124	0	4	10%DCG	3
Potassium-40	pCi/L	-200	637	158	1	4		
Suspended Alpha	pCi/L	-2.5	0.386	-1.02	0	4		
Suspended Beta	pCi/L	-4	6.44	-0.71	0	4		
Technetium-99	pCi/L	-6.92	10.2	-0.782	0	4	ActionLimit	900
Thorium-228	pCi/L	-0.0198	0.0459	0.0129	0	4		
Thorium-230	pCi/L	-0.0501	0.0869	0.0081	0	4	10%DCG	30
Thorium-232	pCi/L	-0.0307	0.0819	0.0109	0	4		
Uranium	mg/L	ND	0.05	0.00517	1	6	10%DCG	0.0901
Uranium-235	pCi/L	-14.5	-5.98	-8.59	0	4	10%DCG	60

Surface Water Radiological Data

Table 2.22 Radiological Monitoring Data for Surface Water Location L11

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-15.1	11.1	-0.566	0	4	10%DCG	3
Cesium-134	pCi/L	-9.79	-2.12	-5.49	0	4		
Cesium-137	pCi/L	-6.27	1.33	-2.2	0	4	10%DCG	300
Cobalt-60	pCi/L	-6.19	14.3	0.122	0	4	10%DCG	1000
Dissolved Alpha	pCi/L	-1.18	3.68	1.32	0	4		
Dissolved Beta	pCi/L	-1.8	13.3	5.36	1	4		
Neptunium-237	pCi/L	-0.202	0.137	-0.0249	0	4	10%DCG	3
Plutonium-238	pCi/L	-0.0499	0.013	-0.0251	0	4		
Plutonium-239/240	pCi/L	-0.0414	0.0296	-0.00768	0	4	10%DCG	3
Potassium-40	pCi/L	-182	102	-50.7	0	4		
Suspended Alpha	pCi/L	-2.65	-0.38	-1.18	0	4		
Suspended Beta	pCi/L	-0.196	5.77	1.99	0	4		
Technetium-99	pCi/L	-4.73	10.7	0.275	0	4	ActionLimit	900
Thorium-228	pCi/L	-0.0257	0.0258	0.000395	0	4		
Thorium-230	pCi/L	0.0106	0.107	0.0515	0	4	10%DCG	30
Thorium-232	pCi/L	-0.00898	0.0337	0.0164	0	4		
Uranium	pCi/L	1200	1200	1200	0	1	10%DCG	60
Uranium	mg/L	ND	0.05	0.00883	5	6	10%DCG	0.0901
Uranium-234	pCi/L	698	698	698	0	1	10%DCG	50
Uranium-235	pCi/L	0	31.6	7.9	1	4	10%DCG	60
Uranium-238	pCi/L	467	467	467	1	1	10%DCG	60

Table 2.23 Radiological Monitoring Data for Surface Water Location L12

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-9.83	-2.31	-6.07	0	2	10%DCG	3
Cesium-134	pCi/L	-5.97	1.06	-2.46	0	2		
Cesium-137	pCi/L	8.28	11.1	9.69	0	2	10%DCG	300
Cobalt-60	pCi/L	-6.2	15	4.4	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	0.574	5.28	2.93	0	2		
Dissolved Beta	pCi/L	9.21	10.8	10	1	2		
Neptunium-237	pCi/L	-0.0405	0.992	0.476	1	2	10%DCG	3
Plutonium-238	pCi/L	-0.0865	-0.0215	-0.054	0	2		
Plutonium-239/240	pCi/L	0.00225	0.00553	0.00389	0	2	10%DCG	3
Potassium-40	pCi/L	-56.3	-26.1	-41.2	0	2		
Suspended Alpha	pCi/L	-1.62	-0.623	-1.12	0	2		
Suspended Beta	pCi/L	-2.64	-0.791	-1.72	0	2		
Technetium-99	pCi/L	8.13	25.9	17	1	2	ActionLimit	900
Thorium-228	pCi/L	-0.0343	-0.0183	-0.0263	0	2		
Thorium-230	pCi/L	-0.0339	0.119	0.0425	0	2	10%DCG	30
Thorium-232	pCi/L	0	0.0145	0.00725	0	2		
Uranium-235	pCi/L	-7.3	9.08	0.89	0	2	10%DCG	60

Surface Water Radiological Data

Table 2.24 Radiological Monitoring Data for Surface Water Location L241

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-19	-4.08	-11.5	0	2	10%DCG	3
Cesium-134	pCi/L	-9.54	-0.0054	-4.77	0	2		
Cesium-137	pCi/L	-5.99	-1.89	-3.94	0	2	10%DCG	300
Cobalt-60	pCi/L	-5.96	-5.2	-5.58	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	-0.164	3.4	1.62	0	2		
Dissolved Beta	pCi/L	4.6	24.4	14.5	1	2		
Neptunium-237	pCi/L	0.171	0.445	0.308	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.118	0.0906	-0.0137	0	2		
Plutonium-239/240	pCi/L	0.0293	0.0319	0.0306	0	2	10%DCG	3
Potassium-40	pCi/L	-17.5	47.2	14.8	0	2		
Suspended Alpha	pCi/L	-1.81	-1.04	-1.43	0	2		
Suspended Beta	pCi/L	-2.6	2.56	-0.02	0	2		
Technetium-99	pCi/L	7.56	49.1	28.3	1	2	ActionLimit	900
Thorium-228	pCi/L	-0.0266	0.0272	0.0003	0	2		
Thorium-230	pCi/L	0.00791	0.0212	0.0146	0	2	10%DCG	30
Thorium-232	pCi/L	-0.0234	0.00894	-0.00723	0	2		
Uranium-235	pCi/L	-6.73	12.1	2.68	0	2	10%DCG	60

Table 2.25 Radiological Monitoring Data for Surface Water Location LBCN1

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	1.53	16.2	8.87	0	2	10%DCG	3
Cesium-134	pCi/L	-16.4	-5.49	-10.9	0	2		
Cesium-137	pCi/L	-2.98	0.691	-1.14	0	2	10%DCG	300
Cobalt-60	pCi/L	-13.6	-6.41	-10	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	1.17	5.69	3.43	1	2		
Dissolved Beta	pCi/L	0.806	13.7	7.25	1	2		
Neptunium-237	pCi/L	-0.0761	0.102	0.0129	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.0108	-0.00295	-0.00687	0	2		
Plutonium-239/240	pCi/L	0.0212	0.0564	0.0388	0	2	10%DCG	3
Potassium-40	pCi/L	26	56.9	41.5	0	2		
Suspended Alpha	pCi/L	-1.24	0.354	-0.443	0	2		
Suspended Beta	pCi/L	-0.196	8.95	4.38	1	2		
Technetium-99	pCi/L	4.93	6.77	5.85	0	2	ActionLimit	900
Thorium-228	pCi/L	0.0311	0.0962	0.0636	0	2		
Thorium-230	pCi/L	0.111	0.175	0.143	0	2	10%DCG	30
Thorium-232	pCi/L	0.0596	0.0638	0.0617	0	2		
Uranium	mg/L	ND	0.05	0.01	3	4	10%DCG	0.0901
Uranium-235	pCi/L	-3.77	0	-1.88	0	2	10%DCG	60

Surface Water Radiological Data

Table 2.26 Radiological Monitoring Data for Surface Water Location C746K-5

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-26.1	16	-3.01	0	4	10%DCG	3
Cesium-134	pCi/L	-13.8	2.16	-4.58	0	4		
Cesium-137	pCi/L	-6.39	-0.349	-2.6	0	4	10%DCG	300
Cobalt-60	pCi/L	-9.25	9.07	1.39	0	4	10%DCG	1000
Dissolved Alpha	pCi/L	-4.38	1.25	-1.93	0	4		
Dissolved Beta	pCi/L	1.32	12.5	6.19	2	4		
Neptunium-237	pCi/L	-0.261	0.247	0.0697	0	4	10%DCG	3
Plutonium-238	pCi/L	-0.18	0.0393	-0.0756	0	4		
Plutonium-239/240	pCi/L	-0.0418	0.00395	-0.0154	0	4	10%DCG	3
Potassium-40	pCi/L	-3.18	767	239	1	4		
Suspended Alpha	pCi/L	-2.38	0.926	-0.604	0	4		
Suspended Beta	pCi/L	-4.41	2.59	-0.259	0	4		
Technetium-99	pCi/L	-2.64	8.38	2.96	0	4	ActionLimit	900
Thorium-228	pCi/L	-0.0112	0.0404	0.0152	0	4		
Thorium-230	pCi/L	-0.0328	0.024	-0.0126	0	4	10%DCG	30
Thorium-232	pCi/L	0.00114	0.0133	0.00791	0	4		
Uranium	pCi/L	1520	1520	1520	1	1	10%DCG	60
Uranium	mg/L	ND	ND	ND	0	6	10%DCG	0.0901
Uranium-234	pCi/L	566	566	566	1	1	10%DCG	50
Uranium-235	pCi/L	0	31.5	7.87	1	4	10%DCG	60
Uranium-238	pCi/L	925	925	925	1	1	10%DCG	60

Table 2.27 Radiological Monitoring Data for Surface Water Location C746KTB1

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-7.74	-5.86	-6.8	0	2	10%DCG	3
Cesium-134	pCi/L	-3.23	3.56	0.165	0	2		
Cesium-137	pCi/L	-5.06	1.88	-1.59	0	2	10%DCG	300
Cobalt-60	pCi/L	-2.99	0.145	-1.42	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	-2.25	-1.03	-1.64	0	2		
Dissolved Beta	pCi/L	6.38	6.56	6.47	0	2		
Neptunium-237	pCi/L	-0.0774	0.0761	-0.00065	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.0662	0.0243	-0.0209	0	2		
Plutonium-239/240	pCi/L	-0.0258	-0.0128	-0.0193	0	2	10%DCG	3
Potassium-40	pCi/L	-96.9	-88.3	-92.6	0	2		
Suspended Alpha	pCi/L	-0.4	0.327	-0.0365	0	2		
Suspended Beta	pCi/L	2.06	2.16	2.11	0	2		
Technetium-99	pCi/L	-4.77	0.572	-2.1	0	2	ActionLimit	900
Thorium-228	pCi/L	-0.0143	0.00509	-0.0046	0	2		
Thorium-230	pCi/L	-0.0578	0.038	-0.0099	0	2	10%DCG	30
Thorium-232	pCi/L	0	0.0123	0.00615	0	2		
Uranium	mg/L	ND	ND	ND	0	4	10%DCG	0.0901
Uranium-235	pCi/L	-1.5	0	-0.75	0	2	10%DCG	60

Surface Water Radiological Data

Table 2.28 Radiological Monitoring Data for Surface Water Location C746KTB2

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-9.44	-0.293	-4.87	0	2	10%DCG	3
Cesium-134	pCi/L	-10.3	-4.01	-7.16	0	2		
Cesium-137	pCi/L	1.58	3.41	2.5	0	2	10%DCG	300
Cobalt-60	pCi/L	-9.94	-2.47	-6.2	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	-0.0858	1.72	0.817	0	2		
Dissolved Beta	pCi/L	5.88	9.88	7.88	1	2		
Neptunium-237	pCi/L	0.152	0.155	0.153	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.0928	0.128	0.0176	0	2		
Plutonium-239/240	pCi/L	-0.00612	-0.00386	-0.00499	0	2	10%DCG	3
Potassium-40	pCi/L	2.18	80.5	41.3	0	2		
Suspended Alpha	pCi/L	-0.277	1.53	0.626	0	2		
Suspended Beta	pCi/L	-0.784	3.23	1.22	0	2		
Technetium-99	pCi/L	-11.4	3.95	-3.73	0	2	ActionLimit	900
Thorium-228	pCi/L	-0.0393	0.0121	-0.0136	0	2		
Thorium-230	pCi/L	-0.0615	0.0155	-0.023	0	2	10%DCG	30
Thorium-232	pCi/L	-0.0235	0.042	0.00925	0	2		
Uranium	mg/L	ND	ND	ND	0	4	10%DCG	0.0901
Uranium-235	pCi/L	-3.21	0	-1.6	0	2	10%DCG	60

Table 2.29 Radiological Monitoring Data for Surface Water Location C746KUP

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-25.6	-6.36	-16	0	2	10%DCG	3
Cesium-134	pCi/L	-12	5.36	-3.32	0	2		
Cesium-137	pCi/L	1.64	17.4	9.52	0	2	10%DCG	300
Cobalt-60	pCi/L	-4.82	1.67	-1.57	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	-0.647	0.111	-0.268	0	2		
Dissolved Beta	pCi/L	7.42	12.7	10.1	1	2		
Neptunium-237	pCi/L	-0.0354	0.0381	0.00135	0	2	10%DCG	3
Plutonium-238	pCi/L	0.0143	0.0327	0.0235	0	2		
Plutonium-239/240	pCi/L	-0.0281	0.0146	-0.00675	0	2	10%DCG	3
Potassium-40	pCi/L	-189	87.9	-50.5	0	2		
Suspended Alpha	pCi/L	1.68	2.82	2.25	0	2		
Suspended Beta	pCi/L	-0.777	1.15	0.186	0	2		
Technetium-99	pCi/L	0.624	1.09	0.857	0	2	ActionLimit	900
Thorium-228	pCi/L	0.0557	0.0582	0.0569	0	2		
Thorium-230	pCi/L	0.0443	0.0686	0.0564	0	2	10%DCG	30
Thorium-232	pCi/L	0.0132	0.0392	0.0262	0	2		
Uranium	mg/L	ND	ND	ND	0	4	10%DCG	0.0901
Uranium-235	pCi/L	0	0	0	0	2	10%DCG	60
Uranium-238	pCi/L	0	0	0	0	1	10%DCG	60

Surface Water Radiological Data

Table 2.30 Radiological Monitoring Data for Surface Water Location L8

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	8.16	8.16	8.16	0	1	10%DCG	3
Cesium-134	pCi/L	-3.54	-3.54	-3.54	0	1		
Cesium-137	pCi/L	2.27	2.27	2.27	0	1	10%DCG	300
Cobalt-60	pCi/L	-0.241	-0.241	-0.241	0	1	10%DCG	1000
Dissolved Alpha	pCi/L	3.01	3.01	3.01	0	1		
Dissolved Beta	pCi/L	16.2	16.2	16.2	0	1		
Neptunium-237	pCi/L	0.177	0.177	0.177	0	1	10%DCG	3
Plutonium-238	pCi/L	-0.0377	-0.0377	-0.0377	0	1		
Plutonium-239/240	pCi/L	-0.0134	-0.0134	-0.0134	0	1	10%DCG	3
Potassium-40	pCi/L	157	157	157	0	1		
Suspended Alpha	pCi/L	16.9	16.9	16.9	0	1		
Suspended Beta	pCi/L	48.6	48.6	48.6	1	1		
Technetium-99	pCi/L	11.7	11.7	11.7	0	1	ActionLimit	900
Thorium-228	pCi/L	0.0618	0.0618	0.0618	0	1		
Thorium-230	pCi/L	0.0331	0.0331	0.0331	0	1	10%DCG	30
Thorium-232	pCi/L	0.0372	0.0372	0.0372	0	1		
Uranium-235	pCi/L	-2.79	-2.79	-2.79	0	1	10%DCG	60

Table 2.31 Radiological Monitoring Data for Surface Water Location L29

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-1.64	13.9	6.09	0	4	10%DCG	3
Cesium-134	pCi/L	-16.4	1.45	-6.21	0	4		
Cesium-137	pCi/L	-1.56	3.05	0.357	0	4	10%DCG	300
Cobalt-60	pCi/L	-4.74	2.68	-0.608	0	4	10%DCG	1000
Dissolved Alpha	pCi/L	-5.36	4.34	-1.64	0	4		
Dissolved Beta	pCi/L	-4.54	11	2.89	1	4		
Neptunium-237	pCi/L	-0.223	0	-0.105	0	4	10%DCG	3
Plutonium-238	pCi/L	-0.0767	0.0589	-0.0213	0	4		
Plutonium-239/240	pCi/L	-0.0256	-0.00355	-0.0136	0	4	10%DCG	3
Potassium-40	pCi/L	-180	-51.4	-131	0	4		
Suspended Alpha	pCi/L	-2.86	-0.328	-1.65	0	4		
Suspended Beta	pCi/L	-3.34	0.587	-1	0	4		
Technetium-99	pCi/L	-10.3	10.1	-3.19	0	4	ActionLimit	900
Thorium-228	pCi/L	-0.00262	0.0482	0.0206	0	4		
Thorium-230	pCi/L	-0.0592	0.0124	-0.0333	0	4	10%DCG	30
Thorium-232	pCi/L	-0.0543	0.014	-0.0192	0	4		
Uranium	mg/L	ND	ND	ND	0	6	10%DCG	0.0901
Uranium-235	pCi/L	0	0	0	0	4	10%DCG	60

Surface Water Radiological Data

Table 2.32 Radiological Monitoring Data for Surface Water Location L30

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-34.5	20.3	-2.98	0	4	10%DCG	3
Cesium-134	pCi/L	-11	1.11	-3.1	0	4		
Cesium-137	pCi/L	-3.94	7.27	1.6	0	4	10%DCG	300
Cobalt-60	pCi/L	-4.28	1.2	-2.27	0	4	10%DCG	1000
Dissolved Alpha	pCi/L	-3.59	2.53	-0.971	0	4		
Dissolved Beta	pCi/L	0.437	10.6	3.72	1	4		
Neptunium-237	pCi/L	-0.0745	0.283	0.0801	0	4	10%DCG	3
Plutonium-238	pCi/L	-0.114	0.0625	-0.0332	0	4		
Plutonium-239/240	pCi/L	-0.0635	0.0388	-0.0104	0	4	10%DCG	3
Potassium-40	pCi/L	-206	221	-1.13	1	4		
Suspended Alpha	pCi/L	-0.822	1.66	0.273	0	4		
Suspended Beta	pCi/L	0.2	2.18	0.945	0	4		
Technetium-99	pCi/L	-9.17	12.2	-2.11	0	4	ActionLimit	900
Thorium-228	pCi/L	-0.0198	0.0248	0.00394	0	4		
Thorium-230	pCi/L	-0.0837	0.0433	-0.0366	0	4	10%DCG	30
Thorium-232	pCi/L	-0.0631	0.0344	-0.0129	0	4		
Uranium	mg/L	ND	0.05	0.005	1	6	10%DCG	0.0901
Uranium-235	pCi/L	0	0	0	0	4	10%DCG	60

Table 2.33 Radiological Monitoring Data for Surface Water Location L306

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-12.6	7.07	-2.6	0	4	10%DCG	3
Cesium-134	pCi/L	-9.93	-1.25	-5.97	0	4		
Cesium-137	pCi/L	3.22	12.3	6.33	0	4	10%DCG	300
Cobalt-60	pCi/L	-6.63	0.386	-3.35	0	4	10%DCG	1000
Dissolved Alpha	pCi/L	-2.2	2.29	-0.77	0	4		
Dissolved Beta	pCi/L	-0.454	6.39	1.98	0	4		
Neptunium-237	pCi/L	-0.324	-0.0684	-0.165	0	4	10%DCG	3
Plutonium-238	pCi/L	-0.145	0.0575	-0.022	0	4		
Plutonium-239/240	pCi/L	-0.0388	0.00641	-0.019	0	4	10%DCG	3
Potassium-40	pCi/L	-160	-6.96	-57.4	0	4		
Suspended Alpha	pCi/L	-2.19	-0.0885	-1.21	0	4		
Suspended Beta	pCi/L	-0.391	4.84	1.29	0	4		
Technetium-99	pCi/L	-1.17	14.8	4.99	0	4	ActionLimit	900
Thorium-228	pCi/L	-0.0158	0.0524	0.0035	0	4		
Thorium-230	pCi/L	-0.0555	0.0479	-0.0127	0	4	10%DCG	30
Thorium-232	pCi/L	-0.091	0.0241	-0.0143	0	4		
Uranium	mg/L	ND	ND	ND	0	6	10%DCG	0.0901
Uranium-235	pCi/L	-2.46	0	-1.2	0	4	10%DCG	60

Surface Water Radiological Data

Table 2.34 Radiological Monitoring Data for Surface Water Location L64

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Americium-241	pCi/L	-37.7	-3.05	-20.4	0	2	10%DCG	3
Cesium-134	pCi/L	-4.76	-4.12	-4.44	0	2		
Cesium-137	pCi/L	-3.48	2.99	-0.245	0	2	10%DCG	300
Cobalt-60	pCi/L	-3.28	-1.7	-2.49	0	2	10%DCG	1000
Dissolved Alpha	pCi/L	-5.06	-1.23	-3.14	0	2		
Dissolved Beta	pCi/L	1.08	1.65	1.36	0	2		
Neptunium-237	pCi/L	0.162	0.411	0.286	0	2	10%DCG	3
Plutonium-238	pCi/L	-0.0759	-0.0614	-0.0686	0	2		
Plutonium-239/240	pCi/L	0.00021	0.0338	0.017	0	2	10%DCG	3
Potassium-40	pCi/L	-72.3	68.4	-1.95	0	2		
Suspended Alpha	pCi/L	-2.29	2.7	0.205	0	2		
Suspended Beta	pCi/L	-4.37	0.6	-1.88	0	2		
Technetium-99	pCi/L	-4.2	10.9	3.35	0	2	ActionLimit	900
Thorium-228	pCi/L	0	0.000352	0.000176	0	2		
Thorium-230	pCi/L	-0.0366	-0.0245	-0.0305	0	2	10%DCG	30
Thorium-232	pCi/L	0.00361	0.0289	0.0163	0	2		
Uranium	mg/L	ND	0.09	0.0303	1	3	10%DCG	0.0901
Uranium-235	pCi/L	-3.24	0	-1.62	0	2	10%DCG	60

Sediment Radiological Data

Table 2.35 Radiological Data for Sediment Location S20

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	1.46	2.31	1.88	2	2		
Americium-241	pCi/g	-0.00571	0.00704	0.000665	0	2		
Beta activity	pCi/g	0.775	1.53	1.15	2	2		
Cesium-137	pCi/g	0.0067	0.00932	0.00801	1	2		
Cobalt-60	pCi/g	-0.00193	-0.00068	-0.00131	0	2		
Neptunium-237	pCi/g	-0.00525	0.00129	-0.00198	0	2		
Potassium-40	pCi/g	1.43	3.48	2.46	2	2		
Pu-239/240	pCi/g	-0.00247	0.000248	-0.00111	0	2		
Technetium-99	pCi/g	0	0	0	0	2		
Thorium-230	pCi/g	0.108	0.187	0.147	2	2		
Uranium	mg/kg	ND	ND	ND	0	4		
Uranium-234	pCi/g	0.018	0.018	0.018	1	1		
Uranium-235	pCi/g	0.001	0.001	0.001	1	1		
Uranium-238	pCi/g	0.019	0.019	0.019	1	1		

Table 2.36 Radiological Data for Sediment Location C612

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	4.02	18.9	11.5	2	2		
Americium-241	pCi/g	0.0333	0.0714	0.0523	0	2		
Beta activity	pCi/g	5.36	32.8	19.1	2	2		
Cesium-137	pCi/g	0.025	0.0974	0.0612	2	2		
Cobalt-60	pCi/g	0.000554	0.000633	0.000593	0	2		
Neptunium-237	pCi/g	0.0202	0.0277	0.0239	0	2		
Potassium-40	pCi/g	4.2	6.5	5.35	2	2		
Pu-239/240	pCi/g	0.0111	0.0268	0.019	2	2		
Technetium-99	pCi/g	0.21	3.52	1.86	2	2		
Thorium-230	pCi/g	0.471	0.513	0.492	2	2		
Uranium	mg/kg	ND	200	47	2	4		
Uranium-234	pCi/g	0.126	5.5	2.81	2	2		
Uranium-235	pCi/g	0.008	0.339	0.173	2	2		
Uranium-238	pCi/g	0.338	12.4	6.37	2	2		

Sediment Radiological Data

Table 2.37 Radiological Data for Sediment Location C616

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	19.3	43.2	31.2	2	2		
Americium-241	pCi/g	0.0502	0.232	0.141	0	2		
Beta activity	pCi/g	61.8	178	120	2	2		
Cesium-137	pCi/g	0.0298	0.194	0.112	2	2		
Cobalt-60	pCi/g	-0.00299	-0.00068	-0.00184	0	2		
Neptunium-237	pCi/g	0.209	0.218	0.213	2	2		
Potassium-40	pCi/g	3.86	6.52	5.19	2	2		
Pu-239/240	pCi/g	0.27	0.293	0.281	2	2		
Technetium-99	pCi/g	13.1	21.9	17.5	2	2		
Thorium-230	pCi/g	2.16	2.61	2.38	2	2		
Uranium	mg/kg	ND	200	58.7	2	4		
Uranium-234	pCi/g	0.995	0.995	0.995	1	1		
Uranium-235	pCi/g	0.053	0.053	0.053	1	1		
Uranium-238	pCi/g	1.41	1.41	1.41	1	1		

Table 2.38 Radiological Data for Sediment Location K001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	7.39	8.84	8.12	2	2		
Americium-241	pCi/g	0.0226	0.0372	0.0299	0	2		
Beta activity	pCi/g	15.3	17.8	16.5	2	2		
Cesium-137	pCi/g	0.0355	0.0454	0.0404	2	2		
Cobalt-60	pCi/g	0.00044	0.00391	0.00217	0	2		
Neptunium-237	pCi/g	0.0348	0.0693	0.052	0	2		
Potassium-40	pCi/g	4.69	5.25	4.97	2	2		
Pu-239/240	pCi/g	0.0205	0.0295	0.025	2	2		
Technetium-99	pCi/g	4.45	4.73	4.59	2	2		
Thorium-230	pCi/g	0.436	0.569	0.502	2	2		
Uranium	mg/kg	ND	200	38.1	1	4		
Uranium-234	pCi/g	0.4	0.4	0.4	1	1		
Uranium-235	pCi/g	0.0238	0.0238	0.0238	1	1		
Uranium-238	pCi/g	0.813	0.813	0.813	1	1		

Sediment Radiological Data

Table 2.39 Radiological Data for Sediment Location K006

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	2.07	2.56	2.31	2	2		
Americium-241	pCi/g	0.00942	0.0193	0.0144	0	2		
Beta activity	pCi/g	1.66	1.92	1.79	2	2		
Cesium-137	pCi/g	-0.00209	0.00861	0.00326	1	2		
Cobalt-60	pCi/g	-0.00156	0.0028	0.00062	0	2		
Neptunium-237	pCi/g	-0.00242	0.00662	0.0021	0	2		
Potassium-40	pCi/g	3.09	4.28	3.68	2	2		
Pu-239/240	pCi/g	-0.000069	0.000738	0.000334	0	2		
Technetium-99	pCi/g	0.0395	0.0957	0.0676	0	2		
Thorium-230	pCi/g	0.233	0.363	0.298	2	2		
Uranium	mg/kg	ND	200	37.5	1	4		
Uranium-234	pCi/g	0.031	0.031	0.031	1	1		
Uranium-235	pCi/g	0.002	0.002	0.002	1	1		
Uranium-238	pCi/g	0.033	0.033	0.033	1	1		

Table 2.40 Radiological Data for Sediment Location S1

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	3.7	5.83	4.76	2	2		
Americium-241	pCi/g	0.0128	0.0168	0.0148	0	2		
Beta activity	pCi/g	3.24	7.09	5.16	2	2		
Cesium-137	pCi/g	0.0151	0.0589	0.037	2	2		
Cobalt-60	pCi/g	-0.00145	0.00113	-0.00016	0	2		
Neptunium-237	pCi/g	0.0137	0.0162	0.0149	0	2		
Potassium-40	pCi/g	1.51	2.08	1.79	2	2		
Pu-239/240	pCi/g	0.0129	0.013	0.0129	2	2		
Technetium-99	pCi/g	0.454	2.08	1.27	2	2		
Thorium-230	pCi/g	0.228	0.382	0.305	2	2		
Uranium	mg/kg	ND	200	37.7	1	4		
Uranium-234	pCi/g	0.161	0.161	0.161	1	1		
Uranium-235	pCi/g	0.009	0.009	0.009	1	1		
Uranium-238	pCi/g	0.293	0.293	0.293	1	1		

Sediment Radiological Data

Table 2.41 Radiological Data for Sediment Location S31

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	3.95	4.84	4.39	2	2		
Americium-241	pCi/g	0.0187	0.0201	0.0194	0	2		
Beta activity	pCi/g	3.47	5.47	4.47	2	2		
Cesium-137	pCi/g	0.0128	0.0151	0.0139	2	2		
Cobalt-60	pCi/g	-0.000009	0.000678	0.000334	0	2		
Neptunium-237	pCi/g	0.00176	0.0119	0.00683	0	2		
Potassium-40	pCi/g	1.85	2.3	2.08	2	2		
Pu-239/240	pCi/g	0.0282	0.0488	0.0385	2	2		
Technetium-99	pCi/g	0.208	0.973	0.591	2	2		
Thorium-230	pCi/g	0.587	0.746	0.666	2	2		
Uranium	mg/kg	ND	200	37.6	1	4		
Uranium-234	pCi/g	0.121	0.121	0.121	1	1		
Uranium-235	pCi/g	0.006	0.006	0.006	1	1		
Uranium-238	pCi/g	0.157	0.157	0.157	1	1		

Table 2.42 Radiological Data for Sediment Location S33

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	3.62	4.25	3.93	2	2		
Americium-241	pCi/g	0.0179	0.0379	0.0279	0	2		
Beta activity	pCi/g	3.57	5.43	4.5	2	2		
Cesium-137	pCi/g	0.0385	0.0488	0.0436	2	2		
Cobalt-60	pCi/g	-0.0015	-0.00093	-0.00122	0	2		
Neptunium-237	pCi/g	0.00824	0.0139	0.0111	0	2		
Potassium-40	pCi/g	3.27	3.38	3.33	2	2		
Pu-239/240	pCi/g	0.0132	0.0143	0.0137	2	2		
Technetium-99	pCi/g	0.268	0.338	0.303	2	2		
Thorium-230	pCi/g	0.28	0.326	0.303	2	2		
Uranium	mg/kg	ND	200	31.9	3	5		
Uranium-234	pCi/g	0.097	0.097	0.097	1	1		
Uranium-235	pCi/g	0.005	0.005	0.005	1	1		
Uranium-238	pCi/g	0.16	0.16	0.16	1	1		

Sediment Radiological Data

Table 2.43 Radiological Data for Sediment Location S21

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	2.56	3.63	3.1	2	2		
Americium-241	pCi/g	0.019	0.0288	0.0239	0	2		
Beta activity	pCi/g	1.94	3.13	2.54	2	2		
Cesium-137	pCi/g	0.00556	0.03	0.0178	1	2		
Cobalt-60	pCi/g	-0.000643	0.00197	0.000664	0	2		
Neptunium-237	pCi/g	0.000247	0.00447	0.00236	0	2		
Potassium-40	pCi/g	3.77	5.16	4.46	2	2		
Pu-239/240	pCi/g	0.000136	0.00109	0.000613	0	2		
Technetium-99	pCi/g	0.0591	0.0712	0.0651	0	2		
Thorium-230	pCi/g	0.297	0.375	0.336	2	2		
Uranium	mg/kg	ND	200	37.5	1	4		
Uranium-234	pCi/g	0.023	0.023	0.023	1	1		
Uranium-235	pCi/g	0.001	0.001	0.001	1	1		
Uranium-238	pCi/g	0.033	0.033	0.033	1	1		

Table 2.44 Radiological Data for Sediment Location K010

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	3.41	5.68	4.54	2	2		
Americium-241	pCi/g	0.041	0.0598	0.0504	0	2		
Beta activity	pCi/g	4.01	6.94	5.47	2	2		
Cesium-137	pCi/g	0.0194	0.0276	0.0235	2	2		
Cobalt-60	pCi/g	-0.000139	0.00219	0.00103	0	2		
Neptunium-237	pCi/g	0.0019	0.0101	0.006	0	2		
Potassium-40	pCi/g	5.08	5.11	5.09	2	2		
Pu-239/240	pCi/g	0.00204	0.00281	0.00242	0	2		
Technetium-99	pCi/g	0.175	0.205	0.19	2	2		
Thorium-230	pCi/g	0.285	0.412	0.348	2	2		
Uranium	mg/kg	ND	200	39.2	2	4		
Uranium-234	pCi/g	0.086	0.086	0.086	1	1		
Uranium-235	pCi/g	0.005	0.005	0.005	1	1		
Uranium-238	pCi/g	0.13	0.13	0.13	1	1		

Sediment Radiological Data

Table 2.45 Radiological Data for Sediment Location K012

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	4.19	7.32	5.75	2	2		
Americium-241	pCi/g	0.00454	0.069	0.0368	0	2		
Beta activity	pCi/g	3.55	5.61	4.58	2	2		
Cesium-137	pCi/g	0.0432	0.105	0.0741	2	2		
Cobalt-60	pCi/g	-0.00594	-0.00278	-0.00436	0	2		
Neptunium-237	pCi/g	0.0559	0.136	0.0959	0	2		
Potassium-40	pCi/g	5.17	5.85	5.51	2	2		
Pu-239/240	pCi/g	0.00101	0.131	0.066	1	2		
Technetium-99	pCi/g	0.112	0.446	0.279	1	2		
Thorium-230	pCi/g	0.373	0.387	0.38	2	2		
Uranium	mg/kg	ND	200	37.7	1	4		
Uranium-234	pCi/g	0.111	0.111	0.111	1	1		
Uranium-235	pCi/g	0.007	0.007	0.007	1	1		
Uranium-238	pCi/g	0.301	0.301	0.301	1	1		

Table 2.46 Radiological Data for Sediment Location S2

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	4.11	9.37	6.74	2	2		
Americium-241	pCi/g	0.00766	0.0122	0.00993	0	2		
Beta activity	pCi/g	2.68	12.8	7.74	2	2		
Cesium-137	pCi/g	0.000862	0.0209	0.0109	1	2		
Cobalt-60	pCi/g	-0.00247	0.00156	-0.000455	0	2		
Neptunium-237	pCi/g	0.00661	0.00778	0.00719	0	2		
Potassium-40	pCi/g	2.64	5.12	3.88	2	2		
Pu-239/240	pCi/g	-0.00187	0.000632	-0.000619	0	2		
Technetium-99	pCi/g	0.0233	0.165	0.0941	1	2		
Thorium-230	pCi/g	0.235	0.323	0.279	2	2		
Uranium	mg/kg	ND	200	41.7	2	4		
Uranium-234	pCi/g	0.032	0.51	0.271	2	2		
Uranium-235	pCi/g	0.0023	0.0717	0.037	2	2		
Uranium-238	pCi/g	0.106	5.56	2.83	2	2		

Sediment Radiological Data

Table 2.47 Radiological Data for Sediment Location S30

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	13.9	55.6	34.6	3	3		
Americium-241	pCi/g	0.0284	0.0397	0.034	0	3		
Beta activity	pCi/g	17.2	66.8	40	3	3		
Cesium-137	pCi/g	0.014	0.0352	0.0266	3	3		
Cobalt-60	pCi/g	0.000111	0.00194	0.000951	0	3		
Neptunium-237	pCi/g	0.00629	0.0391	0.0215	0	3		
Potassium-40	pCi/g	1.97	3.06	2.69	3	3		
Pu-239/240	pCi/g	0.000614	0.00468	0.00234	0	3		
Technetium-99	pCi/g	0.176	0.239	0.209	3	3		
Thorium-230	pCi/g	0.247	0.275	0.26	3	3		
Uranium	mg/kg	ND	200	50.8	3	6		
Uranium-234	pCi/g	0.262	0.376	0.319	2	2		
Uranium-235	pCi/g	0.046	0.076	0.061	2	2		
Uranium-238	pCi/g	3.91	6.67	5.29	2	2		

Table 2.48 Radiological Data for Sediment Location LBCN1

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	2.93	9.84	6.89	3	3		
Americium-241	pCi/g	0.00689	0.0543	0.0345	0	3		
Beta activity	pCi/g	9.92	29.8	23.1	3	3		
Cesium-137	pCi/g	-0.00291	0.0185	0.0102	1	3		
Cobalt-60	pCi/g	0.000422	0.00177	0.00089	0	3		
Neptunium-237	pCi/g	0.0132	0.0661	0.046	1	3		
Potassium-40	pCi/g	1.36	2.95	1.95	3	3		
Pu-239/240	pCi/g	0.000455	0.0934	0.0597	2	3		
Technetium-99	pCi/g	2.27	17.4	9.92	3	3		
Thorium-230	pCi/g	0.247	2.03	1.43	3	3		
Uranium	mg/kg	ND	ND	ND	0	6		
Uranium-234	pCi/g	0.019	0.019	0.019	1	1		
Uranium-235	pCi/g	0.001	0.001	0.001	1	1		
Uranium-238	pCi/g	0.02	0.02	0.02	1	1		

Sediment Radiological Data

Table 2.49 Radiological Data for Sediment Location S27

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	4.94	13.1	9.02	2	2		
Americium-241	pCi/g	0.0192	0.0527	0.036	1	2		
Beta activity	pCi/g	4.95	11	7.97	2	2		
Cesium-137	pCi/g	0.0126	0.0222	0.0174	2	2		
Cobalt-60	pCi/g	-0.00302	-0.00106	-0.00204	0	2		
Neptunium-237	pCi/g	0.00644	0.0365	0.0215	0	2		
Potassium-40	pCi/g	0.553	1.99	1.27	2	2		
Pu-239/240	pCi/g	0.0396	0.279	0.159	2	2		
Technetium-99	pCi/g	1.11	1.41	1.26	2	2		
Thorium-230	pCi/g	0.666	4.55	2.61	2	2		
Uranium	mg/kg	ND	200	37.7	1	4		
Uranium-234	pCi/g	0.046	0.046	0.046	1	1		
Uranium-235	pCi/g	0.0037	0.0037	0.0037	1	1		
Uranium-238	pCi/g	0.195	0.195	0.195	1	1		

Table 2.50 Radiological Data for Sediment Location S34

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	6.36	6.61	6.49	2	2		
Americium-241	pCi/g	0.0261	0.0557	0.0409	0	2		
Beta activity	pCi/g	5.36	6.46	5.91	2	2		
Cesium-137	pCi/g	0.0116	0.021	0.0163	1	2		
Cobalt-60	pCi/g	0.000676	0.0017	0.00119	0	2		
Neptunium-237	pCi/g	0.0074	0.014	0.0107	0	2		
Potassium-40	pCi/g	2.58	2.79	2.68	2	2		
Pu-239/240	pCi/g	0.0441	0.0642	0.0541	2	2		
Technetium-99	pCi/g	0.914	1.03	0.972	2	2		
Thorium-230	pCi/g	1.15	1.22	1.19	2	2		
Uranium	mg/kg	ND	200	37.7	1	4		
Uranium-234	pCi/g	0.067	0.067	0.067	1	1		
Uranium-235	pCi/g	0.0056	0.0056	0.0056	1	1		
Uranium-238	pCi/g	0.305	0.305	0.305	1	1		

Sediment Radiological Data

Table 2.51 Radiological Data for Sediment Location C746KTB2

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	2.26	2.39	2.33	2	2		
Americium-241	pCi/g	0.00481	0.00931	0.00706	0	2		
Beta activity	pCi/g	1.97	2.42	2.19	2	2		
Cesium-137	pCi/g	0.01	0.023	0.0165	2	2		
Cobalt-60	pCi/g	0.000259	0.00368	0.00197	0	2		
Neptunium-237	pCi/g	0.00161	0.00348	0.00254	0	2		
Potassium-40	pCi/g	1.59	2.33	1.96	2	2		
Pu-239/240	pCi/g	0.00225	0.00644	0.00434	0	2		
Technetium-99	pCi/g	0	0.146	0.073	1	2		
Thorium-230	pCi/g	0.169	0.202	0.185	2	2		
Uranium	mg/kg	ND	ND	ND	0	3		

Table 2.52 Radiological Data for Sediment Location C746KUP

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	1.62	1.95	1.78	2	2		
Americium-241	pCi/g	0.00581	0.0102	0.008	0	2		
Beta activity	pCi/g	1.35	1.53	1.44	2	2		
Cesium-137	pCi/g	0.00943	0.0113	0.0104	2	2		
Cobalt-60	pCi/g	0.00174	0.00403	0.00288	0	2		
Neptunium-237	pCi/g	-0.017	0.00974	-0.00363	0	2		
Potassium-40	pCi/g	1.97	3.11	2.54	2	2		
Pu-239/240	pCi/g	-0.00159	0.00268	0.000545	0	2		
Technetium-99	pCi/g	0	0.112	0.056	0	2		
Thorium-230	pCi/g	0.165	0.293	0.229	2	2		
Uranium	mg/kg	ND	ND	ND	0	3		

Sediment Radiological Data

Table 2.53 Radiological Data for Sediment Location S32

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	47.1	152	99.5	2	2		
Americium-241	pCi/g	0.302	0.728	0.515	2	2		
Beta activity	pCi/g	55.7	116	85.8	2	2		
Cesium-137	pCi/g	0.499	1.1	0.799	2	2		
Cobalt-60	pCi/g	0.00225	0.00425	0.00325	0	2		
Neptunium-237	pCi/g	0.695	0.707	0.701	2	2		
Potassium-40	pCi/g	4.97	7.16	6.07	2	2		
Pu-239/240	pCi/g	2.36	3.21	2.79	2	2		
Technetium-99	pCi/g	11.5	23.2	17.4	2	2		
Thorium-230	pCi/g	49.6	99.3	74.4	2	2		
Uranium	mg/kg	ND	200	39.4	1	4		
Uranium-234	pCi/g	1.64	1.64	1.64	1	1		
Uranium-235	pCi/g	0.089	0.089	0.089	1	1		
Uranium-238	pCi/g	2.47	2.47	2.47	1	1		

Table 2.54 Radiological Data for Sediment Location S28

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Alpha activity	pCi/g	2.07	2.97	2.52	2	2		
Americium-241	pCi/g	-0.0075	0.0182	0.00535	0	2		
Beta activity	pCi/g	1.58	1.92	1.75	2	2		
Cesium-137	pCi/g	0.00824	0.0405	0.0244	1	2		
Cobalt-60	pCi/g	-0.000126	0.00173	0.000802	0	2		
Neptunium-237	pCi/g	-0.00967	-0.00463	-0.00715	0	2		
Potassium-40	pCi/g	3.22	3.73	3.48	2	2		
Pu-239/240	pCi/g	-0.00223	0.00472	0.00124	0	2		
Technetium-99	pCi/g	0	0	0	0	2		
Thorium-230	pCi/g	0.115	0.171	0.143	2	2		
Uranium	mg/kg	ND	ND	ND	0	4		

Direct Gamma Radiation (TLD) Data

Table 2.55 Radiological Exposure Due to Gamma Radiation (mrem)

Location	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Annualized[1]
TLD-1	105	140	150	82	505
TLD-2	165	220	240	145	815
TLD-3	210	94	72	35	434
TLD-4	25	27.5	32	19	109
TLD-5	27	28	34	19	114
TLD-6	24	25	31	17	102
TLD-7	29	32	37	21	121
TLD-8	21	21	27	15	85
TLD-9	27.5	27	34	19	109
TLD-10	23	24	29	17	95
TLD-11	26	27	33	19	107
TLD-12	25	25	30	17.5	100
TLD-13	28	31	34	20	117
TLD-14	23	24	29	17	95
TLD-15	22	22	28	16	89
TLD-16	28	29	32	20	111
TLD-17	22	22	28.5	16	90
TLD-18	23	24	30	16	95
TLD-19	23	24	29	17	95
TLD-20	26	26	32.5	19	105
TLD-25	30	30	36	22	120
TLD-27	27	28	34	20	111
TLD-28	23	25	29	18	97
TLD-29	23	24	29	16	94
TLD-30	23	25	30	18	98
TLD-31	25	27	31	19	104
TLD-32	30	32	35	21	121
TLD-35	24	26	31	17	100
TLD-36	22	23	28	16	90
TLD-37	21	22	28	15.5	88
TLD-38			28	16	102
TLD-39	21	22	27	16	87
TLD-40	28	30	37	21	118
TLD-41		23	27	16	93
TLD-46	24	24	30	17	97
TLD-47	66		43	52	234
TLD-48	46		26	25	145
TLD-49	25	28	32	19	113
TLD-50	38	45	48	27	171
TLD-51	35	36	56	27	164
TLD-52	32	33			130
TLD-53		58	88	50	298
TLD-21	29	27	40	21	121
TLD-22	27	28	34	20	116
TLD-23	27	28	33	20	115

[1]Note: Annualized results represent a summation of the quarters adjusted to ensure that there is a correlation between the results and 1 year (365 days). TLDs may not have been collected on the last day of each quarter so this accounts for varying number of days.

Deer Radiological Data

Table 2.56 Radiological Analysis of Deer Bone Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Cesium-137	pCi/g	-0.438	1.08	0.133	0	7		
Neptunium-237	pCi/g	-0.0314	0.0198	-0.00795	0	7		
Plutonium-239/240	pCi/g	-0.0072	0.0264	0.00655	0	7		
Potassium-40	pCi/g	32	65.2	48.6	2	2		
Strontium-90	pCi/g	-0.08	0.73	0.146	0	7		
Technetium-99	pCi/g	0.02	0.14	0.0686	0	7		
Thorium-230	pCi/g	-0.136	0.149	0.0543	3	7		
Uranium-234	pCi/g	-0.0876	0.0793	0.0283	1	7		
Uranium-235	pCi/g	0	0.0304	0.00958	0	7		
Uranium-238	pCi/g	-0.00121	0.026	0.00984	0	7		

Table 2.57 Radiological Background (BCWA) Analysis of Deer Bone Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Cesium-137	pCi/g	-0.0186	1.62	0.803	0	2		
Neptunium-237	pCi/g	-0.0337	-0.0168	-0.0253	0	2		
Plutonium-239/240	pCi/g	0.00815	0.012	0.0101	0	2		
Strontium-90	pCi/g	-0.03	0.76	0.365	0	2		
Technetium-99	pCi/g	0	0.1	0.05	0	2		
Thorium-230	pCi/g	0.0546	0.131	0.0927	0	2		
Uranium-234	pCi/g	-0.0515	0.0226	-0.0144	0	2		
Uranium-235	pCi/g	-0.00735	0.000591	-0.00338	0	2		
Uranium-238	pCi/g	0.00685	0.00717	0.00701	0	2		

Table 2.58 Radiological Analysis of Deer Thyroid Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Technetium-99	pCi/g	0.13	1.29	0.697	0	4		

Table 2.59 Radiological Background (BCWA) Analysis of Deer Thyroid Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Technetium-99	pCi/g	0.35	0.35	0.35	0	1		

Deer Radiological Data

Table 2.60 Radiological Analysis of Deer Muscle Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Actinium-228	pCi/g	5.72	5.72	5.72	1	1		
Cesium-137	pCi/g	-0.369	1.02	0.115	0	7		
Lead-210	pCi/g	6.32	6.32	6.32	1	1		
Neptunium-237	pCi/g	-0.108	0.0125	-0.0276	0	7		
Plutonium-239/240	pCi/g	-0.0107	0.0206	0.00623	0	7		
Potassium-40	pCi/g	23	28.3	25.6	2	2		
Strontium-90	pCi/g	0.18	0.4	0.29	0	7		
Technetium-99	pCi/g	-0.02	0.16	0.0914	0	7		
Thorium-230	pCi/g	-0.000001	0.138	0.0879	3	7		
Thorium-234	pCi/g	7.21	7.21	7.21	1	1		
Uranium-234	pCi/g	-0.0135	0.0608	0.0276	0	7		
Uranium-235	pCi/g	-0.00732	0.00922	0.00155	0	7		
Uranium-238	pCi/g	-0.0131	0.0148	0.00561	0	7		

Table 2.61 Radiological Background (BCWA) Analysis of Deer Muscle Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Cesium-137	pCi/g	-0.11	0.301	0.095	0	2		
Neptunium-237	pCi/g	0.00289	0.00987	0.00638	0	2		
Plutonium-239/240	pCi/g	-0.00732	0	-0.00366	0	2		
Strontium-90	pCi/g	0.11	0.38	0.245	0	2		
Technetium-99	pCi/g	0.04	0.17	0.105	0	2		
Thorium-230	pCi/g	0.0764	0.0788	0.0776	2	2		
Uranium-234	pCi/g	0.00968	0.0251	0.0174	0	2		
Uranium-235	pCi/g	0.00775	0.0145	0.0111	0	2		
Uranium-238	pCi/g	-0.000089	0.0111	0.00553	0	2		

Table 2.62 Radiological Analysis of Deer Liver Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Cesium-137	pCi/g	-0.114	0.0874	-0.0329	0	7		
Neptunium-237	pCi/g	-0.0598	0.00695	-0.0158	0	7		
Plutonium-239/240	pCi/g	0	0.019	0.0092	0	7		
Potassium-40	pCi/g	3.43	6.37	5.05	5	5		
Strontium-90	pCi/g	-0.08	0.3	0.0914	0	7		
Technetium-99	pCi/g	0.03	0.15	0.0829	0	7		
Thorium-230	pCi/g	-0.0282	0.0366	0.00675	0	7		
Uranium-234	pCi/g	-0.0806	0.0895	0.0342	4	7		
Uranium-235	pCi/g	0	0.0165	0.0047	0	7		
Uranium-238	pCi/g	-0.00745	0.0442	0.00981	1	7		

Deer Radiological Data

Table 2.63 Radiological Background (BCWA) Analysis of Deer Liver Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples	Reference Criteria	Reference Value
Cesium-137	pCi/g	-0.15	-0.0492	-0.0995	0	2		
Neptunium-237	pCi/g	-0.0349	0.0129	-0.011	0	2		
Plutonium-239/240	pCi/g	-0.00646	-0.00000	-0.00323	0	2		
Potassium-40	pCi/g	8.72	8.72	8.72	1	1		
Strontium-90	pCi/g	0.35	0.41	0.38	0	2		
Technetium-99	pCi/g	0.05	0.16	0.105	0	2		
Thorium-230	pCi/g	0.0261	0.0324	0.0292	0	2		
Uranium-234	pCi/g	0.0257	0.041	0.0334	0	2		
Uranium-235	pCi/g	-0.00793	0.00843	0.000246	0	2		
Uranium-238	pCi/g	-0.0123	0.088	0.0379	0	2		

3. NONRADIOLOGICAL EFFLUENT DATA

KPDES Outfall Non-Radiological Data

Table 3.1 Non-Radiological Effluent Data for Outfall 001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,1,1-Trichloroethane	ug/L	ND	ND	ND	0	2
1,1,2,2-Tetrachloroethane	ug/L	ND	ND	ND	0	2
1,1,2-Trichloroethane	ug/L	ND	ND	ND	0	2
1,1-Dichloroethane	ug/L	ND	ND	ND	0	2
1,1-Dichloroethene	ug/L	ND	ND	ND	0	2
1,2,4-Trichlorobenzene	ug/L	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/L	ND	ND	ND	0	2
1,2-Dichloroethane	ug/L	ND	ND	ND	0	2
1,2-Dichloropropane	ug/L	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/L	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/L	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/L	ND	ND	ND	0	2
2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	ND	ND	ND	0	1
2,4,6-Trichlorophenol	ug/L	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/L	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/L	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/L	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/L	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/L	ND	ND	ND	0	2
2-Chloroethyl vinyl ether	ug/L	ND	ND	ND	0	2
2-Chloronaphthalene	ug/L	ND	ND	ND	0	2
2-Chlorophenol	ug/L	ND	ND	ND	0	2
2-Nitrophenol	ug/L	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/L	ND	ND	ND	0	2
4,4'-DDD	ug/L	ND	ND	ND	0	1
4,4'-DDE	ug/L	ND	ND	ND	0	1
4,4'-DDT	ug/L	ND	ND	ND	0	1
4-Bromophenyl phenyl ether	ug/L	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/L	ND	ND	ND	0	2
4-Chlorophenyl phenyl ether	ug/L	ND	ND	ND	0	2
4-Nitrophenol	ug/L	ND	ND	ND	0	2
Acenaphthene	ug/L	ND	ND	ND	0	2
Acenaphthylene	ug/L	ND	ND	ND	0	2
Acrolein	ug/L	ND	ND	ND	0	2
Acrylonitrile	ug/L	ND	ND	ND	0	2
Aldrin	ug/L	ND	ND	ND	0	1
alpha-BHC	ug/L	ND	ND	ND	0	1
alpha-Chlordane	ug/L	ND	ND	ND	0	1
Aluminum	mg/L	0.767	1.38	1.07	2	2
Ammonia	mg/L	ND	ND	ND	0	2
Anthracene	ug/L	ND	ND	ND	0	2
Antimony	mg/L	ND	ND	ND	0	7
Arsenic	mg/L	ND	ND	ND	0	7

KPDES Outfall Non-Radiological Data

Barium	mg/L	0.036	0.043	0.0395	2	2
Benz(a)anthracene	ug/L	ND	ND	ND	0	2
Benzene	ug/L	ND	ND	ND	0	2
Benzidine	ug/L	ND	ND	ND	0	2
Benzo(a)pyrene	ug/L	ND	ND	ND	0	2
Benzo(b)fluoranthene	ug/L	ND	ND	ND	0	2
Benzo(ghi)perylene	ug/L	ND	ND	ND	0	2
Benzo(k)fluoranthene	ug/L	ND	ND	ND	0	2
Beryllium	mg/L	ND	ND	ND	0	7
beta-BHC	ug/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	4
Bis(2-chloroethoxy)methane	ug/L	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/L	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/L	ND	ND	ND	0	2
Boron	mg/L	ND	ND	ND	0	2
Bromide	mg/L	ND	ND	ND	0	4
Bromodichloromethane	ug/L	ND	ND	ND	0	2
Bromoform	ug/L	ND	ND	ND	0	2
Bromomethane	ug/L	ND	ND	ND	0	2
Cadmium	mg/L	ND	ND	ND	0	7
Carbon tetrachloride	ug/L	ND	ND	ND	0	2
Chemical Oxygen Demand (COD)	mg/L	ND	ND	ND	0	2
Chloride	mg/L	27.7	48.9	38.7	4	4
Chlorine, Total Residual	mg/L	ND	0.09	0.0196	13	98
Chlorobenzene	ug/L	ND	ND	ND	0	2
Chloroethane	ug/L	ND	ND	ND	0	2
Chloroform	ug/L	ND	ND	ND	0	2
Chromium	mg/L	ND	ND	ND	0	7
Chrysene	ug/L	ND	ND	ND	0	2
Cobalt	mg/L	ND	ND	ND	0	2
Color	TCU	28	80	55	4	4
Conductivity	umho/cm	247	1730	1040	102	102
Copper	mg/L	ND	ND	ND	0	7
Cyanide	mg/L	ND	ND	ND	0	2
delta-BHC	ug/L	ND	ND	ND	0	1
Dibenz(a,h)anthracene	ug/L	ND	ND	ND	0	2
Dibromochloromethane	ug/L	ND	ND	ND	0	2
Dieldrin	ug/L	ND	ND	ND	0	1
Diethyl phthalate	ug/L	ND	ND	ND	0	2
Dimethyl phthalate	ug/L	ND	ND	ND	0	2
Di-n-butyl phthalate	ug/L	ND	ND	ND	0	2
Di-n-octylphthalate	ug/L	ND	ND	ND	0	2
Dissolved Oxygen	mg/L	4.5	14	8.93	102	102
Endosulfan I	ug/L	ND	ND	ND	0	1
Endosulfan II	ug/L	ND	ND	ND	0	1
Endosulfan sulfate	ug/L	ND	ND	ND	0	1
Endrin	ug/L	ND	ND	ND	0	1
Endrin aldehyde	ug/L	ND	ND	ND	0	1
Ethylbenzene	ug/L	ND	ND	ND	0	2
Fecal Coliform (PIP)	col/100m	170	230	200	2	2

KPDES Outfall Non-Radiological Data

Flow Rate	mgd	ND	11.7	2.11	100	102
Fluoranthene	ug/L	ND	ND	ND	0	2
Fluorene	ug/L	ND	ND	ND	0	2
Fluoride	mg/L	0.3	0.36	0.333	4	4
gamma-Chlordane	ug/L	ND	ND	ND	0	2
Hardness - Total as CaCO3	mg/L	96	421	249	15	15
Heptachlor	ug/L	ND	ND	ND	0	1
Heptachlor epoxide	ug/L	ND	ND	ND	0	1
Hexachlorobenzene	ug/L	ND	ND	ND	0	2
Hexachlorobutadiene	ug/L	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/L	ND	ND	ND	0	2
Hexachloroethane	ug/L	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/L	ND	ND	ND	0	2
Iron	mg/L	0.245	1.11	0.545	7	7
Isophorone	ug/L	ND	ND	ND	0	2
Kjeldahl Nitrogen	mg/L	20	20	20	1	1
Lead	mg/L	ND	ND	ND	0	7
Magnesium	mg/L	6.81	6.86	6.83	2	2
Manganese	mg/L	0.07	0.078	0.074	2	2
MBAS	mg/L	ND	ND	ND	0	4
Mercury	mg/L	ND	ND	ND	0	7
Methoxychlor	ug/L	ND	ND	ND	0	1
Methylene chloride	ug/L	ND	ND	ND	0	2
Molybdenum	mg/L	ND	ND	ND	0	2
Naphthalene	ug/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	7
Nitrate/Nitrite as Nitrogen	mg/L	0.53	0.58	0.545	4	4
Nitrobenzene	ug/L	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/L	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/L	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/L	ND	ND	ND	0	2
Oil and Grease	mg/L	ND	6.2	2.57	1	54
PCB-1016	ug/L	ND	ND	ND	0	15
PCB-1221	ug/L	ND	ND	ND	0	15
PCB-1232	ug/L	ND	ND	ND	0	15
PCB-1242	ug/L	ND	ND	ND	0	15
PCB-1248	ug/L	ND	ND	ND	0	15
PCB-1254	ug/L	ND	ND	ND	0	15
PCB-1260	ug/L	ND	ND	ND	0	15
PCB-1268	ug/L	ND	ND	ND	0	15
Pentachlorophenol	ug/L	ND	ND	ND	0	2
pH	Std Unit	6.8	8.96	7.52	102	102
Phenanthrene	ug/L	ND	ND	ND	0	2
Phenol	ug/L	ND	ND	ND	0	2
Phosphorous	mg/L	0.1	0.48	0.201	52	52
Phosphorous, Dissolved	mg/L	0.07	0.18	0.12	4	4
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	15
Pyrene	ug/L	ND	ND	ND	0	2
Selenium	mg/L	ND	ND	ND	0	7
Silver	mg/L	ND	ND	ND	0	7

KPDES Outfall Non-Radiological Data

Sulfate	mg/L	68.6	98.7	84.3	4	4
Sulfide	mg/L	ND	ND	ND	0	2
Sulfite	mg/L	ND	ND	ND	0	4
Suspended Solids	mg/L	ND	ND	ND	0	2
Temperature	deg F	41.8	84.2	65.2	102	102
Tetrachloroethene	ug/L	ND	ND	ND	0	2
Thallium	mg/L	ND	ND	ND	0	7
Tin	mg/L	ND	ND	ND	0	2
Titanium	mg/L	ND	ND	ND	0	2
Toluene	ug/L	ND	ND	ND	0	2
Total Metals	mg/L	ND	ND	ND	0	5
Total Organic Carbon	mg/L	8.6	8.6	8.6	2	2
Toxaphene	ug/L	ND	ND	ND	0	1
trans-1,2-Dichloroethene	ug/L	ND	ND	ND	0	2
trans-1,3-Dichloropropene	ug/L	ND	ND	ND	0	2
Trichloroethene	ug/L	ND	ND	ND	0	15
Vinyl chloride	ug/L	ND	ND	ND	0	2
Zinc	mg/L	ND	ND	ND	0	7

KPDES Outfall Non-Radiological Data

Table 3.2 Non-Radiological Effluent Data for Outfall 015

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,1,1-Trichloroethane	ug/L	ND	ND	ND	0	1
1,1,2,2-Tetrachloroethane	ug/L	ND	ND	ND	0	1
1,1,2-Trichloroethane	ug/L	ND	ND	ND	0	1
1,1-Dichloroethane	ug/L	ND	ND	ND	0	1
1,1-Dichloroethene	ug/L	ND	ND	ND	0	1
1,2,4-Trichlorobenzene	ug/L	ND	ND	ND	0	1
1,2-Dichlorobenzene	ug/L	ND	ND	ND	0	1
1,2-Dichloroethane	ug/L	ND	ND	ND	0	1
1,2-Dichloropropane	ug/L	ND	ND	ND	0	1
1,2-Diphenylhydrazine	ug/L	ND	ND	ND	0	1
1,3-Dichlorobenzene	ug/L	ND	ND	ND	0	1
1,4-Dichlorobenzene	ug/L	ND	ND	ND	0	1
2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	ND	ND	ND	0	1
2,4,6-Trichlorophenol	ug/L	ND	ND	ND	0	1
2,4-Dichlorophenol	ug/L	ND	ND	ND	0	1
2,4-Dimethylphenol	ug/L	ND	ND	ND	0	1
2,4-Dinitrophenol	ug/L	ND	ND	ND	0	1
2,4-Dinitrotoluene	ug/L	ND	ND	ND	0	1
2,6-Dinitrotoluene	ug/L	ND	ND	ND	0	1
2-Chloroethyl vinyl ether	ug/L	ND	ND	ND	0	1
2-Chloronaphthalene	ug/L	ND	ND	ND	0	1
2-Chlorophenol	ug/L	ND	ND	ND	0	1
2-Nitrophenol	ug/L	ND	ND	ND	0	1
3,3'-Dichlorobenzidine	ug/L	ND	ND	ND	0	1
4,4'-DDD	ug/L	ND	ND	ND	0	1
4,4'-DDE	ug/L	ND	ND	ND	0	1
4,4'-DDT	ug/L	ND	ND	ND	0	1
4-Bromophenyl phenyl ether	ug/L	ND	ND	ND	0	1
4-Chloro-3-methylphenol	ug/L	ND	ND	ND	0	1
4-Chlorophenyl phenyl ether	ug/L	ND	ND	ND	0	1
4-Nitrophenol	ug/L	ND	ND	ND	0	1
Acenaphthene	ug/L	ND	ND	ND	0	1
Acenaphthylene	ug/L	ND	ND	ND	0	1
Acrolein	ug/L	ND	ND	ND	0	1
Acrylonitrile	ug/L	ND	ND	ND	0	1
Aldrin	ug/L	ND	ND	ND	0	1
alpha-BHC	ug/L	ND	ND	ND	0	1
alpha-Chlordane	ug/L	ND	ND	ND	0	1
Aluminum	mg/L	ND	ND	ND	0	1
Ammonia	mg/L	ND	ND	ND	0	1
Anthracene	ug/L	ND	ND	ND	0	1
Antimony	mg/L	ND	ND	ND	0	5
Arsenic	mg/L	ND	ND	ND	0	5
Barium	mg/L	0.031	0.031	0.031	1	1
Benz(a)anthracene	ug/L	ND	ND	ND	0	1

KPDES Outfall Non-Radiological Data

Benzene	ug/L	ND	ND	ND	0	1
Benzidine	ug/L	ND	ND	ND	0	1
Benzo(a)pyrene	ug/L	ND	ND	ND	0	1
Benzo(b)fluoranthene	ug/L	ND	ND	ND	0	1
Benzo(ghi)perylene	ug/L	ND	ND	ND	0	1
Benzo(k)fluoranthene	ug/L	ND	ND	ND	0	1
Beryllium	mg/L	ND	ND	ND	0	5
beta-BHC	ug/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/L	ND	ND	ND	0	1
Bis(2-chloroisopropyl) ether	ug/L	ND	ND	ND	0	1
Bis(2-ethylhexyl)phthalate	ug/L	ND	ND	ND	0	1
Boron	mg/L	ND	ND	ND	0	1
Bromide	mg/L	ND	ND	ND	0	2
Bromodichloromethane	ug/L	ND	ND	ND	0	1
Bromoform	ug/L	ND	ND	ND	0	1
Bromomethane	ug/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	5
Carbon tetrachloride	ug/L	ND	ND	ND	0	1
Chemical Oxygen Demand (COD)	mg/L	35	35	35	1	1
Chloride	mg/L	3.5	14.1	8.8	2	2
Chlorine, Total Residual	mg/L	ND	0.03	0.02	2	6
Chlorobenzene	ug/L	ND	ND	ND	0	1
Chloroethane	ug/L	ND	ND	ND	0	1
Chloroform	ug/L	ND	ND	ND	0	1
Chromium	mg/L	ND	ND	ND	0	5
Chrysene	ug/L	ND	ND	ND	0	1
Cobalt	mg/L	ND	ND	ND	0	1
Color	TCU	65	85	75	2	2
Conductivity	umho/cm	157	857	477	21	21
Copper	mg/L	ND	ND	ND	0	5
Cyanide	mg/L	ND	ND	ND	0	1
delta-BHC	ug/L	ND	ND	ND	0	1
Dibenz(a,h)anthracene	ug/L	ND	ND	ND	0	1
Dibromochloromethane	ug/L	ND	ND	ND	0	1
Dieldrin	ug/L	ND	ND	ND	0	1
Diethyl phthalate	ug/L	ND	ND	ND	0	1
Dimethyl phthalate	ug/L	ND	ND	ND	0	1
Di-n-butyl phthalate	ug/L	ND	ND	ND	0	1
Di-n-octylphthalate	ug/L	ND	ND	ND	0	1
Dissolved Oxygen	mg/L	5.12	10	7.64	21	21
Endosulfan I	ug/L	ND	ND	ND	0	1
Endosulfan II	ug/L	ND	ND	ND	0	1
Endosulfan sulfate	ug/L	ND	ND	ND	0	1
Endrin	ug/L	ND	ND	ND	0	1
Endrin aldehyde	ug/L	ND	ND	ND	0	1
Ethylbenzene	ug/L	ND	ND	ND	0	1
Fecal Coliform (PIP)	col/100m	6500	6500	6500	1	1
Flow Rate	mgd	0.0068	4.01	0.514	21	21
Fluoranthene	ug/L	ND	ND	ND	0	1

KPDES Outfall Non-Radiological Data

Fluorene	ug/L	ND	ND	ND	0	1
Fluoride	mg/L	0.31	0.31	0.31	2	2
gamma-Chlordane	ug/L	ND	ND	ND	0	2
Hardness - Total as CaCO3	mg/L	82	368	168	13	13
Heptachlor	ug/L	ND	ND	ND	0	1
Heptachlor epoxide	ug/L	ND	ND	ND	0	1
Hexachlorobenzene	ug/L	ND	ND	ND	0	1
Hexachlorobutadiene	ug/L	ND	ND	ND	0	1
Hexachlorocyclopentadiene	ug/L	ND	ND	ND	0	1
Hexachloroethane	ug/L	ND	ND	ND	0	1
Indeno(1,2,3-cd)pyrene	ug/L	ND	ND	ND	0	1
Iron	mg/L	0.215	1.59	0.792	5	5
Isophorone	ug/L	ND	ND	ND	0	1
Kjeldahl Nitrogen	mg/L	2.8	2.8	2.8	1	1
Lead	mg/L	ND	ND	ND	0	5
Magnesium	mg/L	3.9	3.9	3.9	1	1
Manganese	mg/L	ND	ND	ND	0	1
MBAS	mg/L	ND	ND	ND	0	2
Mercury	mg/L	ND	ND	ND	0	5
Methoxychlor	ug/L	ND	ND	ND	0	1
Methylene chloride	ug/L	ND	ND	ND	0	1
Molybdenum	mg/L	ND	ND	ND	0	1
Naphthalene	ug/L	ND	ND	ND	0	1
Nickel	mg/L	ND	ND	ND	0	5
Nitrate/Nitrite as Nitrogen	mg/L	0.3	0.6	0.45	2	2
Nitrobenzene	ug/L	ND	ND	ND	0	1
N-Nitrosodimethylamine	ug/L	ND	ND	ND	0	1
N-Nitroso-di-n-propylamine	ug/L	ND	ND	ND	0	1
N-Nitrosodiphenylamine	ug/L	ND	ND	ND	0	1
Oil and Grease	mg/L	ND	ND	ND	0	13
PCB-1016	ug/L	ND	ND	ND	0	13
PCB-1221	ug/L	ND	ND	ND	0	13
PCB-1232	ug/L	ND	ND	ND	0	13
PCB-1242	ug/L	ND	ND	ND	0	13
PCB-1248	ug/L	ND	ND	ND	0	13
PCB-1254	ug/L	ND	ND	ND	0	13
PCB-1260	ug/L	ND	ND	ND	0	13
PCB-1268	ug/L	ND	ND	ND	0	13
Pentachlorophenol	ug/L	ND	ND	ND	0	1
pH	Std Unit	7.2	7.69	7.42	21	21
Phenanthrene	ug/L	ND	ND	ND	0	1
Phenol	ug/L	ND	ND	ND	0	1
Phosphorous	mg/L	0.16	0.56	0.36	2	2
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	13
Pyrene	ug/L	ND	ND	ND	0	1
Selenium	mg/L	ND	ND	ND	0	5
Silver	mg/L	ND	ND	ND	0	5
Sulfate	mg/L	45	128	86.4	2	2
Sulfide	mg/L	ND	ND	ND	0	1
Sulfite	mg/L	ND	ND	ND	0	2

KPDES Outfall Non-Radiological Data

Suspended Solids	mg/L	ND	ND	ND	0	1
Temperature	deg F	42.5	77.7	60	21	21
Tetrachloroethene	ug/L	ND	ND	ND	0	1
Thallium	mg/L	ND	ND	ND	0	5
Tin	mg/L	ND	ND	ND	0	1
Titanium	mg/L	ND	ND	ND	0	1
Toluene	ug/L	ND	ND	ND	0	1
Total Metals	mg/L	ND	ND	ND	0	4
Total Organic Carbon	mg/L	15	15	15	1	1
Toxaphene	ug/L	ND	ND	ND	0	1
trans-1,2-Dichloroethene	ug/L	ND	ND	ND	0	1
trans-1,3-Dichloropropene	ug/L	ND	ND	ND	0	1
Trichloroethene	ug/L	2	2	2	1	1
Vinyl chloride	ug/L	ND	ND	ND	0	1
Zinc	mg/L	ND	ND	ND	0	5

KPDES Outfall Non-Radiological Data

Table 3.3 Non-Radiological Effluent Data for Outfall 017

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,1,1-Trichloroethane	ug/L	ND	ND	ND	0	1
1,1,2,2-Tetrachloroethane	ug/L	ND	ND	ND	0	1
1,1,2-Trichloroethane	ug/L	ND	ND	ND	0	1
1,1-Dichloroethane	ug/L	ND	ND	ND	0	1
1,1-Dichloroethene	ug/L	ND	ND	ND	0	1
1,2,4-Trichlorobenzene	ug/L	ND	ND	ND	0	1
1,2-Dichlorobenzene	ug/L	ND	ND	ND	0	1
1,2-Dichloroethane	ug/L	ND	ND	ND	0	1
1,2-Dichloropropane	ug/L	ND	ND	ND	0	1
1,2-Diphenylhydrazine	ug/L	ND	ND	ND	0	1
1,3-Dichlorobenzene	ug/L	ND	ND	ND	0	1
1,4-Dichlorobenzene	ug/L	ND	ND	ND	0	1
2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	ND	ND	ND	0	1
2,4,6-Trichlorophenol	ug/L	ND	ND	ND	0	1
2,4-Dichlorophenol	ug/L	ND	ND	ND	0	1
2,4-Dimethylphenol	ug/L	ND	ND	ND	0	1
2,4-Dinitrophenol	ug/L	ND	ND	ND	0	1
2,4-Dinitrotoluene	ug/L	ND	ND	ND	0	1
2,6-Dinitrotoluene	ug/L	ND	ND	ND	0	1
2-Chloroethyl vinyl ether	ug/L	ND	ND	ND	0	1
2-Chloronaphthalene	ug/L	ND	ND	ND	0	1
2-Chlorophenol	ug/L	ND	ND	ND	0	1
2-Nitrophenol	ug/L	ND	ND	ND	0	1
3,3'-Dichlorobenzidine	ug/L	ND	ND	ND	0	1
4,4'-DDD	ug/L	ND	ND	ND	0	1
4,4'-DDE	ug/L	ND	ND	ND	0	1
4,4'-DDT	ug/L	ND	ND	ND	0	1
4-Bromophenyl phenyl ether	ug/L	ND	ND	ND	0	1
4-Chloro-3-methylphenol	ug/L	ND	ND	ND	0	1
4-Chlorophenyl phenyl ether	ug/L	ND	ND	ND	0	1
4-Nitrophenol	ug/L	ND	ND	ND	0	1
Acenaphthene	ug/L	ND	ND	ND	0	1
Acenaphthylene	ug/L	ND	ND	ND	0	1
Acrolein	ug/L	ND	ND	ND	0	1
Acrylonitrile	ug/L	ND	ND	ND	0	1
Aldrin	ug/L	ND	ND	ND	0	1
alpha-BHC	ug/L	ND	ND	ND	0	1
alpha-Chlordane	ug/L	ND	ND	ND	0	1
Aluminum	mg/L	0.398	0.398	0.398	1	1
Ammonia	mg/L	ND	ND	ND	0	1
Anthracene	ug/L	ND	ND	ND	0	1
Antimony	mg/L	ND	ND	ND	0	6
Arsenic	mg/L	ND	ND	ND	0	6
Barium	mg/L	0.034	0.034	0.034	1	1
Benz(a)anthracene	ug/L	ND	ND	ND	0	1

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Benzene	ug/L	ND	ND	ND	0	1
Benzidine	ug/L	ND	ND	ND	0	1
Benzo(a)pyrene	ug/L	ND	ND	ND	0	1
Benzo(b)fluoranthene	ug/L	ND	ND	ND	0	1
Benzo(ghi)perylene	ug/L	ND	ND	ND	0	1
Benzo(k)fluoranthene	ug/L	ND	ND	ND	0	1
Beryllium	mg/L	ND	ND	ND	0	6
beta-BHC	ug/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/L	ND	ND	ND	0	1
Bis(2-chloroisopropyl) ether	ug/L	ND	ND	ND	0	1
Bis(2-ethylhexyl)phthalate	ug/L	ND	ND	ND	0	1
Boron	mg/L	ND	ND	ND	0	1
Bromide	mg/L	ND	1.1	0.8	1	2
Bromodichloromethane	ug/L	ND	ND	ND	0	1
Bromoform	ug/L	ND	ND	ND	0	1
Bromomethane	ug/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	6
Carbon tetrachloride	ug/L	ND	ND	ND	0	1
Chemical Oxygen Demand (COD)	mg/L	ND	ND	ND	0	1
Chloride	mg/L	2.1	2.1	2.1	2	2
Chlorine, Total Residual	mg/L	ND	ND	ND	0	31
Chlorobenzene	ug/L	ND	ND	ND	0	1
Chloroethane	ug/L	ND	ND	ND	0	1
Chloroform	ug/L	ND	ND	ND	0	1
Chromium	mg/L	ND	ND	ND	0	6
Chrysene	ug/L	ND	ND	ND	0	1
Cobalt	mg/L	ND	ND	ND	0	1
Color	TCU	30	50	40	2	2
Conductivity	umho/cm	57.5	509	193	46	46
Copper	mg/L	ND	ND	ND	0	6
Cyanide	mg/L	ND	ND	ND	0	1
delta-BHC	ug/L	ND	ND	ND	0	1
Dibenz(a,h)anthracene	ug/L	ND	ND	ND	0	1
Dibromochloromethane	ug/L	ND	ND	ND	0	1
Dieldrin	ug/L	ND	ND	ND	0	1
Diethyl phthalate	ug/L	ND	ND	ND	0	1
Dimethyl phthalate	ug/L	ND	ND	ND	0	1
Di-n-butyl phthalate	ug/L	ND	ND	ND	0	1
Di-n-octylphthalate	ug/L	ND	ND	ND	0	1
Dissolved Oxygen	mg/L	4.6	12.2	9.07	46	46
Endosulfan I	ug/L	ND	ND	ND	0	1
Endosulfan II	ug/L	ND	ND	ND	0	1
Endosulfan sulfate	ug/L	ND	ND	ND	0	1
Endrin	ug/L	ND	ND	ND	0	1
Endrin aldehyde	ug/L	ND	ND	ND	0	1
Ethylbenzene	ug/L	ND	ND	ND	0	1
Fecal Coliform (PIP)	col/100m	26000	26000	26000	1	1
Flow Rate	mgd	0.0321	16.6	2.34	46	46
Fluoranthene	ug/L	ND	ND	ND	0	1

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Fluorene	ug/L	ND	ND	ND	0	1
Fluoride	mg/L	0.24	0.24	0.24	2	2
gamma-Chlordane	ug/L	ND	ND	ND	0	2
Hardness - Total as CaCO3	mg/L	24	527	93.3	42	42
Heptachlor	ug/L	ND	ND	ND	0	1
Heptachlor epoxide	ug/L	ND	ND	ND	0	1
Hexachlorobenzene	ug/L	ND	ND	ND	0	1
Hexachlorobutadiene	ug/L	ND	ND	ND	0	1
Hexachlorocyclopentadiene	ug/L	ND	ND	ND	0	1
Hexachloroethane	ug/L	ND	ND	ND	0	1
Indeno(1,2,3-cd)pyrene	ug/L	ND	ND	ND	0	1
Iron	mg/L	0.293	2.88	1.16	6	6
Isophorone	ug/L	ND	ND	ND	0	1
Kjeldahl Nitrogen	mg/L	ND	ND	ND	0	1
Lead	mg/L	ND	ND	ND	0	6
Magnesium	mg/L	3.53	3.53	3.53	1	1
Manganese	mg/L	ND	ND	ND	0	1
MBAS	mg/L	ND	ND	ND	0	2
Mercury	mg/L	ND	ND	ND	0	6
Methoxychlor	ug/L	ND	ND	ND	0	1
Methylene chloride	ug/L	ND	ND	ND	0	1
Molybdenum	mg/L	ND	ND	ND	0	1
Naphthalene	ug/L	ND	ND	ND	0	1
Nickel	mg/L	ND	ND	ND	0	6
Nitrate/Nitrite as Nitrogen	mg/L	0.71	1.65	1.18	2	2
Nitrobenzene	ug/L	ND	ND	ND	0	1
N-Nitrosodimethylamine	ug/L	ND	ND	ND	0	1
N-Nitroso-di-n-propylamine	ug/L	ND	ND	ND	0	1
N-Nitrosodiphenylamine	ug/L	ND	ND	ND	0	1
Oil and Grease	mg/L	ND	ND	ND	0	14
PCB-1016	ug/L	ND	ND	ND	0	14
PCB-1221	ug/L	ND	ND	ND	0	14
PCB-1232	ug/L	ND	ND	ND	0	14
PCB-1242	ug/L	ND	0.234	0.0956	1	14
PCB-1248	ug/L	ND	0.181	0.0919	1	14
PCB-1254	ug/L	ND	ND	ND	0	14
PCB-1260	ug/L	ND	ND	ND	0	14
PCB-1268	ug/L	ND	ND	ND	0	14
Pentachlorophenol	ug/L	ND	ND	ND	0	1
pH	Std Unit	7.29	8.3	7.76	46	46
Phenanthrene	ug/L	ND	ND	ND	0	1
Phenol	ug/L	ND	ND	ND	0	1
Phosphorous	mg/L	ND	0.21	0.117	1	2
Polychlorinated biphenyl	ug/L	ND	0.415	0.109	1	14
Pyrene	ug/L	ND	ND	ND	0	1
Selenium	mg/L	ND	ND	ND	0	6
Silver	mg/L	ND	ND	ND	0	6
Sulfate	mg/L	33.4	39	36.2	2	2
Sulfide	mg/L	ND	ND	ND	0	1
Sulfite	mg/L	ND	ND	ND	0	2

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Suspended Solids	mg/L	ND	177	37	8	25
Temperature	deg F	38.7	78.6	57	46	46
Tetrachloroethene	ug/L	ND	ND	ND	0	1
Thallium	mg/L	ND	ND	ND	0	6
Tin	mg/L	ND	ND	ND	0	1
Titanium	mg/L	ND	ND	ND	0	1
Toluene	ug/L	ND	ND	ND	0	1
Total Metals	mg/L	ND	ND	ND	0	10
Total Organic Carbon	mg/L	6.6	6.6	6.6	1	1
Toxaphene	ug/L	ND	ND	ND	0	1
trans-1,2-Dichloroethene	ug/L	ND	ND	ND	0	1
trans-1,3-Dichloropropene	ug/L	ND	ND	ND	0	1
Trichloroethene	ug/L	ND	ND	ND	0	1
Vinyl chloride	ug/L	ND	ND	ND	0	1
Zinc	mg/kg	229	280	254	2	2
Zinc	mg/L	ND	4.12	0.2	16	85
Zinc, Dissolved	mg/L	ND	4.04	0.132	14	111

KPDES Outfall Non-Radiological Data

Table 3.4 Non-Radiological Effluent Data for Outfall 019

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,1,1-Trichloroethane	ug/L	ND	ND	ND	0	1
1,1,2,2-Tetrachloroethane	ug/L	ND	ND	ND	0	1
1,1,2-Trichloroethane	ug/L	ND	ND	ND	0	1
1,1-Dichloroethane	ug/L	ND	ND	ND	0	1
1,1-Dichloroethene	ug/L	ND	ND	ND	0	1
1,2,4-Trichlorobenzene	ug/L	ND	ND	ND	0	1
1,2-Dichlorobenzene	ug/L	ND	ND	ND	0	1
1,2-Dichloroethane	ug/L	ND	ND	ND	0	1
1,2-Dichloropropane	ug/L	ND	ND	ND	0	1
1,2-Diphenylhydrazine	ug/L	ND	ND	ND	0	1
1,3-Dichlorobenzene	ug/L	ND	ND	ND	0	1
1,4-Dichlorobenzene	ug/L	ND	ND	ND	0	1
2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	ND	ND	ND	0	1
2,4,6-Trichlorophenol	ug/L	ND	ND	ND	0	1
2,4-Dichlorophenol	ug/L	ND	ND	ND	0	1
2,4-Dimethylphenol	ug/L	ND	ND	ND	0	1
2,4-Dinitrophenol	ug/L	ND	ND	ND	0	1
2,4-Dinitrotoluene	ug/L	ND	ND	ND	0	1
2,6-Dinitrotoluene	ug/L	ND	ND	ND	0	1
2-Chloroethyl vinyl ether	ug/L	ND	ND	ND	0	1
2-Chloronaphthalene	ug/L	ND	ND	ND	0	1
2-Chlorophenol	ug/L	ND	ND	ND	0	1
2-Nitrophenol	ug/L	ND	ND	ND	0	1
3,3'-Dichlorobenzidine	ug/L	ND	ND	ND	0	1
4,4'-DDD	ug/L	ND	ND	ND	0	1
4,4'-DDE	ug/L	ND	ND	ND	0	1
4,4'-DDT	ug/L	ND	ND	ND	0	1
4-Bromophenyl phenyl ether	ug/L	ND	ND	ND	0	1
4-Chloro-3-methylphenol	ug/L	ND	ND	ND	0	1
4-Chlorophenyl phenyl ether	ug/L	ND	ND	ND	0	1
4-Nitrophenol	ug/L	ND	ND	ND	0	1
Acenaphthene	ug/L	ND	ND	ND	0	1
Acenaphthylene	ug/L	ND	ND	ND	0	1
Acrolein	ug/L	ND	ND	ND	0	1
Acrylonitrile	ug/L	ND	ND	ND	0	1
Aldrin	ug/L	ND	ND	ND	0	1
alpha-BHC	ug/L	ND	ND	ND	0	1
alpha-Chlordane	ug/L	ND	ND	ND	0	1
Aluminum	mg/L	0.672	0.672	0.672	1	1
Ammonia	mg/L	0.53	0.53	0.53	1	1
Anthracene	ug/L	ND	ND	ND	0	1
Antimony	mg/L	ND	ND	ND	0	4
Arsenic	mg/L	ND	ND	ND	0	4
Barium	mg/L	0.039	0.039	0.039	1	1
Benz(a)anthracene	ug/L	ND	ND	ND	0	1

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Benzene	ug/L	ND	ND	ND	0	1
Benzidine	ug/L	ND	ND	ND	0	1
Benzo(a)pyrene	ug/L	ND	ND	ND	0	1
Benzo(b)fluoranthene	ug/L	ND	ND	ND	0	1
Benzo(ghi)perylene	ug/L	ND	ND	ND	0	1
Benzo(k)fluoranthene	ug/L	ND	ND	ND	0	1
Beryllium	mg/L	ND	ND	ND	0	4
beta-BHC	ug/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Bis(2-chloroethoxy)methane	ug/L	ND	ND	ND	0	1
Bis(2-chloroisopropyl) ether	ug/L	ND	ND	ND	0	1
Bis(2-ethylhexyl)phthalate	ug/L	ND	ND	ND	0	1
Boron	mg/L	ND	ND	ND	0	1
Bromide	mg/L	ND	ND	ND	0	1
Bromodichloromethane	ug/L	ND	ND	ND	0	1
Bromoform	ug/L	ND	ND	ND	0	1
Bromomethane	ug/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	4
Carbon tetrachloride	ug/L	ND	ND	ND	0	1
Chemical Oxygen Demand (COD)	mg/L	ND	ND	ND	0	1
Chloride	mg/L	4.6	4.6	4.6	1	1
Chlorine, Total Residual	mg/L	ND	ND	ND	0	3
Chlorobenzene	ug/L	ND	ND	ND	0	1
Chloroethane	ug/L	ND	ND	ND	0	1
Chloroform	ug/L	ND	ND	ND	0	1
Chromium	mg/L	ND	ND	ND	0	4
Chrysene	ug/L	ND	ND	ND	0	1
Cobalt	mg/L	ND	ND	ND	0	1
Color	TCU	33	33	33	1	1
Conductivity	umho/cm	133	160	148	11	11
Copper	mg/L	ND	ND	ND	0	4
Cyanide	mg/L	ND	ND	ND	0	1
delta-BHC	ug/L	ND	ND	ND	0	1
Dibenz(a,h)anthracene	ug/L	ND	ND	ND	0	1
Dibromochloromethane	ug/L	ND	ND	ND	0	1
Dieldrin	ug/L	ND	ND	ND	0	1
Diethyl phthalate	ug/L	ND	ND	ND	0	1
Dimethyl phthalate	ug/L	ND	ND	ND	0	1
Di-n-butyl phthalate	ug/L	ND	ND	ND	0	1
Di-n-octylphthalate	ug/L	ND	ND	ND	0	1
Dissolved Oxygen	mg/L	5.97	11.4	8.31	11	11
Endosulfan I	ug/L	ND	ND	ND	0	1
Endosulfan II	ug/L	ND	ND	ND	0	1
Endosulfan sulfate	ug/L	ND	ND	ND	0	1
Endrin	ug/L	ND	ND	ND	0	1
Endrin aldehyde	ug/L	ND	ND	ND	0	1
Ethylbenzene	ug/L	ND	ND	ND	0	1
Fecal Coliform (PIP)	col/100m	ND	ND	ND	0	1
Flow Rate	mgd	0.6	0.85	0.759	11	11
Fluoranthene	ug/L	ND	ND	ND	0	1

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Fluorene	ug/L	ND	ND	ND	0	1
Fluoride	mg/L	0.3	0.3	0.3	1	1
gamma-Chlordane	ug/L	ND	ND	ND	0	2
Hardness - Total as CaCO3	mg/L	63	79	71	5	5
Heptachlor	ug/L	ND	ND	ND	0	1
Heptachlor epoxide	ug/L	ND	ND	ND	0	1
Hexachlorobenzene	ug/L	ND	ND	ND	0	1
Hexachlorobutadiene	ug/L	ND	ND	ND	0	1
Hexachlorocyclopentadiene	ug/L	ND	ND	ND	0	1
Hexachloroethane	ug/L	ND	ND	ND	0	1
Indeno(1,2,3-cd)pyrene	ug/L	ND	ND	ND	0	1
Iron	mg/L	0.523	2.03	1.33	4	4
Isophorone	ug/L	ND	ND	ND	0	1
Kjeldahl Nitrogen	mg/L	ND	ND	ND	0	1
Lead	mg/L	ND	ND	ND	0	4
Magnesium	mg/L	4.04	4.04	4.04	1	1
Manganese	mg/L	ND	ND	ND	0	1
MBAS	mg/L	ND	ND	ND	0	1
Mercury	mg/L	ND	ND	ND	0	4
Methoxychlor	ug/L	ND	ND	ND	0	1
Methylene chloride	ug/L	ND	ND	ND	0	1
Molybdenum	mg/L	ND	ND	ND	0	1
Naphthalene	ug/L	ND	ND	ND	0	1
Nickel	mg/L	ND	ND	ND	0	4
Nitrate/Nitrite as Nitrogen	mg/L	0.03	0.03	0.03	1	1
Nitrobenzene	ug/L	ND	ND	ND	0	1
N-Nitrosodimethylamine	ug/L	ND	ND	ND	0	1
N-Nitroso-di-n-propylamine	ug/L	ND	ND	ND	0	1
N-Nitrosodiphenylamine	ug/L	ND	ND	ND	0	1
Oil and Grease	mg/L	ND	ND	ND	0	5
PCB-1016	ug/L	ND	ND	ND	0	5
PCB-1221	ug/L	ND	ND	ND	0	5
PCB-1232	ug/L	ND	ND	ND	0	5
PCB-1242	ug/L	ND	ND	ND	0	5
PCB-1248	ug/L	ND	ND	ND	0	5
PCB-1254	ug/L	ND	ND	ND	0	5
PCB-1260	ug/L	ND	ND	ND	0	5
PCB-1268	ug/L	ND	ND	ND	0	5
Pentachlorophenol	ug/L	ND	ND	ND	0	1
pH	Std Unit	7.32	8.7	7.76	11	11
Phenanthrene	ug/L	ND	ND	ND	0	1
Phenol	ug/L	ND	ND	ND	0	1
Phosphorous	mg/L	0.18	0.18	0.18	1	1
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	5
Pyrene	ug/L	ND	ND	ND	0	1
Selenium	mg/L	ND	ND	ND	0	4
Silver	mg/L	ND	ND	ND	0	4
Sulfate	mg/L	7.5	7.5	7.5	1	1
Sulfide	mg/L	ND	ND	ND	0	1
Sulfite	mg/L	ND	ND	ND	0	1

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Suspended Solids	mg/L	ND	ND	ND	0	5
Temperature	deg F	34	86.6	61.6	11	11
Tetrachloroethene	ug/L	ND	ND	ND	0	1
Thallium	mg/L	ND	ND	ND	0	4
Tin	mg/L	ND	ND	ND	0	1
Titanium	mg/L	ND	ND	ND	0	1
Toluene	ug/L	ND	ND	ND	0	1
Total Metals	mg/L	ND	ND	ND	0	3
Total Organic Carbon	mg/L	6.1	6.1	6.1	1	1
Toxaphene	ug/L	ND	ND	ND	0	1
trans-1,2-Dichloroethene	ug/L	ND	ND	ND	0	1
trans-1,3-Dichloropropene	ug/L	ND	ND	ND	0	1
Trichloroethene	ug/L	ND	ND	ND	0	1
Vinyl chloride	ug/L	ND	ND	ND	0	1
Zinc	mg/L	ND	ND	ND	0	4

Surface Water Non-Radiological Data

Table 3.5 Non-Radiological Effluent Data for Landfill Surface Water Location L135

Upstream C-746 S&T Closed Landfills

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Chemical Oxygen Demand (COD)	mg/L	31	44	39.5	4	4
Chloride	mg/L	ND	67.2	27.8	3	4
Conductivity	umho/cm	66.7	381	221	4	4
Dissolved Oxygen	mg/L	6.74	11.5	8.61	4	4
Dissolved Solids	mg/L	ND	348	199	3	4
Flow Rate	mgd	ND	17.8	4.75	3	4
Iron	mg/L	0.371	7.68	2.71	4	4
pH	Std Unit	6.87	7.7	7.22	4	4
Sodium	mg/L	ND	29.9	9.43	3	4
Sulfate	mg/L	ND	19.7	11.4	3	4
Suspended Solids	mg/L	ND	109	61.5	2	4
Temperature	deg F	44.4	74.4	60.7	4	4
Total Organic Carbon	mg/L	11	19	15	4	4
Total Solids	mg/L	105	348	240	4	4

Table 3.6 Non-Radiological Effluent Data for Landfill Surface Water Location L136

At the C-746 S&T Closed Landfills

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Chemical Oxygen Demand (COD)	mg/L	34	42	38.6	5	5
Chloride	mg/L	ND	28.6	13.9	4	5
Conductivity	umho/cm	174	450	340	5	5
Dissolved Oxygen	mg/L	4.2	10.6	8.32	5	5
Dissolved Solids	mg/L	162	354	270	5	5
Flow Rate	mgd	ND	5.23	1.2	3	5
Iron	mg/L	0.206	0.439	0.313	5	5
pH	Std Unit	7	7.8	7.52	5	5
Sodium	mg/L	ND	9.36	5.04	4	5
Sulfate	mg/L	8.7	74.3	49.2	5	5
Suspended Solids	mg/L	ND	ND	ND	0	5
Temperature	deg F	45.8	75.8	59.9	5	5
Total Organic Carbon	mg/L	12	15	13.8	5	5
Total Solids	mg/L	163	345	247	5	5

Surface Water Non-Radiological Data

Table 3.7 Non-Radiological Effluent Data for Landfill Surface Water Location L137

Downstream of the C-746 S&T Closed Landfills

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Chemical Oxygen Demand (COD)	mg/L	26	44	35.5	4	4
Chloride	mg/L	ND	23.7	12.6	3	4
Conductivity	umho/cm	64.2	299	190	4	4
Dissolved Oxygen	mg/L	6.88	11.3	8.86	4	4
Dissolved Solids	mg/L	ND	343	189	3	4
Flow Rate	mgd	ND	15.4	4.72	2	4
Iron	mg/L	0.813	3.85	2.6	4	4
pH	Std Unit	6.9	7.5	7.22	4	4
Sodium	mg/L	ND	8.77	3.95	2	4
Sulfate	mg/L	ND	45	20.3	3	4
Suspended Solids	mg/L	ND	287	113	3	4
Temperature	deg F	43	74.4	60.4	4	4
Total Organic Carbon	mg/L	11	17	14.2	4	4
Total Solids	mg/L	226	379	284	4	4

Table 3.8 Non-Radiological Effluent Data for Landfill Surface Water Location L150

At the C-746 U Landfill

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Chemical Oxygen Demand (COD)	mg/L	ND	33	22.8	3	5
Chloride	mg/L	ND	9.6	3.48	2	5
Conductivity	umho/cm	126	411	201	5	5
Dissolved Oxygen	mg/L	5.31	12.6	9.19	5	5
Dissolved Solids	mg/L	109	285	172	5	5
Flow Rate	mgd	ND	4.03	1.24	2	5
Iron	mg/L	0.763	13.4	5.9	5	5
pH	Std Unit	7.26	7.9	7.59	5	5
Sodium	mg/L	ND	6.54	2.76	3	5
Sulfate	mg/L	11.5	132	41	5	5
Suspended Solids	mg/L	63	284	170	5	5
Temperature	deg F	45.6	74	59.5	5	5
Total Organic Carbon	mg/L	5.8	13	9.26	5	5
Total Solids	mg/L	203	580	328	5	5

Surface Water Non-Radiological Data

Table 3.9 Non-Radiological Effluent Data for Landfill Surface Water Location L154

Upstream of the C-746 U Landfill

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Chemical Oxygen Demand (COD)	mg/L	31	50	41.2	4	4
Chloride	mg/L	ND	30	11.7	3	4
Conductivity	umho/cm	62	364	214	4	4
Dissolved Oxygen	mg/L	6.85	9.76	8.31	4	4
Dissolved Solids	mg/L	ND	276	170	3	4
Flow Rate	mgd	ND	34	9.99	2	4
Iron	mg/L	0.566	4.14	2.11	4	4
pH	Std Unit	6	7.4	6.67	4	4
Sodium	mg/L	ND	17.1	6.93	2	4
Sulfate	mg/L	ND	69.6	29.7	3	4
Suspended Solids	mg/L	ND	76	37.7	1	4
Temperature	deg F	43.3	74.7	60.2	4	4
Total Organic Carbon	mg/L	9.5	18	15.6	4	4
Total Solids	mg/L	117	364	220	4	4

Table 3.10 Non-Radiological Effluent Data for Landfill Surface Water Location L155

Downstream of the C-746 U Landfill

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Chemical Oxygen Demand (COD)	mg/L	ND	30	16.9	1	4
Chloride	mg/L	ND	27.2	16.9	3	4
Conductivity	umho/cm	47.5	313	216	4	4
Dissolved Oxygen	mg/L	5.25	10.7	8.41	4	4
Dissolved Solids	mg/L	ND	179	143	3	4
Flow Rate	mgd	ND	20.7	7.51	2	4
Iron	mg/L	0.689	9.23	3.41	4	4
pH	Std Unit	6.84	8.1	7.38	4	4
Sodium	mg/L	ND	33.4	20.4	3	4
Sulfate	mg/L	ND	63	37.6	3	4
Suspended Solids	mg/L	ND	609	170	1	4
Temperature	deg F	42.1	74.1	58.5	4	4
Total Organic Carbon	mg/L	4.1	9	6.62	4	4
Total Solids	mg/L	162	657	304	4	4

4. NONRADIOLOGICAL ENVIRONMENTAL SURVEILLANCE DATA

Surface Water Non-Radiological Data

Table 4.1 Non-Radiological Monitoring Data for Surface Water Location L1

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	4
Acetone	ug/L	ND	ND	ND	0	4
Aluminum	mg/L	0.246	2.48	0.85	4	4
Ammonia as Nitrogen	mg/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	4
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	4
Chloride	mg/L	2.2	21.7	11.9	4	4
Chromium	mg/L	ND	ND	ND	0	4
Conductivity	umho/cm	72.2	271	198	3	4
Copper	mg/L	ND	ND	ND	0	4
Cyanide	mg/L	ND	ND	ND	0	1
Dissolved Oxygen	mg/L	7.44	11.9	9.82	3	4
Flow Rate	mgd	ND	172	21.7	2	4
Hardness - Total as CaCO3	mg/L	32	61	50.5	4	4
Iron	mg/L	0.495	2.19	1.05	4	4
Lead	mg/L	ND	ND	ND	0	4
Nickel	mg/L	ND	ND	ND	0	4
Nitrate/Nitrite as Nitrogen	mg/L	0.33	0.33	0.33	1	1
PCB-1016	ug/L	ND	ND	ND	0	4
PCB-1221	ug/L	ND	ND	ND	0	4
PCB-1232	ug/L	ND	ND	ND	0	4
PCB-1242	ug/L	ND	ND	ND	0	4
PCB-1248	ug/L	ND	ND	ND	0	4
PCB-1254	ug/L	ND	ND	ND	0	4
PCB-1260	ug/L	ND	ND	ND	0	4
PCB-1268	ug/L	ND	ND	ND	0	4
pH	Std Unit	7.4	7.72	7.37	3	4
Phosphorous	mg/L	0.06	0.43	0.185	4	4
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	4
Sulfate	mg/L	5.6	5.6	5.6	1	1
Suspended Solids	mg/L	ND	43	19.4	1	4
Temperature	deg F	46	84	63.8	3	4
Trichloroethene	ug/L	ND	1	0.625	1	4
Turbidity	NTU	40	40	40	1	1
Zinc	mg/L	ND	ND	ND	0	4

Surface Water Non-Radiological Data

Table 4.2 Non-Radiological Monitoring Data for Surface Water Location L5

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	5
Acetone	ug/L	ND	ND	ND	0	5
Aluminum	mg/L	ND	0.395	0.159	1	5
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	5
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	5
Chloride	mg/L	24.5	77.6	39.7	5	5
Chromium	mg/L	ND	ND	ND	0	5
Conductivity	umho/cm	487	734	418	4	5
Copper	mg/L	ND	ND	ND	0	5
Dissolved Oxygen	mg/L	9.3	15.3	9.02	4	5
Flow Rate	mgd	ND	36.4	13.4	3	5
Hardness - Total as CaCO3	mg/L	67	187	108	5	5
Iron	mg/L	ND	0.475	0.26	3	5
Lead	mg/L	ND	ND	ND	0	5
Nickel	mg/L	ND	ND	ND	0	5
PCB-1016	ug/L	ND	ND	ND	0	5
PCB-1221	ug/L	ND	ND	ND	0	5
PCB-1232	ug/L	ND	ND	ND	0	5
PCB-1242	ug/L	ND	ND	ND	0	5
PCB-1248	ug/L	ND	ND	ND	0	5
PCB-1254	ug/L	ND	ND	ND	0	5
PCB-1260	ug/L	ND	ND	ND	0	5
PCB-1268	ug/L	ND	ND	ND	0	5
pH	Std Unit	7.3	8.9	7.87	4	5
Phosphorous	mg/L	0.1	0.15	0.117	4	4
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	5
Sulfate	mg/L	112	112	112	1	1
Suspended Solids	mg/L	ND	ND	ND	0	5
Temperature	deg F	53.1	84.7	69.7	4	5
Trichloroethene	ug/L	ND	ND	ND	0	5
Zinc	mg/L	ND	ND	ND	0	5

Surface Water Non-Radiological Data

Table 4.3 Non-Radiological Monitoring Data for Surface Water Location L6

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	3
Acetone	ug/L	ND	ND	ND	0	3
Aluminum	mg/L	ND	ND	ND	0	3
Cadmium	mg/L	ND	ND	ND	0	3
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	3
Chloride	mg/L	29.9	79.6	46.5	3	3
Chromium	mg/L	ND	ND	ND	0	3
Conductivity	umho/cm	311	740	454	3	3
Copper	mg/L	ND	ND	ND	0	3
Dissolved Oxygen	mg/L	7.66	14.6	9.98	3	3
Flow Rate	mgd	ND	44.8	31.1	2	3
Hardness - Total as CaCO3	mg/L	74	188	112	3	3
Iron	mg/L	ND	0.24	0.184	2	3
Lead	mg/L	ND	ND	ND	0	3
Nickel	mg/L	ND	ND	ND	0	3
PCB-1016	ug/L	ND	ND	ND	0	3
PCB-1221	ug/L	ND	ND	ND	0	3
PCB-1232	ug/L	ND	ND	ND	0	3
PCB-1242	ug/L	ND	ND	ND	0	3
PCB-1248	ug/L	ND	ND	ND	0	3
PCB-1254	ug/L	ND	ND	ND	0	3
PCB-1260	ug/L	ND	ND	ND	0	3
PCB-1268	ug/L	ND	ND	ND	0	3
pH	Std Unit	7.85	8.3	8	3	3
Phosphorous	mg/L	0.09	0.1	0.0967	3	3
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	3
Suspended Solids	mg/L	ND	ND	ND	0	3
Temperature	deg F	47.7	82.1	70.6	3	3
Trichloroethene	ug/L	ND	ND	ND	0	3
Zinc	mg/L	ND	ND	ND	0	3

Surface Water Non-Radiological Data

Table 4.4 Non-Radiological Monitoring Data for Surface Water Location C616

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	ND	0.223	0.162	1	2
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	2
Chloride	mg/L	60.1	136	97.8	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	583	1250	916	1	2
Copper	mg/L	ND	ND	ND	0	2
Dissolved Oxygen	mg/L	9.7	9.7	8.35	1	2
Flow Rate	mgd	ND	2.35	1.13	1	2
Hardness - Total as CaCO3	mg/L	125	137	131	2	2
Iron	mg/L	ND	ND	ND	0	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.7	7.7	7.35	1	2
Phosphorous	mg/L	0.15	0.15	0.15	1	1
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	366	366	366	1	1
Suspended Solids	mg/L	ND	ND	ND	0	2
Temperature	deg F	86.7	86.7	74	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.5 Non-Radiological Monitoring Data for Surface Water Location C612

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	3
Acetone	ug/L	ND	ND	ND	0	3
Aluminum	mg/L	ND	ND	ND	0	3
Ammonia as Nitrogen	mg/L	ND	ND	ND	0	2
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	2
Cadmium	mg/L	ND	ND	ND	0	3
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	3
Chloride	mg/L	38.8	38.9	38.9	3	3
Chromium	mg/L	ND	ND	ND	0	3
Conductivity	umho/cm	345	345	327	2	3
Copper	mg/L	ND	ND	ND	0	3
Cyanide	mg/L	ND	ND	ND	0	2
Dissolved Oxygen	mg/L	9	9	8.62	2	3
Hardness - Total as CaCO3	mg/L	97	108	104	3	3
Iron	mg/L	ND	ND	ND	0	3
Lead	mg/L	ND	ND	ND	0	3
Nickel	mg/L	ND	ND	ND	0	3
Nitrate/Nitrite as Nitrogen	mg/L	1.2	1.3	1.25	2	2
PCB-1016	ug/L	ND	ND	ND	0	3
PCB-1221	ug/L	ND	ND	ND	0	3
PCB-1232	ug/L	ND	ND	ND	0	3
PCB-1242	ug/L	ND	ND	ND	0	3
PCB-1248	ug/L	ND	ND	ND	0	3
PCB-1254	ug/L	ND	ND	ND	0	3
PCB-1260	ug/L	ND	ND	ND	0	3
PCB-1268	ug/L	ND	ND	ND	0	3
pH	Std Unit	8.1	8.1	8.03	2	3
Phosphorous	mg/L	ND	ND	ND	0	3
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	3
Sulfate	mg/L	15.9	15.9	15.9	2	2
Suspended Solids	mg/L	ND	ND	ND	0	3
Temperature	deg F	68	68	61.7	2	3
Trichloroethene	ug/L	1	1	1	3	3
Turbidity	NTU	ND	ND	ND	0	2
Zinc	mg/L	ND	ND	ND	0	3

Surface Water Non-Radiological Data

Table 4.6 Non-Radiological Monitoring Data for Surface Water Location K004

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	ND	ND	ND	0	2
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	11	8	1	2
Chloride	mg/L	29.5	33.8	31.6	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	361	361	332	1	2
Copper	mg/L	ND	ND	ND	0	2
Dissolved Oxygen	mg/L	6.1	6.1	5.21	1	2
Flow Rate	mgd	ND	0.94	0.32	1	2
Hardness - Total as CaCO3	mg/L	57	92	74.5	2	2
Iron	mg/L	0.244	0.299	0.272	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.1	7.1	7.01	1	2
Phosphorous	mg/L	1.2	1.2	1.2	1	1
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	56.8	56.8	56.8	1	1
Suspended Solids	mg/L	ND	ND	ND	0	2
Temperature	deg F	93.1	93.1	82.5	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.7 Non-Radiological Monitoring Data for Surface Water Location K006

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	1
Acetone	ug/L	ND	ND	ND	0	1
Aluminum	mg/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	1
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	1
Chloride	mg/L	17.9	17.9	17.9	1	1
Chromium	mg/L	ND	ND	ND	0	1
Conductivity	umho/cm	262	262	262	1	1
Copper	mg/L	ND	ND	ND	0	1
Dissolved Oxygen	mg/L	11.4	11.4	11.4	1	1
Flow Rate	mgd	ND	ND	ND	0	1
Hardness - Total as CaCO3	mg/L	89	89	89	1	1
Iron	mg/L	0.449	0.449	0.449	1	1
Lead	mg/L	ND	ND	ND	0	1
Nickel	mg/L	ND	ND	ND	0	1
PCB-1016	ug/L	ND	ND	ND	0	1
PCB-1221	ug/L	ND	ND	ND	0	1
PCB-1232	ug/L	ND	ND	ND	0	1
PCB-1242	ug/L	ND	ND	ND	0	1
PCB-1248	ug/L	ND	ND	ND	0	1
PCB-1254	ug/L	ND	ND	ND	0	1
PCB-1260	ug/L	ND	ND	ND	0	1
PCB-1268	ug/L	ND	ND	ND	0	1
pH	Std Unit	7.2	7.2	7.2	1	1
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	1
Sulfate	mg/L	43.6	43.6	43.6	1	1
Suspended Solids	mg/L	ND	ND	ND	0	1
Temperature	deg F	56.2	56.2	56.2	1	1
Trichloroethene	ug/L	ND	ND	ND	0	1
Zinc	mg/L	ND	ND	ND	0	1

Surface Water Non-Radiological Data

Table 4.8 Non-Radiological Monitoring Data for Surface Water Location K008

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	ND	ND	ND	0	2
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	2
Chloride	mg/L	19	25.9	22.4	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	335	335	284	1	2
Copper	mg/L	ND	ND	ND	0	2
Dissolved Oxygen	mg/L	5.95	5.95	5.92	1	2
Flow Rate	mgd	ND	2.1	1.19	1	2
Hardness - Total as CaCO3	mg/L	51	89	70	2	2
Iron	mg/L	0.203	0.226	0.214	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.29	7.29	7.14	1	2
Phosphorous	mg/L	0.28	0.28	0.28	1	1
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	68.6	68.6	68.6	1	1
Suspended Solids	mg/L	ND	ND	ND	0	2
Temperature	deg F	87.9	87.9	78.2	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.9 Non-Radiological Monitoring Data for Surface Water Location K009

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	3
Acetone	ug/L	ND	ND	ND	0	3
Aluminum	mg/L	ND	0.748	0.512	2	3
Ammonia as Nitrogen	mg/L	ND	ND	ND	0	2
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	2
Cadmium	mg/L	ND	ND	ND	0	3
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	3
Chloride	mg/L	5.7	18.7	10	3	3
Chromium	mg/L	ND	ND	ND	0	3
Conductivity	umho/cm	235	235	158	2	3
Copper	mg/L	ND	0.038	0.021	1	3
Cyanide	mg/L	ND	ND	ND	0	2
Dissolved Oxygen	mg/L	8.43	8.43	7.3	2	3
Flow Rate	mgd	ND	8.85	3.19	1	3
Hardness - Total as CaCO3	mg/L	54	60	56.3	3	3
Iron	mg/L	0.565	0.677	0.625	3	3
Lead	mg/L	ND	ND	ND	0	3
Nickel	mg/L	ND	ND	ND	0	3
Nitrate/Nitrite as Nitrogen	mg/L	0.12	0.13	0.125	2	2
PCB-1016	ug/L	ND	ND	ND	0	3
PCB-1221	ug/L	ND	ND	ND	0	3
PCB-1232	ug/L	ND	ND	ND	0	3
PCB-1242	ug/L	ND	ND	ND	0	3
PCB-1248	ug/L	ND	ND	ND	0	3
PCB-1254	ug/L	ND	ND	ND	0	3
PCB-1260	ug/L	ND	ND	ND	0	3
PCB-1268	ug/L	ND	ND	ND	0	3
pH	Std Unit	7.5	7.5	7.11	2	3
Phosphorous	mg/L	0.15	0.29	0.243	3	3
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	3
Sulfate	mg/L	8.4	8.4	8.4	2	2
Suspended Solids	mg/L	ND	ND	ND	0	3
Temperature	deg F	80.8	80.8	59.7	2	3
Trichloroethene	ug/L	ND	ND	ND	0	3
Turbidity	NTU	12	13	12.5	2	2
Zinc	mg/L	ND	ND	ND	0	3

Surface Water Non-Radiological Data

Table 4.10 Non-Radiological Monitoring Data for Surface Water Location K016

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	ND	0.469	0.284	1	2
Ammonia as Nitrogen	mg/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	1
Chloride	mg/L	4.1	18.1	11.1	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	393	393	269	1	2
Copper	mg/L	ND	ND	ND	0	2
Cyanide	mg/L	ND	ND	ND	0	1
Dissolved Oxygen	mg/L	3.9	11.6	7.75	1	2
Flow Rate	mgd	ND	4.18	1.17	1	2
Hardness - Total as CaCO3	mg/L	81	161	121	2	2
Iron	mg/L	0.208	0.351	0.28	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
Nitrate/Nitrite as Nitrogen	mg/L	0.09	0.09	0.09	1	1
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	8	8	7.55	1	2
Phosphorous	mg/L	0.14	0.45	0.295	2	2
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	9.3	9.3	9.3	1	1
Suspended Solids	mg/L	ND	ND	ND	0	2
Temperature	deg F	64.4	64.4	55.6	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Turbidity	NTU	13	13	13	1	1
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.11 Non-Radiological Monitoring Data for Surface Water Location L291

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	4
Acetone	ug/L	ND	ND	ND	0	4
Aluminum	mg/L	ND	2.88	0.911	3	4
Ammonia as Nitrogen	mg/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	4
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	4
Chloride	mg/L	2.1	22.7	11.3	4	4
Chromium	mg/L	ND	ND	ND	0	4
Conductivity	umho/cm	67.3	252	186	3	4
Copper	mg/L	ND	ND	ND	0	4
Cyanide	mg/L	ND	ND	ND	0	1
Dissolved Oxygen	mg/L	4.53	13.8	8.72	3	4
Flow Rate	mgd	ND	110	13.9	2	4
Hardness - Total as CaCO3	mg/L	32	60	52.7	4	4
Iron	mg/L	0.368	2.54	0.965	4	4
Lead	mg/L	ND	ND	ND	0	4
Nickel	mg/L	ND	ND	ND	0	4
Nitrate/Nitrite as Nitrogen	mg/L	0.3	0.3	0.3	1	1
PCB-1016	ug/L	ND	ND	ND	0	4
PCB-1221	ug/L	ND	ND	ND	0	4
PCB-1232	ug/L	ND	ND	ND	0	4
PCB-1242	ug/L	ND	ND	ND	0	4
PCB-1248	ug/L	ND	ND	ND	0	4
PCB-1254	ug/L	ND	ND	ND	0	4
PCB-1260	ug/L	ND	ND	ND	0	4
PCB-1268	ug/L	ND	ND	ND	0	4
pH	Std Unit	7.2	8.1	7.37	3	4
Phosphorous	mg/L	0.06	0.39	0.172	4	4
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	4
Sulfate	mg/L	5.2	5.2	5.2	1	1
Suspended Solids	mg/L	ND	64	24.6	1	4
Temperature	deg F	45.8	82.8	62.7	3	4
Trichloroethene	ug/L	ND	ND	ND	0	4
Turbidity	NTU	45	45	45	1	1
Zinc	mg/L	ND	ND	ND	0	4

Surface Water Non-Radiological Data

Table 4.12 Non-Radiological Monitoring Data for Surface Water Location K002

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	0.51	0.547	0.528	2	2
Ammonia as Nitrogen	mg/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	2
Chloride	mg/L	2.9	10.5	6.7	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	264	264	188	1	2
Copper	mg/L	ND	0.028	0.0202	1	2
Cyanide	mg/L	ND	ND	ND	0	1
Dissolved Oxygen	mg/L	585	585	298	1	2
Flow Rate	mgd	ND	0.57	0.15	1	2
Hardness - Total as CaCO3	mg/L	58	101	79.5	2	2
Iron	mg/L	0.412	0.5	0.456	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
Nitrate/Nitrite as Nitrogen	mg/L	0.08	0.08	0.08	1	1
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.36	7.53	7.44	1	2
Phosphorous	mg/L	0.18	0.23	0.205	2	2
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	11.8	11.8	11.8	1	1
Suspended Solids	mg/L	ND	ND	ND	0	2
Temperature	deg F	71.6	71.6	59.7	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Turbidity	NTU	10	10	10	1	1
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.13 Non-Radiological Monitoring Data for Surface Water Location K010

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	ND	ND	ND	0	2
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	2
Chloride	mg/L	24.5	29.9	27.2	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	377	377	332	1	2
Copper	mg/L	ND	ND	ND	0	2
Dissolved Oxygen	mg/L	8.97	8.97	7.78	1	2
Flow Rate	mgd	ND	0.501	0.375	1	2
Hardness - Total as CaCO3	mg/L	69	109	89	2	2
Iron	mg/L	0.223	0.245	0.234	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.33	7.33	7.17	1	2
Phosphorous	mg/L	0.38	0.38	0.38	1	1
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	84.1	84.1	84.1	1	1
Suspended Solids	mg/L	ND	ND	ND	0	2
Temperature	deg F	90.8	90.8	79.7	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.14 Non-Radiological Monitoring Data for Surface Water Location K011

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	0.48	0.531	0.505	2	2
Ammonia as Nitrogen	mg/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	2
Chloride	mg/L	2.5	6.1	4.3	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	215	215	165	1	2
Copper	mg/L	ND	ND	ND	0	2
Cyanide	mg/L	ND	ND	ND	0	1
Dissolved Oxygen	mg/L	4.03	11	7.53	1	2
Flow Rate	mgd	ND	0.649	0.163	1	2
Hardness - Total as CaCO3	mg/L	61	64	62.5	2	2
Iron	mg/L	0.405	0.421	0.413	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
Nitrate/Nitrite as Nitrogen	mg/L	0.1	0.1	0.1	1	1
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.86	7.86	7.65	1	2
Phosphorous	mg/L	0.21	0.21	0.21	2	2
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	7.7	7.7	7.7	1	1
Suspended Solids	mg/L	ND	ND	ND	0	2
Temperature	deg F	71.4	71.4	60.1	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Turbidity	NTU	7.9	7.9	7.9	1	1
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.15 Non-Radiological Monitoring Data for Surface Water Location K012

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	ND	0.279	0.189	1	2
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	2
Chloride	mg/L	13.5	25.7	19.6	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	468	468	460	1	2
Copper	mg/L	ND	ND	ND	0	2
Dissolved Oxygen	mg/L	8.51	8.51	8.14	1	2
Flow Rate	mgd	ND	0.0218	0.0134	1	2
Hardness - Total as CaCO3	mg/L	148	152	150	2	2
Iron	mg/L	0.651	1.09	0.871	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.49	7.49	7.3	1	2
Phosphorous	mg/L	0.16	0.16	0.16	1	1
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	19.1	19.1	19.1	1	1
Suspended Solids	mg/L	ND	ND	ND	0	2
Temperature	deg F	75.6	75.6	63.8	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.16 Non-Radiological Monitoring Data for Surface Water Location K013

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	0.749	2.67	1.71	2	2
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	2
Chloride	mg/L	ND	ND	ND	0	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	546	546	433	1	2
Copper	mg/L	ND	ND	ND	0	2
Dissolved Oxygen	mg/L	7.99	7.99	7.29	1	2
Flow Rate	mgd	ND	0.202	0.102	1	2
Hardness - Total as CaCO3	mg/L	162	273	218	2	2
Iron	mg/L	0.706	2.06	1.38	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.55	7.55	7.39	1	2
Phosphorous	mg/L	0.07	0.07	0.07	1	1
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	71.3	71.3	71.3	1	1
Suspended Solids	mg/L	ND	37	24	1	2
Temperature	deg F	85	85	69.8	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.17 Non-Radiological Monitoring Data for Surface Water Location L10

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	5
Acetone	ug/L	ND	ND	ND	0	5
Aluminum	mg/L	ND	0.636	0.323	4	5
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	5
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	5
Chloride	mg/L	20.9	31.9	26.9	5	5
Chromium	mg/L	ND	ND	ND	0	5
Conductivity	umho/cm	306	332	307	4	5
Copper	mg/L	ND	ND	ND	0	5
Dissolved Oxygen	mg/L	8.33	9.29	6.52	4	5
Flow Rate	mgd	ND	2.94	1.17	3	5
Hardness - Total as CaCO3	mg/L	74	86	81	5	5
Iron	mg/L	0.259	0.764	0.446	5	5
Lead	mg/L	ND	ND	ND	0	5
Nickel	mg/L	ND	ND	ND	0	5
PCB-1016	ug/L	ND	ND	ND	0	5
PCB-1221	ug/L	ND	ND	ND	0	5
PCB-1232	ug/L	ND	ND	ND	0	5
PCB-1242	ug/L	ND	ND	ND	0	5
PCB-1248	ug/L	ND	ND	ND	0	5
PCB-1254	ug/L	ND	ND	ND	0	5
PCB-1260	ug/L	ND	ND	ND	0	5
PCB-1268	ug/L	ND	ND	ND	0	5
pH	Std Unit	7.3	7.61	7.38	4	5
Phosphorous	mg/L	0.13	0.28	0.215	4	4
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	5
Sulfate	mg/L	44.6	44.6	44.6	1	1
Suspended Solids	mg/L	ND	ND	ND	0	5
Temperature	deg F	52.1	81.3	67.3	4	5
Trichloroethene	ug/L	ND	ND	ND	0	5
Zinc	mg/L	ND	ND	ND	0	5

Surface Water Non-Radiological Data

Table 4.18 Non-Radiological Monitoring Data for Surface Water Location L194

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	5
Acetone	ug/L	ND	ND	ND	0	5
Aluminum	mg/L	0.22	2.14	0.639	5	5
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	5
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	5
Chloride	mg/L	13.1	33	26.3	5	5
Chromium	mg/L	ND	ND	ND	0	5
Conductivity	umho/cm	300	342	306	4	5
Copper	mg/L	ND	ND	ND	0	5
Dissolved Oxygen	mg/L	5.77	10.4	8.68	4	5
Flow Rate	mgd	ND	5.98	1.51	2	5
Hardness - Total as CaCO3	mg/L	71	88	79.4	5	5
Iron	mg/L	0.317	2.09	0.704	5	5
Lead	mg/L	ND	ND	ND	0	5
Nickel	mg/L	ND	ND	ND	0	5
PCB-1016	ug/L	ND	ND	ND	0	5
PCB-1221	ug/L	ND	ND	ND	0	5
PCB-1232	ug/L	ND	ND	ND	0	5
PCB-1242	ug/L	ND	ND	ND	0	5
PCB-1248	ug/L	ND	ND	ND	0	5
PCB-1254	ug/L	ND	ND	ND	0	5
PCB-1260	ug/L	ND	ND	ND	0	5
PCB-1268	ug/L	ND	ND	ND	0	5
pH	Std Unit	7.25	7.75	7.45	4	5
Phosphorous	mg/L	0.17	0.33	0.225	4	4
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	5
Sulfate	mg/L	16.6	16.6	16.6	1	1
Suspended Solids	mg/L	ND	ND	ND	0	5
Temperature	deg F	54.3	88.7	66.5	4	5
Trichloroethene	ug/L	ND	ND	ND	0	5
Zinc	mg/L	ND	ND	ND	0	5

Surface Water Non-Radiological Data

Table 4.19 Non-Radiological Monitoring Data for Surface Water Location L55

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	0.415	0.572	0.493	2	2
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	2
Chloride	mg/L	27.9	48	38	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	456	480	468	2	2
Copper	mg/L	ND	ND	ND	0	2
Dissolved Oxygen	mg/L	7.27	12.2	9.74	2	2
Flow Rate	mgd	ND	0.45	0.138	1	2
Hardness - Total as CaCO3	mg/L	114	142	128	2	2
Iron	mg/L	0.515	0.782	0.648	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.4	7.78	7.59	2	2
Phosphorous	mg/L	0.05	0.07	0.06	2	2
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Suspended Solids	mg/L	ND	ND	ND	0	2
Temperature	deg F	48.5	76.1	62.3	2	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.20 Non-Radiological Monitoring Data for Surface Water Location L56

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	4
Acetone	ug/L	ND	ND	ND	0	4
Aluminum	mg/L	0.292	2.21	0.848	4	4
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	4
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	4
Chloride	mg/L	11.4	47	32.2	4	4
Chromium	mg/L	ND	ND	ND	0	4
Conductivity	umho/cm	436	472	387	3	4
Copper	mg/L	ND	ND	ND	0	4
Dissolved Oxygen	mg/L	7.39	10.6	8.7	3	4
Flow Rate	mgd	ND	8.48	2.19	2	4
Hardness - Total as CaCO3	mg/L	85	154	111	4	4
Iron	mg/L	0.575	2.34	1.05	4	4
Lead	mg/L	ND	ND	ND	0	4
Nickel	mg/L	ND	ND	ND	0	4
PCB-1016	ug/L	ND	ND	ND	0	4
PCB-1221	ug/L	ND	ND	ND	0	4
PCB-1232	ug/L	ND	ND	ND	0	4
PCB-1242	ug/L	ND	ND	ND	0	4
PCB-1248	ug/L	ND	ND	ND	0	4
PCB-1254	ug/L	ND	ND	ND	0	4
PCB-1260	ug/L	ND	ND	ND	0	4
PCB-1268	ug/L	ND	ND	ND	0	4
pH	Std Unit	7.11	7.11	7	3	4
Phosphorous	mg/L	ND	0.07	0.04	1	3
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	4
Sulfate	mg/L	23	23	23	1	1
Suspended Solids	mg/L	ND	ND	ND	0	4
Temperature	deg F	54	79.6	64.4	3	4
Trichloroethene	ug/L	ND	ND	ND	0	4
Zinc	mg/L	ND	ND	ND	0	4

Surface Water Non-Radiological Data

Table 4.21 Non-Radiological Monitoring Data for Surface Water Location L11

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	4
Acetone	ug/L	ND	ND	ND	0	4
Aluminum	mg/L	0.281	2.56	1.11	4	4
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	4
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	4
Chloride	mg/L	9.4	25.6	19.5	4	4
Chromium	mg/L	ND	ND	ND	0	4
Conductivity	umho/cm	274	289	254	3	4
Copper	mg/L	ND	ND	ND	0	4
Dissolved Oxygen	mg/L	8.9	12.8	8.44	3	4
Flow Rate	mgd	ND	4.69	1.47	2	4
Hardness - Total as CaCO3	mg/L	63	87	72	4	4
Iron	mg/L	0.668	2.31	1.18	4	4
Lead	mg/L	ND	ND	ND	0	4
Nickel	mg/L	ND	ND	ND	0	4
PCB-1016	ug/L	ND	ND	ND	0	4
PCB-1221	ug/L	ND	ND	ND	0	4
PCB-1232	ug/L	ND	ND	ND	0	4
PCB-1242	ug/L	ND	ND	ND	0	4
PCB-1248	ug/L	ND	ND	ND	0	4
PCB-1254	ug/L	ND	ND	ND	0	4
PCB-1260	ug/L	ND	ND	ND	0	4
PCB-1268	ug/L	ND	ND	ND	0	4
pH	Std Unit	7.31	7.73	7.36	3	4
Phosphorous	mg/L	0.13	0.18	0.147	3	3
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	4
Sulfate	mg/L	23.7	23.7	23.7	1	1
Suspended Solids	mg/L	ND	ND	ND	0	4
Temperature	deg F	49.3	80.3	62.2	3	4
Trichloroethene	ug/L	ND	ND	ND	0	4
Zinc	mg/L	ND	ND	ND	0	4

Table 4.22 Non-Radiological Monitoring Data for Surface Water Location L12

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Conductivity	umho/cm	329	344	336	2	2
Dissolved Oxygen	mg/L	5.07	5.6	5.33	2	2
Flow Rate	mgd	ND	14.2	7.91	1	2
pH	Std Unit	6.6	6.72	6.66	2	2
Temperature	deg F	48	71.2	59.6	2	2
Trichloroethene	ug/L	1	1	1	2	2

Surface Water Non-Radiological Data

Table 4.23 Non-Radiological Monitoring Data for Surface Water Location L241

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Conductivity	umho/cm	267	293	280	2	2
Dissolved Oxygen	mg/L	6.03	14.4	10.2	2	2
Flow Rate	mgd	ND	4.5	2.81	1	2
pH	Std Unit	6.45	6.91	6.68	2	2
Temperature	deg F	40.8	74.2	57.5	2	2
Trichloroethene	ug/L	11	29	20	2	2

Table 4.24 Non-Radiological Monitoring Data for Surface Water Location LBCN1

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	1.37	3.21	2.29	2	2
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	2
Chloride	mg/L	8.9	11	9.95	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	190	190	176	1	2
Copper	mg/L	ND	0.03	0.0213	1	2
Dissolved Oxygen	mg/L	9.56	9.56	8.02	1	2
Flow Rate	mgd	ND	8.75	4.28	1	2
Hardness - Total as CaCO3	mg/L	59	61	60	2	2
Iron	mg/L	1.58	3.21	2.39	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.33	7.33	7.32	1	2
Phosphorous	mg/L	0.17	0.17	0.17	1	1
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	22.6	22.6	22.6	1	1
Suspended Solids	mg/L	ND	66	38.5	1	2
Temperature	deg F	71.3	71.3	60.1	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.25 Non-Radiological Monitoring Data for Surface Water Location C746K-5

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	4
Acetone	ug/L	ND	ND	ND	0	4
Aluminum	mg/L	ND	0.624	0.292	2	4
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	4
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	4
Chloride	mg/L	3.8	29.9	17.1	4	4
Chromium	mg/L	ND	ND	ND	0	4
Conductivity	umho/cm	212	261	213	3	4
Copper	mg/L	ND	ND	ND	0	4
Dissolved Oxygen	mg/L	8.1	14.6	9.73	3	4
Flow Rate	mgd	ND	7.8	1.28	2	4
Hardness - Total as CaCO3	mg/L	51	72	61.2	4	4
Iron	mg/L	0.496	1.02	0.722	4	4
Lead	mg/L	ND	ND	ND	0	4
Nickel	mg/L	ND	ND	ND	0	4
PCB-1016	ug/L	ND	ND	ND	0	4
PCB-1221	ug/L	ND	ND	ND	0	4
PCB-1232	ug/L	ND	ND	ND	0	4
PCB-1242	ug/L	ND	ND	ND	0	4
PCB-1248	ug/L	ND	ND	ND	0	4
PCB-1254	ug/L	ND	ND	ND	0	4
PCB-1260	ug/L	ND	ND	ND	0	4
PCB-1268	ug/L	ND	ND	ND	0	4
pH	Std Unit	7.4	8.49	7.8	3	4
Phosphorous	mg/L	0.07	0.09	0.08	3	3
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	4
Sulfate	mg/L	18	18	18	1	1
Suspended Solids	mg/L	ND	ND	ND	0	4
Temperature	deg F	55.1	84.9	67.9	3	4
Trichloroethene	ug/L	ND	ND	ND	0	4
Zinc	mg/L	ND	ND	ND	0	4

Surface Water Non-Radiological Data

Table 4.26 Non-Radiological Monitoring Data for Surface Water Location C746KTB1

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	ND	1.63	0.865	1	2
Ammonia as Nitrogen	mg/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	2
Chloride	mg/L	2.5	23.4	12.9	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	59.5	275	167	1	2
Copper	mg/L	ND	ND	ND	0	2
Cyanide	mg/L	ND	ND	ND	0	1
Dissolved Oxygen	mg/L	4.08	10.3	7.19	1	2
Flow Rate	mgd	ND	5.28	1.34	1	2
Hardness - Total as CaCO3	mg/L	26	69	47.5	2	2
Iron	mg/L	0.881	1.32	1.1	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
Nitrate/Nitrite as Nitrogen	mg/L	0.27	0.27	0.27	1	1
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.4	7.4	7.25	1	2
Phosphorous	mg/L	0.07	0.23	0.15	2	2
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	5.7	5.7	5.7	1	1
Suspended Solids	mg/L	ND	36	23.5	1	2
Temperature	deg F	74.4	74.4	60.3	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Turbidity	NTU	33	33	33	1	1
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.27 Non-Radiological Monitoring Data for Surface Water Location C746KTB2

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	ND	3.06	1.58	1	2
Ammonia as Nitrogen	mg/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	2
Chloride	mg/L	2.5	14.1	8.3	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	59.2	268	164	1	2
Copper	mg/L	ND	ND	ND	0	2
Cyanide	mg/L	ND	ND	ND	0	1
Dissolved Oxygen	mg/L	2.9	10.6	6.76	1	2
Flow Rate	mgd	ND	43.5	11	1	2
Hardness - Total as CaCO3	mg/L	28	69	48.5	2	2
Iron	mg/L	ND	2.53	1.31	1	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
Nitrate/Nitrite as Nitrogen	mg/L	0.29	0.29	0.29	1	1
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.14	7.14	6.97	1	2
Phosphorous	mg/L	0.16	0.35	0.255	2	2
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	5.7	5.7	5.7	1	1
Suspended Solids	mg/L	ND	57	34	1	2
Temperature	deg F	75.4	75.4	61.2	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Turbidity	NTU	45	45	45	1	1
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.28 Non-Radiological Monitoring Data for Surface Water Location C746KUP

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	0.891	3.1	2	2	2
Ammonia as Nitrogen	mg/L	ND	ND	ND	0	1
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	10	7.5	1	2
Chloride	mg/L	2.1	8.8	5.45	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	73.7	185	129	1	2
Copper	mg/L	ND	ND	ND	0	2
Cyanide	mg/L	ND	ND	ND	0	1
Dissolved Oxygen	mg/L	5.85	10.9	8.37	1	2
Flow Rate	mgd	ND	9.21	6.68	1	2
Hardness - Total as CaCO3	mg/L	34	63	48.5	2	2
Iron	mg/L	0.74	3.04	1.89	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
Nitrate/Nitrite as Nitrogen	mg/L	0.31	0.31	0.31	1	1
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.12	7.12	7.11	1	2
Phosphorous	mg/L	0.34	0.68	0.51	2	2
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Sulfate	mg/L	6.2	6.2	6.2	1	1
Suspended Solids	mg/L	44	55	49.5	2	2
Temperature	deg F	68.2	68.2	57	1	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Turbidity	NTU	37	37	37	1	1
Zinc	mg/L	ND	ND	ND	0	2

Surface Water Non-Radiological Data

Table 4.29 Non-Radiological Monitoring Data for Surface Water Location L8

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Conductivity	umho/cm	214	214	214	1	1
Dissolved Oxygen	mg/L	4.91	4.91	4.91	1	1
Flow Rate	mgd	14.8	14.8	14.8	1	1
pH	Std Unit	6.83	6.83	6.83	1	1
Temperature	deg F	80	80	80	1	1
Trichloroethene	ug/L	ND	ND	ND	0	1

Table 4.30 Non-Radiological Monitoring Data for Surface Water Location L29

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	4
Acetone	ug/L	ND	ND	ND	0	4
Aluminum	mg/L	0.485	2.4	1.04	4	4
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	4
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	4
Chloride	mg/L	12.4	18.9	16.1	4	4
Chromium	mg/L	ND	ND	ND	0	4
Conductivity	umho/cm	328	328	281	3	4
Copper	mg/L	ND	ND	ND	0	4
Dissolved Oxygen	mg/L	9.58	12	8.35	3	4
Hardness - Total as CaCO3	mg/L	89	160	122	4	4
Iron	mg/L	0.619	2.51	1.13	4	4
Lead	mg/L	ND	ND	ND	0	4
Nickel	mg/L	ND	ND	ND	0	4
PCB-1016	ug/L	ND	ND	ND	0	4
PCB-1221	ug/L	ND	ND	ND	0	4
PCB-1232	ug/L	ND	ND	ND	0	4
PCB-1242	ug/L	ND	ND	ND	0	4
PCB-1248	ug/L	ND	ND	ND	0	4
PCB-1254	ug/L	ND	ND	ND	0	4
PCB-1260	ug/L	ND	ND	ND	0	4
PCB-1268	ug/L	ND	ND	ND	0	4
pH	Std Unit	7.89	7.89	7.78	3	4
Phosphorous	mg/L	0.09	0.12	0.107	3	3
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	4
Sulfate	mg/L	32.9	32.9	32.9	1	1
Suspended Solids	mg/L	ND	71	34.2	3	4
Temperature	deg F	56.7	86.3	66.9	3	4
Trichloroethene	ug/L	ND	ND	ND	0	4
Zinc	mg/L	ND	ND	ND	0	4

Surface Water Non-Radiological Data

Table 4.31 Non-Radiological Monitoring Data for Surface Water Location L30

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	4
Acetone	ug/L	ND	ND	ND	0	4
Aluminum	mg/L	0.49	2.54	1.24	4	4
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	4
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	4
Chloride	mg/L	12.5	19.3	16.9	4	4
Chromium	mg/L	ND	ND	ND	0	4
Conductivity	umho/cm	278	305	264	3	4
Copper	mg/L	ND	ND	ND	0	4
Dissolved Oxygen	mg/L	9.57	12.3	8.8	3	4
Hardness - Total as CaCO3	mg/L	95	164	124	4	4
Iron	mg/L	0.65	3.07	1.51	4	4
Lead	mg/L	ND	ND	ND	0	4
Nickel	mg/L	ND	ND	ND	0	4
PCB-1016	ug/L	ND	ND	ND	0	4
PCB-1221	ug/L	ND	ND	ND	0	4
PCB-1232	ug/L	ND	ND	ND	0	4
PCB-1242	ug/L	ND	ND	ND	0	4
PCB-1248	ug/L	ND	ND	ND	0	4
PCB-1254	ug/L	ND	ND	ND	0	4
PCB-1260	ug/L	ND	ND	ND	0	4
PCB-1268	ug/L	ND	ND	ND	0	4
pH	Std Unit	7.88	7.88	7.79	3	4
Phosphorous	mg/L	0.11	0.2	0.143	3	3
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	4
Sulfate	mg/L	38.2	38.2	38.2	1	1
Suspended Solids	mg/L	ND	92	43.7	3	4
Temperature	deg F	59.8	84	67.8	3	4
Trichloroethene	ug/L	ND	ND	ND	0	4
Zinc	mg/L	ND	ND	ND	0	4

Surface Water Non-Radiological Data

Table 4.32 Non-Radiological Monitoring Data for Surface Water Location L306

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	4
Acetone	ug/L	ND	ND	ND	0	4
Aluminum	mg/L	0.323	6.46	2.01	4	4
Biochemical Oxygen Demand (BOD)	mg/L	ND	ND	ND	0	1
Cadmium	mg/L	ND	ND	ND	0	4
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	4
Chloride	mg/L	13.5	30.9	21.3	4	4
Chromium	mg/L	ND	ND	ND	0	4
Conductivity	umho/cm	326	379	334	3	4
Copper	mg/L	ND	ND	ND	0	4
Dissolved Oxygen	mg/L	9.61	12.5	9.03	3	4
Hardness - Total as CaCO3	mg/L	108	170	149	4	4
Iron	mg/L	0.435	7.63	2.42	4	4
Lead	mg/L	ND	ND	ND	0	4
Nickel	mg/L	ND	ND	ND	0	4
PCB-1016	ug/L	ND	ND	ND	0	4
PCB-1221	ug/L	ND	ND	ND	0	4
PCB-1232	ug/L	ND	ND	ND	0	4
PCB-1242	ug/L	ND	ND	ND	0	4
PCB-1248	ug/L	ND	ND	ND	0	4
PCB-1254	ug/L	ND	ND	ND	0	4
PCB-1260	ug/L	ND	ND	ND	0	4
PCB-1268	ug/L	ND	ND	ND	0	4
pH	Std Unit	8.01	8.01	7.78	3	4
Phosphorous	mg/L	0.07	0.21	0.153	3	3
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	4
Sulfate	mg/L	33.2	33.2	33.2	1	1
Suspended Solids	mg/L	ND	180	75	2	3
Temperature	deg F	57.6	84.9	66.3	3	4
Trichloroethene	ug/L	ND	ND	ND	0	4
Zinc	mg/L	ND	ND	ND	0	4

Surface Water Non-Radiological Data

Table 4.33 Non-Radiological Monitoring Data for Surface Water Location L64

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
2-Propanol	ug/L	ND	ND	ND	0	2
Acetone	ug/L	ND	ND	ND	0	2
Aluminum	mg/L	ND	2.44	1.27	1	2
Cadmium	mg/L	ND	ND	ND	0	2
Carbonaceous Biochemical Oxygen De	mg/L	ND	ND	ND	0	2
Chloride	mg/L	7.1	19.5	13.3	2	2
Chromium	mg/L	ND	ND	ND	0	2
Conductivity	umho/cm	117	165	141	2	2
Copper	mg/L	ND	ND	ND	0	2
Dissolved Oxygen	mg/L	7.49	12.3	9.91	2	2
Flow Rate	mgd	ND	2.16	1.29	1	2
Hardness - Total as CaCO3	mg/L	40	49	44.5	2	2
Iron	mg/L	0.922	2.6	1.76	2	2
Lead	mg/L	ND	ND	ND	0	2
Nickel	mg/L	ND	ND	ND	0	2
PCB-1016	ug/L	ND	ND	ND	0	2
PCB-1221	ug/L	ND	ND	ND	0	2
PCB-1232	ug/L	ND	ND	ND	0	2
PCB-1242	ug/L	ND	ND	ND	0	2
PCB-1248	ug/L	ND	ND	ND	0	2
PCB-1254	ug/L	ND	ND	ND	0	2
PCB-1260	ug/L	ND	ND	ND	0	2
PCB-1268	ug/L	ND	ND	ND	0	2
pH	Std Unit	7.2	7.39	7.29	2	2
Phosphorous	mg/L	0.09	0.18	0.135	2	2
Polychlorinated biphenyl	ug/L	ND	ND	ND	0	2
Suspended Solids	mg/L	ND	ND	ND	0	2
Temperature	deg F	46.3	83.2	64.7	2	2
Trichloroethene	ug/L	ND	ND	ND	0	2
Zinc	mg/L	ND	ND	ND	0	2

Sediment Non-Radiological Data

Table 4.34 Non-Radiological Data for Sediment Location S20

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	3.4	2.27	1	2
4,4'-DDE	ug/kg	ND	12	3.33	1	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	1640	3230	2440	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	ND	ND	0	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	37.9	37.9	29.8	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	500	137	1	4
Benzo(a)pyrene	ug/Kg	ND	ND	ND	0	4
Benzo(b)fluoranthene	ug/Kg	ND	500	139	1	4
Benzo(e)pyrene	ug/Kg	ND	ND	ND	0	2
Benzo(ghi)perylene	ug/Kg	ND	ND	ND	0	4
Benzo(k)fluoranthene	ug/Kg	ND	ND	ND	0	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	392	563	478	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	8.14	8.14	6.79	1	2
Chrysene	ug/Kg	ND	500	137	1	4
Chrysene C1	ug/Kg	ND	ND	ND	0	2
Cobalt	mg/kg	ND	2.99	2.12	1	2
Copper	mg/kg	ND	3.05	2.15	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Demeton	ug/kg	ND	ND	ND	0	1
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	ug/Kg	ND	ND	ND	0	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	ND	770	502	1	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Ethyl parathion	ug/kg	ND	ND	ND	0	2
Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	500	143	1	4
Fluoranthene C1	ug/Kg	ND	ND	ND	0	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	4.2	38.9	21.6	2	2
Grain Size Diameter > 0.125 mm	%	9.01	19.9	14.5	2	2
Grain Size Diameter > 0.25 mm	%	19.6	51	35.3	2	2
Grain Size Diameter > 0.5 mm	%	5.27	22.4	13.9	2	2
Grain Size Diameter > 1 mm	%	1.29	4.79	3.04	2	2
Grain Size Diameter > 2 mm	%	1.09	4.15	2.62	2	2
Grain Size Diameter > 4 mm	%	0.664	0.71	0.687	2	2
Grain Size Diameter > 8 mm	%	0.296	0.65	0.473	2	2
Grain Size Diameter >16 mm	%	0	0.0252	0.0126	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	0	15.8	7.92	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	ND	ND	0	4
Iron	mg/kg	6460	6460	5780	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	180	401	290	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	160	164	162	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	34.8	43.3	39	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	8	9	8.5	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	37	140	88.5	2	2

Sediment Non-Radiological Data

n-Eicosane	ug/Kg	6	10	8	2	2
n-Heneicosane	ug/Kg	11	16	13.5	2	2
n-Hentriacontane	ug/Kg	680	2600	1640	2	2
n-Heptacosane	ug/Kg	440	690	565	2	2
n-Heptadecane	ug/Kg	35	47	41	2	2
n-Hexacosane	ug/Kg	33	41	37	2	2
n-Hexadecane	ug/Kg	8	10	9	2	2
Nickel	mg/kg	ND	ND	ND	0	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	1100	2600	1850	2	2
n-Nonadecane	ug/Kg	ND	320	85.5	1	2
n-Octacosane	ug/Kg	57	84	70.5	2	2
n-Octadecane	ug/Kg	6	10	8	2	2
n-Pentacosane	ug/Kg	120	130	125	2	2
n-Pentadecane	ug/Kg	11	15	13	2	2
n-Tetracosane	ug/Kg	16	17	16.5	2	2
n-Tetradecane	ug/Kg	6	9	7.5	2	2
n-Tetratriacontane	UG/KG	ND	380	105	1	2
n-Triacontane	ug/Kg	51	200	126	2	2
n-Tricosane	ug/Kg	34	41	37.5	2	2
n-Tridecane	ug/Kg	ND	320	82	1	2
n-Tritriacontane	ug/Kg	200	820	510	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	ND	ND	0	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	25	30.8	27.9	2	2
Perylene	ug/Kg	ND	ND	ND	0	2
Phenanthrene	ug/Kg	ND	500	135	1	4
Phenanthrene C1	ug/Kg	37	37	27.5	1	2
Phenanthrene C2	ug/Kg	ND	72	52.2	1	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	ND	250	175	1	2
Pristane	ug/Kg	ND	320	95.5	1	2
Pyrene	ug/Kg	ND	500	139	1	4
Pyrene C1	ug/Kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Pyridine	ug/kg	ND	ND	ND	0	2
Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	290	195	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	7320	8460	7890	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	8.88	14.7	11.8	1	2
Zinc	mg/kg	ND	20	10.8	1	2

Sediment Non-Radiological Data

Table 4.35 Non-Radiological Data for Sediment Location C612

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	15	4.35	1	2
4,4'-DDE	ug/kg	ND	ND	ND	0	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	5060	5490	5280	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	ND	ND	0	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	87.1	87.1	63.7	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	480	216	1	4
Benzo(a)pyrene	ug/Kg	ND	480	173	1	4
Benzo(b)fluoranthene	ug/Kg	ND	580	270	1	4
Benzo(e)pyrene	ug/Kg	360	360	190	1	2
Benzo(ghi)perylene	ug/Kg	ND	480	175	1	4
Benzo(k)fluoranthene	ug/Kg	ND	480	162	1	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	1460	29200	15300	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	13.6	13.6	11.9	1	2
Chrysene	ug/Kg	ND	480	176	1	4
Chrysene C1	ug/Kg	ND	ND	ND	0	2
Cobalt	mg/kg	3.16	4.95	4.05	2	2
Copper	mg/kg	8.79	10	9.39	1	2
Coumaphos	ug/kg	ND	30	19	1	2
delta-BHC	ug/kg	ND	15	3.91	1	2
Demeton	ug/kg	ND	ND	ND	0	1
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	480	137	1	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	UG/KG	ND	160	112	1	2
Dichlorvos	ug/kg	ND	30	16.5	1	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	ND	1400	818	1	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	15	7.7	1	2

Sediment Non-Radiological Data

Ethyl parathion	ug/kg	ND	ND	ND	0	2
Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	680	298	1	4
Fluoranthene C1	ug/Kg	ND	140	87.7	1	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	7	9.9	8.45	2	2
Grain Size Diameter > 0.125 mm	%	4.86	8.18	6.52	2	2
Grain Size Diameter > 0.25 mm	%	4.47	5.3	4.88	2	2
Grain Size Diameter > 0.5 mm	%	7.66	9.19	8.42	2	2
Grain Size Diameter > 1 mm	%	14.8	16.7	15.8	2	2
Grain Size Diameter > 2 mm	%	8.81	13.8	11.3	2	2
Grain Size Diameter > 4 mm	%	1.77	2.62	2.2	2	2
Grain Size Diameter > 8 mm	%	0	0.894	0.447	2	2
Grain Size Diameter >16 mm	%	0	0	0	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	41.3	42.8	42.1	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	480	193	1	4
Iron	mg/kg	7960	7960	7040	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	854	2340	1600	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	81.6	406	244	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	67.5	72.6	70	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	12	22	17	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	79	92	85.5	2	2

Sediment Non-Radiological Data

n-Eicosane	ug/Kg	10	37	23.5	2	2
n-Heneicosane	ug/Kg	15	51	33	2	2
n-Hentriacontane	ug/Kg	1200	1900	1550	2	2
n-Heptacosane	ug/Kg	170	410	290	2	2
n-Heptadecane	ug/Kg	130	520	325	2	2
n-Hexacosane	ug/Kg	29	66	47.5	2	2
n-Hexadecane	ug/Kg	13	28	20.5	2	2
Nickel	mg/kg	9.15	11.7	10.4	2	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	930	1200	1060	2	2
n-Nonadecane	UG/KG	ND	490	126	1	2
n-Octacosane	ug/Kg	71	110	90.5	2	2
n-Octadecane	ug/Kg	13	35	24	2	2
n-Pentacosane	ug/Kg	58	170	114	2	2
n-Pentadecane	ug/Kg	15	31	23	2	2
n-Tetracosane	ug/Kg	17	34	25.5	2	2
n-Tetradecane	UG/KG	ND	490	128	1	2
n-Tetratriacontane	UG/KG	ND	490	131	1	2
n-Triacontane	ug/Kg	120	120	120	2	2
n-Tricosane	ug/Kg	37	110	73.5	2	2
n-Tridecane	UG/KG	ND	490	126	1	2
n-Tritriacontane	ug/Kg	570	680	625	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	100	70	1	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	90	67.5	1	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	43	43.2	43.1	2	2
Perylene	ug/Kg	ND	95	65.2	1	2
Phenanthrene	ug/Kg	ND	480	208	1	4
Phenanthrene C1	ug/Kg	66	66	54	1	2
Phenanthrene C2	ug/Kg	ND	ND	ND	0	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	386	453	420	2	2
Pristane	ug/Kg	ND	ND	ND	0	2
Pyrene	ug/Kg	ND	540	260	1	4
Pyrene C1	ug/Kg	ND	150	92.7	1	2

Sediment Non-Radiological Data

Pyridine	ug/kg	ND	ND	ND	0	2
Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	354	227	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	20000	24700	22400	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	17.7	17.7	13.9	1	2
Zinc	mg/kg	98.4	98.4	66.5	1	2

Sediment Non-Radiological Data

Table 4.36 Non-Radiological Data for Sediment Location C616

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	2.2	0.86	1	2
2,4'-DDT	ug/kg	ND	2.2	0.825	1	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	UG/KG	ND	490	140	1	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	ND	ND	0	2
4,4'-DDE	ug/kg	ND	ND	ND	0	2
4,4'-DDT	ug/kg	ND	12	3.45	1	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	4710	7070	5890	2	2
Aniline	ug/kg	ND	490	368	1	2
Anthracene	ug/Kg	ND	ND	ND	0	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	87	87	64.5	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	UG/KG	ND	490	139	1	4
Benzo(a)pyrene	ug/Kg	ND	ND	ND	0	4
Benzo(b)fluoranthene	UG/KG	ND	490	141	1	4
Benzo(e)pyrene	ug/Kg	ND	ND	ND	0	2
Benzo(ghi)perylene	ug/Kg	ND	ND	ND	0	4
Benzo(k)fluoranthene	UG/KG	ND	490	142	1	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	1050	1210	1130	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	77.9	77.9	52.8	1	2
Chrysene	ug/Kg	ND	ND	ND	0	4
Chrysene C1	ug/Kg	ND	ND	ND	0	2
Cobalt	mg/kg	3.76	5.33	4.54	2	2
Copper	mg/kg	31.6	31.6	22.9	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	12	3.5	1	2
Demeton	ug/kg	11	11	11	1	1
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	ug/Kg	ND	ND	ND	0	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	690	1100	895	2	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Ethyl parathion	ug/kg	ND	ND	ND	0	2
Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	UG/KG	ND	490	142	1	4
Fluoranthene C1	ug/Kg	ND	ND	ND	0	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	5.73	9.55	7.64	2	2
Grain Size Diameter > 0.125 mm	%	5.79	24.9	15.3	2	2
Grain Size Diameter > 0.25 mm	%	6.51	17.5	12	2	2
Grain Size Diameter > 0.5 mm	%	1.82	11.9	6.85	2	2
Grain Size Diameter > 1 mm	%	3.79	20.6	12.2	2	2
Grain Size Diameter > 2 mm	%	1.59	16.3	8.95	2	2
Grain Size Diameter > 4 mm	%	0.946	2.95	1.95	2	2
Grain Size Diameter > 8 mm	%	0.0405	2.13	1.09	2	2
Grain Size Diameter >16 mm	%	0	0	0	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	30.3	38	34.2	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	ND	ND	0	4
Iron	mg/kg	6300	11000	8650	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	614	804	709	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	181	224	202	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	43.8	96.3	70	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	UG/KG	ND	98	37	1	2
Naphthalene C2	UG/KG	ND	98	33.5	1	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	16	25	20.5	2	2
n-Dodecane	UG/KG	ND	450	118	1	2
n-Dotriacontane	ug/Kg	72	100	86	2	2

Sediment Non-Radiological Data

n-Eicosane	ug/Kg	15	28	21.5	2	2
n-Heneicosane	ug/Kg	20	36	28	2	2
n-Hentriacontane	ug/Kg	1700	1900	1800	2	2
n-Heptacosane	ug/Kg	200	320	260	2	2
n-Heptadecane	ug/Kg	47	160	104	2	2
n-Hexacosane	ug/Kg	31	48	39.5	2	2
n-Hexadecane	ug/Kg	18	18	18	2	2
Nickel	mg/kg	13.6	21.7	17.6	2	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	1000	1100	1050	2	2
n-Nonadecane	ug/Kg	11	16	13.5	2	2
n-Octacosane	ug/Kg	66	90	78	2	2
n-Octadecane	ug/Kg	17	19	18	2	2
n-Pentacosane	ug/Kg	70	120	95	2	2
n-Pentadecane	ug/Kg	11	21	16	2	2
n-Tetracosane	ug/Kg	18	31	24.5	2	2
n-Tetradecane	ug/Kg	17	18	17.5	2	2
n-Tetratriacontane	ug/Kg	19	21	20	2	2
n-Triacontane	ug/Kg	110	130	120	2	2
n-Tricosane	ug/Kg	44	75	59.5	2	2
n-Tridecane	UG/KG	ND	450	118	1	2
n-Tritriacontane	ug/Kg	440	600	520	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	ND	ND	0	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	26.4	47.5	37	2	2
Perylene	ug/Kg	ND	ND	ND	0	2
Phenanthrene	UG/KG	ND	490	142	1	4
Phenanthrene C1	UG/KG	ND	98	32.5	1	2
Phenanthrene C2	ug/Kg	ND	ND	ND	0	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	360	483	422	2	2
Pristane	UG/KG	ND	450	133	1	2
Pyrene	ug/Kg	ND	ND	ND	0	4
Pyrene C1	ug/Kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Pyridine	ug/kg	ND	ND	ND	0	2
Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	251	251	229	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	7300	46900	27100	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	15.3	15.3	14.7	1	2
Zinc	mg/kg	32.8	32.8	31.5	1	2

Sediment Non-Radiological Data

Table 4.37 Non-Radiological Data for Sediment Location K001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	ND	ND	0	2
4,4'-DDE	ug/kg	ND	ND	ND	0	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	30	9	1	2
Aluminum	mg/kg	3440	4370	3900	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	ND	ND	0	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	40	40	37.9	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	490	164	1	4
Benzo(a)pyrene	ug/Kg	ND	490	152	1	4
Benzo(b)fluoranthene	ug/Kg	ND	490	178	1	4
Benzo(e)pyrene	ug/Kg	48	110	79	1	2
Benzo(ghi)perylene	UG/KG	ND	490	142	1	4
Benzo(k)fluoranthene	ug/Kg	ND	490	147	1	4
Benzoic acid	ug/kg	ND	510	378	1	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	1410	1730	1570	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	31.6	31.6	21.9	1	2
Chrysene	ug/Kg	ND	490	152	1	4
Chrysene C1	ug/Kg	ND	78	57.5	1	2
Cobalt	mg/kg	2.81	6.56	4.68	2	2
Copper	mg/kg	13.7	13.7	12	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	ug/Kg	ND	ND	ND	0	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	1300	1600	1450	2	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	15	5.25	1	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	490	209	1	4
Fluoranthene C1	ug/Kg	44	44	32.5	1	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	30	8.5	1	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	8.58	10.1	9.36	2	2
Grain Size Diameter > 0.125 mm	%	9.15	9.3	9.23	2	2
Grain Size Diameter > 0.25 mm	%	5.9	6.36	6.13	2	2
Grain Size Diameter > 0.5 mm	%	2.69	5.96	4.32	2	2
Grain Size Diameter > 1 mm	%	6.68	11.7	9.18	2	2
Grain Size Diameter > 2 mm	%	4.74	5.85	5.3	2	2
Grain Size Diameter > 4 mm	%	0.74	1.02	0.882	2	2
Grain Size Diameter > 8 mm	%	0.327	0.764	0.546	2	2
Grain Size Diameter >16 mm	%	0	0	0	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	51.1	59	55	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	490	146	1	4
Iron	mg/kg	8580	8580	6610	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	573	650	612	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	47.7	168	108	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	59.9	76.5	68.2	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	9	17	13	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	34	47	40.5	2	2
n-Eicosane	ug/Kg	12	20	16	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	19	36	27.5	2	2
n-Hentriacontane	ug/Kg	560	1000	780	2	2
n-Heptacosane	ug/Kg	140	220	180	2	2
n-Heptadecane	ug/Kg	82	95	88.5	2	2
n-Hexacosane	ug/Kg	24	42	33	2	2
n-Hexadecane	ug/Kg	8	21	14.5	2	2
Nickel	mg/kg	7.02	15.2	11.1	2	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	820	1800	1310	2	2
n-Nonadecane	ug/Kg	14	16	15	2	2
n-Octacosane	ug/Kg	56	110	83	2	2
n-Octadecane	ug/Kg	12	24	18	2	2
n-Pentacosane	ug/Kg	56	88	72	2	2
n-Pentadecane	ug/Kg	10	18	14	2	2
n-Tetracosane	ug/Kg	12	24	18	2	2
n-Tetradecane	ug/Kg	ND	370	99.5	1	2
n-Tetratriacontane	ug/Kg	ND	ND	ND	0	2
n-Triacontane	ug/Kg	62	120	91	2	2
n-Tricosane	ug/Kg	34	69	51.5	2	2
n-Tridecane	ug/Kg	ND	370	95.5	1	2
n-Tritriacontane	ug/Kg	180	270	225	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	80	170	125	2	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	80	170	125	2	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	37.3	43.7	40.5	2	2
Perylene	ug/Kg	29	29	25	1	2
Phenanthrene	ug/Kg	ND	490	164	1	4
Phenanthrene C1	ug/Kg	ND	100	68.5	1	2
Phenanthrene C2	UG/KG	ND	110	37	1	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	286	359	322	2	2
Pristane	ug/Kg	ND	ND	ND	0	2
Pyrene	ug/Kg	ND	490	184	1	4
Pyrene C1	ug/Kg	48	48	33.5	1	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	288	194	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	12300	14800	13500	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	9.36	13.3	11.3	1	2
Zinc	mg/kg	68.4	68.4	54.4	1	2

Sediment Non-Radiological Data

Table 4.38 Non-Radiological Data for Sediment Location K006

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	ND	ND	0	2
4,4'-DDE	ug/kg	ND	ND	ND	0	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	4130	5160	4640	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	ND	ND	0	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	45.1	45.1	38.5	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	ND	ND	0	4
Benzo(a)pyrene	ug/Kg	ND	ND	ND	0	4
Benzo(b)fluoranthene	ug/Kg	ND	ND	ND	0	4
Benzo(e)pyrene	ug/Kg	ND	ND	ND	0	2
Benzo(ghi)perylene	ug/Kg	ND	ND	ND	0	4
Benzo(k)fluoranthene	ug/Kg	ND	ND	ND	0	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	501	2510	1510	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	20.4	20.4	15.3	1	2
Chrysene	ug/Kg	ND	ND	ND	0	4
Chrysene C1	ug/Kg	ND	ND	ND	0	2
Cobalt	mg/kg	ND	6.07	3.66	1	2
Copper	mg/kg	8.32	8.32	6.16	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	UG/KG	ND	110	77.5	1	2
Dichlorvos	ug/kg	ND	22	13.5	1	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	ND	1200	720	1	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	ND	ND	0	4
Fluoranthene C1	ug/Kg	ND	ND	ND	0	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	5.65	12.3	9	2	2
Grain Size Diameter > 0.125 mm	%	7.29	10.5	8.89	2	2
Grain Size Diameter > 0.25 mm	%	8.67	26	17.3	2	2
Grain Size Diameter > 0.5 mm	%	8.05	9.77	8.91	2	2
Grain Size Diameter > 1 mm	%	10	13.7	11.8	2	2
Grain Size Diameter > 2 mm	%	3.63	14.9	9.25	2	2
Grain Size Diameter > 4 mm	%	3.21	7.98	5.59	2	2
Grain Size Diameter > 8 mm	%	3.31	5.88	4.59	2	2
Grain Size Diameter >16 mm	%	0	0	0	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	20.7	27.9	24.3	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	ND	ND	0	4
Iron	mg/kg	4890	16500	10700	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	451	695	573	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	121	263	192	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	23.9	32.6	28.2	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	4	7	5.5	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	9	18	13.5	2	2
n-Eicosane	ug/Kg	5	7	6	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	5	13	9	2	2
n-Hentriacontane	ug/Kg	130	380	255	2	2
n-Heptacosane	ug/Kg	93	350	222	2	2
n-Heptadecane	ug/Kg	7	64	35.5	2	2
n-Hexacosane	ug/Kg	10	23	16.5	2	2
n-Hexadecane	ug/Kg	ND	150	40	1	2
Nickel	mg/kg	ND	9.67	6.08	1	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	130	580	355	2	2
n-Nonadecane	ug/Kg	9	13	11	2	2
n-Octacosane	ug/Kg	15	36	25.5	2	2
n-Octadecane	ug/Kg	2	5	3.5	2	2
n-Pentacosane	ug/Kg	26	97	61.5	2	2
n-Pentadecane	ug/Kg	ND	150	44	1	2
n-Tetracosane	ug/Kg	6	12	9	2	2
n-Tetradecane	ug/Kg	ND	ND	ND	0	2
n-Tetratriacontane	ug/Kg	ND	ND	ND	0	2
n-Triacontane	ug/Kg	13	28	20.5	2	2
n-Tricosane	ug/Kg	10	26	18	2	2
n-Tridecane	ug/Kg	ND	ND	ND	0	2
n-Tritriacontane	ug/Kg	34	58	46	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	ND	ND	0	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	22.8	26	24.4	2	2
Perylene	ug/Kg	9	26	17.5	1	2
Phenanthrene	ug/Kg	ND	ND	ND	0	4
Phenanthrene C1	ug/Kg	ND	ND	ND	0	2
Phenanthrene C2	ug/Kg	ND	ND	ND	0	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	233	275	254	2	2
Pristane	ug/Kg	ND	ND	ND	0	2
Pyrene	ug/Kg	ND	ND	ND	0	4
Pyrene C1	ug/Kg	ND	ND	ND	0	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	ND	ND	0	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	1960	7130	4550	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	25.2	25.2	21.1	1	2
Zinc	mg/kg	24.2	24.2	18.2	1	2

Sediment Non-Radiological Data

Table 4.39 Non-Radiological Data for Sediment Location S1

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	UG/KG	ND	90	37	1	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	24	7.65	1	2
4,4'-DDE	ug/kg	ND	ND	ND	0	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	3800	4450	4120	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	ND	ND	0	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	29.4	29.4	25.5	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	UG/KG	ND	500	148	1	4
Benzo(a)pyrene	UG/KG	ND	500	148	1	4
Benzo(b)fluoranthene	ug/Kg	ND	500	150	1	4
Benzo(e)pyrene	UG/KG	ND	90	47	1	2
Benzo(ghi)perylene	UG/KG	ND	500	140	1	4
Benzo(k)fluoranthene	UG/KG	ND	500	151	1	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	0.629	0.439	1	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	669	889	779	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	9.87	26.6	18.2	1	2
Chrysene	UG/KG	ND	500	151	1	4
Chrysene C1	ug/Kg	ND	ND	ND	0	2
Cobalt	mg/kg	3.39	4.58	3.98	2	2
Copper	mg/kg	7.23	7.23	5.45	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	ug/Kg	ND	ND	ND	0	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	870	1400	1140	2	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	500	174	1	4
Fluoranthene C1	UG/KG	ND	90	36.5	1	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	6.89	7.23	7.06	2	2
Grain Size Diameter > 0.125 mm	%	17.2	23.8	20.5	2	2
Grain Size Diameter > 0.25 mm	%	35	42.1	38.6	2	2
Grain Size Diameter > 0.5 mm	%	5.25	8.28	6.77	2	2
Grain Size Diameter > 1 mm	%	2.06	6.06	4.06	2	2
Grain Size Diameter > 2 mm	%	1.23	1.39	1.31	2	2
Grain Size Diameter > 4 mm	%	0.232	2.65	1.44	2	2
Grain Size Diameter > 8 mm	%	0.582	3.32	1.95	2	2
Grain Size Diameter >16 mm	%	0	0	0	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	17.1	19.7	18.4	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	UG/KG	ND	500	142	1	4
Iron	mg/kg	7510	15400	11500	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	339	357	348	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	133	220	176	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	33	38.2	35.6	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	UG/KG	ND	90	34.5	1	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	7	46	26.5	2	2
n-Dodecane	UG/KG	ND	400	111	1	2
n-Dotriacontane	ug/Kg	38	73	55.5	2	2
n-Eicosane	ug/Kg	21	34	27.5	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	18	68	43	2	2
n-Hentriacontane	ug/Kg	500	680	590	2	2
n-Heptacosane	ug/Kg	150	350	250	2	2
n-Heptadecane	ug/Kg	55	600	328	2	2
n-Hexacosane	ug/Kg	20	97	58.5	2	2
n-Hexadecane	ug/Kg	10	45	27.5	2	2
Nickel	mg/kg	6.85	8.8	7.83	2	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	430	870	650	2	2
n-Nonadecane	ug/Kg	18	49	33.5	2	2
n-Octacosane	ug/Kg	42	110	76	2	2
n-Octadecane	ug/Kg	15	32	23.5	2	2
n-Pentacosane	ug/Kg	58	150	104	2	2
n-Pentadecane	ug/Kg	34	61	47.5	2	2
n-Tetracosane	ug/Kg	12	70	41	2	2
n-Tetradecane	UG/KG	ND	400	118	1	2
n-Tetratriacontane	UG/KG	ND	400	114	1	2
n-Triacontane	ug/Kg	44	130	87	2	2
n-Tricosane	ug/Kg	31	89	60	2	2
n-Tridecane	UG/KG	ND	400	114	1	2
n-Tritriacontane	ug/Kg	200	210	205	2	2
n-Undecane	UG/KG	ND	400	108	1	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	ND	ND	0	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	27	30.5	28.7	2	2
Perylene	UG/KG	ND	90	40	1	2
Phenanthrene	ug/Kg	ND	500	147	1	4
Phenanthrene C1	ug/Kg	57	57	55	1	2
Phenanthrene C2	UG/KG	ND	90	34	1	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	UG/KG	ND	400	130	1	2
Potassium	mg/kg	222	222	222	2	2
Pristane	UG/KG	ND	780	490	1	2
Pyrene	ug/Kg	ND	500	156	1	4
Pyrene C1	UG/KG	ND	90	38	1	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	286	193	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	4740	6540	5640	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	39.6	39.6	26.1	1	2
Zinc	mg/kg	24.4	24.4	24.3	1	2

Sediment Non-Radiological Data

Table 4.40 Non-Radiological Data for Sediment Location S31

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	ND	ND	0	2
4,4'-DDE	ug/kg	ND	ND	ND	0	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	5060	5460	5260	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	ND	ND	0	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	31	31	28.2	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	490	151	1	4
Benzo(a)pyrene	ug/Kg	ND	490	142	1	4
Benzo(b)fluoranthene	ug/Kg	ND	490	162	1	4
Benzo(e)pyrene	ug/Kg	72	72	48.5	1	2
Benzo(ghi)perylene	ug/Kg	ND	490	129	1	4
Benzo(k)fluoranthene	ug/Kg	ND	490	147	1	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	804	4820	2810	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	42.4	42.4	28.7	1	2
Chrysene	ug/Kg	ND	490	148	1	4
Chrysene C1	ug/Kg	ND	51	32.2	1	2
Cobalt	mg/kg	3.03	3.55	3.29	2	2
Copper	mg/kg	7.26	7.26	6.54	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	ug/Kg	ND	ND	ND	0	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	ND	790	518	1	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	490	178	1	4
Fluoranthene C1	ug/Kg	36	36	26	1	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	6.56	9.37	7.97	2	2
Grain Size Diameter > 0.125 mm	%	8.02	15.8	11.9	2	2
Grain Size Diameter > 0.25 mm	%	9.65	25	17.3	2	2
Grain Size Diameter > 0.5 mm	%	8.57	9.86	9.22	2	2
Grain Size Diameter > 1 mm	%	4.44	14.6	9.52	2	2
Grain Size Diameter > 2 mm	%	4.01	13.9	8.96	2	2
Grain Size Diameter > 4 mm	%	4.46	9.31	6.88	2	2
Grain Size Diameter > 8 mm	%	6.06	6.23	6.14	2	2
Grain Size Diameter >16 mm	%	0	4.52	2.26	2	2
Grain Size Diameter >31.5 mm	%	-0.00942	0	-	2	2
Grain Size Diameter Fines	%	15.5	23.7	19.6	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	490	135	1	4
Iron	mg/kg	12300	12300	11300	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	349	430	390	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	92.3	104	98.2	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	27.8	29.6	28.7	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	27	13.7	1	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	ND	270	71.5	1	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	8	17	12.5	2	2
n-Eicosane	ug/Kg	5	6	5.5	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	6	6	6	2	2
n-Hentriacontane	ug/Kg	110	200	155	2	2
n-Heptacosane	ug/Kg	58	59	58.5	2	2
n-Heptadecane	ug/Kg	9	10	9.5	2	2
n-Hexacosane	ug/Kg	10	11	10.5	2	2
n-Hexadecane	ug/Kg	5	6	5.5	2	2
Nickel	mg/kg	6.23	8.25	7.24	2	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	92	120	106	2	2
n-Nonadecane	ug/Kg	6	7	6.5	2	2
n-Octacosane	ug/Kg	10	16	13	2	2
n-Octadecane	ug/Kg	6	6	6	2	2
n-Pentacosane	ug/Kg	33	36	34.5	2	2
n-Pentadecane	ug/Kg	6	6	6	2	2
n-Tetracosane	ug/Kg	9	9	9	2	2
n-Tetradecane	ug/Kg	ND	270	69.5	1	2
n-Tetratriacontane	ug/Kg	ND	270	71.5	1	2
n-Triacontane	ug/Kg	10	22	16	2	2
n-Tricosane	ug/Kg	9	11	10	2	2
n-Tridecane	ug/Kg	ND	270	69.5	1	2
n-Tritriacontane	ug/Kg	50	77	63.5	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	ND	ND	0	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	22	25.1	23.5	2	2
Perylene	ug/Kg	19	19	18	1	2
Phenanthrene	ug/Kg	ND	490	151	1	4
Phenanthrene C1	ug/Kg	ND	31	22.2	1	2
Phenanthrene C2	ug/Kg	ND	ND	ND	0	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	ND	ND	ND	0	2
Pristane	ug/Kg	ND	270	80	1	2
Pyrene	ug/Kg	ND	490	164	1	4
Pyrene C1	ug/Kg	38	38	26.5	1	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	1.08	0.79	1	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	ND	ND	0	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	3250	4360	3810	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	31.5	31.5	26.8	1	2
Zinc	mg/kg	21.4	21.4	20.4	1	2

Sediment Non-Radiological Data

Table 4.41 Non-Radiological Data for Sediment Location S33

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	ND	ND	0	2
4,4'-DDE	ug/kg	ND	11	3.09	1	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	480	129	1	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	3620	3890	3760	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	480	131	1	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	31.9	31.9	30.7	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	480	155	1	4
Benzo(a)pyrene	ug/Kg	ND	480	144	1	4
Benzo(b)fluoranthene	ug/Kg	ND	480	162	1	4
Benzo(e)pyrene	ug/Kg	83	83	55	1	2
Benzo(ghi)perylene	UG/KG	ND	480	129	1	4
Benzo(k)fluoranthene	ug/Kg	ND	480	146	1	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	571	632	602	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	9.09	9.09	9.03	1	2
Chrysene	ug/Kg	ND	480	148	1	4
Chrysene C1	ug/Kg	ND	62	43	1	2
Cobalt	mg/kg	2.9	3.08	2.99	2	2
Copper	mg/kg	5.81	5.81	5.75	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	11	3.08	1	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	UG/KG	ND	87	54.5	1	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	630	4000	2320	2	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	480	186	1	4
Fluoranthene C1	ug/Kg	40	40	28	1	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	6.42	9.23	7.83	2	2
Grain Size Diameter > 0.125 mm	%	5.75	28	16.9	2	2
Grain Size Diameter > 0.25 mm	%	3.96	21.7	12.8	2	2
Grain Size Diameter > 0.5 mm	%	2.76	6.76	4.76	2	2
Grain Size Diameter > 1 mm	%	1.47	15.2	8.31	2	2
Grain Size Diameter > 2 mm	%	0.898	20.7	10.8	2	2
Grain Size Diameter > 4 mm	%	0.735	10.3	5.54	2	2
Grain Size Diameter > 8 mm	%	0.0121	1.91	0.962	2	2
Grain Size Diameter >16 mm	%	0	0.0034	0.0017	2	2
Grain Size Diameter >31.5 mm	%	-0.0102	0	-	2	2
Grain Size Diameter Fines	%	31.2	33.2	32.2	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	480	134	1	4
Iron	mg/kg	5680	5680	5680	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	379	427	403	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	171	226	198	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	36.2	39.4	37.8	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	7	10	8.5	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	32	36	34	2	2
n-Eicosane	ug/Kg	6	9	7.5	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	11	14	12.5	2	2
n-Hentriacontane	ug/Kg	520	600	560	2	2
n-Heptacosane	ug/Kg	190	280	235	2	2
n-Heptadecane	ug/Kg	43	56	49.5	2	2
n-Hexacosane	ug/Kg	25	26	25.5	2	2
n-Hexadecane	ug/Kg	5	12	8.5	2	2
Nickel	mg/kg	ND	6.33	4.41	1	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	410	590	500	2	2
n-Nonadecane	ug/Kg	5	9	7	2	2
n-Octacosane	ug/Kg	34	49	41.5	2	2
n-Octadecane	ug/Kg	6	13	9.5	2	2
n-Pentacosane	ug/Kg	76	78	77	2	2
n-Pentadecane	ug/Kg	8	14	11	2	2
n-Tetracosane	ug/Kg	14	14	14	2	2
n-Tetradecane	ug/Kg	3	10	6.5	2	2
n-Tetratriacontane	UG/KG	ND	380	100	1	2
n-Triacontane	ug/Kg	41	53	47	2	2
n-Tricosane	ug/Kg	24	30	27	2	2
n-Tridecane	ug/Kg	ND	ND	ND	0	2
n-Tritriacontane	ug/Kg	190	200	195	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	ND	ND	0	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	24.2	27.2	25.7	2	2
Perylene	ug/Kg	27	27	21	1	2
Phenanthrene	ug/Kg	ND	480	167	1	4
Phenanthrene C1	ug/Kg	54	54	42	1	2
Phenanthrene C2	ug/Kg	ND	ND	ND	0	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	230	278	254	2	2
Pristane	ug/Kg	ND	240	82.5	1	2
Pyrene	ug/Kg	ND	480	175	1	4
Pyrene C1	ug/Kg	36	36	24	1	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	ND	ND	0	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	5740	6060	5900	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	9.94	12	11	1	2
Zinc	mg/kg	23.5	23.5	20.8	1	2

Sediment Non-Radiological Data

Table 4.42 Non-Radiological Data for Sediment Location S21

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	ND	ND	0	2
4,4'-DDE	ug/kg	ND	ND	ND	0	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	5440	6590	6020	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	ND	ND	0	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	64.6	64.6	59.4	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	ND	ND	0	4
Benzo(a)pyrene	ug/Kg	ND	ND	ND	0	4
Benzo(b)fluoranthene	ug/Kg	ND	ND	ND	0	4
Benzo(e)pyrene	ug/Kg	ND	ND	ND	0	2
Benzo(ghi)perylene	ug/Kg	ND	ND	ND	0	4
Benzo(k)fluoranthene	ug/Kg	ND	ND	ND	0	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	1510	1900	1700	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	16.5	16.5	13.8	1	2
Chrysene	ug/Kg	ND	ND	ND	0	4
Chrysene C1	ug/Kg	ND	ND	ND	0	2
Cobalt	mg/kg	4.06	5.79	4.92	2	2
Copper	mg/kg	6.09	6.09	5.66	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	ug/Kg	ND	ND	ND	0	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	ND	870	555	1	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	ND	ND	0	4
Fluoranthene C1	ug/Kg	ND	ND	ND	0	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	4.39	6.05	5.22	2	2
Grain Size Diameter > 0.125 mm	%	7.77	8.59	8.18	2	2
Grain Size Diameter > 0.25 mm	%	9.71	11.2	10.5	2	2
Grain Size Diameter > 0.5 mm	%	8.76	9.88	9.32	2	2
Grain Size Diameter > 1 mm	%	15.6	17.2	16.4	2	2
Grain Size Diameter > 2 mm	%	12.6	21.7	17.1	2	2
Grain Size Diameter > 4 mm	%	2.67	7.71	5.19	2	2
Grain Size Diameter > 8 mm	%	0.012	0.938	0.475	2	2
Grain Size Diameter >16 mm	%	0	0.016	0.0079	2	2
Grain Size Diameter >31.5 mm	%	0	0.004	0.002	2	2
Grain Size Diameter Fines	%	22.9	32.5	27.7	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	ND	ND	0	4
Iron	mg/kg	9000	10700	9850	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	705	725	715	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	80.5	228	154	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	33.1	37.6	35.3	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	28	30	29	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	54	98	76	2	2
n-Eicosane	ug/Kg	12	14	13	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	24	34	29	2	2
n-Hentriacontane	ug/Kg	460	1800	1130	2	2
n-Heptacosane	ug/Kg	130	400	265	2	2
n-Heptadecane	ug/Kg	23	41	32	2	2
n-Hexacosane	ug/Kg	42	69	55.5	2	2
n-Hexadecane	ug/Kg	3	12	7.5	2	2
Nickel	mg/kg	5.88	7.91	6.89	2	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	380	2200	1290	2	2
n-Nonadecane	ug/Kg	7	8	7.5	2	2
n-Octacosane	ug/Kg	56	130	93	2	2
n-Octadecane	ug/Kg	8	10	9	2	2
n-Pentacosane	ug/Kg	71	160	116	2	2
n-Pentadecane	ug/Kg	10	11	10.5	2	2
n-Tetracosane	ug/Kg	43	58	50.5	2	2
n-Tetradecane	ug/Kg	ND	160	44	1	2
n-Tetratriacontane	ug/Kg	32	49	40.5	2	2
n-Triacontane	ug/Kg	57	130	93.5	2	2
n-Tricosane	ug/Kg	57	84	70.5	2	2
n-Tridecane	ug/Kg	ND	ND	ND	0	2
n-Tritriacontane	ug/Kg	200	490	345	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	ND	ND	0	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	26.2	27.9	27	2	2
Perylene	ug/Kg	ND	ND	ND	0	2
Phenanthrene	ug/Kg	ND	ND	ND	0	4
Phenanthrene C1	UG/KG	ND	47	16.2	1	2
Phenanthrene C2	ug/Kg	ND	ND	ND	0	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	ND	250	175	1	2
Pristane	ug/Kg	ND	ND	ND	0	2
Pyrene	ug/Kg	ND	ND	ND	0	4
Pyrene C1	ug/Kg	ND	ND	ND	0	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	239	170	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	6000	6100	6050	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	22.8	22.8	19.1	1	2
Zinc	mg/kg	ND	22.1	16	1	2

Sediment Non-Radiological Data

Table 4.43 Non-Radiological Data for Sediment Location K010

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	ND	ND	0	2
4,4'-DDE	ug/kg	ND	ND	ND	0	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	480	138	1	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	4560	8100	6330	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	480	142	1	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	51.6	51.6	47.3	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	620	296	1	4
Benzo(a)pyrene	ug/Kg	ND	480	225	1	4
Benzo(b)fluoranthene	ug/Kg	ND	1100	422	1	4
Benzo(e)pyrene	ug/Kg	84	630	357	1	2
Benzo(ghi)perylene	ug/Kg	ND	480	186	1	4
Benzo(k)fluoranthene	ug/Kg	ND	480	214	1	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	940	590	1	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	1280	6100	3690	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	23.5	23.5	18.2	1	2
Chrysene	ug/Kg	ND	480	249	1	4
Chrysene C1	ug/Kg	ND	320	179	1	2
Cobalt	mg/kg	3.97	4.23	4.1	2	2
Copper	mg/kg	8.23	17.2	12.7	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	480	138	1	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	ug/Kg	ND	ND	ND	0	2
Dichlorvos	ug/kg	ND	31	13.7	1	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	ND	680	460	1	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	15	4.95	1	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	1100	602	2	4
Fluoranthene C1	ug/Kg	37	190	114	1	2
Fluorene	ug/Kg	ND	480	136	1	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	6.67	7.77	7.22	2	2
Grain Size Diameter > 0.125 mm	%	6.95	8.83	7.89	2	2
Grain Size Diameter > 0.25 mm	%	5.22	9	7.11	2	2
Grain Size Diameter > 0.5 mm	%	5.64	11	8.33	2	2
Grain Size Diameter > 1 mm	%	11.7	14.4	13	2	2
Grain Size Diameter > 2 mm	%	6.96	9.01	7.99	2	2
Grain Size Diameter > 4 mm	%	1.14	1.46	1.3	2	2
Grain Size Diameter > 8 mm	%	0	0.224	0.112	2	2
Grain Size Diameter >16 mm	%	0	0	0	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	41.9	52.4	47.1	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	490	257	1	4
Iron	mg/kg	7660	10000	8830	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	713	1310	1010	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	133	195	164	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	40.4	67.7	54	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	11	14	12.5	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	43	64	53.5	2	2
n-Eicosane	ug/Kg	9	13	11	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	16	20	18	2	2
n-Hentriacontane	ug/Kg	810	1200	1000	2	2
n-Heptacosane	ug/Kg	180	420	300	2	2
n-Heptadecane	ug/Kg	94	790	442	2	2
n-Hexacosane	ug/Kg	19	46	32.5	2	2
n-Hexadecane	ug/Kg	15	19	17	2	2
Nickel	mg/kg	ND	11.4	6.95	1	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	670	1800	1240	2	2
n-Nonadecane	ug/Kg	13	14	13.5	2	2
n-Octacosane	ug/Kg	49	98	73.5	2	2
n-Octadecane	ug/Kg	11	25	18	2	2
n-Pentacosane	ug/Kg	72	120	96	2	2
n-Pentadecane	ug/Kg	51	67	59	2	2
n-Tetracosane	ug/Kg	13	23	18	2	2
n-Tetradecane	ug/Kg	7	8	7.5	2	2
n-Tetratriacontane	ug/Kg	ND	380	104	1	2
n-Triacontane	ug/Kg	65	88	76.5	2	2
n-Tricosane	ug/Kg	44	48	46	2	2
n-Tridecane	ug/Kg	ND	ND	ND	0	2
n-Tritriacontane	ug/Kg	280	430	355	2	2
n-Undecane	UG/KG	ND	440	116	1	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	150	200	175	2	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	200	118	1	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	150	97.5	1	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	27	44.4	35.7	2	2
Perylene	ug/Kg	87	87	60	1	2
Phenanthrene	ug/Kg	ND	680	313	1	4
Phenanthrene C1	ug/Kg	ND	230	134	1	2
Phenanthrene C2	ug/Kg	ND	120	79	1	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	288	497	392	2	2
Pristane	ug/Kg	ND	ND	ND	0	2
Pyrene	ug/Kg	ND	940	490	2	4
Pyrene C1	ug/Kg	200	200	110	1	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	214	157	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	13400	16400	14900	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	17.2	17.2	16.5	1	2
Zinc	mg/kg	89.5	89.5	70.2	1	2

Sediment Non-Radiological Data

Table 4.44 Non-Radiological Data for Sediment Location K012

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	ND	ND	0	2
4,4'-DDE	ug/kg	ND	27	8.65	1	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	490	170	1	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	27	11.6	1	2
Aluminum	mg/kg	6470	8230	7350	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	490	178	1	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	5.97	4.24	1	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	76.1	76.1	75.8	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	2000	781	1	4
Benzo(a)pyrene	ug/Kg	ND	940	589	2	4
Benzo(b)fluoranthene	ug/Kg	ND	2700	1080	2	4
Benzo(e)pyrene	ug/Kg	240	1500	870	1	2
Benzo(ghi)perylene	ug/Kg	ND	490	248	1	4
Benzo(k)fluoranthene	ug/Kg	ND	1000	546	2	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	0.776	0.513	1	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	1520	1910	1720	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	77.1	77.1	49.1	1	2
Chrysene	ug/Kg	ND	1100	679	2	4
Chrysene C1	ug/Kg	770	770	490	1	2
Cobalt	mg/kg	3.63	6.3	4.96	2	2
Copper	mg/kg	16.4	16.4	13.5	1	2
Coumaphos	ug/kg	ND	33	23.2	1	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	490	155	1	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	ug/Kg	ND	ND	ND	0	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	ND	530	382	1	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	3200	1600	2	4
Fluoranthene C1	ug/Kg	680	680	450	1	2
Fluorene	ug/Kg	ND	490	158	1	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	5.5	8.66	7.08	2	2
Grain Size Diameter > 0.125 mm	%	5.4	9.65	7.53	2	2
Grain Size Diameter > 0.25 mm	%	6.32	6.37	6.34	2	2
Grain Size Diameter > 0.5 mm	%	8.24	10.7	9.48	2	2
Grain Size Diameter > 1 mm	%	8.79	17.9	13.3	2	2
Grain Size Diameter > 2 mm	%	2.57	15.2	8.9	2	2
Grain Size Diameter > 4 mm	%	0.551	3.45	2	2	2
Grain Size Diameter > 8 mm	%	0.0648	0.921	0.493	2	2
Grain Size Diameter >16 mm	%	0	0	0	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	34.5	55.1	44.8	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	900	464	2	4
Iron	mg/kg	8050	18200	13100	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	931	1130	1030	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	70.5	319	195	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	13	7.75	1	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	51.7	55.1	53.4	2	2
Naphthalene	ug/Kg	ND	490	142	1	4
Naphthalene C1	ug/Kg	ND	73	36.7	1	2
Naphthalene C2	ug/Kg	ND	73	33.7	1	2
Naphthalene C3	ug/Kg	ND	73	34.2	1	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	9	30	19.5	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	42	130	86	2	2
n-Eicosane	ug/Kg	9	17	13	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	10	40	25	2	2
n-Hentriacontane	ug/Kg	640	3000	1820	2	2
n-Heptacosane	ug/Kg	240	540	390	2	2
n-Heptadecane	ug/Kg	20	35	27.5	2	2
n-Hexacosane	ug/Kg	20	80	50	2	2
n-Hexadecane	ug/Kg	9	15	12	2	2
Nickel	mg/kg	6.69	11.3	8.99	2	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	700	2900	1800	2	2
n-Nonadecane	ug/Kg	11	21	16	2	2
n-Octacosane	ug/Kg	50	170	110	2	2
n-Octadecane	ug/Kg	11	14	12.5	2	2
n-Pentacosane	ug/Kg	48	160	104	2	2
n-Pentadecane	UG/KG	ND	480	123	1	2
n-Tetracosane	ug/Kg	14	40	27	2	2
n-Tetradecane	ug/Kg	ND	360	94	1	2
n-Tetratriacontane	ug/Kg	ND	360	114	1	2
n-Triacontane	ug/Kg	54	220	137	2	2
n-Tricosane	ug/Kg	28	86	57	2	2
n-Tridecane	ug/Kg	ND	360	93	1	2
n-Tritriacontane	ug/Kg	220	850	535	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	130	300	215	2	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	130	80	1	2
PCB-1260	ug/kg	ND	300	172	1	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	37.5	38.1	37.8	2	2
Perylene	ug/Kg	460	460	295	1	2
Phenanthrene	ug/Kg	ND	1600	791	2	4
Phenanthrene C1	ug/Kg	370	370	275	1	2
Phenanthrene C2	ug/Kg	ND	140	88.2	1	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	346	521	434	2	2
Pristane	ug/Kg	ND	ND	ND	0	2
Pyrene	ug/Kg	ND	2200	1150	2	4
Pyrene C1	ug/Kg	600	600	400	1	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	414	414	345	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	17200	17400	17300	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	37.3	37.3	26.3	1	2
Zinc	mg/kg	212	212	157	1	2

Sediment Non-Radiological Data

Table 4.45 Non-Radiological Data for Sediment Location S2

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	ND	ND	0	2
4,4'-DDE	ug/kg	ND	ND	ND	0	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	4500	7830	6160	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	UG/KG	ND	490	131	1	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	58.4	58.4	48.5	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	UG/KG	ND	490	147	1	4
Benzo(a)pyrene	UG/KG	ND	490	149	1	4
Benzo(b)fluoranthene	UG/KG	ND	490	149	1	4
Benzo(e)pyrene	UG/KG	ND	65	43	1	2
Benzo(ghi)perylene	UG/KG	ND	490	132	1	4
Benzo(k)fluoranthene	UG/KG	ND	490	145	1	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	442	3410	1930	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	20.9	20.9	15.5	1	2
Chrysene	UG/KG	ND	490	153	1	4
Chrysene C1	ug/Kg	ND	ND	ND	0	2
Cobalt	mg/kg	ND	4.03	2.64	1	2
Copper	mg/kg	5.65	5.65	5.04	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	UG/KG	ND	150	85.5	1	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	ND	550	398	1	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	UG/KG	ND	490	178	1	4
Fluoranthene C1	UG/KG	ND	42	25.5	1	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	8.75	14.9	11.8	2	2
Grain Size Diameter > 0.125 mm	%	11.3	17.4	14.3	2	2
Grain Size Diameter > 0.25 mm	%	10.6	11.4	11	2	2
Grain Size Diameter > 0.5 mm	%	12.7	16.4	14.5	2	2
Grain Size Diameter > 1 mm	%	9.11	12	10.5	2	2
Grain Size Diameter > 2 mm	%	0.577	3.52	2.05	2	2
Grain Size Diameter > 4 mm	%	0.2	0.755	0.478	2	2
Grain Size Diameter > 8 mm	%	0.00785	2.06	1.03	2	2
Grain Size Diameter >16 mm	%	0	0	0	2	2
Grain Size Diameter >31.5 mm	%	0	0.00785	0.0039	2	2
Grain Size Diameter Fines	%	32.8	35.1	34	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	UG/KG	ND	490	134	1	4
Iron	mg/kg	7750	7750	6780	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	496	581	538	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	50	192	121	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	29.5	47.9	38.7	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	6	14	10	2	2
n-Dodecane	UG/KG	ND	190	49.5	1	2
n-Dotriacontane	ug/Kg	14	51	32.5	2	2
n-Eicosane	ug/Kg	5	8	6.5	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	5	15	10	2	2
n-Hentriacontane	ug/Kg	110	1200	655	2	2
n-Heptacosane	ug/Kg	36	520	278	2	2
n-Heptadecane	ug/Kg	26	80	53	2	2
n-Hexacosane	ug/Kg	9	42	25.5	2	2
n-Hexadecane	ug/Kg	9	10	9.5	2	2
Nickel	mg/kg	ND	6.94	4.72	1	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	86	1200	643	2	2
n-Nonadecane	ug/Kg	4	9	6.5	2	2
n-Octacosane	ug/Kg	14	68	41	2	2
n-Octadecane	ug/Kg	6	8	7	2	2
n-Pentacosane	ug/Kg	16	100	58	2	2
n-Pentadecane	ug/Kg	6	12	9	2	2
n-Tetracosane	ug/Kg	6	22	14	2	2
n-Tetradecane	ug/Kg	6	6	6	2	2
n-Tetratriacontane	ug/Kg	5	13	9	2	2
n-Triacontane	ug/Kg	16	78	47	2	2
n-Tricosane	ug/Kg	11	50	30.5	2	2
n-Tridecane	UG/KG	ND	190	49.5	1	2
n-Tritriacontane	ug/Kg	36	250	143	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	350	200	1	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	200	120	1	2
PCB-1254	ug/kg	ND	150	90	1	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	22.4	32	27.2	2	2
Perylene	UG/KG	ND	42	25.5	1	2
Phenanthrene	UG/KG	ND	490	158	1	4
Phenanthrene C1	UG/KG	ND	52	36.5	1	2
Phenanthrene C2	ug/Kg	ND	ND	ND	0	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	239	354	296	2	2
Pristane	ug/Kg	ND	ND	ND	0	2
Pyrene	UG/KG	ND	490	160	1	4
Pyrene C1	UG/KG	ND	42	23.5	1	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	ND	ND	0	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	2320	8380	5350	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	17.9	17.9	15.3	1	2
Zinc	mg/kg	ND	31.7	20.9	1	2

Sediment Non-Radiological Data

Table 4.46 Non-Radiological Data for Sediment Location S30

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	3
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	3
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	3
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	3
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	3
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	3
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	3
2,4'-DDD	ug/kg	ND	ND	ND	0	3
2,4'-DDE	ug/kg	ND	ND	ND	0	3
2,4'-DDT	ug/kg	ND	ND	ND	0	3
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	3
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	3
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	3
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	3
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	3
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	3
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	3
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	3
2-Chlorophenol	ug/kg	ND	ND	ND	0	3
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	3
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	6
2-Nitroaniline	ug/kg	ND	ND	ND	0	3
2-Nitrophenol	ug/kg	ND	ND	ND	0	3
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	3
3-Nitroaniline	ug/kg	ND	ND	ND	0	3
4,4'-DDD	ug/kg	ND	24	6.1	2	3
4,4'-DDE	ug/kg	1.4	6.2	4.43	3	3
4,4'-DDT	ug/kg	ND	ND	ND	0	3
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	3
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	3
4-Chloroaniline	ug/kg	ND	ND	ND	0	3
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	3
4-Nitroaniline	ug/kg	ND	ND	ND	0	3
4-Nitrophenol	ug/kg	ND	ND	ND	0	3
Acenaphthene	ug/Kg	ND	490	129	1	6
Acenaphthylene	ug/Kg	ND	ND	ND	0	6
Aldrin	ug/kg	ND	ND	ND	0	3
Alpha-BHC	ug/kg	ND	ND	ND	0	3
alpha-Chlordane	ug/kg	ND	24	7.27	2	3
Aluminum	mg/kg	5710	8040	6690	3	3
Aniline	ug/kg	ND	ND	ND	0	3
Anthracene	ug/Kg	ND	490	129	1	6
Antimony	mg/kg	ND	ND	ND	0	3
Aroclor-1268	ug/kg	ND	ND	ND	0	3
Arsenic	mg/kg	ND	ND	ND	0	3

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	3
Barium	mg/kg	48.9	51.3	46.5	2	3
Benzidine	ug/kg	ND	ND	ND	0	3
Benzo(a)anthracene	ug/Kg	ND	490	159	2	6
Benzo(a)pyrene	ug/Kg	ND	490	144	2	6
Benzo(b)fluoranthene	ug/Kg	ND	490	180	2	6
Benzo(e)pyrene	ug/Kg	90	140	83.7	2	3
Benzo(ghi)perylene	ug/Kg	ND	ND	ND	0	6
Benzo(k)fluoranthene	ug/Kg	ND	490	149	2	6
Benzoic acid	ug/kg	ND	ND	ND	0	3
Benzyl Alcohol	ug/kg	ND	ND	ND	0	3
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	3
Beryllium	mg/kg	ND	ND	ND	0	3
Beta-BHC	ug/kg	ND	ND	ND	0	3
Biphenyl	ug/Kg	ND	ND	ND	0	3
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	3
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	3
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	3
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	3
Cadmium	mg/kg	ND	ND	ND	0	3
Calcium	mg/kg	1030	2490	1580	3	3
Carbazole	ug/kg	ND	ND	ND	0	3
Chlordane	ug/kg	ND	ND	ND	0	3
Chlorpyrifos	ug/kg	ND	ND	ND	0	3
Chromium	mg/kg	34.2	64	41.7	2	3
Chrysene	ug/Kg	ND	490	147	2	6
Chrysene C1	ug/Kg	ND	ND	ND	0	3
Cobalt	mg/kg	2.93	3.86	3.42	3	3
Copper	mg/kg	5.91	8.45	5.97	2	3
Coumaphos	ug/kg	ND	ND	ND	0	3
delta-BHC	ug/kg	ND	12	4.33	1	3
Demeton	ug/kg	ND	ND	ND	0	1
Diazinon	ug/kg	ND	ND	ND	0	3
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	6
Dibenzofuran	ug/kg	ND	ND	ND	0	3
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	3
Dibenzothiophene C2	UG/KG	ND	140	62	1	3
Dichlorvos	ug/kg	ND	ND	ND	0	3
Dieldrin	ug/kg	ND	ND	ND	0	3
Diethylphthalate	ug/kg	ND	ND	ND	0	3
Dimethoate	ug/kg	ND	ND	ND	0	3
Dimethylphthalate	ug/kg	ND	ND	ND	0	3
Di-n-butylphthalate	ug/kg	ND	1200	562	1	3
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	3
Endosulfan I	ug/kg	ND	24	6.57	1	3
Endosulfan II	ug/kg	ND	24	5.67	2	3
Endosulfan sulfate	ug/kg	ND	24	9.5	2	3
Endrin	ug/kg	ND	ND	ND	0	3
Endrin aldehyde	ug/kg	ND	ND	ND	0	3
Ethoprop	ug/kg	ND	ND	ND	0	3

Sediment Non-Radiological Data

Ethyl parathion	ug/kg	ND	ND	ND	0	3
Famphur	ug/kg	ND	ND	ND	0	3
Fensulfothion	ug/kg	ND	ND	ND	0	3
Fenthion	ug/kg	ND	ND	ND	0	3
Fluoranthene	ug/Kg	ND	490	195	2	6
Fluoranthene C1	ug/Kg	28	39	26	2	3
Fluorene	ug/Kg	ND	490	129	1	6
Fluorene C1	ug/Kg	ND	ND	ND	0	3
Fluorene C2	ug/Kg	ND	ND	ND	0	3
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	3
gamma-Chlordane	ug/kg	ND	ND	ND	0	3
Grain Size Diameter > 0.063 mm	%	6.35	11.5	8.23	3	3
Grain Size Diameter > 0.125 mm	%	10.3	17.9	13.8	3	3
Grain Size Diameter > 0.25 mm	%	8.08	15.3	12.1	3	3
Grain Size Diameter > 0.5 mm	%	7.75	10.4	9.09	3	3
Grain Size Diameter > 1 mm	%	7.89	16.6	12.6	3	3
Grain Size Diameter > 2 mm	%	2.8	12.7	8.1	3	3
Grain Size Diameter > 4 mm	%	2.27	5.03	3.38	3	3
Grain Size Diameter > 8 mm	%	0.339	4.57	1.85	3	3
Grain Size Diameter >16 mm	%	0	0	0	3	3
Grain Size Diameter >31.5 mm	%	0	0	0	3	3
Grain Size Diameter Fines	%	28	33.3	30.7	3	3
Heptachlor	ug/kg	ND	ND	ND	0	3
Heptachlor epoxide	ug/kg	ND	ND	ND	0	3
Hexachlorobenzene	ug/kg	ND	ND	ND	0	3
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	3
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	3
Hexachloroethane	ug/kg	ND	ND	ND	0	3
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	490	136	2	6
Iron	mg/kg	7720	9490	7990	2	3
Isophorone	ug/kg	ND	ND	ND	0	3
Lead	mg/kg	ND	ND	ND	0	3
m,p-cresol	ug/kg	ND	ND	ND	0	3
Magnesium	mg/kg	491	692	568	3	3
Malathion	ug/kg	ND	ND	ND	0	3
Manganese	mg/kg	68.1	100	82.9	3	3
Mercury	mg/kg	ND	ND	ND	0	3
Methoxychlor	ug/kg	ND	ND	ND	0	3
Methyl parathion	ug/kg	ND	ND	ND	0	3
Mirex	ug/kg	ND	ND	ND	0	3
Moisture	%	32.5	39.4	36.9	3	3
Naphthalene	ug/Kg	ND	ND	ND	0	6
Naphthalene C1	ug/Kg	ND	ND	ND	0	3
Naphthalene C2	ug/Kg	ND	ND	ND	0	3
Naphthalene C3	ug/Kg	ND	ND	ND	0	3
Naphthalene C4	ug/Kg	ND	ND	ND	0	3
n-Decane	ug/Kg	ND	ND	ND	0	3
n-Docosane	ug/Kg	10	22	16.3	3	3
n-Dodecane	ug/Kg	ND	ND	ND	0	3
n-Dotriacontane	ug/Kg	42	130	97.3	3	3

Sediment Non-Radiological Data

n-Eicosane	ug/Kg	4	10	7.67	3	3
n-Heneicosane	ug/Kg	7	19	14	3	3
n-Hentriacontane	ug/Kg	2600	3900	3400	3	3
n-Heptacosane	ug/Kg	350	1100	690	3	3
n-Heptadecane	ug/Kg	9	20	14	3	3
n-Hexacosane	ug/Kg	52	110	75.7	3	3
n-Hexadecane	ug/Kg	6	17	11	3	3
Nickel	mg/kg	ND	9.82	6.42	2	3
Nitrobenzene	ug/kg	ND	ND	ND	0	3
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	3
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	3
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	3
n-Nonacosane	ug/Kg	2400	3600	3030	3	3
n-Nonadecane	ug/Kg	6	25	16.7	3	3
n-Octacosane	ug/Kg	75	180	125	3	3
n-Octadecane	ug/Kg	7	14	10	3	3
n-Pentacosane	ug/Kg	110	260	167	3	3
n-Pentadecane	ug/Kg	5	14	10.7	3	3
n-Tetracosane	ug/Kg	26	50	35.7	3	3
n-Tetradecane	ug/Kg	6	11	8.33	3	3
n-Tetratriacontane	UG/KG	ND	750	196	1	3
n-Triacontane	ug/Kg	80	260	170	3	3
n-Tricosane	ug/Kg	34	80	54	3	3
n-Tridecane	ug/Kg	ND	ND	ND	0	3
n-Tritriacontane	ug/Kg	280	670	517	3	3
n-Undecane	ug/Kg	ND	ND	ND	0	3
o-Cresol	ug/kg	ND	ND	ND	0	3
PCB, Total	ug/kg	900	13600	8770	3	3
PCB-1016	ug/kg	ND	ND	ND	0	3
PCB-1221	ug/kg	ND	ND	ND	0	3
PCB-1232	ug/kg	ND	ND	ND	0	3
PCB-1242	ug/kg	ND	ND	ND	0	3
PCB-1248	ug/kg	400	7100	4470	3	3
PCB-1254	ug/kg	ND	300	120	1	3
PCB-1260	ug/kg	200	6500	4200	3	3
Pentachlorophenol	ug/kg	ND	ND	ND	0	3
Percent Moisture	%	22.4	28.4	26	3	3
Perylene	ug/Kg	9	24	16	2	3
Phenanthrene	ug/Kg	ND	490	169	2	6
Phenanthrene C1	ug/Kg	44	50	36	2	3
Phenanthrene C2	ug/Kg	ND	ND	ND	0	3
Phenanthrene C3	ug/Kg	ND	ND	ND	0	3
Phenanthrene C4	ug/Kg	ND	ND	ND	0	3
Phenol	ug/kg	ND	ND	ND	0	3
Phorate	ug/kg	ND	ND	ND	0	3
Phytane	ug/Kg	ND	ND	ND	0	3
Potassium	mg/kg	213	307	244	3	3
Pristane	ug/Kg	ND	ND	ND	0	3
Pyrene	ug/Kg	ND	490	174	2	6
Pyrene C1	ug/Kg	9	38	22.3	2	3

Sediment Non-Radiological Data

Pyridine	ug/kg	ND	ND	ND	0	3
Selenium	mg/kg	ND	ND	ND	0	3
Silver	mg/kg	ND	ND	ND	0	3
Sodium	mg/kg	ND	236	145	1	3
Thallium	mg/kg	ND	ND	ND	0	3
Total Organic Carbon	mg/Kg	5540	11000	8120	3	3
Toxaphene	ug/kg	ND	ND	ND	0	3
Vanadium	mg/kg	20	22.3	18.7	2	3
Zinc	mg/kg	30.7	48.6	33.7	2	3

Sediment Non-Radiological Data

Table 4.47 Non-Radiological Data for Sediment Location LBCN1

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	3
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	3
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	3
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	3
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	3
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	3
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	3
2,4'-DDD	ug/kg	ND	ND	ND	0	3
2,4'-DDE	ug/kg	ND	ND	ND	0	3
2,4'-DDT	ug/kg	ND	ND	ND	0	3
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	3
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	3
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	3
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	3
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	3
2,6-Dimethylnaphthalene	UG/KG	ND	60	26	1	3
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	3
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	3
2-Chlorophenol	ug/kg	ND	ND	ND	0	3
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	3
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	6
2-Nitroaniline	ug/kg	ND	ND	ND	0	3
2-Nitrophenol	ug/kg	ND	ND	ND	0	3
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	3
3-Nitroaniline	ug/kg	ND	ND	ND	0	3
4,4'-DDD	ug/kg	ND	14	2.92	1	3
4,4'-DDE	ug/kg	ND	14	2.86	1	3
4,4'-DDT	ug/kg	ND	ND	ND	0	3
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	3
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	3
4-Chloroaniline	ug/kg	ND	ND	ND	0	3
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	3
4-Nitroaniline	ug/kg	ND	ND	ND	0	3
4-Nitrophenol	ug/kg	ND	ND	ND	0	3
Acenaphthene	UG/KG	ND	490	150	1	6
Acenaphthylene	ug/Kg	ND	ND	ND	0	6
Aldrin	ug/kg	ND	ND	ND	0	3
Alpha-BHC	ug/kg	ND	ND	ND	0	3
alpha-Chlordane	ug/kg	ND	ND	ND	0	3
Aluminum	mg/kg	1410	3500	2260	3	3
Aniline	ug/kg	ND	ND	ND	0	3
Anthracene	UG/KG	ND	490	192	1	6
Antimony	mg/kg	ND	ND	ND	0	3
Aroclor-1268	ug/kg	ND	ND	ND	0	3
Arsenic	mg/kg	ND	ND	ND	0	3

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	3
Barium	mg/kg	36.4	36.4	21.5	2	3
Benzidine	ug/kg	ND	ND	ND	0	3
Benzo(a)anthracene	UG/KG	ND	600	229	2	6
Benzo(a)pyrene	UG/KG	ND	660	238	2	6
Benzo(b)fluoranthene	UG/KG	ND	520	215	2	6
Benzo(e)pyrene	UG/KG	ND	470	171	2	3
Benzo(ghi)perylene	UG/KG	ND	490	166	2	6
Benzo(k)fluoranthene	UG/KG	ND	700	245	2	6
Benzoic acid	ug/kg	ND	ND	ND	0	3
Benzyl Alcohol	ug/kg	ND	ND	ND	0	3
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	3
Beryllium	mg/kg	ND	ND	ND	0	3
Beta-BHC	ug/kg	ND	ND	ND	0	3
Biphenyl	ug/Kg	ND	ND	ND	0	3
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	3
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	3
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	3
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	3
Cadmium	mg/kg	ND	ND	ND	0	3
Calcium	mg/kg	227	259	248	3	3
Carbazole	ug/kg	ND	ND	ND	0	3
Chlordane	ug/kg	ND	ND	ND	0	3
Chlorpyrifos	ug/kg	ND	ND	ND	0	3
Chromium	mg/kg	5.09	31.4	19.6	2	3
Chrysene	UG/KG	ND	820	266	2	6
Chrysene C1	UG/KG	ND	500	183	1	3
Cobalt	mg/kg	ND	2.59	1.7	1	3
Copper	mg/kg	ND	3.97	2.16	1	3
Coumaphos	ug/kg	ND	ND	ND	0	3
delta-BHC	ug/kg	ND	ND	ND	0	3
Demeton	ug/kg	ND	ND	ND	0	1
Diazinon	ug/kg	ND	ND	ND	0	3
Dibenz(a,h)anthracene	UG/KG	ND	490	145	1	6
Dibenzofuran	ug/kg	ND	ND	ND	0	3
Dibenzothiophene C1	UG/KG	ND	60	28	1	3
Dibenzothiophene C2	UG/KG	ND	60	26	1	3
Dichlorvos	ug/kg	ND	ND	ND	0	3
Dieldrin	ug/kg	ND	ND	ND	0	3
Diethylphthalate	ug/kg	ND	ND	ND	0	3
Dimethoate	ug/kg	ND	ND	ND	0	3
Dimethylphthalate	ug/kg	ND	ND	ND	0	3
Di-n-butylphthalate	ug/kg	ND	1900	1080	2	3
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	3
Endosulfan I	ug/kg	ND	ND	ND	0	3
Endosulfan II	ug/kg	ND	ND	ND	0	3
Endosulfan sulfate	ug/kg	ND	14	3.03	1	3
Endrin	ug/kg	ND	ND	ND	0	3
Endrin aldehyde	ug/kg	ND	ND	ND	0	3
Ethoprop	ug/kg	ND	ND	ND	0	3

Sediment Non-Radiological Data

Ethyl parathion	ug/kg	ND	ND	ND	0	3
Famphur	ug/kg	ND	ND	ND	0	3
Fensulfothion	ug/kg	ND	50	19.1	1	3
Fenthion	ug/kg	ND	ND	ND	0	3
Fluoranthene	UG/KG	ND	1900	456	2	6
Fluoranthene C1	UG/KG	ND	300	116	1	3
Fluorene	UG/KG	ND	490	152	1	6
Fluorene C1	UG/KG	ND	320	123	1	3
Fluorene C2	ug/Kg	ND	ND	ND	0	3
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	3
gamma-Chlordane	ug/kg	ND	ND	ND	0	3
Grain Size Diameter > 0.063 mm	%	9.47	13.9	11.1	3	3
Grain Size Diameter > 0.125 mm	%	0	40.4	23.1	3	3
Grain Size Diameter > 0.25 mm	%	0	29.1	12.5	3	3
Grain Size Diameter > 0.5 mm	%	0.0498	1.84	1.1	3	3
Grain Size Diameter > 1 mm	%	0.169	6.73	2.53	3	3
Grain Size Diameter > 2 mm	%	0.321	2.79	1.16	3	3
Grain Size Diameter > 4 mm	%	0.133	0.634	0.375	3	3
Grain Size Diameter > 8 mm	%	0.0187	1.39	0.652	3	3
Grain Size Diameter >16 mm	%	0	27.9	9.29	3	3
Grain Size Diameter >31.5 mm	%	0	19.3	6.45	3	3
Grain Size Diameter Fines	%	17.1	40.8	31.7	3	3
Heptachlor	ug/kg	ND	ND	ND	0	3
Heptachlor epoxide	ug/kg	ND	56	11.1	1	3
Hexachlorobenzene	ug/kg	ND	ND	ND	0	3
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	3
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	3
Hexachloroethane	ug/kg	ND	ND	ND	0	3
Indeno(1,2,3-cd)pyrene	UG/KG	ND	490	183	1	6
Iron	mg/kg	3190	3190	2720	2	3
Isophorone	ug/kg	ND	ND	ND	0	3
Lead	mg/kg	ND	ND	ND	0	3
m,p-cresol	ug/kg	ND	ND	ND	0	3
Magnesium	mg/kg	131	313	199	3	3
Malathion	ug/kg	ND	ND	ND	0	3
Manganese	mg/kg	45.2	63.6	51.5	3	3
Mercury	mg/kg	ND	ND	ND	0	3
Methoxychlor	ug/kg	ND	28	5.66	1	3
Methyl parathion	ug/kg	ND	ND	ND	0	3
Mirex	ug/kg	ND	ND	ND	0	3
Moisture	%	26.4	31.5	29.6	3	3
Naphthalene	UG/KG	ND	490	132	1	6
Naphthalene C1	ug/Kg	ND	ND	ND	0	3
Naphthalene C2	UG/KG	ND	60	27.7	1	3
Naphthalene C3	ug/Kg	ND	ND	ND	0	3
Naphthalene C4	ug/Kg	ND	ND	ND	0	3
n-Decane	ug/Kg	ND	ND	ND	0	3
n-Docosane	ug/Kg	4	10	6.67	3	3
n-Dodecane	ug/Kg	ND	ND	ND	0	3
n-Dotriacontane	ug/Kg	6	23	15.7	3	3

Sediment Non-Radiological Data

n-Eicosane	ug/Kg	ND	300	101	1	3
n-Heneicosane	ug/Kg	3	10	7.33	3	3
n-Hentriacontane	ug/Kg	48	490	316	3	3
n-Heptacosane	ug/Kg	18	210	139	3	3
n-Heptadecane	UG/KG	ND	180	35.7	2	3
n-Hexacosane	ug/Kg	7	25	18.7	3	3
n-Hexadecane	ug/Kg	ND	300	101	1	3
Nickel	mg/kg	ND	ND	ND	0	3
Nitrobenzene	ug/kg	ND	ND	ND	0	3
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	3
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	3
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	3
n-Nonacosane	ug/Kg	35	490	338	3	3
n-Nonadecane	ug/Kg	ND	300	101	1	3
n-Octacosane	ug/Kg	9	40	28.3	3	3
n-Octadecane	ug/Kg	ND	300	52.7	2	3
n-Pentacosane	ug/Kg	12	60	41	3	3
n-Pentadecane	UG/KG	ND	180	33.3	2	3
n-Tetracosane	ug/Kg	5	13	10	3	3
n-Tetradecane	ug/Kg	ND	ND	ND	0	3
n-Tetratriacontane	ug/Kg	ND	ND	ND	0	3
n-Triacontane	ug/Kg	10	42	29	3	3
n-Tricosane	ug/Kg	7	40	22.7	3	3
n-Tridecane	ug/Kg	ND	ND	ND	0	3
n-Tritriacontane	ug/Kg	17	95	65	3	3
n-Undecane	ug/Kg	ND	ND	ND	0	3
o-Cresol	ug/kg	ND	ND	ND	0	3
PCB, Total	ug/kg	ND	ND	ND	0	3
PCB-1016	ug/kg	ND	ND	ND	0	3
PCB-1221	ug/kg	ND	ND	ND	0	3
PCB-1232	ug/kg	ND	ND	ND	0	3
PCB-1242	ug/kg	ND	ND	ND	0	3
PCB-1248	ug/kg	ND	ND	ND	0	3
PCB-1254	ug/kg	ND	ND	ND	0	3
PCB-1260	ug/kg	ND	ND	ND	0	3
Pentachlorophenol	ug/kg	ND	ND	ND	0	3
Percent Moisture	%	22.5	40.5	32.5	3	3
Perylene	ug/Kg	20	230	127	2	3
Phenanthrene	UG/KG	ND	2100	485	2	6
Phenanthrene C1	UG/KG	ND	81	39	2	3
Phenanthrene C2	UG/KG	ND	60	23.3	1	3
Phenanthrene C3	ug/Kg	ND	ND	ND	0	3
Phenanthrene C4	ug/Kg	ND	ND	ND	0	3
Phenol	ug/kg	ND	ND	ND	0	3
Phorate	ug/kg	ND	ND	ND	0	3
Phytane	ug/Kg	ND	ND	ND	0	3
Potassium	mg/kg	ND	ND	ND	0	3
Pristane	ug/Kg	ND	ND	ND	0	3
Pyrene	UG/KG	ND	1400	369	2	6
Pyrene C1	UG/KG	ND	250	99.7	1	3

Sediment Non-Radiological Data

Pyridine	ug/kg	ND	ND	ND	0	3
Selenium	mg/kg	ND	ND	ND	0	3
Silver	mg/kg	ND	ND	ND	0	3
Sodium	mg/kg	ND	267	201	2	3
Thallium	mg/kg	ND	ND	ND	0	3
Total Organic Carbon	mg/Kg	1160	2790	2220	3	3
Toxaphene	ug/kg	ND	ND	ND	0	3
Vanadium	mg/kg	8.71	8.71	7.48	2	3
Zinc	mg/kg	ND	21.6	16.7	2	3

Sediment Non-Radiological Data

Table 4.48 Non-Radiological Data for Sediment Location S27

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	11	4.75	1	2
4,4'-DDE	ug/kg	ND	ND	ND	0	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	UG/KG	ND	490	146	1	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	844	2840	1840	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	UG/KG	ND	490	166	1	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	18.3	18.3	14.4	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	490	196	1	4
Benzo(a)pyrene	ug/Kg	ND	490	194	1	4
Benzo(b)fluoranthene	ug/Kg	ND	490	208	1	4
Benzo(e)pyrene	ug/Kg	20	190	105	1	2
Benzo(ghi)perylene	ug/Kg	ND	490	152	1	4
Benzo(k)fluoranthene	ug/Kg	ND	490	190	1	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	ND	380	240	1	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	53.7	53.7	35	1	2
Chrysene	ug/Kg	ND	490	220	1	4
Chrysene C1	UG/KG	ND	250	135	1	2
Cobalt	mg/kg	ND	ND	ND	0	2
Copper	mg/kg	ND	4.83	3.04	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	11	3.45	1	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	UG/KG	ND	490	134	1	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	UG/KG	ND	150	85	1	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	ND	1100	665	1	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	1000	516	2	4
Fluoranthene C1	UG/KG	ND	150	85	1	2
Fluorene	UG/KG	ND	490	140	1	4
Fluorene C1	UG/KG	ND	120	70	1	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	3.07	12.1	7.58	2	2
Grain Size Diameter > 0.125 mm	%	31.3	34.1	32.7	2	2
Grain Size Diameter > 0.25 mm	%	28.2	54.9	41.6	2	2
Grain Size Diameter > 0.5 mm	%	2.95	4.72	3.83	2	2
Grain Size Diameter > 1 mm	%	0.461	0.653	0.557	2	2
Grain Size Diameter > 2 mm	%	0.249	0.288	0.269	2	2
Grain Size Diameter > 4 mm	%	0.0916	0.154	0.123	2	2
Grain Size Diameter > 8 mm	%	0.0178	0.22	0.119	2	2
Grain Size Diameter >16 mm	%	0	0	0	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	4.65	21.7	13.2	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	490	166	1	4
Iron	mg/kg	3330	3330	2800	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	65.7	250	158	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	16.9	46.9	31.9	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	27.8	27.9	27.8	2	2
Naphthalene	UG/KG	ND	490	130	1	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	UG/KG	ND	40	29	1	2
Naphthalene C3	UG/KG	ND	40	22	1	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	6	6	6	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	7	18	12.5	2	2
n-Eicosane	ug/Kg	4	5	4.5	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	6	7	6.5	2	2
n-Hentriacontane	ug/Kg	100	230	165	2	2
n-Heptacosane	ug/Kg	42	66	54	2	2
n-Heptadecane	ug/Kg	ND	300	78	1	2
n-Hexacosane	ug/Kg	10	12	11	2	2
n-Hexadecane	ug/Kg	ND	300	78	1	2
Nickel	mg/kg	ND	ND	ND	0	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	110	220	165	2	2
n-Nonadecane	ug/Kg	ND	300	77.5	1	2
n-Octacosane	ug/Kg	12	20	16	2	2
n-Octadecane	ug/Kg	ND	300	78.5	1	2
n-Pentacosane	ug/Kg	16	28	22	2	2
n-Pentadecane	ug/Kg	ND	300	77	1	2
n-Tetracosane	ug/Kg	9	9	9	2	2
n-Tetradecane	ug/Kg	ND	300	77	1	2
n-Tetratriacontane	ug/Kg	ND	300	78	1	2
n-Triacontane	ug/Kg	10	23	16.5	2	2
n-Tricosane	ug/Kg	11	16	13.5	2	2
n-Tridecane	ug/Kg	ND	ND	ND	0	2
n-Tritriacontane	ug/Kg	21	66	43.5	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	11200	5620	1	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	11200	5620	1	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	20.7	22.4	21.5	2	2
Perylene	ug/Kg	12	110	61	1	2
Phenanthrene	ug/Kg	ND	1000	482	2	4
Phenanthrene C1	ug/Kg	290	290	152	1	2
Phenanthrene C2	UG/KG	ND	78	49	1	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	ND	ND	ND	0	2
Pristane	ug/Kg	ND	ND	ND	0	2
Pyrene	ug/Kg	ND	690	381	2	4
Pyrene C1	UG/KG	ND	120	70	1	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	257	178	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	1300	2140	1720	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	8.05	8.05	7.24	1	2
Zinc	mg/kg	ND	20	11.7	1	2

Sediment Non-Radiological Data

Table 4.49 Non-Radiological Data for Sediment Location S34

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	ND	ND	0	2
4,4'-DDE	ug/kg	ND	ND	ND	0	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	2110	2450	2280	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	ND	ND	0	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	24.1	24.1	22.9	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	500	134	1	4
Benzo(a)pyrene	ug/Kg	ND	500	132	1	4
Benzo(b)fluoranthene	ug/Kg	ND	500	135	1	4
Benzo(e)pyrene	ug/Kg	ND	63	24.7	1	2
Benzo(ghi)perylene	ug/Kg	ND	ND	ND	0	4
Benzo(k)fluoranthene	ug/Kg	ND	500	133	1	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	330	353	342	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	16.2	16.2	14.5	1	2
Chrysene	ug/Kg	ND	500	134	1	4
Chrysene C1	ug/Kg	ND	ND	ND	0	2
Cobalt	mg/kg	ND	ND	ND	0	2
Copper	mg/kg	ND	5.01	3.13	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	ug/Kg	ND	ND	ND	0	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	950	1200	1080	2	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	500	136	1	4
Fluoranthene C1	ug/Kg	ND	ND	ND	0	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	14.3	14.4	14.4	2	2
Grain Size Diameter > 0.125 mm	%	41.3	41.9	41.6	2	2
Grain Size Diameter > 0.25 mm	%	14.7	18.4	16.6	2	2
Grain Size Diameter > 0.5 mm	%	1.58	2.98	2.28	2	2
Grain Size Diameter > 1 mm	%	1.76	4.65	3.21	2	2
Grain Size Diameter > 2 mm	%	0.283	1.72	1	2	2
Grain Size Diameter > 4 mm	%	0.038	0.195	0.116	2	2
Grain Size Diameter > 8 mm	%	0	0.0208	0.0104	2	2
Grain Size Diameter >16 mm	%	0	0.0208	0.0104	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	19.6	22.1	20.8	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	ND	ND	0	4
Iron	mg/kg	3610	3610	3600	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	195	235	215	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	61.8	66.5	64.2	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	36	38.8	37.4	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	8	11	9.5	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	31	34	32.5	2	2
n-Eicosane	ug/Kg	ND	310	82	1	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	8	12	10	2	2
n-Hentriacontane	ug/Kg	770	1000	885	2	2
n-Heptacosane	ug/Kg	280	290	285	2	2
n-Heptadecane	ug/Kg	22	39	30.5	2	2
n-Hexacosane	ug/Kg	27	28	27.5	2	2
n-Hexadecane	ug/Kg	ND	310	83.5	1	2
Nickel	mg/kg	ND	ND	ND	0	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	550	1200	875	2	2
n-Nonadecane	ug/Kg	ND	310	81	1	2
n-Octacosane	ug/Kg	39	54	46.5	2	2
n-Octadecane	ug/Kg	ND	310	83.5	1	2
n-Pentacosane	ug/Kg	69	110	89.5	2	2
n-Pentadecane	ug/Kg	8	9	8.5	2	2
n-Tetracosane	ug/Kg	15	16	15.5	2	2
n-Tetradecane	ug/Kg	ND	310	81	1	2
n-Tetratriacontane	ug/Kg	ND	ND	ND	0	2
n-Triacontane	ug/Kg	44	50	47	2	2
n-Tricosane	ug/Kg	26	28	27	2	2
n-Tridecane	ug/Kg	ND	310	78.5	1	2
n-Tritriacontane	ug/Kg	150	200	175	2	2
n-Undecane	ug/Kg	ND	310	90.5	1	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	ND	ND	0	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	28.8	29.1	28.9	2	2
Perylene	ug/Kg	ND	ND	ND	0	2
Phenanthrene	ug/Kg	ND	500	135	1	4
Phenanthrene C1	ug/Kg	ND	63	22.7	1	2
Phenanthrene C2	ug/Kg	ND	ND	ND	0	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	ND	ND	ND	0	2
Pristane	ug/Kg	ND	ND	ND	0	2
Pyrene	ug/Kg	ND	500	134	1	4
Pyrene C1	ug/Kg	ND	63	21.2	1	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	251	176	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	3780	4660	4220	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	7.44	7.44	6.92	1	2
Zinc	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Table 4.50 Non-Radiological Data for Sediment Location C746KTB2

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	22	14	1	2
4,4'-DDE	ug/kg	ND	63	34.5	1	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	2700	3030	2860	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	ND	ND	0	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	11.4	6.95	1	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	27.6	27.6	27.1	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	470	138	1	4
Benzo(a)pyrene	ug/Kg	ND	470	134	1	4
Benzo(b)fluoranthene	ug/Kg	ND	470	145	1	4
Benzo(e)pyrene	ug/Kg	56	56	40	1	2
Benzo(ghi)perylene	UG/KG	ND	470	130	1	4
Benzo(k)fluoranthene	ug/Kg	ND	470	141	1	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	546	577	562	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	9.21	11.1	10.2	1	2
Chrysene	ug/Kg	ND	470	138	1	4
Chrysene C1	ug/Kg	30	30	27	1	2
Cobalt	mg/kg	3.58	4.19	3.88	2	2
Copper	mg/kg	3.84	3.84	3.58	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	ug/Kg	ND	ND	ND	0	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	12	6.65	1	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	49	26.2	1	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	470	163	1	4
Fluoranthene C1	ug/Kg	27	27	22.5	1	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	4.38	5.08	4.73	2	2
Grain Size Diameter > 0.125 mm	%	6.92	16.1	11.5	2	2
Grain Size Diameter > 0.25 mm	%	9.18	52.4	30.8	2	2
Grain Size Diameter > 0.5 mm	%	8.75	9.25	9	2	2
Grain Size Diameter > 1 mm	%	1.88	14.9	8.39	2	2
Grain Size Diameter > 2 mm	%	1.13	14.4	7.79	2	2
Grain Size Diameter > 4 mm	%	1.05	6.99	4.02	2	2
Grain Size Diameter > 8 mm	%	0.767	6.56	3.66	2	2
Grain Size Diameter >16 mm	%	0	7.4	3.7	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	13.6	19.3	16.5	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	UG/KG	ND	470	130	1	4
Iron	mg/kg	9020	9020	8150	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	290	310	300	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	178	226	202	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	28.3	42.9	35.6	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	14	15	14.5	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	30	61	45.5	2	2
n-Eicosane	ug/Kg	8	13	10.5	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	13	21	17	2	2
n-Hentriacontane	ug/Kg	550	820	685	2	2
n-Heptacosane	ug/Kg	260	360	310	2	2
n-Heptadecane	ug/Kg	15	49	32	2	2
n-Hexacosane	ug/Kg	28	35	31.5	2	2
n-Hexadecane	ug/Kg	8	9	8.5	2	2
Nickel	mg/kg	ND	5.03	3.77	1	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	560	900	730	2	2
n-Nonadecane	ug/Kg	7	7	7	2	2
n-Octacosane	ug/Kg	39	61	50	2	2
n-Octadecane	ug/Kg	7	8	7.5	2	2
n-Pentacosane	ug/Kg	65	120	92.5	2	2
n-Pentadecane	ug/Kg	7	11	9	2	2
n-Tetracosane	ug/Kg	15	20	17.5	2	2
n-Tetradecane	ug/Kg	4	5	4.5	2	2
n-Tetratriacontane	ug/Kg	14	30	22	2	2
n-Triacontane	ug/Kg	38	76	57	2	2
n-Tricosane	ug/Kg	36	47	41.5	2	2
n-Tridecane	ug/Kg	ND	ND	ND	0	2
n-Tritriacontane	ug/Kg	150	280	215	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	ND	ND	0	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	28.5	33.1	30.8	2	2
Perylene	UG/KG	ND	85	31.7	1	2
Phenanthrene	ug/Kg	ND	470	144	1	4
Phenanthrene C1	ug/Kg	46	46	33	1	2
Phenanthrene C2	UG/KG	ND	85	25.2	1	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	ND	213	156	1	2
Pristane	ug/Kg	ND	ND	ND	0	2
Pyrene	ug/Kg	ND	470	152	1	4
Pyrene C1	ug/Kg	29	29	22	1	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	ND	ND	0	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	6160	6730	6440	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	16.3	16.3	15	1	2
Zinc	mg/kg	ND	20	12.3	1	2

Sediment Non-Radiological Data

Table 4.51 Non-Radiological Data for Sediment Location C746KUP

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	ND	ND	0	2
4,4'-DDE	ug/kg	ND	ND	ND	0	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	3050	3840	3440	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	ND	ND	0	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	36	36	31.5	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	490	132	1	4
Benzo(a)pyrene	ug/Kg	ND	490	131	1	4
Benzo(b)fluoranthene	ug/Kg	ND	490	134	1	4
Benzo(e)pyrene	ug/Kg	ND	45	29.5	1	2
Benzo(ghi)perylene	ug/Kg	ND	ND	ND	0	4
Benzo(k)fluoranthene	ug/Kg	ND	490	130	1	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	449	829	639	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	6.26	12.6	9.43	1	2
Chrysene	ug/Kg	ND	490	131	1	4
Chrysene C1	ug/Kg	ND	ND	ND	0	2
Cobalt	mg/kg	2.84	3.84	3.34	2	2
Copper	mg/kg	ND	4.82	3.04	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	ug/Kg	ND	ND	ND	0	2
Dichlorvos	ug/kg	ND	24	15.5	1	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	ND	760	502	1	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	490	140	1	4
Fluoranthene C1	ug/Kg	ND	ND	ND	0	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	6.75	7.65	7.2	2	2
Grain Size Diameter > 0.125 mm	%	20.1	29.8	25	2	2
Grain Size Diameter > 0.25 mm	%	23.3	34.9	29.1	2	2
Grain Size Diameter > 0.5 mm	%	1.03	3.45	2.24	2	2
Grain Size Diameter > 1 mm	%	0.905	6.32	3.61	2	2
Grain Size Diameter > 2 mm	%	0.301	2.67	1.48	2	2
Grain Size Diameter > 4 mm	%	0.231	4.23	2.23	2	2
Grain Size Diameter > 8 mm	%	0.0361	4.62	2.33	2	2
Grain Size Diameter >16 mm	%	0	0.00312	0.0015	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	26	27.6	26.8	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	ND	ND	0	4
Iron	mg/kg	7840	7840	6580	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	282	362	322	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	155	226	190	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	32.4	33	32.7	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	7	22	14.5	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	26	83	54.5	2	2
n-Eicosane	ug/Kg	6	14	10	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	9	37	23	2	2
n-Hentriacontane	ug/Kg	370	1400	885	2	2
n-Heptacosane	ug/Kg	240	700	470	2	2
n-Heptadecane	ug/Kg	21	67	44	2	2
n-Hexacosane	ug/Kg	21	75	48	2	2
n-Hexadecane	ug/Kg	4	7	5.5	2	2
Nickel	mg/kg	ND	6.48	4.49	1	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	380	3200	1790	2	2
n-Nonadecane	ug/Kg	4	15	9.5	2	2
n-Octacosane	ug/Kg	31	100	65.5	2	2
n-Octadecane	ug/Kg	5	10	7.5	2	2
n-Pentacosane	ug/Kg	59	220	140	2	2
n-Pentadecane	ug/Kg	6	11	8.5	2	2
n-Tetracosane	ug/Kg	10	40	25	2	2
n-Tetradecane	ug/Kg	ND	140	37	1	2
n-Tetratriacontane	ug/Kg	12	28	20	2	2
n-Triacontane	ug/Kg	31	110	70.5	2	2
n-Tricosane	ug/Kg	22	78	50	2	2
n-Tridecane	ug/Kg	ND	ND	ND	0	2
n-Tritriacontane	ug/Kg	120	420	270	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	ND	ND	0	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	27.6	29.4	28.5	2	2
Perylene	ug/Kg	ND	ND	ND	0	2
Phenanthrene	ug/Kg	ND	490	134	1	4
Phenanthrene C1	ug/Kg	ND	ND	ND	0	2
Phenanthrene C2	ug/Kg	ND	ND	ND	0	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	ND	217	158	1	2
Pristane	ug/Kg	ND	ND	ND	0	2
Pyrene	ug/Kg	ND	490	133	1	4
Pyrene C1	ug/Kg	ND	ND	ND	0	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	210	155	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	7160	12700	9930	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	17	17	14.2	1	2
Zinc	mg/kg	28	28	20	1	2

Sediment Non-Radiological Data

Table 4.52 Non-Radiological Data for Sediment Location S32

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	20	11.3	1	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	ND	130	71.5	1	2
4,4'-DDE	ug/kg	8.2	32	20.1	2	2
4,4'-DDT	ug/kg	ND	ND	ND	0	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	6340	7450	6900	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	UG/KG	ND	480	138	1	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	56.2	56.2	54.2	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	480	188	1	4
Benzo(a)pyrene	ug/Kg	ND	480	167	1	4
Benzo(b)fluoranthene	ug/Kg	ND	480	215	1	4
Benzo(e)pyrene	ug/Kg	140	140	120	1	2
Benzo(ghi)perylene	UG/KG	ND	480	143	1	4
Benzo(k)fluoranthene	ug/Kg	ND	480	194	1	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	1890	2840	2360	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	40.9	40.9	39.6	1	2
Chrysene	ug/Kg	ND	480	177	1	4
Chrysene C1	ug/Kg	ND	ND	ND	0	2
Cobalt	mg/kg	3.74	3.95	3.85	2	2
Copper	mg/kg	28.3	28.3	26.9	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	UG/KG	ND	170	110	1	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	ND	890	565	1	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	550	282	1	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	480	238	1	4
Fluoranthene C1	ug/Kg	66	66	58	1	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	6.85	8.32	7.58	2	2
Grain Size Diameter > 0.125 mm	%	5.91	8.9	7.41	2	2
Grain Size Diameter > 0.25 mm	%	4.42	7.3	5.86	2	2
Grain Size Diameter > 0.5 mm	%	6.62	9.5	8.06	2	2
Grain Size Diameter > 1 mm	%	11.4	13.9	12.6	2	2
Grain Size Diameter > 2 mm	%	8.67	10.2	9.43	2	2
Grain Size Diameter > 4 mm	%	2.73	4.74	3.74	2	2
Grain Size Diameter > 8 mm	%	1.01	1.03	1.02	2	2
Grain Size Diameter >16 mm	%	0	17.6	8.82	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	31.4	39.5	35.4	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	480	150	1	4
Iron	mg/kg	9620	9620	9220	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	840	961	900	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	128	207	168	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	54.6	65.8	60.2	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	22	39	30.5	2	2
n-Dodecane	ug/Kg	ND	350	90	1	2
n-Dotriacontane	ug/Kg	120	150	135	2	2
n-Eicosane	ug/Kg	25	28	26.5	2	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	22	45	33.5	2	2
n-Hentriacontane	ug/Kg	2200	3600	2900	2	2
n-Heptacosane	ug/Kg	340	1100	720	2	2
n-Heptadecane	ug/Kg	14	39	26.5	2	2
n-Hexacosane	ug/Kg	67	76	71.5	2	2
n-Hexadecane	ug/Kg	10	20	15	2	2
Nickel	mg/kg	25.4	28	26.7	2	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	3500	3600	3550	2	2
n-Nonadecane	ug/Kg	12	17	14.5	2	2
n-Octacosane	ug/Kg	120	270	195	2	2
n-Octadecane	ug/Kg	12	25	18.5	2	2
n-Pentacosane	ug/Kg	100	140	120	2	2
n-Pentadecane	ug/Kg	17	19	18	2	2
n-Tetracosane	ug/Kg	34	40	37	2	2
n-Tetradecane	ug/Kg	ND	350	94	1	2
n-Tetratriacontane	ug/Kg	ND	ND	ND	0	2
n-Triacontane	ug/Kg	150	210	180	2	2
n-Tricosane	ug/Kg	53	90	71.5	2	2
n-Tridecane	ug/Kg	6	6	6	2	2
n-Tritriacontane	ug/Kg	540	660	600	2	2
n-Undecane	ug/Kg	ND	ND	ND	0	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	440	52100	26300	2	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	41100	20600	1	2
PCB-1254	ug/kg	ND	250	140	1	2
PCB-1260	ug/kg	170	11000	5580	2	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	35.4	36	35.7	2	2
Perylene	ug/Kg	50	50	41.5	1	2
Phenanthrene	ug/Kg	ND	480	182	1	4
Phenanthrene C1	ug/Kg	92	140	116	1	2
Phenanthrene C2	ug/Kg	ND	ND	ND	0	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	479	651	565	2	2
Pristane	ug/Kg	ND	350	104	1	2
Pyrene	ug/Kg	ND	480	210	1	4
Pyrene C1	ug/Kg	52	52	46.5	1	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	ND	ND	0	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	20200	22800	21400	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	19.9	19.9	17.9	1	2
Zinc	mg/kg	59.2	59.2	55.6	1	2

Sediment Non-Radiological Data

Table 4.53 Non-Radiological Data for Sediment Location S28

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
1,2,4-Trichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,2-Diphenylhydrazine	ug/kg	ND	ND	ND	0	2
1,3-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
1,4-Dichlorobenzene	ug/kg	ND	ND	ND	0	2
2,4,5-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4,6-Trichlorophenol	ug/kg	ND	ND	ND	0	2
2,4'-DDD	ug/kg	ND	ND	ND	0	2
2,4'-DDE	ug/kg	ND	ND	ND	0	2
2,4'-DDT	ug/kg	ND	ND	ND	0	2
2,4-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,4-Dimethylphenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrophenol	ug/kg	ND	ND	ND	0	2
2,4-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2,6-Dichlorophenol	ug/kg	ND	ND	ND	0	2
2,6-Dimethylnaphthalene	ug/Kg	ND	ND	ND	0	2
2,6-Dinitrotoluene	ug/kg	ND	ND	ND	0	2
2-Chloronaphthalene	ug/kg	ND	ND	ND	0	2
2-Chlorophenol	ug/kg	ND	ND	ND	0	2
2-Methyl-4,6-dinitrophenol	ug/kg	ND	ND	ND	0	2
2-Methylnaphthalene	ug/Kg	ND	ND	ND	0	4
2-Nitroaniline	ug/kg	ND	ND	ND	0	2
2-Nitrophenol	ug/kg	ND	ND	ND	0	2
3,3'-Dichlorobenzidine	ug/kg	ND	ND	ND	0	2
3-Nitroaniline	ug/kg	ND	ND	ND	0	2
4,4'-DDD	ug/kg	1.3	3.8	2.55	2	2
4,4'-DDE	ug/kg	ND	12	3.3	1	2
4,4'-DDT	ug/kg	ND	12	9	1	2
4-Bromophenyl phenyl ether	ug/kg	ND	ND	ND	0	2
4-Chloro-3-methylphenol	ug/kg	ND	ND	ND	0	2
4-Chloroaniline	ug/kg	ND	ND	ND	0	2
4-Chlorophenylphenyl ether	ug/kg	ND	ND	ND	0	2
4-Nitroaniline	ug/kg	ND	ND	ND	0	2
4-Nitrophenol	ug/kg	ND	ND	ND	0	2
Acenaphthene	ug/Kg	ND	ND	ND	0	4
Acenaphthylene	ug/Kg	ND	ND	ND	0	4
Aldrin	ug/kg	ND	ND	ND	0	2
Alpha-BHC	ug/kg	ND	ND	ND	0	2
alpha-Chlordane	ug/kg	ND	ND	ND	0	2
Aluminum	mg/kg	4030	4390	4210	2	2
Aniline	ug/kg	ND	ND	ND	0	2
Anthracene	ug/Kg	ND	ND	ND	0	4
Antimony	mg/kg	ND	ND	ND	0	2
Aroclor-1268	ug/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Azinphos-methyl	ug/kg	ND	ND	ND	0	2
Barium	mg/kg	47.4	47.4	44.3	1	2
Benzidine	ug/kg	ND	ND	ND	0	2
Benzo(a)anthracene	ug/Kg	ND	490	131	1	4
Benzo(a)pyrene	ug/Kg	ND	490	131	1	4
Benzo(b)fluoranthene	ug/Kg	ND	490	132	1	4
Benzo(e)pyrene	ug/Kg	ND	64	21.5	1	2
Benzo(ghi)perylene	ug/Kg	ND	ND	ND	0	4
Benzo(k)fluoranthene	ug/Kg	ND	ND	ND	0	4
Benzoic acid	ug/kg	ND	ND	ND	0	2
Benzyl Alcohol	ug/kg	ND	ND	ND	0	2
Benzylbutyphthalate	ug/kg	ND	ND	ND	0	2
Beryllium	mg/kg	ND	ND	ND	0	2
Beta-BHC	ug/kg	ND	ND	ND	0	2
Biphenyl	ug/Kg	ND	ND	ND	0	2
Bis(2-chloroethoxy)methane	ug/kg	ND	ND	ND	0	2
Bis(2-chloroethyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-chloroisopropyl) ether	ug/kg	ND	ND	ND	0	2
Bis(2-ethylhexyl)phthalate	ug/kg	ND	ND	ND	0	2
Cadmium	mg/kg	ND	ND	ND	0	2
Calcium	mg/kg	355	637	496	2	2
Carbazole	ug/kg	ND	ND	ND	0	2
Chlordane	ug/kg	ND	ND	ND	0	2
Chlorpyrifos	ug/kg	ND	ND	ND	0	2
Chromium	mg/kg	6.87	6.87	6.37	1	2
Chrysene	ug/Kg	ND	ND	ND	0	4
Chrysene C1	ug/Kg	ND	ND	ND	0	2
Cobalt	mg/kg	3.75	4.2	3.98	2	2
Copper	mg/kg	ND	5.07	3.16	1	2
Coumaphos	ug/kg	ND	ND	ND	0	2
delta-BHC	ug/kg	ND	ND	ND	0	2
Diazinon	ug/kg	ND	ND	ND	0	2
Dibenz(a,h)anthracene	ug/Kg	ND	ND	ND	0	4
Dibenzofuran	ug/kg	ND	ND	ND	0	2
Dibenzothiophene C1	ug/Kg	ND	ND	ND	0	2
Dibenzothiophene C2	ug/Kg	ND	ND	ND	0	2
Dichlorvos	ug/kg	ND	ND	ND	0	2
Dieldrin	ug/kg	ND	ND	ND	0	2
Diethylphthalate	ug/kg	ND	ND	ND	0	2
Dimethoate	ug/kg	ND	ND	ND	0	2
Dimethylphthalate	ug/kg	ND	ND	ND	0	2
Di-n-butylphthalate	ug/kg	940	1000	970	2	2
Di-n-octylphthlate	ug/kg	ND	ND	ND	0	2
Endosulfan I	ug/kg	ND	ND	ND	0	2
Endosulfan II	ug/kg	ND	ND	ND	0	2
Endosulfan sulfate	ug/kg	ND	ND	ND	0	2
Endrin	ug/kg	ND	ND	ND	0	2
Endrin aldehyde	ug/kg	ND	ND	ND	0	2
Ethoprop	ug/kg	ND	ND	ND	0	2
Ethyl parathion	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Famphur	ug/kg	ND	ND	ND	0	2
Fensulfothion	ug/kg	ND	ND	ND	0	2
Fenthion	ug/kg	ND	ND	ND	0	2
Fluoranthene	ug/Kg	ND	490	132	1	4
Fluoranthene C1	ug/Kg	ND	ND	ND	0	2
Fluorene	ug/Kg	ND	ND	ND	0	4
Fluorene C1	ug/Kg	ND	ND	ND	0	2
Fluorene C2	ug/Kg	ND	ND	ND	0	2
gamma-BHC (Lindane)	ug/kg	ND	ND	ND	0	2
gamma-Chlordane	ug/kg	ND	ND	ND	0	2
Grain Size Diameter > 0.063 mm	%	9.18	11.9	10.5	2	2
Grain Size Diameter > 0.125 mm	%	27.9	30.6	29.3	2	2
Grain Size Diameter > 0.25 mm	%	16.6	22.5	19.6	2	2
Grain Size Diameter > 0.5 mm	%	3.95	4.66	4.31	2	2
Grain Size Diameter > 1 mm	%	3.4	4.07	3.73	2	2
Grain Size Diameter > 2 mm	%	0.708	1.94	1.32	2	2
Grain Size Diameter > 4 mm	%	0.562	1.66	1.11	2	2
Grain Size Diameter > 8 mm	%	1.43	1.66	1.55	2	2
Grain Size Diameter >16 mm	%	0	0	0	2	2
Grain Size Diameter >31.5 mm	%	0	0	0	2	2
Grain Size Diameter Fines	%	26.9	30	28.5	2	2
Heptachlor	ug/kg	ND	ND	ND	0	2
Heptachlor epoxide	ug/kg	ND	ND	ND	0	2
Hexachlorobenzene	ug/kg	ND	ND	ND	0	2
Hexachlorobutadiene	ug/kg	ND	ND	ND	0	2
Hexachlorocyclopentadiene	ug/kg	ND	ND	ND	0	2
Hexachloroethane	ug/kg	ND	ND	ND	0	2
Indeno(1,2,3-cd)pyrene	ug/Kg	ND	ND	ND	0	4
Iron	mg/kg	6810	6810	6740	1	2
Isophorone	ug/kg	ND	ND	ND	0	2
Lead	mg/kg	ND	ND	ND	0	2
m,p-cresol	ug/kg	ND	ND	ND	0	2
Magnesium	mg/kg	455	460	458	2	2
Malathion	ug/kg	ND	ND	ND	0	2
Manganese	mg/kg	383	424	404	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Methoxychlor	ug/kg	ND	ND	ND	0	2
Methyl parathion	ug/kg	ND	ND	ND	0	2
Mirex	ug/kg	ND	ND	ND	0	2
Moisture	%	30.7	47	38.8	2	2
Naphthalene	ug/Kg	ND	ND	ND	0	4
Naphthalene C1	ug/Kg	ND	ND	ND	0	2
Naphthalene C2	ug/Kg	ND	ND	ND	0	2
Naphthalene C3	ug/Kg	ND	ND	ND	0	2
Naphthalene C4	ug/Kg	ND	ND	ND	0	2
n-Decane	ug/Kg	ND	ND	ND	0	2
n-Docosane	ug/Kg	9	10	9.5	2	2
n-Dodecane	ug/Kg	ND	ND	ND	0	2
n-Dotriacontane	ug/Kg	23	130	76.5	2	2
n-Eicosane	ug/Kg	ND	320	82.5	1	2

Sediment Non-Radiological Data

n-Heneicosane	ug/Kg	8	14	11	2	2
n-Hentriacontane	ug/Kg	260	2300	1280	2	2
n-Heptacosane	ug/Kg	77	320	198	2	2
n-Heptadecane	ug/Kg	6	27	16.5	2	2
n-Hexacosane	ug/Kg	15	32	23.5	2	2
n-Hexadecane	ug/Kg	2	8	5	2	2
Nickel	mg/kg	ND	6.87	4.68	1	2
Nitrobenzene	ug/kg	ND	ND	ND	0	2
N-Nitrosodimethylamine	ug/kg	ND	ND	ND	0	2
N-Nitroso-di-n-propylamine	ug/kg	ND	ND	ND	0	2
N-Nitrosodiphenylamine	ug/kg	ND	ND	ND	0	2
n-Nonacosane	ug/Kg	180	1300	740	2	2
n-Nonadecane	ug/Kg	4	7	5.5	2	2
n-Octacosane	ug/Kg	23	60	41.5	2	2
n-Octadecane	ug/Kg	3	6	4.5	2	2
n-Pentacosane	ug/Kg	35	130	82.5	2	2
n-Pentadecane	ug/Kg	2	23	12.5	2	2
n-Tetracosane	ug/Kg	13	16	14.5	2	2
n-Tetradecane	ug/Kg	ND	320	81	1	2
n-Tetratriacontane	ug/Kg	ND	320	84.5	1	2
n-Triacontane	ug/Kg	30	95	62.5	2	2
n-Tricosane	ug/Kg	16	39	27.5	2	2
n-Tridecane	ug/Kg	ND	ND	ND	0	2
n-Tritriacontane	ug/Kg	120	790	455	2	2
n-Undecane	UG/KG	ND	190	54	1	2
o-Cresol	ug/kg	ND	ND	ND	0	2
PCB, Total	ug/kg	ND	ND	ND	0	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Pentachlorophenol	ug/kg	ND	ND	ND	0	2
Percent Moisture	%	22.9	31.8	27.3	2	2
Perylene	ug/Kg	60	60	39.5	1	2
Phenanthrene	ug/Kg	ND	ND	ND	0	4
Phenanthrene C1	ug/Kg	ND	ND	ND	0	2
Phenanthrene C2	ug/Kg	ND	ND	ND	0	2
Phenanthrene C3	ug/Kg	ND	ND	ND	0	2
Phenanthrene C4	ug/Kg	ND	ND	ND	0	2
Phenol	ug/kg	ND	ND	ND	0	2
Phorate	ug/kg	ND	ND	ND	0	2
Phytane	ug/Kg	ND	ND	ND	0	2
Potassium	mg/kg	282	366	324	2	2
Pristane	ug/Kg	ND	ND	ND	0	2
Pyrene	ug/Kg	ND	490	132	1	4
Pyrene C1	ug/Kg	ND	ND	ND	0	2
Pyridine	ug/kg	ND	ND	ND	0	2

Sediment Non-Radiological Data

Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Sodium	mg/kg	ND	262	181	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Total Organic Carbon	mg/Kg	4410	6660	5530	2	2
Toxaphene	ug/kg	ND	ND	ND	0	2
Vanadium	mg/kg	13.4	13.4	12.2	1	2
Zinc	mg/kg	ND	20	11.3	1	2

Deer Non-Radiological Data

Table 4.54 Non-Radiological Analysis of Deer Liver Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Aluminum	mg/kg	1.81	63.2	11	7	7
Antimony	mg/kg	ND	ND	ND	0	7
Arsenic	mg/kg	ND	ND	ND	0	7
Barium	mg/kg	0.0422	0.112	0.0823	7	7
Beryllium	mg/kg	0.0894	0.234	0.169	7	7
Cadmium	mg/kg	0.0354	0.157	0.0778	7	7
Chromium	mg/kg	ND	0.612	0.23	5	7
Cobalt	mg/kg	0.0363	0.103	0.0694	7	7
Copper	mg/kg	21.7	66.7	43.9	7	7
Iron	mg/kg	57.4	138	104	7	7
Lead	mg/kg	ND	ND	ND	0	7
Lipids	%	5.04	6.74	5.74	7	7
Manganese	mg/kg	3.9	5.05	4.43	7	7
Mercury	mg/kg	ND	ND	ND	0	7
Nickel	mg/kg	0.279	0.435	0.33	7	7
PCB-1016	ug/kg	ND	ND	ND	0	7
PCB-1221	ug/kg	ND	ND	ND	0	7
PCB-1232	ug/kg	ND	ND	ND	0	7
PCB-1242	ug/kg	ND	ND	ND	0	7
PCB-1248	ug/kg	ND	ND	ND	0	7
PCB-1254	ug/kg	ND	ND	ND	0	7
PCB-1260	ug/kg	ND	ND	ND	0	7
Selenium	mg/kg	ND	0.32	0.151	1	7
Silver	mg/kg	ND	0.808	0.124	3	7
Thallium	mg/kg	ND	ND	ND	0	7
Vanadium	mg/kg	ND	ND	ND	0	7
Zinc	mg/kg	13	24.2	20.9	7	7

Deer Non-Radiological Data

Table 4.55 Non-Radiological Background (BCWA) Analysis of Deer Liver Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Aluminum	mg/kg	2.19	3.1	2.64	2	2
Antimony	mg/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2
Barium	mg/kg	ND	0.0639	0.0344	1	2
Beryllium	mg/kg	0.0895	0.157	0.123	2	2
Cadmium	mg/kg	0.0911	0.219	0.155	2	2
Chromium	mg/kg	0.211	0.251	0.231	2	2
Cobalt	mg/kg	0.106	0.115	0.11	2	2
Copper	mg/kg	48.7	86.8	67.7	2	2
Iron	mg/kg	55.6	98.9	77.2	2	2
Lead	mg/kg	ND	ND	ND	0	2
Lipids	%	5.65	6.19	5.92	2	2
Manganese	mg/kg	3.77	5.7	4.74	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Nickel	mg/kg	0.354	0.455	0.405	2	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	ND	ND	ND	0	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	ND	ND	ND	0	2
Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	0.0382	0.0877	0.063	2	2
Thallium	mg/kg	ND	ND	ND	0	2
Vanadium	mg/kg	ND	ND	ND	0	2
Zinc	mg/kg	15.2	41.4	28.3	2	2

Deer Non-Radiological Data

Table 4.56 Non-Radiological Analysis of Deer Muscle Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Aluminum	mg/kg	ND	5.4	2.52	6	7
Antimony	mg/kg	ND	ND	ND	0	7
Arsenic	mg/kg	ND	ND	ND	0	7
Barium	mg/kg	0.0151	0.211	0.0622	7	7
Beryllium	mg/kg	0.0517	0.143	0.0775	7	7
Cadmium	mg/kg	ND	0.1	0.0309	2	7
Chromium	mg/kg	ND	0.265	0.136	3	7
Cobalt	mg/kg	ND	0.071	0.0256	2	7
Copper	mg/kg	1.31	2.14	1.64	7	7
Iron	mg/kg	27.8	46.4	36.6	7	7
Lead	mg/kg	ND	0.477	0.254	1	7
Manganese	mg/kg	0.127	0.58	0.242	7	7
Mercury	mg/kg	ND	ND	ND	0	7
Nickel	mg/kg	0.217	0.681	0.372	7	7
Selenium	mg/kg	ND	ND	ND	0	7
Silver	mg/kg	ND	0.621	0.093	1	7
Thallium	mg/kg	ND	ND	ND	0	7
Vanadium	mg/kg	ND	0.149	0.0721	1	7
Zinc	mg/kg	ND	13.3	6.3	6	7

Table 4.57 Non-Radiological Background (BCWA) Analysis of Deer Muscle Tissue for 200

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Aluminum	mg/kg	2.73	3.22	2.98	2	2
Antimony	mg/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2
Barium	mg/kg	0.0491	0.0888	0.0689	2	2
Beryllium	mg/kg	0.0791	0.0828	0.0809	2	2
Cadmium	mg/kg	ND	ND	ND	0	2
Chromium	mg/kg	0.171	0.241	0.206	2	2
Cobalt	mg/kg	ND	ND	ND	0	2
Copper	mg/kg	1.86	2.74	2.3	2	2
Iron	mg/kg	43.6	46.8	45.2	2	2
Lead	mg/kg	ND	ND	ND	0	2
Manganese	mg/kg	0.211	0.343	0.277	2	2
Mercury	mg/kg	ND	ND	ND	0	2
Nickel	mg/kg	0.544	0.727	0.635	2	2
Selenium	mg/kg	ND	ND	ND	0	2
Silver	mg/kg	ND	ND	ND	0	2
Thallium	mg/kg	ND	ND	ND	0	2
Vanadium	mg/kg	ND	ND	ND	0	2
Zinc	mg/kg	3.58	5.08	4.33	2	2

Deer Non-Radiological Data

Table 4.58 Non-Radiological Analysis of Deer Kidney Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Aluminum	mg/kg	ND	3.7	2.18	6	7
Antimony	mg/kg	ND	ND	ND	0	7
Arsenic	mg/kg	ND	ND	ND	0	7
Barium	mg/kg	0.277	1.11	0.507	7	7
Beryllium	mg/kg	0.0647	0.162	0.105	7	7
Cadmium	mg/kg	0.226	1.48	0.607	7	7
Chromium	mg/kg	ND	0.34	0.138	3	7
Cobalt	mg/kg	ND	0.196	0.0407	1	7
Copper	mg/kg	3.49	11	4.96	7	7
Iron	mg/kg	42.4	105	67.5	7	7
Lead	mg/kg	ND	0.502	0.29	2	7
Manganese	mg/kg	1.01	1.62	1.36	7	7
Mercury	mg/kg	ND	0.034	0.0188	3	7
Nickel	mg/kg	0.225	0.476	0.322	7	7
Selenium	mg/kg	0.61	1.1	0.886	7	7
Silver	mg/kg	ND	5.49	0.792	3	7
Thallium	mg/kg	ND	ND	ND	0	7
Vanadium	mg/kg	ND	ND	ND	0	7
Zinc	mg/kg	5.93	15.9	9.94	7	7

Table 4.59 Non-Radiological Background (BCWA) Analysis of Deer Kidney Tissue for 200

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Aluminum	mg/kg	1.68	2.58	2.13	2	2
Antimony	mg/kg	ND	ND	ND	0	2
Arsenic	mg/kg	ND	ND	ND	0	2
Barium	mg/kg	0.16	0.223	0.191	2	2
Beryllium	mg/kg	0.0864	0.0964	0.0914	2	2
Cadmium	mg/kg	1.45	1.74	1.59	2	2
Chromium	mg/kg	0.153	0.268	0.21	2	2
Cobalt	mg/kg	0.0365	0.0623	0.0494	2	2
Copper	mg/kg	3.39	3.71	3.55	2	2
Iron	mg/kg	54.5	62.4	58.4	2	2
Lead	mg/kg	ND	ND	ND	0	2
Manganese	mg/kg	1.52	2.22	1.87	2	2
Mercury	mg/kg	ND	0.036	0.0242	1	2
Nickel	mg/kg	0.351	0.381	0.366	2	2
Selenium	mg/kg	0.59	1	0.795	2	2
Silver	mg/kg	ND	0.0201	0.0126	1	2
Thallium	mg/kg	ND	ND	ND	0	2
Vanadium	mg/kg	ND	ND	ND	0	2
Zinc	mg/kg	13	15.3	14.1	2	2

Deer Non-Radiological Data

Table 4.60 Non-Radiological Analysis of Deer Fat Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Lipids	%	49	113	80.6	13	13
PCB-1016	ug/kg	ND	ND	ND	0	13
PCB-1221	ug/kg	ND	ND	ND	0	13
PCB-1232	ug/kg	ND	ND	ND	0	13
PCB-1242	ug/kg	ND	ND	ND	0	13
PCB-1248	ug/kg	ND	ND	ND	0	13
PCB-1254	ug/kg	ND	ND	ND	0	13
PCB-1260	ug/kg	21.5	106	57.3	13	13

Table 4.61 Non-Radiological Background (BCWA) Analysis of Deer Fat Tissue for 2001

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Lipids	%	49.7	94.1	71.6	4	4
PCB-1016	ug/kg	ND	ND	ND	0	4
PCB-1221	ug/kg	ND	ND	ND	0	4
PCB-1232	ug/kg	ND	ND	ND	0	4
PCB-1242	ug/kg	ND	ND	ND	0	4
PCB-1248	ug/kg	ND	ND	ND	0	4
PCB-1254	ug/kg	ND	ND	ND	0	4
PCB-1260	ug/kg	ND	145	43.9	2	4

Fish Tissue Non-Radiological Data

Table 4.62 Non-Radiological Analysis of Fish Tissue for 2001 at Location LUK 4.3

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Lipids	%	0.72	1.89	1.3	2	2
PCB-1016	ug/kg	ND	ND	ND	0	2
PCB-1221	ug/kg	ND	ND	ND	0	2
PCB-1232	ug/kg	ND	ND	ND	0	2
PCB-1242	ug/kg	ND	ND	ND	0	2
PCB-1248	ug/kg	15.8	20.3	18	2	2
PCB-1254	ug/kg	ND	ND	ND	0	2
PCB-1260	ug/kg	92.2	95.8	94	2	2
PCB-1268	ug/kg	ND	ND	ND	0	2

Table 4.63 Non-Radiological Analysis of Fish Tissue for 2001 at Location LUK 7.2

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Lipids	%	0.93	1.12	1.02	5	5
PCB-1016	ug/kg	ND	ND	ND	0	6
PCB-1221	ug/kg	ND	ND	ND	0	6
PCB-1232	ug/kg	ND	ND	ND	0	6
PCB-1242	ug/kg	ND	ND	ND	0	6
PCB-1248	ug/kg	25.2	71.3	43.1	6	6
PCB-1254	ug/kg	ND	ND	ND	0	6
PCB-1260	ug/kg	80.9	341	175	6	6
PCB-1268	ug/kg	ND	ND	ND	0	6

Table 4.64 Non-Radiological Analysis of Fish Tissue for 2001 at Location LUK 9.0

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Lipids	%	0.54	1.01	0.823	6	6
PCB-1016	ug/kg	ND	ND	ND	0	6
PCB-1221	ug/kg	ND	ND	ND	0	6
PCB-1232	ug/kg	ND	ND	ND	0	6
PCB-1242	ug/kg	ND	ND	ND	0	6
PCB-1248	ug/kg	21.3	71.9	48.7	6	6
PCB-1254	ug/kg	ND	ND	ND	0	6
PCB-1260	ug/kg	57.2	603	292	6	6
PCB-1268	ug/kg	ND	ND	ND	0	6

Fish Tissue Non-Radiological Data

Table 4.65 Non-Radiological Analysis of Fish Tissue for 2001 at Location MAK 13.8

Analysis	Units	Minimum	Maximum	Average	Count Detects	Count Samples
Lipids	%	0.76	1.66	1.14	7	7
PCB-1016	ug/kg	ND	ND	ND	0	7
PCB-1221	ug/kg	ND	ND	ND	0	7
PCB-1232	ug/kg	ND	ND	ND	0	7
PCB-1242	ug/kg	ND	ND	ND	0	7
PCB-1248	ug/kg	ND	ND	ND	0	7
PCB-1254	ug/kg	ND	ND	ND	0	7
PCB-1260	ug/kg	ND	ND	ND	0	7
PCB-1268	ug/kg	ND	ND	ND	0	7

BJC/PAD-319
Volume III

PADUCAH SITE

Annual Site Environmental Report

Summary

Transforming to Succeed

2001

Preface

This report summarizes the information found in the Paducah Annual Site Environmental Report for 2001, BJC/PAD-319. The U. S. Department of Energy requires an annual site environmental report that presents the results from various environmental monitoring programs and activities carried out during the year. This summary report is written so that it can be easily understood and educate the reader about mission, goals, and activities of the Department of Energy at Paducah. It is a brief summary of 2001 activities, including environmental monitoring, clean-up activities, accomplishments, and general information. This report also interprets some of the data contained in the 2001 Annual Site Environmental Report. The data presented is a subset of the data found in the Annual Site Environmental Report Volumes I and II. This subset is considered the most appropriate for this summary. More information can be found in the Paducah Annual Site Environmental Report for 2001, BJC/PAD-319, Bechtel Jacobs Company, LLC, Paducah, KY.

You are encouraged to comment on the content of this report, as well to make suggestions for future documents. Please send your comments and suggestions to:

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Phone: (270) 441-6800
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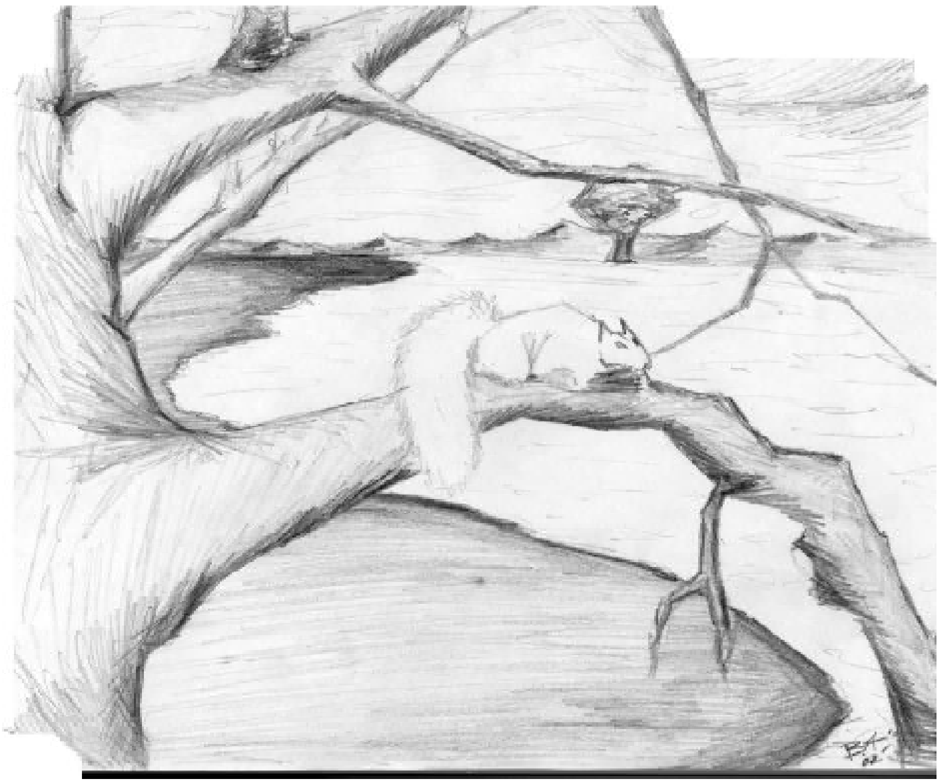
Cover Art: Drawing by student artist, Sarah Nance, Heath High School, West Paducah, Kentucky



Drawing by student artist from
Heath High School,
West Paducah, Kentucky

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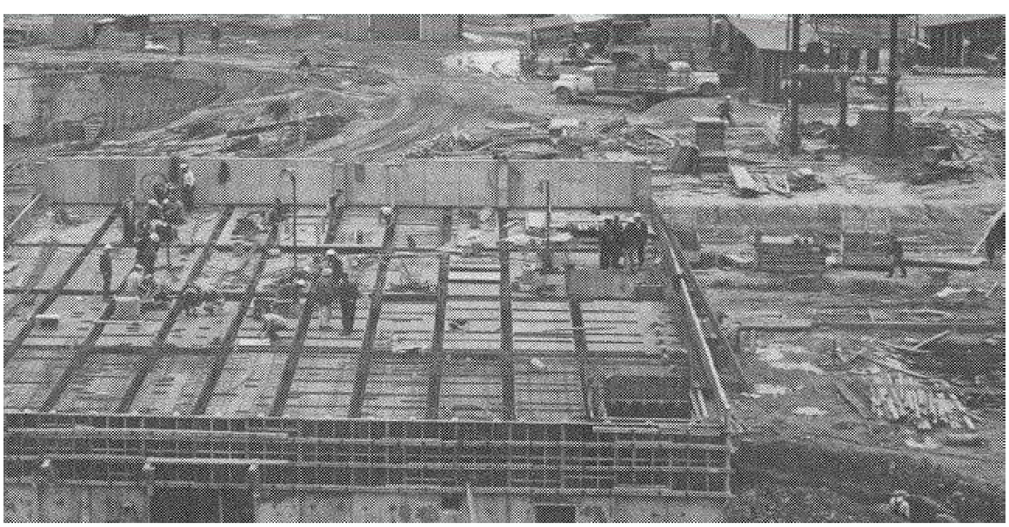
The History of the Department of Energy in Paducah

Before World War II (prior to 1939), the land now occupied by the United States Department of Energy (DOE) and the Paducah Gaseous Diffusion Plant (PGDP) was used primarily for agricultural purposes. Early during the war, thousands of acres were assembled for construction of the Kentucky Ordnance Works, which was operated by the Atlas Powder Company until the end of the war. In October 1950, President Harry Truman directed the Atomic Energy Commission to begin expanding production of atomic weapons. One way of expanding production was to construct and begin operating a new gaseous diffusion plant. Paducah was a candidate for the location because of a plentiful water source, well-developed transportation systems, inexpensive power from the Tennessee Valley Authority, and access to fuel from regional coal mines. Former Paducah native, Vice President Alben Barkley, also played a major role in the plant site selection.

On October 18, 1950, the Atomic Energy Commission approved the Paducah Site for uranium enrichment operations. On December 14, 1950, the Atomic Energy Commission publicly announced that it was building a gaseous diffusion plant for uranium enrichment in Paducah. Construction of the PGDP began in 1951. The $500 million project occupied over 7000 acres at that time and included the former site of the Kentucky Ordnance Works.

The construction of the plant took place on a 750-acre tract of land, located 15 miles west of Paducah. The population of Paducah almost doubled in two years, creating problems with housing, traffic control, recreational opportunities, education, and medical care. In the first year of the construction, about 2,500 housing units were built and more than 20,000 workers located here for the plant's construction. This took more than three years to complete.

Although construction of the plant was not completed until 1954, uranium enrichment production began in 1952. Today, the plant's mission has not changed and the original facilities are still in operation, with substantial upgrading and refurbishment.



Under Construction 1951.

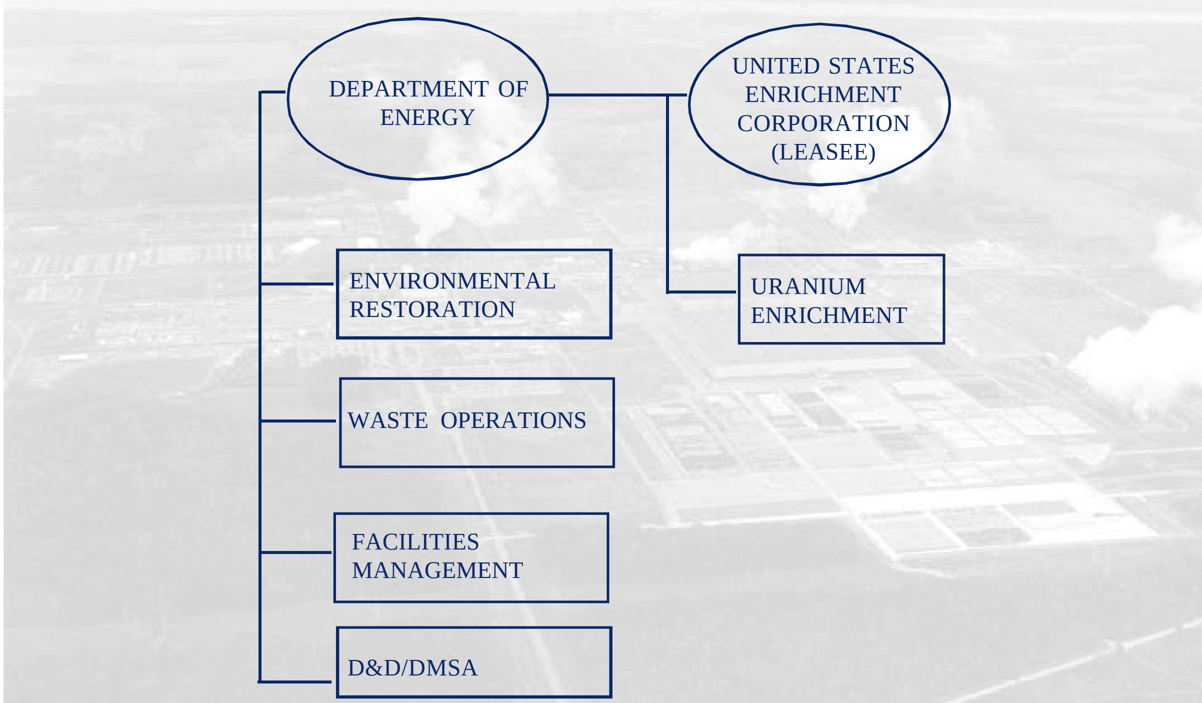
In August 1946, President Truman signed the Atomic Energy Act of 1946 creating the Atomic Energy Commission. In 1977, President Jimmy Carter signed the DOE Organization Act. After thirty-one years, the Atomic Energy Commission was officially changed to the DOE.

Today, the Paducah Site property includes 3,556 acres of which 748 are within PGDP security fence. The DOE began leasing some of its facilities to the United States Enrichment Corporation (USEC) on July 1, 1993. At that time, USEC took over the mission of uranium enrichment. USEC was established in October 1992 by the National Energy Policy Act. Under the terms of the lease agreement, USEC assumed responsibility for environmental compliance activities directly associated with current uranium enrichment operations. USEC performs environmental sampling related to the operation of the uranium enrichment facilities. However, USEC data are not presented in this summary report. The DOE annual site reports only included data that were generated by DOE and its subcontractors for compliance or surveillance of DOE activities.

The DOE retained responsibility for the environmental cleanup activities, the legacy waste management, and the management of the Paducah facilities not leased to USEC. The legacy waste management includes waste inventories predating July 1, 1993.

The DOE and its contractors employ approximately 450 employees who work on various waste management projects. The managing and integrating contractor, Bechtel Jacobs Company LLC, implements many of the DOE activities to restore the environment at the Paducah Site. The figure below provides the Paducah Site employers and their responsibilities.

PADUCAH SITE EMPLOYERS AND THEIR RESPONSIBILITIES



Timeline of Events at PGDP

1951-1954	**Construction of PGDP as the second gaseous diffusion plant in the United States. Oak Ridge, Tennessee, was first and Portsmouth, Ohio, third.**
1952	**Enriched uranium hexafluoride production begins. First cylinders of depleted uranium hexafluoride generated and stored inside the PGDP security fence.**
1952-1984	**Union Carbide Corporation manages and operates the Paducah and Oak Ridge gaseous diffusion plants under federal contract.**
1964	**Use of ongoing enrichment services ended for nuclear weapons production. Primary customer becomes utility companies with nuclear power reactors, and until 1991, for Navy nuclear-powered submarines.**
1979	**Waste Management function established at Paducah.**
1984	**Martin Marietta Energy Systems Inc. becomes management and operating contractor for DOE facilities at Paducah and Oak Ridge (Portsmouth added in 1986).**
1988	**Contaminated groundwater was discovered outside the DOE Property Boundary. DOE policy of extending water lines to homes in area begins.**
1989-1990	**Creeks and ditches near the plant are posted to restrict public access. Expanded network of groundwater monitoring wells begins. First major site investigation begins to determine nature and extent of contamination outside the PGDP security fence.**
1990	**Second phase of sitewide investigation begins to further determine nature and extent of contamination outside the PGDP security fence.**
1993	**DOE leases enrichment production facilities to USEC. Plant ends use of the degreasor trichloroethene, the primary groundwater contaminant. DOE opens the Environmental Information Center in the West Kentucky Technology Park at Kevil.**
1994	**PGDP is chosen as national demonstration site for Lasagna™ soil cleanup technology; removal of rust and painting of depleted uranium cylinders begins; shipped 6,500 polychlorinated biphenyl capacitors off-site for disposal.**
1995	**Concrete cylinder yards built; tons of radioactive contaminated concrete, soil and gravel removed and disposed; cleanup actions completed around closed landfill; new solid waste contained landfill constructed. Paducah Area Community Reuse Organization chartered.**
1997	**Groundwater treatment begins to remove trichloroethene and technetium-99. The Environmental Protection Agency adds PGDP to its Superfund National Priorities List. Treatment and re-routing of flow in the plant's North South Diversion Ditch begins.**
1998	**Completed Federal Facility Agreement with state and federal regulators for long-term cleanup plan; made major strides in waste treatment and disposal. DOE awards Management and Integration contract to BJC. USEC privatizes.**
1999	**Implemented new clean-up strategy that is expected to complete work more rapidly; implemented new waste management strategy that prioritizes waste disposition based on risk.**
2000	**Continued operation of the Lasagna™ technology; removal of Drum Mountain; mobilization and a Phase 1 attempt of the Permeable Treatment Zone study; continued operation of the Northwest and Northeast Plume Groundwater Treatment Systems; initiation of the Rubble Pile Removal project.**
2001	**Continued operation of the Lasagna™ technology; continued operation of the Northwest and Northeast Plume Groundwater Treatment Systems; initiation of the Scrap Yard Sedimentation Basin; preparation of several project documents written for work in 2002.**

Site Program Missions

The following four major programs are operated by the DOE at the Paducah Site: (1) Environmental Restoration, (2) Waste Operations, (3) Facilities Management, and (4) Decontamination and Decommissioning/DOE Material Storage Area (D&D/DMSA). Each of these programs has a mission as described below.

ENVIRONMENTAL RESTORATION

The mission of the Environmental Restoration Program is to ensure that releases from past operations and waste management at the Paducah Site are investigated and that appropriate remedial action is taken for protection of human health and the environment.

WASTE OPERATIONS

The mission of the Waste Operations Program is to characterize and dispose of the legacy waste stored on-site in compliance with various agreements between DOE and the regulatory agencies.

FACILITIES MANAGEMENT

The primary mission of the Facilities Management Program is to maintain safe, compliant storage of the DOE depleted Uranium Hexafluoride (DUF_6) inventory, pending final disposal of the material, and to manage facilities and grounds not leased to USEC.

D&D/DMSA

The primary mission of the D&D/DMSA programs is to disposition surplus facilities and prepare materials or waste for disposal.

Environmental Compliance Activities

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)

RCRA is a law that requires a permit to manage hazardous waste. PGDP received a RCRA permit in 1991 that must be renewed every ten years. The hazardous waste permit renewal application was submitted to the Kentucky Division (KDWM) on February 21, 2001. This application was a renewal application to the original permit that was issued on August 19, 1991, and expired on August 19, 2001. On September 28, 2001, KDWM requested additional information. A revised permit application was submitted in February 2002. DOE is awaiting the issuance of a new permit and continues to operate under the expired permit.

On July 30, 2001, KDWM issued a Notice of Violation (NOV) alleging the "Failure to Comply with Permit Condition II.J.1 of the PGDP Hazardous Waste Management Permit." KDWM alleged in the NOV that DOE failed to submit a well abandonment and replacement work plan for Monitoring Well (MW) 87 as originally required. This well has since been replaced.

An NOV, dated July 31, 2001, was issued by KDWM alleging the "Failure to Comply with 401 Kentucky Administrative Regulation (KAR) 32:030, Section 5, 401 KAR 38:010, Section 4, Kentucky Revised Statute (KRS) 224.46-520 and Part II of the Facility's Hazardous Waste Management Permit" pertaining to DMSA C-331-10 (SWMU 244). The regulations prohibit the storage of hazardous waste for greater than 90 days without a permit.

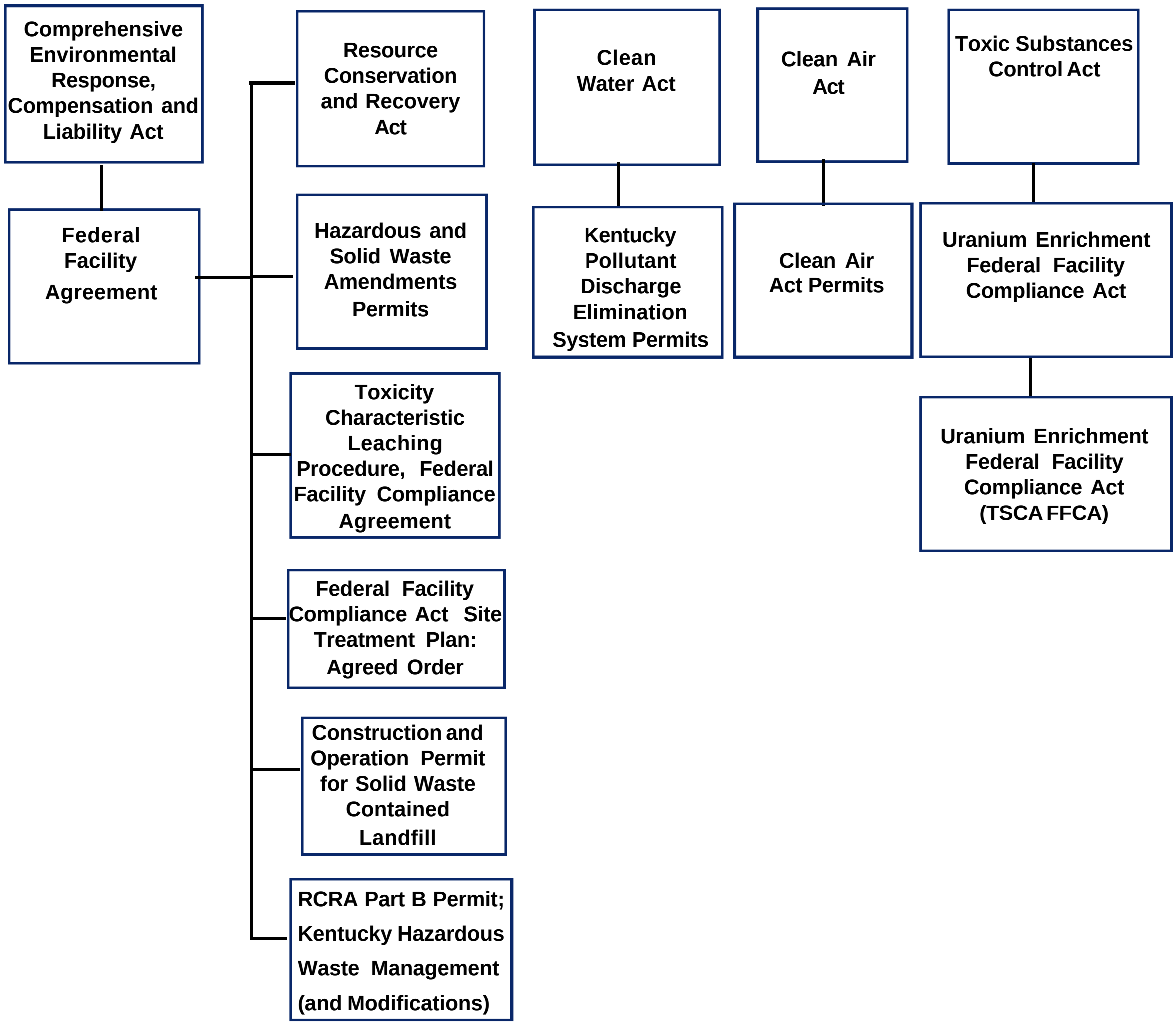
On October 9, 2001, KDWM issued an NOV as a result of DOE's identification of hazardous waste stored in DMSAs. The violation alleged that there was a "Failure to Comply with 401 KAR 32:030, Section 5, 401 KAR 38:010, Section 4, KRS 224.46-520 and Part II of the facility's Hazardous Waste Management Permit." KDWM has claimed that DMSAs C-331-15, C-335-05, and C-333-31 contained hazardous waste for greater than 90 days without a permit.

DOE is contesting these allegations. However, during 2001, DOE submitted closure plans to KDWM for hazardous waste discovered in DMSAs C-400-04, C-331-10, C-335-05, C-331-10, and C-331-15.

RCRA SOLID WASTE MANAGEMENT

The Paducah Site disposes of a portion of its solid waste at its on-site contained landfill facility, C-746-U. On June 13, 2001, the landfill was opened for disposal of cylinder yard construction waste. Cylinder yard construction waste (2948 tons) was placed in the landfill from June 13, 2001, through July 25, 2001. On August 10, 2001, KDWM issued a letter ordering DOE to cease the placement of waste in the landfill until such time that the monitoring well network has been re-established due to potential corrosion of monitoring wells (MWs) discovered in late 2000. The potential corrosion in the landfill MWs was a result of an electrochemical reaction. The electrochemical reaction discovered in 2000 was caused by the difference in electrical potential between the two types of steel used in the well riser and isolation casing. Activities were initiated to replace MWs at the landfill in late 2001.

Regulatory Drivers at the Paducah Site.



Environmental permit summary

Permit Type	Issued By	Expiration Date	Permit Number	Issued To
Water				
KPDES	KDOW	3/31/2003	KY0004049	DOE
Stormwater Point Sources	KDOW	9/30/2002	KYR100000	DOE
Solid Waste				
Residential Landfill (closed)	KDWM	11/1/2003	073-00014	DOE
Inert Landfill (closed)	KDWM	6/11/2003	073-00015	DOE
Solid Waste Contained Landfill (construction/operation)	KDWM	11/4/2006	073-00045	DOE
RCRA/TSCA				
State Hazardous Waste Management Permit	KDWM	8/19/2001*	KY8890008982	DOE/BJC
EPA Hazardous & Solid Waste Amendments Permit	EPA	8/19/2001*	KY8890008982	DOE/BJC
Toxicity Characteristic Leaching Procedure, Federal Facility Compliance Agreement	EPA	NA	NA	DOE
Federal Facility Compliance Act Site Treatment Plan: Agreed Order	EPA	NA	NA	DOE
Federal Facility Agreement	EPA KDWM	NA	NA	DOE
TSCA FFCA	EPA		NA	DOE
Air				
Cylinder Refurbishment – Permit Terminated				
Vortec – Permit Expired Not Renewed				

NA - Not Applicable
KDOW – Kentucky Division of Water
KDWM – Kentucky Division of Waste Management
KDAQ – Kentucky Division of Air Quality
* - New permits have been applied for.

Environmental Compliance Activities (Cont.)

UNDERGROUND STORAGE TANKS (UST)

In August 2001, a previously unknown UST containing petroleum products was discovered during refurbishment of cylinder storage yard C-745-K. KDWM was notified of the discovery. The UST was removed and clean closure for the site was obtained. DOE is responsible for 15 of the 17 site USTs that have been reported to KDWM in accordance with regulatory notification requirements. USEC uses the other two site USTs. At the end of 2001, four of DOE's USTs had not met all regulatory requirements necessary to achieve permanent ("clean") closure. Other UST activities in 2001 included submittal to KDWM of additional information requested related to previously submitted Closure Assessment Reports. Closure activities for USTs will continue into 2002.

NATIONAL ENVIRONMENTAL POLICY ACT

In 2001, DOE continued preparation of two environmental assessments (EA). An EA addresses waste disposition. A second EA addresses the process and criteria for accepting Paducah Site waste at the C-746-U Landfill. In addition, numerous minor activities were within the scope of the previously approved categorical exclusions for routine maintenance, small-scale facility modifications, and site characterization.

CLEAN AIR ACT COMPLIANCE STATUS

The Paducah Site had two air emissions point sources in 2001. The Northwest Plume Groundwater System and the Northeast Plume Containment System are interim remedial actions (IRAs) under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for the containment of groundwater contamination at the Paducah Site. These separate facilities remove trichloroethene (TCE) contamination from the groundwater by air stripping. At the Northwest Plume Groundwater System, the TCE-laden air passes through carbon filtration, which removes much of the TCE. Technetium-99 is removed by an ion exchange unit. At the Northeast Plume Containment System, a cooling tower system acts as an air stripper for TCE. The air streams for both systems are then released to the atmosphere where the remaining TCE naturally breaks down.

RADIONUCLIDE NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS PROGRAM

DOE utilized ambient air monitoring data to verify whether any significant levels of radionuclides are released from PGDP to off-site ambient air. The Radiation/Environmental Monitoring Section of the Radiation Health and Toxic Agents Branch of the Department for Public Health of the Kentucky Cabinet for Health Services conducted ambient air monitoring during 2001. Ambient air data were collected at ten sites surrounding the plant in order to measure radionuclides emitted from Paducah Site sources, including fugitive emissions.

CLEAN WATER ACT NOVS

DOE received a NOV, dated February 28, 2001, by KDOW alleging the failure to submit sampling data for Outfall 017 in the November 2000 Discharge Monitoring Report. The November samples for toxicity were not collected. DOE implemented contract modifications to ensure future toxicity samples will be collected and extended toxicity sampling through May 2001.

KENTUCKY POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMITS

KPDES Permit No. KY0004049 applies to the following four DOE outfalls: 001, 015, 017, and 019. Outfall 001 had one permit exceedence during 2001 for chronic toxicity; however, the re-test showed no toxicity. No exceedences of effluent limits occurred at Outfall 015, which is an intermittent rainfall-dependent outfall. Four permit exceedences occurred at Outfall 017, which contains runoff from DOE depleted uranium hexafluoride (DUF_6) cylinder storage yards. The exceedences were due to acute toxicity, most likely related to zinc from paint associated with recently painted DUF_6 cylinders. No exceedences of effluent permit limits occurred at C-746-U Landfill Outfall 019.

TOXIC SUBSTANCES CONTROL ACT

The Uranium Enrichment (UE) TSCA FFCA between the Environmental Protection Agency (EPA) and DOE was signed in February 1992. To meet the compliance goals at the Paducah Site, the UE TSCA FFCA is frequently revised and updated. Under this agreement, action plans have been developed and implemented for removal and disposal of PCB material at the Paducah Site. As part of this program during 2001, four capacitors were removed from service in accordance with the TSCA FFCA agreement schedule.

Nine boxes containing 262 capacitors were shipped off-site for disposal in 2001. The contents of the boxes were shipped on January 25, 2001, and January 31, 2001, by DOE to an offsite permanent disposal facility approved for disposal of PCBs.

The annual PCB document, due July 1, provides details of facility activities associated with the management of PCB materials. All Paducah Site UE TSCA FFCA milestones for 2001 were completed.

Status of large, high-voltage PCB capacitors in 2001

Building Location	Beginning Balance (1/1/01)	Capacitors Removed	New Balance (12/31/01)
C-331	69	0	69
C-333	413	4	409
C-335	46	0	46
C-337	255	0	255
Total	783	4	779

Summary of PCBs and PCB items in service at the end of 2001

Type	Number in Service	Volume (gal)	PCBs (kg)
PCB transformers	66	95,256	277,152
PCB-contaminated transformers	9	2,299	0.95
PCB-contaminated electrical equipment	7	2,094	1.13
PCB capacitors	779	--	--
PCB open systems[a]	3	235	10.90

[a] PCB open systems are addressed in the UE TSCA FFCA. In addition, ventilation gaskets used in various buildings throughout the Paducah Site have been determined to contain PCBs. The average PCB concentration is estimated to be 20% by weight. The total PCB content is estimated at 3840 kg in the 19,200 kg of gaskets.

Environmental Restoration

PGDP has numerous Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) that require further investigation and potential remediation. Complex sites with multiple environmental releases, such as PGDP can be divided into smaller areas for separate remedial investigations/ feasibility studies (RI/FS), as opposed to conducting a single, site-wide RI/FS. These smaller, individual study areas, referred to as operable units (OUs) or Waste Area Groups (WAGs) under the Federal Facility Agreement (FFA), typically contain a limited number of SWMUs/AOCs grouped together based on certain criteria.

The SWMUs and AOCs requiring an RI/FS were initially segregated into 30 WAGs based on the specified characteristics, and then prioritized for cleanup according to their contributions to off-site contamination.

As site conditions were better understood through WAG investigations, the DOE, EPA, and the Commonwealth of Kentucky grouped the WAGs more broadly, thereby providing the framework to more effectively integrate, focus, and prioritize response actions across the site. These data and other process knowledge were used to develop site conceptual models for each of the contamination source areas to support the further consolidation of the WAGs into larger operable units. Source areas that were suspected as primary contributors of contamination to a specific environmental media and/or exposure pathway were grouped under the same OU. The following five potential OUs were identified:

(1) Groundwater OU,

(2) Surface Water OU,

(3) Burial Grounds OU,

(4) Soils OU, and

(5) D&D OU.

The OUs include a number of SWMUs and AOCs that require an RI/FS. The scopes of these OUs are intended to include both the contributing source area and the affected environment, which is a significant change from the previous WAG strategy where sources were addressed separately from the contamination that had already migrated to groundwater and surface water. Combining the source areas and affected media by OU has helped DOE develop integrated remedial solutions that better addresses interactions between source areas and affected media.

Once the five OU are fully studied, a comprehensive site-wide OU (CSOU) will be evaluated. The scope of the CSOU will include a comprehensive site-wide baseline risk assessment to evaluate any residual risk remaining at the site after completion of the five OUs, and the cumulative effects from all media.

SITE PRIORITIES

The prioritization process for implementing the OU strategy incorporates the general principles of the CERCLA National Contingency Plan, which uses early actions to reduce migration on and off-site contamination to the environment. Consistent with those principles, a series of interim actions were taken during the earlier phases of the cleanup program. These actions focused exclusively on mitigating current threats of that nature, including, for example, alternate drinking supplies to affected residents, construction and operation of groundwater treatment systems for the northwest and northeast plumes, and surface water actions in the North-South Diversion Ditch and Bayou and Little Bayou creeks. With regard to potential on-site exposure, current threats, in general, have been mitigated through access restrictions and institutional controls. Data generated from implementation of the OU strategy will be continuously reviewed to determine if additional expedited action is needed.

Assuming imminent threats have been adequately addressed through previous actions, groundwater and surface water have been identified as the highest priority since those media serve as migration pathways to off-site receptors. The soils and burial grounds OUs are the next priority followed by the D&D facilities. However, it should be noted that while the RI/FSs for the five OUs have been sequenced in accordance with the previous priorities, a key strategy of implementing the OU approach is early evaluation of existing data to help identify opportunities to implement early actions prior to, or in conjunction with, the RI/FSs for each OU. While a series of early actions have already been identified for several of the OUs (e.g., Scrap Metal, North-South Diversion Ditch, C-410 D&D, etc.), this revised strategy formalizes a process to further facilitate identification and implementation of early actions.

2001 REMEDIAL ACTIVITIES

- Continued operation of the Lasagna™ technology as the selected remedial alternative for reducing the concentration of trichloroethene in SWMU 91. Conducted the verification sampling in 2001, which will be used to verify that the remediation goals have been met.
- Continued operation of the Northwest and Northeast Plume Groundwater treatment systems, which collects and treats groundwater for the TCE and technetium-99 contamination. The Northwest Plume system extracted and treated approximately 109 million gallons of groundwater during 2001. The Northeast Plume system has treated approximately 67 million gallons during 2001.
- Prepared major regulatory documents for North-South Diversion Ditch, C-720 Groundwater, and Scrap Metal Removal Project.
- Initiated the CERCLA Waste Disposition Field Work project.
- Initiated construction of the sediment basin for the Scrap Yards Removal Project in November 2001.

Sediment Basin Construction.

Waste Operations

The Paducah Site Waste Operations Program directs the safe treatment, storage, and disposal of waste generated before July 1, 1993 (i.e., legacy waste), and waste from current DOE activities. The primary objective of the program is to ensure that waste materials do not migrate into the environment. Waste managed under the program is divided into the following seven categories:

- *Low-level radioactive waste* - radioactive waste not classified as high-level or transuranic and does not contain any components regulated by RCRA or TSCA.
- *Hazardous waste* - waste that contains one or more of the wastes listed under RCRA or that exhibits one or more of the four RCRA hazardous characteristics: ignitability, corrosivity, reactivity, and toxicity.
- *Mixed waste* - waste containing both hazardous and radioactive components. Mixed waste is subject to RCRA, which governs the hazardous components, and is subject to additional regulations that govern the radioactive components.
- *Transuranic waste* - waste that contains more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years.
- *Polychlorinated biphenyl (PCB) and PCB-contaminated waste* - waste containing or contaminated with PCBs, a class of synthetic organic chemicals including 209 known isomers, each with 1 to 10 chlorine atoms on a biphenyl ring. Under TSCA regulations, PCB manufacturing was prohibited after 1978. However, continued use of PCBs is allowed provided that the use does not pose a risk to human health or the environment. Disposal of all PCB materials is regulated.
- *Asbestos waste* - asbestos-containing materials from renovation and demolition activities.
- *Solid Waste* - waste that is neither radioactive nor hazardous. Solid sanitary/industrial waste is basically refuse or industrial/construction debris and is disposed in landfills.
- *PCB/Radioactive Waste* - PCB waste or PCB items mixed with radioactive materials and managed as radioactive waste. PCB/radioactive/RCRA shall mean PCB/radioactive waste that may also be hazardous waste under RCRA.

Requirements for meeting waste management regulatory objectives are varied and complex because of the variety of waste streams generated by DOE activities. The goal, however, is to comply with all current regulations while planning cleanup actions that will comply with anticipated future regulations.

WASTE MINIMIZATION/POLLUTION PREVENTION (WM/PP)

Recycling efforts in 2001 included 4.82 metric tons (mt) (10,600 pounds) of office paper, 0.11 mt (240 pounds) of aluminum cans, 0.07 mt (150 pounds) of telephone books, dozens of printer and fax toner cartridges, carbon used in the Northwest Plume Groundwater Treatment Facility, and reuse of gravel generated from reconstruction of cylinder storage yards. Additional accomplishments of the WM/PP Program included incorporating micropurging techniques into groundwater sampling resulting in wastewater reductions; transferring unused chemicals and materials to other programs for re-use; and obtaining surplus equipment from the Weldon Springs Site for reuse at the Paducah Site.

WASTE SHIPMENTS FOR OFF-SITE DISPOSAL

Legacy waste at the Paducah Site has reached approximately 395,000 cubic feet of mixed radioactive waste. Listed below are the off-site shipments of waste for 2001.

Shipped 1320 cubic feet of radioactively contaminated soil to the Nevada Test Site.

Shipped 128 cubic feet of treated uranium chips and empty drums to Envirocare of Utah for disposal.

Shipped 783 cubic feet of PCB Capacitors to Clean Harbors for disposal.

Shipped 7.4 cubic feet of mixed low-level waste to Waste Control Specialist for treatment.

Facilities Management

DEPLETED URANIUM HEXAFLUORIDE CYLINDER PROGRAM

DUF_6 is a product of the uranium enrichment process. A solid at ambient temperatures, DUF_6 is stored in large metal cylinders. At the end of 2001, the Paducah Site managed an inventory of 37,895 cylinders (most containing DUF_6) stored in outdoor facilities commonly referred to as cylinder storage yards.

The mission of the DUF_6 Cylinder Program is to safely store the DOE-owned DUF_6 inventory until its ultimate disposition. DOE has an active cylinder management program that includes cylinder and cylinder yard maintenance, routine inspections, cylinder yard improvement construction, and other programmatic activities such as cylinder corrosion studies. The Program maintains a cylinder inventory database, which serves as a repository for all cylinder inspection data.

DUF_6 cylinder handler.

DOE is upgrading the quality of the cylinder yards to maintain the integrity of the cylinders. Because more yards are available, fewer cylinders are stored in the refurbished yards resulting in easier access for inspections to detect corrosion or leaks. The C-745-K South yard was under construction in 2001 and completed in 2002. Refurbishment of the C-745-M yard is planned for 2002.

DUF_6 cylinder storage yard.

D&D/DMSAs

DECONTAMINATION AND DECOMMISSIONING

D&D is conducted for facilities and other structures contaminated with radiological and hazardous material. Facilities are accepted for D&D when they are no longer required to fulfill a site mission. Legacy contamination on the structure, floors, walls, and equipment may be released to the environment if not appropriately managed in the near term and ultimately removed. The D&D Program is currently focusing on cleaning up two major facilities comprising approximately 46,450 m^2 (500,000 ft^2). These facilities are the C-340 Metal Reduction Plant complex, where UF_6 was converted to uranium metal and hydrogen fluoride, and the C-410 Feed Plant complex, where uranium trioxide (UO_3) was converted to UF_6. Contaminants at these facilities include depleted uranium, natural uranium and transuranic radionuclides, UF_4, PCBs, asbestos, and lead paint. Other facilities are included in the D&D program. However, they are not undergoing major D&D actions at this time.

Development of CERCLA documentation for the removal and disposal of piping, process equipment, and stored materials from the C-410 complex was initiated in 2001. The regulatory documents have been approved. Preparations for implementing the removal action, including completion of utility isolation, lighting improvements, relocation of stored materials, and radiological and chemical characterization of the building were performed, as well as routine surveillance and maintenance activities. Activities at the C-340 complex during 2001 were limited to surveillance and maintenance of the structures to ensure containment of residual materials.

C-410 building.

DOE MATERIAL STORAGE AREAS

DOE Material Storage Area.

The DMSA project is managing 160 DMSAs located throughout the Paducah Site. These areas store DOE materials within buildings and also in designated outside areas. The project is undergoing a characterization to comply with Nuclear Criticality Safety (NCS), RCRA, TSCA, and solid waste concerns. During this process, the material is segregated in several categories to ensure appropriate waste management. It is anticipated that most of the material in the DMSAs will be considered low-level waste after characterization is complete. Most of the low-level waste will remain in-place until D&D of each area. RCRA and TSCA materials found are removed and placed in proper storage areas. In 2001, six DMSAs were characterized. Characterization of twenty-one DMSAs is planned for 2002.

Radiation - What is it?

It comes from outer space, the ground, and even from within our own bodies. Radiation is all around us and has been present since the birth of this planet. It is found in the food we eat. Even our own bodies give off some radiation. Naturally occurring radioactive materials were discovered in 1896. Less than 50 years later, the physicist Enrico Fermi split the atom, producing the first sustainable nuclear chain reaction. Today, both man-made and natural radiation are part of our lives. We use radioactive materials for beneficial purposes, such as generating electricity and diagnosing and treating medical problems. For example, more than 200 million X-rays are performed in America every year. Though radiation offers many benefits, exposure to it can also threaten our health, and the quality of our environment. We cannot eliminate radiation from our environment. We can, however, reduce our risks by controlling our exposure to it.

Atoms are the microscopic building blocks that make up everything around us. Some atoms are unstable or somehow become unstable, and these atoms give off energy in the form of radiation. There are different types of radiation, some more energetic than others. One type of radiation, non-ionizing radiation, has enough energy to move atoms, but not enough to alter them chemically.

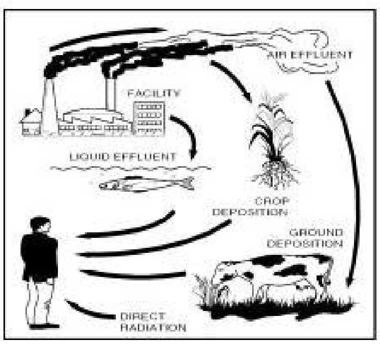
Because radiation is a carcinogen it can cause cancer if the exposure is great enough. In this respect, it is similar to many hazardous chemicals found in the environment that can cause cancer. It may also cause other adverse health effects, including genetic defects in the children of exposed parents or mental retardation in the children of mothers exposed during pregnancy. However, the risk of developing cancer due to radiation exposure is much higher than the risk of these other effects. Much of our knowledge about the risks from radiation is based on studies of over 100,000 survivors of the atomic bombs at Hiroshima and Nagasaki. In these studies, which have continued over the last 50 years, scientists have been able to observe the effects of a wide range of radiation doses, including doses comparable to an average person's lifetime dose from naturally occurring background radiation (about 20,000 millirem). We have learned many things from these studies. The most important are:

- The higher the radiation dose a person receives, the greater the chance of developing cancer.
- It is the chance of cancer occurring, not the kind or severity of cancer, that increases as the radiation dose increases.
- Most cancers do not appear until many years after the radiation dose is received (typically 10 to 40 years).

Current evidence suggests that any exposure to radiation poses some risk (i.e., there is no level below which we can say an exposure poses no risk). For the entire dose of radiation we accumulate over a lifetime from natural background radiation, the risk of developing cancer is estimated to be about one in one hundred. Based on this estimate, several percent of all fatal cancers in the U. S. are caused by background radiation. The additional contribution from all man-made sources of radiation is much smaller. A good reference for additional radiation information is the *Ionizing Radiation Exposure of the Population of the United States,* NCRP Report No. 93, National Council on Radiation Protection and Measurements, Washington, D.C.

EXPOSURE PATHWAYS

Radiation and radioactive material in the environment can reach people through many routes. Potential routes for radiation are referred to as pathways. Several radiation pathways are shown in the figure below. For example, radioactive material in the air could fall on a pasture. Cows could then eat the grass, and the radioactive material on the grass would show up in the cow's milk. People drinking the milk would thus be exposed to this radiation. Or, people could simply inhale the radioactive material in the air. The same events could occur with radioactive material in water. Fish living in the water would be exposed. People eating the fish would then be exposed to the radiation in the fish. Or, people swimming in the water would be exposed.

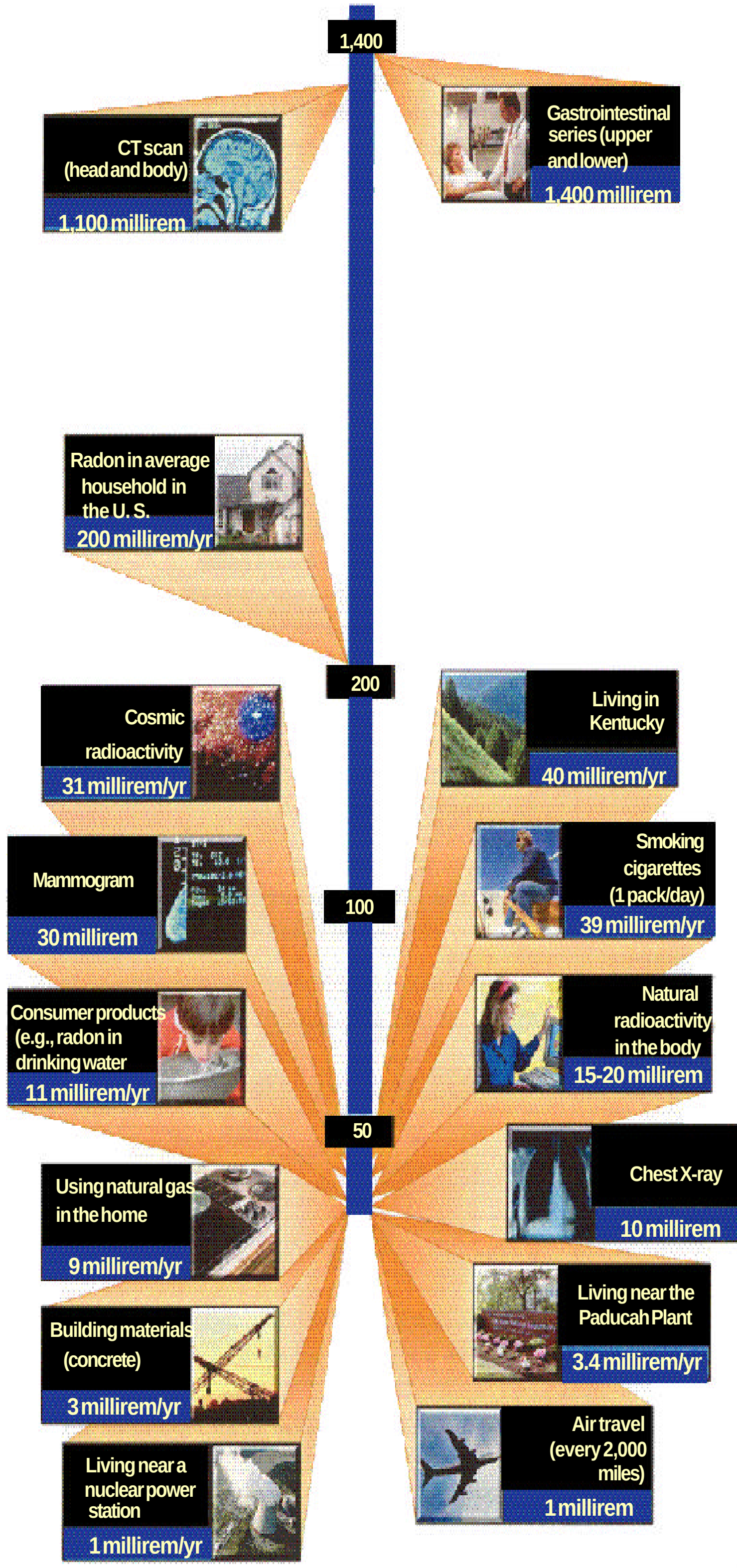


Possible radiation pathways.

RELATIVE DOSES FROM RADIATION SOURCES

Over 80 percent of our exposure to radiation comes from natural sources. Our own bodies, which contain the radioactive element potassium, account for 11 percent of our total exposure. Consumer products make up another 3 percent of our exposure to radiation. The average annual radiation exposure for a person living in the United States is 360 millirem.

RELATIVE DOSES FROM RADIATION SOURCES

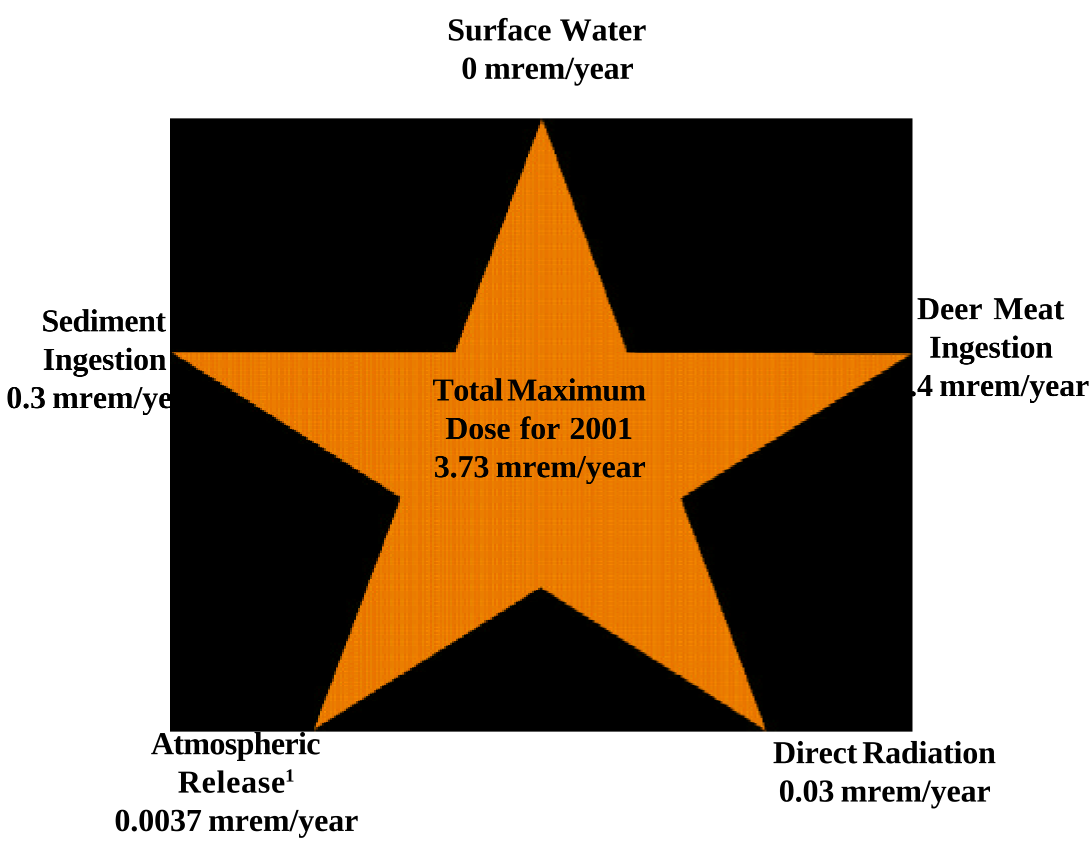


Reference: Oak Ridge Annual Site Environmental Report Summary, 1999

2001 Paducah Site Dose

Everyone is exposed to radiation through normal daily activities. The amount of radiation a person receives in a year depends on many factors. A typical person living in the United States receives approximately 300 millirem per year from all-natural sources of radiation such as cosmic rays from outer space; radon from the ground; and natural radioactive elements found in soil, water, and food. Another 40 to 60 millirem/year come from man-made sources such as medical and dental exams (through X-rays), air travel, and consumer products (through wrist watches and smoke detectors).

The figure below shows the DOE's maximum potential contribution to the radiation dose that a person could receive from being exposed to various media in the environment around the Paducah Site (potential USEC dose contributions are not included) for 2001. The dose is calculated based on monitoring conducted during 2001 of media such as air, surface water, sediment, and deer meat. Groundwater is not included because residents living near the site are not drinking the groundwater. The worst-case combined (internal and external) dose to an individual member of the public was calculated at 3.73 mrem. This level is well below the DOE annual dose limit of 100 mrem/year to members of the public and below the EPA limit of 10 mrem airborne dose to the public. The dose chart shows all media used for the calculation.



[1]DOE source emissions were from the Northwest Plume and Concrete Crushing

Environmental Monitoring

Environmental monitoring is performed at the Paducah Site to comply with applicable laws and regulations, to identify trends, and contribute to environmental awareness. Effluent monitoring and environmental surveillance monitoring are two ways environmental monitoring are performed. Effluent monitoring (which is that monitoring required by environmental regulations) is performed, by collecting and analyzing samples, of discharges from the plant into the air and water. Surveillance monitoring (which is monitoring that the DOE performs to evaluate its impacts on the environment) is performed by collecting and analyzing samples of environmental media to measure the concentration of contaminants. The information obtained from these two types of environmental monitoring are used to determine the effects of the operations at the DOE facilities on the environment.

Surface Water Monitoring.

WHAT ENVIRONMENTAL MEDIA ARE SAMPLED?

Routine sampling is performed on several different media: air, groundwater, sediment, surface water, fish, and deer. When a need for sampling is identified, other types of samples may be collected under special one-time studies. In 2001, approximately 1200 samples were collected. The different media are discussed in the text on the following pages, providing some detail of what is sampled, the results of sampling during 2001, and the relative effect on the dose calculation from the environmental media based on the results. In most cases contaminants that are specific to the plant site are discussed in detail, such as uranium, technetium-99, TCE, and polychlorinated biphenyls.

Air Monitoring

WHY IS AIR SAMPLED?

Air is required to be sampled by the Clean Air Act, DOE Order 5400.1, and DOE Order 5400.5 to ensure the facility is in compliance with limits established by the Clean Air Act and to ensure that workers and the members of the public are protected from unallowable exposure to radiation.

WHAT CONTAMINANTS OF CONCERN ARE ANALYZED?

Radionuclides and other hazardous air pollutants, such as TCE, known to be emitted from the site, are analyzed.

WHAT ENVIRONMENTAL MONITORING IS PERFORMED?

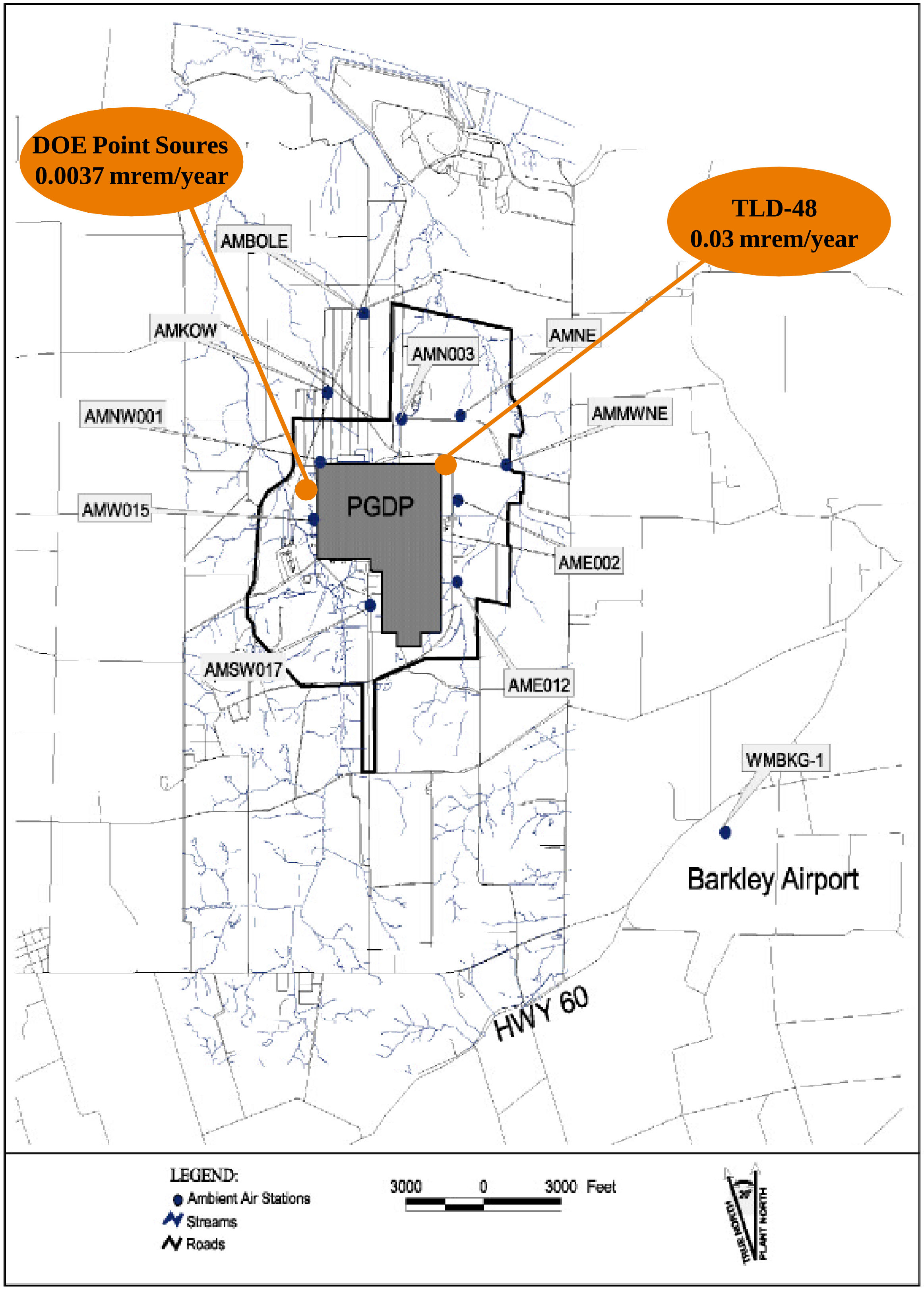
DOE monitors specific sources of contamination such as systems emitting TCE. DOE monitors ambient air for radionuclides. Thermoluminescent dosimeters are used to monitor the dose that may be given by radionuclides in the air near the plant site.

DOE had two sources of airborne radionuclides in 2001. These sources were the Northwest Plume Groundwater System and the Wildlife Area Rubble Pile Removal Project. The amount of radionuclides emitted were calculated or determined based on sampling data and emission factors. Based on the radionuclide results, the dose from these projects to the maximally exposed individual through emissions to the air was calculated to be ***approximately 0.0037 millirem/year in 2001***. Source of air discharges for contaminants other than radionuclides were the Northwest Plume Groundwater System and the Northeast Plume Groundwater System. These systems combined removed 1939 pounds (0.97 tons) of TCE from the groundwater through the use of air stripping processes.

DOE utilized ambient air monitoring data to verify insignificant levels of radionuclides in off-site ambient air. Ambient air data are collected at ten sites surrounding the plant (see figure on following page) in order to measure radionuclides emitted from Paducah Site sources including fugitive emissions. Results indicated that radionuclides emitted in the air emissions were at or below background at the sampling locations. The dose to the maximally exposed individual member of the public (the neighbor living closest to the PGDP security fence) from the DOE operations did not vary statistically from background and was essentially zero.

On a quarterly basis, environmental thermoluminescent dosimeters are located at 46 locations in and around PGDP or at background locations. Monitoring results indicate that nine locations out of 46 were consistently above background levels. These locations were all at or near the PGDP security fence in the vicinity of UF_6 cylinder storage yards. For purposes of this ASER Summary, an additional potential receptor was considered. In a very conservative exposure scenario, this receptor is assumed to be exposed to the location at TLD-48 for 8.3 hours for the year. TLD-48 represents the closest location with results above background that would be accessible to the public in 2001. The 8.3 hours per year assumption is based on an individual driving past this location twice per day at 1 minute per trip, five days per week, 50 weeks per year. The calculated annual dose for location TLD-48, attributable to the Paducah Site, was determined to be ***0.03 mrem/year for 2001***.

Air Monitoring Network



Surface Water Monitoring

WHY IS SURFACE WATER SAMPLED?

Surface water is required to be sampled by the Clean Water Act and DOE Orders 5400.1 and 5400.5 to ensure protection of the environment and the public.

WHAT CONTAMINANTS OF CONCERN ARE ANALYZED?

Contaminants found at the plant site such as uranium and technetium-99 are analyzed. Other contaminants analyzed are chlorine, polychlorinated biphenyls, TCE, acute and chronic toxicity, hardness, oil and grease, phosphorus, and various metals.

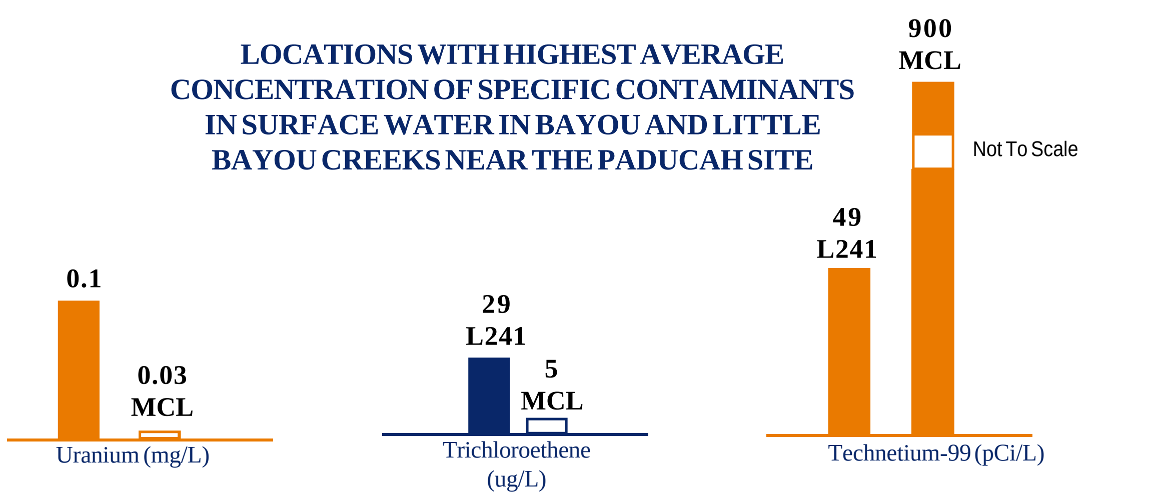
WHAT ENVIRONMENTAL MONITORING IS PERFORMED?

The Kentucky Pollutant Discharge Elimination System permit requires sampling of surface water discharges (also called outfalls) to be performed throughout each month. The Department of Energy has four outfalls that are monitored. These are Outfalls 001, 015, 017, and 019. Outfall 001 had one permit exceedence during 2001 for chronic toxicity and Outfall 017 had four exceedences for acute toxicity. Under the Resource Conservation and Recovery Act permit, surface water runoff is monitored at the C-746-S&T Landfills and the C-746-U Landfill. No unusual data results were identified in 2001.

Sampling is performed at 33 surface water locations upstream and downstream on Bayou Creek, downstream on Little Bayou Creek, in the Ohio River, and at a nearby stream, Massac Creek.

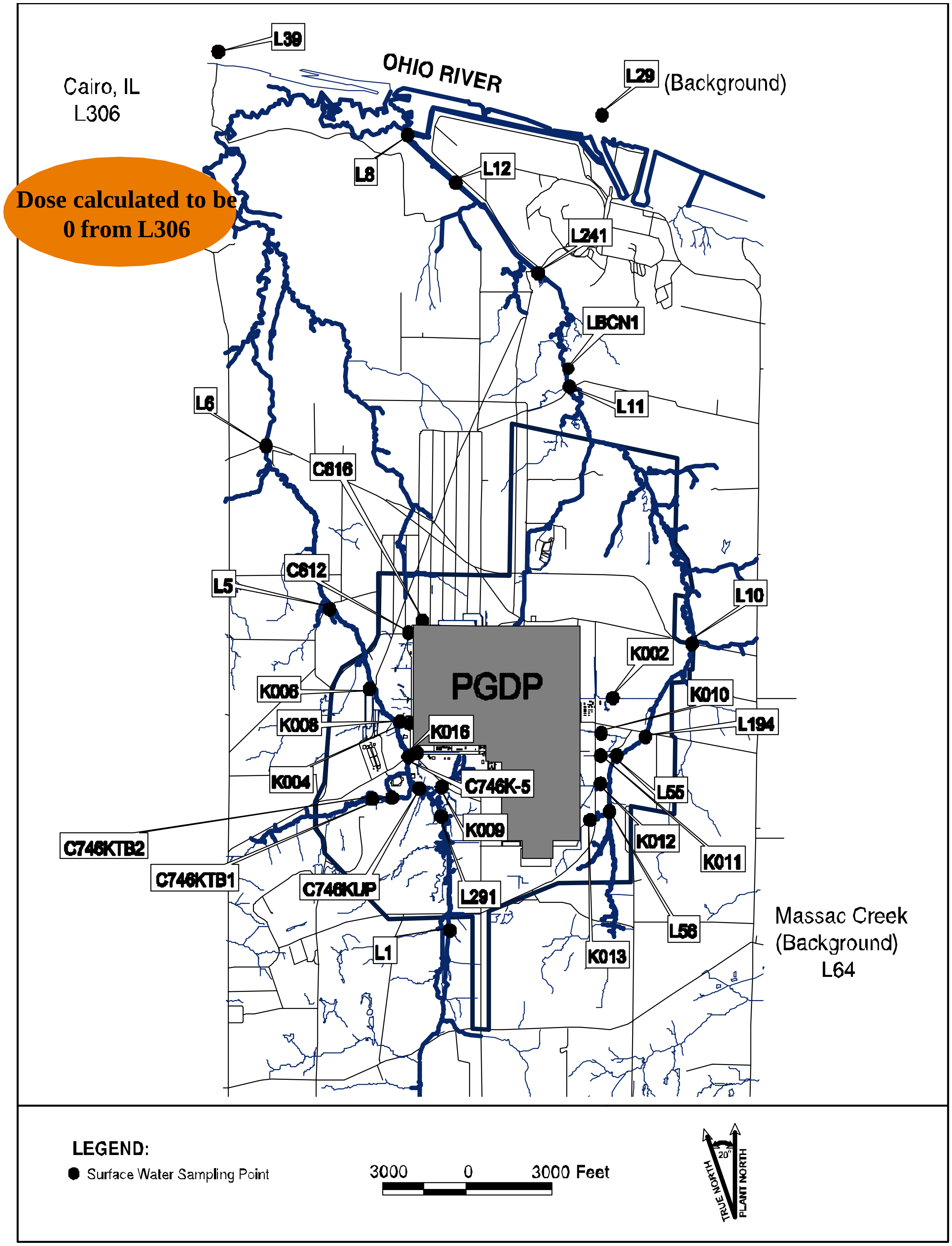
Radionuclides were detected in approximately 11% of the samples collected. TCE was detected at one location that was upstream of plant discharges (L1), near the C-612 area, and detected downstream on Little Bayou Creek (L12 and L241). Although radionuclides were detected, the surface water pathway is not a significant contributor to the dose DOE sources based on results utilized from the L306 site (Cairo intake). Data is used from this location because it is the closest drinking water source

LOCATIONS WITH HIGHEST AVERAGE CONCENTRATION OF SPECIFIC CONTAMINANTS IN SURFACE WATER IN BAYOU AND LITTLE BAYOU CREEKS NEAR THE PADUCAH SITE



MCL = Maximum Contaminant Level; the maximum allowable concentration allowed in groundwater by the U.S. Environmental Protection Agency and Kentucky.
Units of measurement presented are as follows: mg/L = milligrams per liter; ug/L = micrograms per liter; and pCi/L = picocuries per liter.

Surface Water Monitoring Locations



Sediment Monitoring

WHY IS SEDIMENT SAMPLED?

Sediment, or soil found in streams or creeks, is required to be sampled by the DOE order 5400.5 to ensure protection of the environment and the public.

WHAT CONTAMINANTS OF CONCERN ARE ANALYZED?

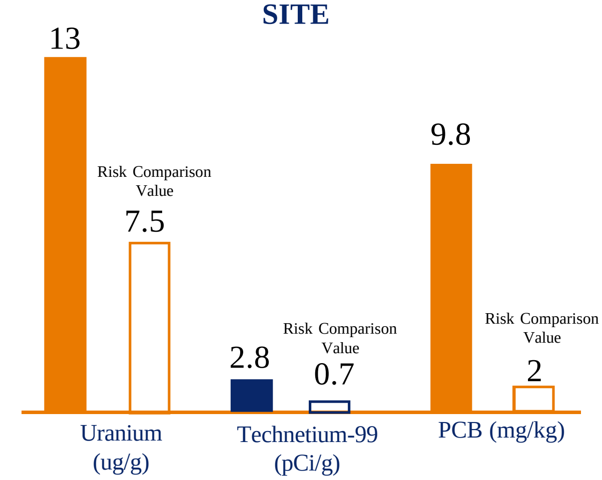
Contaminants which are analyzed consist of several radionuclides, including uranium and technetium; volatile organic compounds, including TCE; anions, metals, polychlorinated biphenyls, and suspended solids.

WHAT ENVIRONMENTAL MONITORING IS PERFORMED?

Sediment was sampled during 2001 at 20 different locations upstream and downstream in Bayou Creek, Little Bayou Creek, and Massac Creek, a nearby stream. Chromium, arsenic, and zinc, showed the most variation between sites for metals. Chromium was identified in the North-South Diversion Ditch at 40 mg/kg and near the plant site on Bayou Creek at 53 mg/kg. Chromium was also found near the plant site on Little Bayou Creek at 49 mg/kg. Chromium at the background site was 6.4 mg/kg. Arsenic was found near the C-746-K Landfill and in Little Bayou Creek near the plant site at background levels. Zinc was found at background levels at all locations; however, the highest was found in Little Bayou Creek near the plant site. PCBs were found in the North-South Diversion Ditch, Little Bayou Creek near the plant site and downstream, and in Bayou Creek. PCB-1248 and PCB-1260 were the most abundant aroclors (PCB compound). This is consistent with PCBs used historically on the plant site.

The uranium concentration increased near the plant site and is attributed to historical plant operations. Concentrations downstream both Bayou and Little Bayou Creeks show levels that are similar to upstream concentrations (areas unaffected by plant operations). C746KUP and C746KTB2 are areas on the unnamed tributary near the C-746-K Landfill. Upstream sampling near the C-746-K and Massac Creek showed essentially no uranium present. The Bayou and Little Bayou Creek sampling points near the plant site are higher than the background and upstream concentrations for all uranium isotopes. Doses were calculated for ingestion of sediments for both Bayou and Little Bayou creeks. The worst-case dose was calculated to be at S32, the North-South Diversion Ditch. The estimated worst-case dose above background from sediment ingestion was ***0.30 mrem in 2001***.

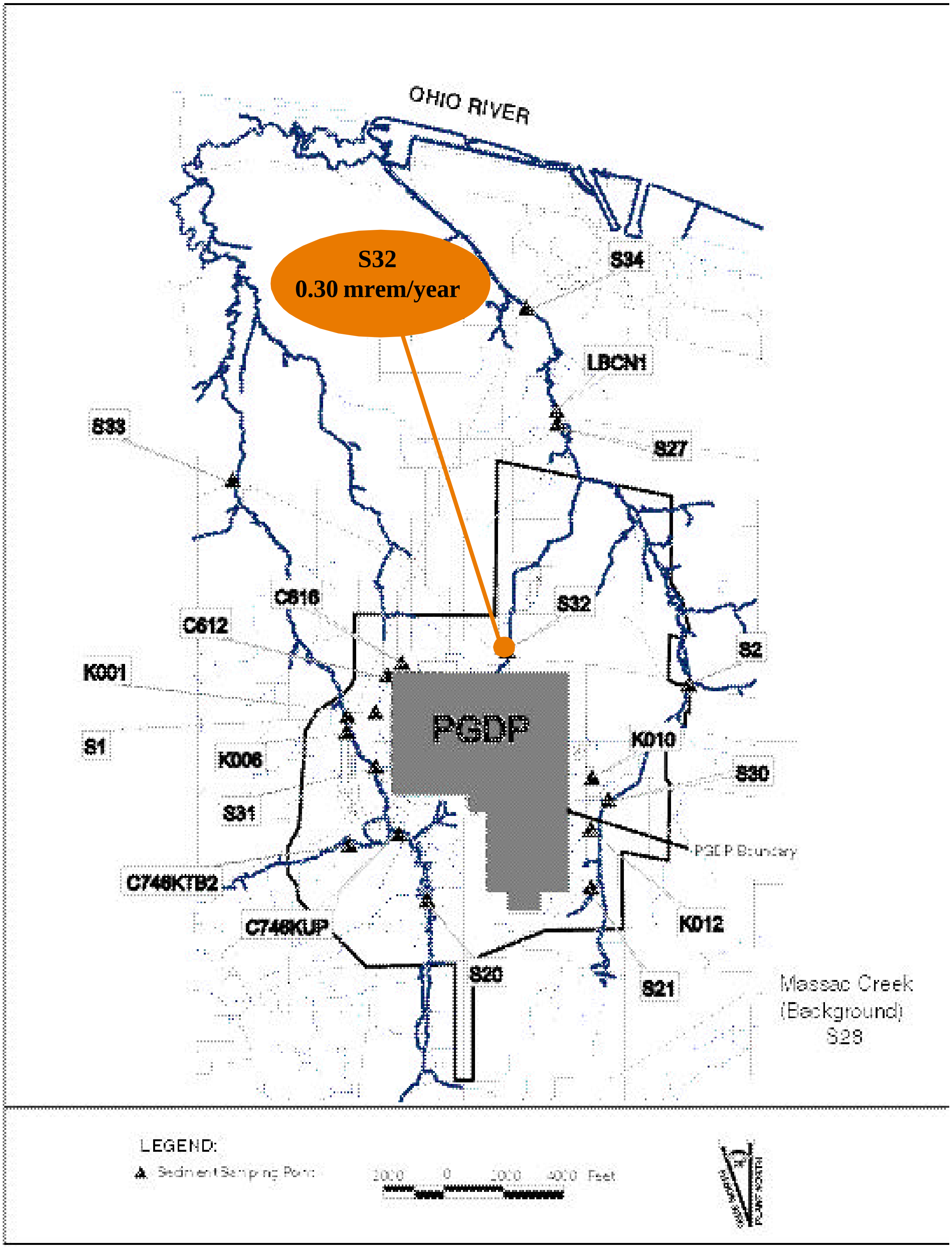
AVERAGE CONCENTRATIONS OF SPECIFIC CONTAMINANTS IN SEDIMENTS IN BAYOU AND LITTLE BAYOU CREEKS NEAR THE PADUCAH SITE



Units of measurement presented are as follows: mg/kg = milligrams per kilogram; ug/g = micrograms per gram; and pCi/g = picocuries per gram.

Risk Comparison Value - A value calculated by risk assessment personnel for the purpose of evaluating risk (or harm) caused by contaminants. Results above the risk comparison value indicate a risk of cancer greater than 1 in 1,000,000.

Sediment Monitoring Locations



Biological Monitoring

WHY ARE DEER SAMPLED?

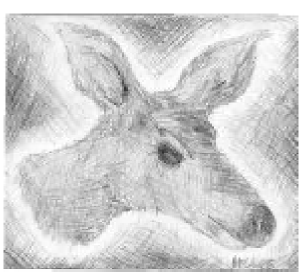
Deer are required to be sampled by DOE Order 5400.5. Deer living within the West Kentucky Wildlife Management Area are harvested and sampled annually to determine if any risk is present to the person or persons consuming the deer.

WHAT CONTAMINANTS OF CONCERN ARE ANALYZED?

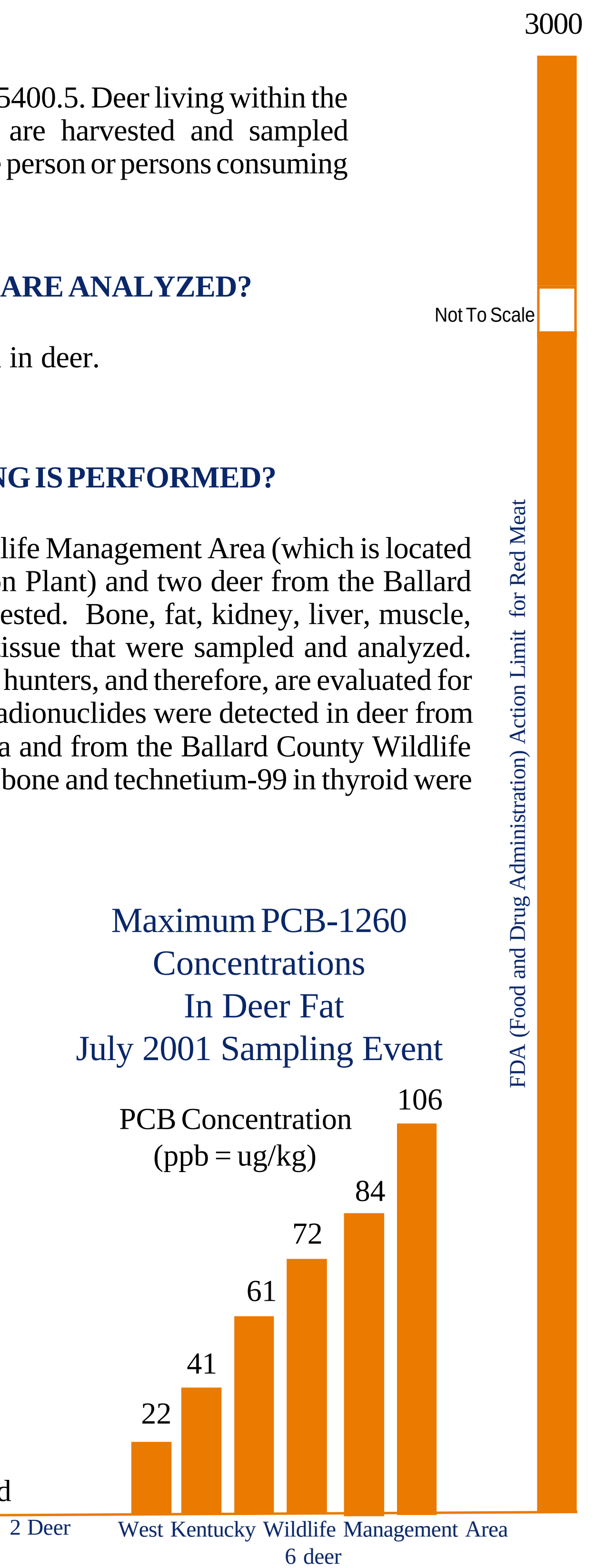
Radionuclides, metals, and PCBs are analyzed in deer.

WHAT ENVIRONMENTAL MONITORING IS PERFORMED?

In 2001, six deer from the West Kentucky Wildlife Management Area (which is located on land around the Paducah Gaseous Diffusion Plant) and two deer from the Ballard County Wildlife Management Area were harvested. Bone, fat, kidney, liver, muscle, and thyroid were the different types of deer tissue that were sampled and analyzed. Liver and muscle are considered edible by deer hunters, and therefore, are evaluated for radiological risk. In bone, muscle, and liver, radionuclides were detected in deer from the West Kentucky Wildlife Management Area and from the Ballard County Wildlife Management Area. All results for strontium in bone and technetium-99 in thyroid were non-detectable. Based on the radionuclide results, the worst-case dose was calculated to be 3.4 millirem/year. The overall maximum allowable dose is 100 millirem per year. In 2001, PCBs were detected in fat in average concentrations of 64 parts per billion (ppb) in the West Kentucky Wildlife Management Area. The Food and Drug Administration Action Limit for red meat is 3000 ppb; this is the level at which the FDA would remove the red meat from the marketplace.



Drawing by student artist from Heath High School, West Paducah, Kentucky



Units of measurement presented are as follows: ug/kg = micrograms per kilogram; also known as ppb (parts per billion).

WHY ARE FISH SAMPLED?

Fish are sampled as part of the Watershed Monitoring Plan, under the Kentucky Pollutant Discharge Elimination System Permit and DOE Order 5400.1. The purpose of this sampling is to determine whether the discharges from PGDP are adversely affecting the fish and its environment.

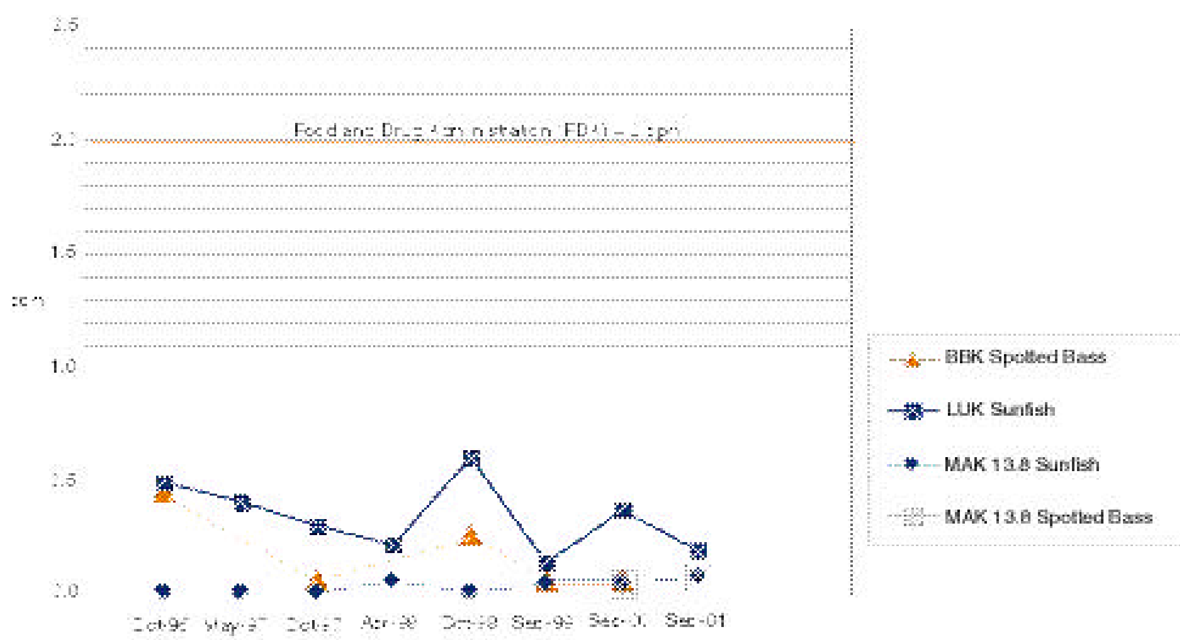
WHAT CONTAMINANTS OF CONCERN ARE ANALYZED?

Analyses obtained on fish include PCBs, percent lipids (or percentage of fat), and other ecological information.

WHAT ENVIRONMENTAL MONITORING IS PERFORMED?

Samples at several locations on Bayou Creek (BBK) , Little Bayou Creek (LUK) , the Ohio River, and Massac Creek (MAK), a nearby stream, were collected for fish and other ecological information. PCB concentrations were detected in fish tissue from the Little Bayou Creek. A sample in 2001 could not be obtained from Bayou Creek due to low fish volume. The mean concentrations of PCBs have varied over the past five years and have consistently been elevated above the background level. The FDA Action limit for fish is 2 ppm. All results in 2001 were below this value for fish collected near the plant site. There has been a general downward trend in PCB concentrations since 1996.

AVERAGE CONCENTRATION OF POLYCHLORINATED BIPHENYLS (PCBs) IN FISH FROM BAYOU AND LITTLE BAYOU CREEKS NEAR THE PADUCAH SITE



Groundwater Monitoring

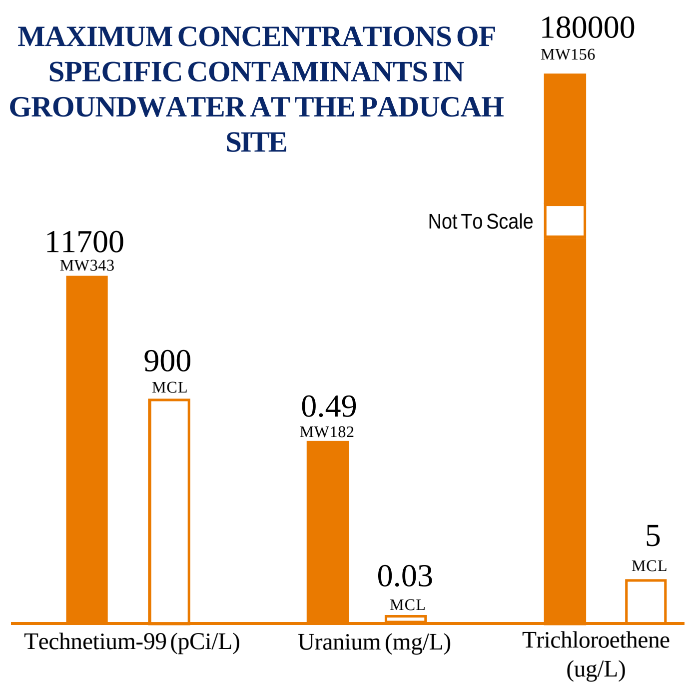
Monitoring and protection of groundwater resources at the Paducah Site are required by federal and state regulations and by DOE orders. Federal groundwater regulations generally are enacted and enforced by EPA. When off-site groundwater contamination from the Paducah Site was discovered in 1988, the EPA Region IV and DOE entered into an Administrative Consent Order (ACO). DOE provided an alternate water supply to affected residences. Under CERCLA, DOE is required also to determine the nature and extent of off-site contamination through sampling of potentially affected wells and a comprehensive site investigation.

A CERCLA/ACO site investigation, completed in 1991, determined off-site contaminants in the Regional Gravel Aquifer to be TCE (commonly used as an industrial degreasing solvent) and technetium-99 (a fission byproduct contained in nuclear power reactor returns that were brought on-site several years ago for re-enrichment.) The practice of re-enriching reactor returns was discontinued in 1976.

Investigations of the on-site source areas of TCE at the Paducah Site are ongoing. A common degreasing agent, TCE is a dense nonaqueous phase liquid (DNAPL) with typically low solubility in water. DNAPLs either sink to the bottom of aquifers or come to rest on a less-permeable layer within an aquifer, forming pools. These DNAPL pools form a continuous source for dissolved-phase contamination (plumes) that are migrating off-site toward the Ohio River. Pools of DNAPL are extremely difficult to clean up. Currently, only the highest concentrations of dissolved TCE are controlled by pump-and-treat systems at Paducah. The pump-and-treat system installed northwest of the plant also contains the highest concentrations of dissolved technetium-99.

Continued groundwater monitoring identifies the extent of contamination, predicts the possible fate of the contaminants, and determines the movement of groundwater near the plant. Calendar year (CY) 2001 plume map (see figure on next page) continue the basic interpretation presented in the plume maps for CY 2000. Revisions for CY 2001 reflect the following: (1) increasing TCE trends in C-404 MWs, (2) the impact of surface water discharge to Little Bayou Creek, and (3) an isolation of contaminants in the C-746-S&T Landfill area.

Groundwater monitoring at Paducah complies with one or more federal or state regulations and permit conditions and includes perimeter exit pathway monitoring and off-site water well monitoring. Scheduled sampling continues for more than 150 MWs and residential wells.

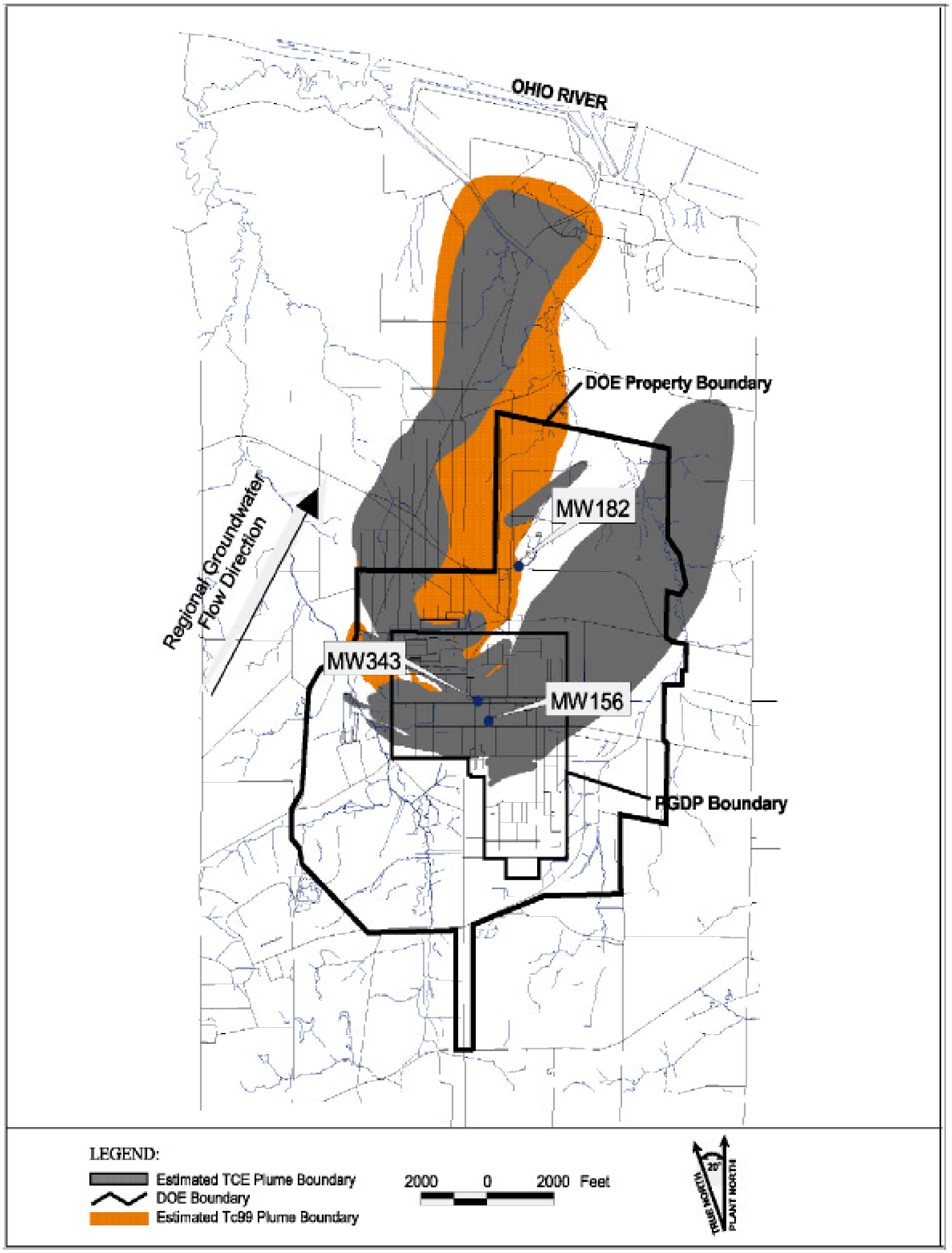


MCL = Maximum Contaminant Level; the maximum allowable concentration allowed in groundwater by the U.S. Environmental Protection Agency and Kentucky.

Units of measurement presented are as follows: mg/L = milligrams per liter; ug/L = micrograms per liter; and pCi/L = picocuries per liter.

Uranium data (units in mg/L) are due to the analysis of uranium as a metal.

Paducah Site Groundwater Plumes



Words From DOE Site Manager, W. Don Seaborg

Environmental management is not an easy topic to discuss. The information is highly technical and often so complex that a lay person struggles to comprehend it. Hopefully, this summary report will assist you in understanding the data presented and forming your own opinion.

The Annual Site Environmental Report is helpful in a number of ways. It gives us a measuring stick for our performance from year to year. It allows us to present monitoring data in a concise form. It gives the public a reference and another point of input to DOE activities.

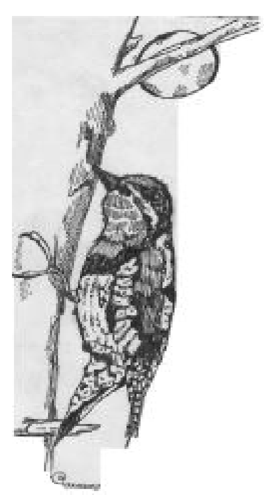
The Department of Energy continued progress in environmental cleanup in 2001. I am pleased to note that among our activities, one was particularly successful.

The Lasagna technology was originally slated to run as long as three years. It was shut down after just two years when results indicated the process had removed more TCE from beneath the surface of a one-acre site than had been expected. TCE is a solvent identified as a groundwater contaminant at many locations in the United States, and is a primary contaminant of much of the groundwater affected by PGDP operations.

This shows that we can develop breakthrough technologies that allow us to clean up contamination more quickly and cost-effectively. We are extremely pleased that Lasagna achieved its goals in such a short time.

In the groundwater operable unit, DOE continued its pump and treat systems on both the Northwest and Northeast plumes. This containment technology continues to be effective in slowing the plume's migration. DOE is looking at additional ways to deal with the contaminated groundwater.

Perhaps one of the most intensive studies during 2001 was related to the potential siting of an on-site landfill that would accept CERCLA waste. The public, including plant neighbors and several environmentalists, expressed concerns about constructing a landfill close to the New Madrid Fault zone.



DOE allocated a great deal of resources to a regional and site-specific seismic study. We pulled in experts from across the country to evaluate the potential strength of an earthquake near the PGDP. We worked with talented engineers to determine how a landfill could be constructed to withstand a significant earthquake.

Results of the study will be released in 2002 and the next course of action will be determined with appropriate input from the regulators and the community.

Dealing with surface water operable unit issues proved challenging during 2001. There are a number of potential sources contributing to contaminated runoff that could leave the site. The North-South Diversion Ditch, Scrap Metal Yard and outfall ditches are among the key suspects. DOE and the regulators spent a great deal of time in 2001 negotiating the best actions to address these areas.

We reached agreement on the scrap metal removal project, but the North-South Diversion Ditch and the outfalls remained in negotiations throughout 2001.

There are a number of burial grounds and landfills within the PGDP security fence. DOE continues to monitor those areas. In an effort to gather additional information, DOE began reviewing a plan to install additional monitoring wells both inside the fence and north of the on-site sanitary landfill located outside the security fence.

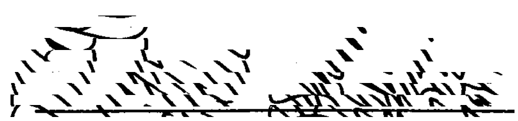
Even during a year with much ongoing discussion between DOE and the regulators regarding the scope of work, a great deal was accomplished. I am pleased to report that a number waste shipments left the PGDP in 2001. This waste was generated during operations of the plant many years ago.

DOE also constructed more concrete beds for the depleted uranium hexaflouride cylinders in its stockpile.

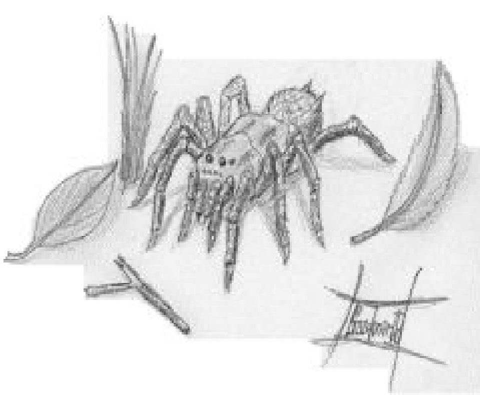
There is also good news from our environmental monitoring. As you read in this report, the levels of contaminants continue to decrease in several areas. Meanwhile, the estimated radiological dose a non-plant worker would receive from the plant is well below the safety standard.

I am committed to cleaning up this plant safely, in a cost-effective manner, with the help of the public. The public is an important element to completing a cleanup program that is satisfactory. I look forward to additional discussions about DOE projects as we move forward at the Paducah site.

I hope you find the information helpful. If you have suggestions for improvement, I welcome your input.



Drawings by student artists
from Heath High School,
West Paducah, Kentucky



Public Involvement and Information

DOE Environmental Information Center. The public has access to Administrative Records and programmatic documents at the DOE Environmental Information Center located at the Barkley Centre, 115 Memorial Drive, Paducah, Kentucky. It is open Monday, Thursday, and Friday from 10 a.m. to 6 p.m.; Tuesday from Noon to 8 p.m.; and the second Saturday of the month from 8 a.m. to Noon. The DOE Environmental Information Center is also open Wednesday from 10 a.m. to 6 p.m. except during the week of the second Saturday of the month, when the Wednesday hours are 2 to 6 p.m. The telephone number is (270) 554-6979. Information on the Environmental Information Center can be found at http://www.bechteljacobs.com/p_eic/p_eic.htm.

Citizens Advisory Board. The PGDP Citizens Advisory Board (CAB), a Site Specific Advisory Board chartered by DOE under the Federal Advisory Committees Act, completed its fifth full year of operation in September 2001. During the year, the CAB held 11 regular meetings, one retreat, and an average of three subcommittee meetings each year. All meetings are open to the public and publicly advertised. The CAB advised and made recommendations to DOE on three projects. In 2001, the CAB had 18 voting members, five ex-officio members, a Deputy Designated Federal Official, and a Federal Coordinator. The Paducah CAB consists of individuals with diverse backgrounds and interests. It meets monthly to focus on early citizen participation in environmental cleanup priorities and related issues at the DOE facility. The Paducah CAB participates only in activities that are governed by DOE. Information on the CAB can be found on the World Wide Web at http://www.oro.doe.gov/pgdpssab. The office phone number is (270) 554-3004.

ADDITIONAL INFORMATION

Additional information concerning DOE activities at PGDP can be found on the World Wide Web at:

http://www.oro.doe.gov/Paducah reaches the local DOE
http://www.doe.gov reaches the United States DOE
http://www.bechteljacobs.com is the public Bechtel Jacobs Company
http://www.epa.gov/region4/ is the Environmental Protection Agency Region IV
http://publichealth.state.ky.us/radiation is the Kentucky Radiation Health and Toxic Agents Control Branch
http://www.nr.state.ky.us/nrepc/dep/waste/dwmhome.htm reaches the Kentucky Department for Environmental Protection, Waste Management Branch
http://www.kdfwr.state.ky.us reaches the Kentucky Department of Fish and Wildlife Resources

ADDITIONAL READING MATERIALS

These documents are available at the DOE Environmental Information Center:

Paducah Site Environmental Monitoring Plan, BJC/PAD-201, Bechtel Jacobs Company, LLC, Paducah, KY.

Paducah Site Annual Site Environmental Report for Calendar Year 2001, BJC/PAD-319, Bechtel Jacobs Company, LLC, Paducah, KY.

Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2001 at the Paducah Gaseous Diffusion Plant, Paducah Kentucky, BJC/PAD-169/R2, Bechtel Jacobs Company, LLC, Paducah, KY.

Ionizing Radiation Exposure of the Population of the United States, NCRP Report No. 93, National Council on Radiation Protection and Measurements, Washington, D.C.

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