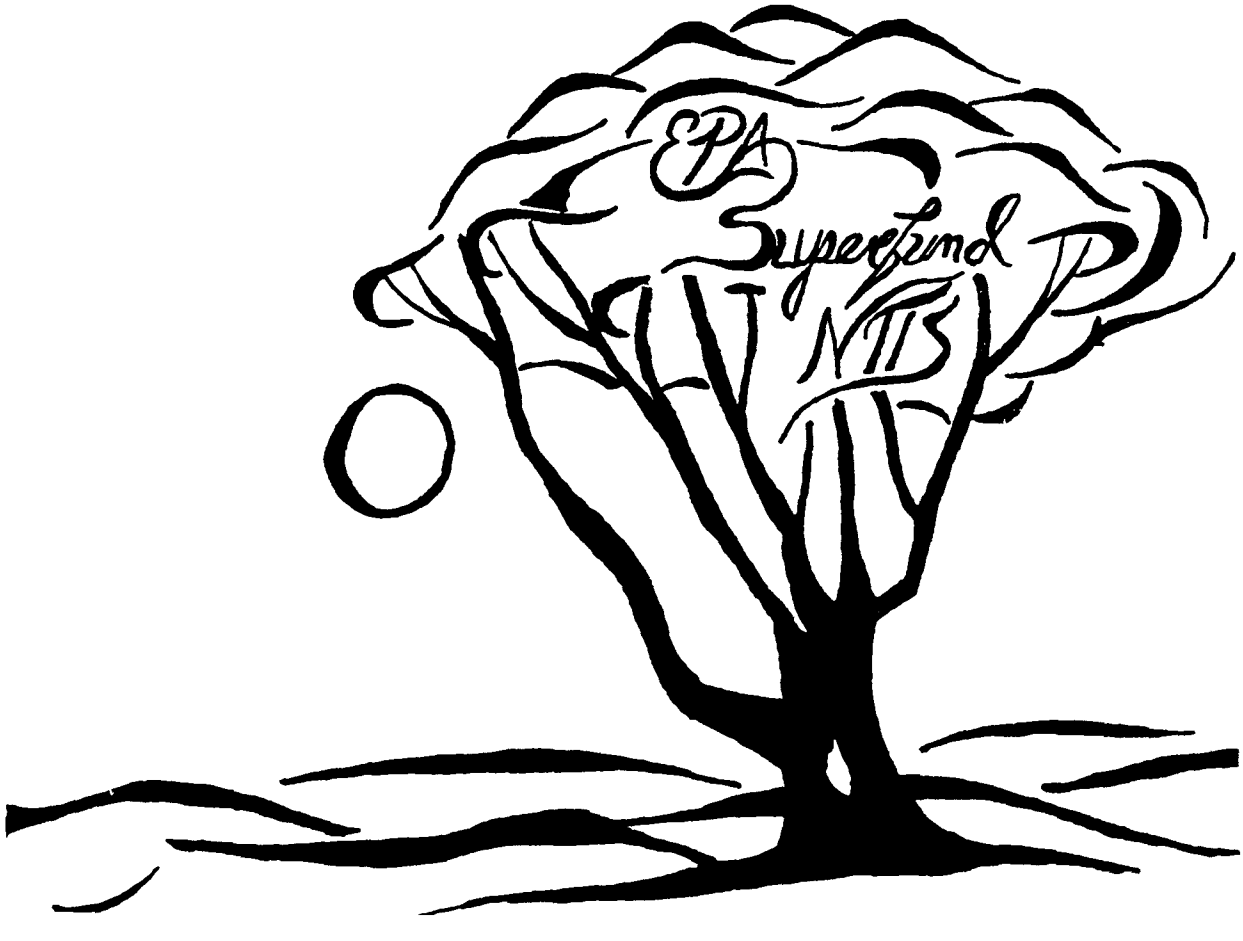
RODR069409

PB94-964213
EPA/ROD/R06-94/090
February 1995

EPA Superfund Record of Decision:

D.L. Mud, Inc. (O.U.1), Abbeville, LA 9/22/1994



RECORD OF DECISION
D.L. MUD, INC. SUPERFUND SITE
VERMILION PARISH, LOUISIANA

SEPTEMBER 1994

D.L. MUD, INC. SUPERFUND SITE
RECORD OF DECISION

STATUTORY PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT HAS BEEN MET AND FIVE-YEAR REVIEW IS REQUIRED

SITE NAME AND LOCATION

D.L. Mud, Inc. Superfund Site
Vermilion Parish, Louisiana

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the D.L. Mud, Inc. Superfund Site (hereinafter D.L. Mud Site or the site), in Vermilion Parish, Louisiana, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. §9601 et seq., and to the extent practicable, the National Contingency Plan (NCP). This decision is based on the Administrative Record for this site.

The State of Louisiana concurs on the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

The site is being addressed as one operable unit. The principal concerns to be addressed at the site are from surface soils contaminated with residual barium and contaminated subsurface sludges associated with former impoundments. The major components of the selected remedy include:

- Imposition of institutional controls to address the low level threats posed by the residual barium contamination in the surface soils. Controls to be implemented include fencing and deed notices/restrictions to ensure that future residential use of the property does not occur.

- Excavation and offsite disposal of contaminated sludges and subsurface soils.

- Limited ground water monitoring to ensure that residual barium contaminants left onsite do not migrate into usable drinking water sources.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy utilizes permanent solutions to the maximum extent practicable for this site.

To address the principal threats to human health and the environment that were present at this site, a State-lead cleanup action was conducted at this site in 1987. This cleanup action included the removal and offsite incineration of wastes from onsite storage tanks and surface soils. Although treatment of the surface soils contaminated with residual barium is not being conducted as part of this ROD due to the limited threats posed by these residual materials, the overall remedial action (including the 1987 State-lead cleanup) for this site does meet the statutory preference for treatment as a principal element of the remedy.

Because the remedy will result in hazardous substances remaining onsite above health-based concentration levels, a review will be conducted within five years of commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Jane N. Saginaw
Regional Administrator
U.S. Environmental Protection Agency
Region 6

9-22-94
Date

D.L. MUD, INC. SUPERFUND SITE

9/94 RECORD OF DECISION

CONCURRENCE PAGE

Jamie VanBuskirk, RPM
D.L. Mud Superfund Site

Lisa Price, Chairman
ROD Peer Review Committee

Bill Luthans, Chief
AR/LA Superfund Enforcement

Sam Becker, Chief
Superfund Enforcement Branch

George Malone, ORC
Assistant Regional Counsel

Mark Peycke, Acting Chief
Superfund Branch, ORC

Walter Sutton
Regional Counsel

for Allyn Davis, Director
Haz. Waste Management Division

TABLE OF CONTENTS
RECORD OF DECISION
D.L. MUD, INC. SUPERFUND SITE
VERMILION PARISH, LOUISIANA

LIST OF ACRONYMS i

LIST OF FIGURES ii

LIST OF APPENDICES iii

I. SITE NAME, LOCATION AND DESCRIPTION 1

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES 4

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION 7

IV. SCOPE AND ROLE OF RESPONSE ACTION 8

V. SUMMARY OF SITE CHARACTERISTICS 9

VI. SUMMARY OF SITE RISKS 40

VII. DESCRIPTION OF ALTERNATIVES 56

VIII. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES . . 66

IX. THE SELECTED REMEDY 72

X. STATUTORY DETERMINATIONS 76

XI. DOCUMENTATION OF SIGNIFICANT CHANGES 81

LIST OF ACRONYMS

ACLs	- ALTERNATE CONCENTRATION LIMITS
AOC	- ADMINISTRATIVE ORDER ON CONSENT
ARARs	- APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
AWR	- ACRE WEIGHTED RISK
BRA	- BASELINE RISK ASSESSME T
CERCLA	- COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT
COCs	- CHEMICALS OF CONCERN
CTE	- CENTRAL TENDENCY EXPOSURE
DOW	- DOW CHEMICAL COMPANY
DSI	- DOWELL SCHLUMBERGER, INC.
EPA	- THE ENVIRONMENTAL PROTECTION AGENCY
ESI	- EXPANDED SITE ASSESSMENT
FIT	- FIELD INVESTIGATION TEAM
FS	- FEASIBILITY STUDY
GCVS	- GULF COAST VACUUM SERVICES
HI	- HAZARD INDEX
HQ	- HAZARD QUOTIENT
HRS	- HAZARDOUS RANKING SCORE
IOCs	- INORGANIC AND ORGANIC CHEMICAL CONSTITUENTS
LDEQ	- THE LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY
LDNR	- THE LOUISIANA DEPARTMENT OF NATURAL RESOURCES
MCLs	- MAXIMUM CONTAMINANT LEVELS
MCLGs	- MAXIMUM CONTAMINANT LEVEL GOALS
MSL	- MEAN SEA LEVEL
NCP	- NATION CONTINGENCY PLAN
NOW	- NON-HAZARDOUS OILFIELD WASTE
NPL	- NATIONAL PRIORITIES LIST
O&M	- OPERATION AND MAINTENANCE
OVA	- ORGANIC VAPOR ANALYZER
OVM	- ORGANIC VAPOR MONITOR
PRPs	- POTENTIALLY RESPONSIBLE PARTIES
RAOs	- REMEDIAL ACTION OBJECTIVES
RCRA	- RESOURCE CONSERVATION AND RECOVERY ACT
RfD	- REFERENCE DOSE
RI	- REMEDIAL INVESTIGATION
RME	- REASONABLE MAXIMUM EXPOSURE
ROD	- RECORD OF DECISION
SARA	- SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT
SFs	- SLOPE FACTORS
S/S	- SOLIDIFICATION/STABILIZATION
TCLP	- TOXICITY CHARACTERISTIC LEACHATE PROCEDURE
TICs	- TENTATIVELY IDENTIFIED COMPOUNDS
UBK	- UPTAKE/BIOKINETIC
UCL95	- UPPER 95th CONFIDENCE LIMIT
USGS	- UNITED STATES GEOLOGICAL SURVEY
VAPE	- VERMILION ASSOCIATION TO PROTECT THE ENVIRONMENT

LIST OF FIGURES

Page

FIGURE #1 - SITE LOCATION MAP . . . . . .

FIGURE #2 - SITE DESCRIPTION MAP . . . . . .

FIGURE #3 - SITE DRAINAGE PATTERNS . . . . . .

FIGURE #4 - SURFACE SOIL SAMPLE LOCATIONS. . . . . .

FIGURE #5 - BACKGROUND SAMPLE LOCATIONS (SURFACE SOILS, SEDIMENTS, AND SURFACE WATER) . . . .

FIGURE #6 - CONTOUR INTERVALS OF BARIUM IN SURFACE SOIL . . . . . .

FIGURE #7 - SUBSURFACE SOIL SAMPLING LOCATIONS . . . .

FIGURE #8 - SUBSURFACE SOIL BORING LOCATIONS NEAR WELL D-7 . . . . . .

FIGURE #9 - SUBSURFACE SOIL BORING LOCATIONS NEAR WELL G-22. . . . . .

FIGURE #10 - SUBSURFACE SOIL BORING LOCATIONS NEAR WELL G-23. . . . . .

FIGURE #11 - SUBSURFACE SOIL BORING LOCATIONS NEAR WELL SB-30 . . . . . .

FIGURE #12 - AREA OF VISUAL CONTAMINATION IN THE FORMER IMPOUNDMENT AREA. . . . . .

FIGURE #13 - AERIAL PHOTOGRAPH SHOWING FORMER IMPOUNDMENTS . . . . . .

FIGURE #14 - AREA OF ELEVATED VOLATILE ORGANIC READINGS NEAR WELL G-22 . . . . . .

FIGURE #15 - AREA OF DISCOLORED SOIL NEAR G-23. . . . .

FIGURE #16 - AREA OF DISCOLORED SOIL NEAR BORING SB-30 . . . . . .

FIGURE #17 - GROUND WATER MONITORING WELL LOCATIONS . .

FIGURE #18 - ONSITE SURFACE WATER/SEDIMENT SAMPLE LOCATIONS. . . . . .

LIST OF APPENDICES

APPENDIX #1 - RESPONSIVENESS SUMMARY

APPENDIX #2 - ADMINISTRATIVE RECORD INDEX

APPENDIX #3 - STATE OF LOUISIANA LETTER OF CONCURRENCE ON THE SELECTED REMEDY

APPENDIX #4 - SELECTED ALTERNATIVE COST ESTIMATE

APPENDIX #5 - JUNE 27, 1994 MEMO FROM ECAO REGARDING SUBCHRONIC AND CHRONIC RfD FOR BARIUM

APPENDIX #6 - INFORMATION ON BARIUM BIOAVAILABILITY

APPENDIX #7 - TABLES

THE DECISION SUMMARY

I. SITE NAME, LOCATION AND DESCRIPTION

The D.L. Mud site is located in a rural area of southern Louisiana, approximately 20 miles north of the Gulf of Mexico and approximately 3 miles southwest of Abbeville, Louisiana. The site comprises approximately 12.8 acres in Range 3 East, Township 12 South, Sections 60, 58, 38, and 32 in Vermilion Parish (Figure #1). The property is located in a generally rural area with the surrounding property being chiefly agricultural with livestock grazing, crawfish farming, and crop production. Residences are located near the site on Parish Road P-7-31 and Louisiana Highway 335 with a population of approximately 116 people within a one-mile radius of the site.

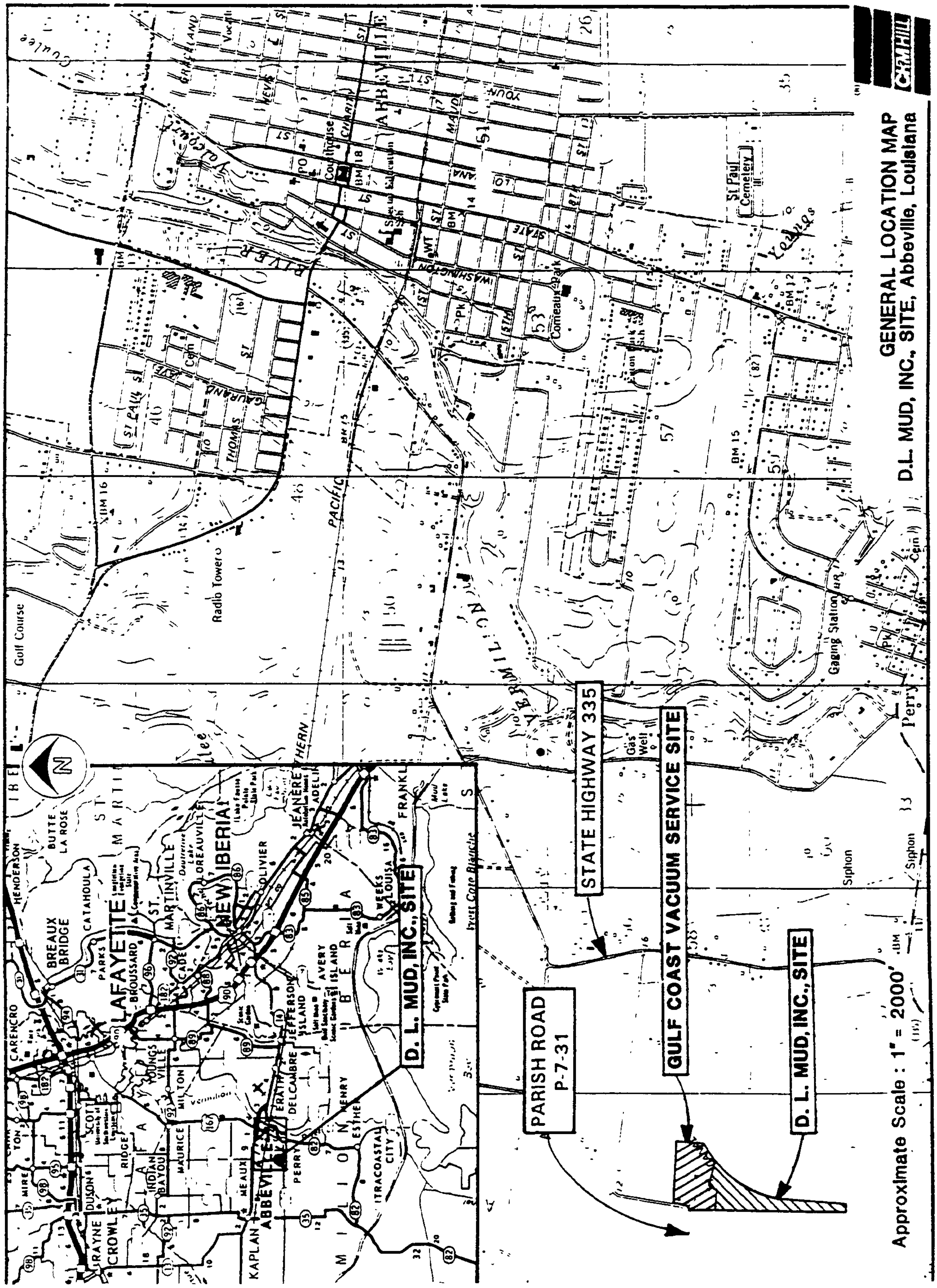
The site was originally part of a general acquisition comprised of several parcels of land in which this parcel was included. The portion of land that later became the site was originally part of a 25.56-acre parcel of land that was used as a drilling mud facility until 1980. In 1981, the Dowell Division of The Dow Chemical Company (Dow) purchased a 12.8-acre portion of the larger tract that contained the barium sulfate based drilling mud blending operation. The remaining portion of the tract, which included impoundments used for disposal of oilfield exploration and production wastes, was purchased by Gulf Coast Vacuum Services, Inc. (GCVS), to support a commercial waste vacuum truck operation. This property is also a Superfund Site (GCVS site) and is located adjacent to the north and west sides of the D.L. Mud site (Figure #2).

The site is presently unused, with the exception of one small shed in which a local farmer stores equipment. The site is typical of ungrazed pastureland, with sporadic tree rows along fences and former irrigation channels. The site is graded to drain and, except for the former irrigation channels, does not contain any standing water. Other than periodic mowing, there are no ongoing maintenance activities at the site.

The site is situated on the Gulf of Mexico coastal plain and is generally flat. Topographic relief is less than 5 feet, at an approximate elevation of 10 feet above mean sea level (MSL). The site is divided into northern and southern portions by the abandoned, leveed irrigation canal that transects the D.L. Mud site south of the GCVS site. The northern portion of the D.L. Mud site is the former drilling mud blending area. This area is bounded on its eastern and southern sides by the levees associated with the former irrigation canal network and the GCVS site on its northern and western sides.

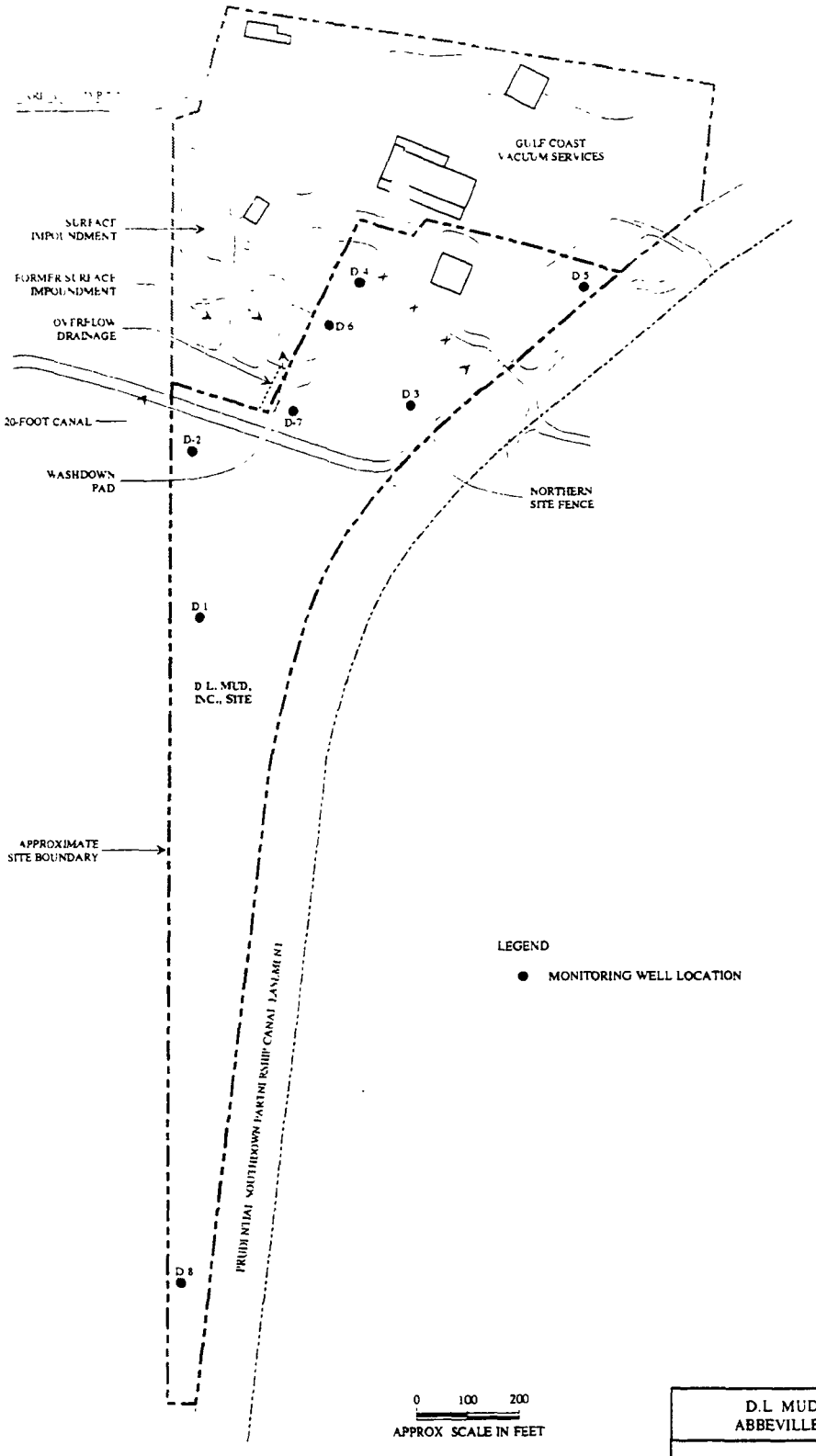
The area surface soils (0-1 feet) consist of silt loam underlain by layers of clay, silty clay and sand. A clay layer approximately 10

Figure #1



GENERAL LOCATION MAP
D.L. MUD, INC., SITE, Abbeville, Louisiana
STATE HIGHWAY 335
GULF COAST VACUUM SERVICE SITE
D. L. MUD, INC., SITE
PARISH ROAD
P-7-31
D. L. MUD, INC., SITE
Approximate Scale : 1" = 2000'
ABBEVILLE
LAFAYETTE
NEW IBERIA

Figure # 2



SOURCE MODIFIED FROM CH2M HILL 1990

D.L MUD, INC , SITE
ABBEVILLE, LOUISIANA

SITE LAYOUT MAP

PRC Environmental Management, Inc

to 15 feet thick is located directly beneath the surface soils. Soils under this clay layer consist of silty clay materials to a depth of 30 feet. Below 30 feet are beds of fine quartz sand interbedded with silt and clay. Ground water beneath the site was encountered at approximately 20 feet below the ground surface in the upper Chicot Aquifer system.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

Relevant site history dates back to 1969 when the site was a part of a 25.56-acre parcel of land that was sold to Lafayette Highway Equipment Sales and Services, Inc. On May 1, 1975, Lafayette Highway Equipment Sales and Services, Inc., sold the property to Gulf Coast Pre-Mix Trucking, Inc. On January 11, 1979, G.H. Drilling Fluid Services, Inc. (later G.H. Fluid Services, Inc.) became the owner of the property when Gulf Coast Pre-Mix Mud Service, Inc., merged with Gulf Coast Pre-Mix Trucking, Inc.

The site took its present form on October 1, 1980, when G.H. Fluid Services, Inc., sold 12.78 acres of the 25.56-acre parcel to Gulf Coast Vacuum Services, Inc. (this later became the GCVS site). On February 11, 1981, G.H. Fluid Services, Inc., sold the remaining 12.78 acres to Dowell, a division of The Dow Chemical Company. Ownership of the site was transferred to Dowell Schlumberger, Inc. (DSI) in April 1984. The site was sold to D.L. Mud, Inc., in March 1985 by DSI.

The 25.56-acre parcel was used for agricultural purposes prior to 1969. From 1969 to 1980 (prior to the division of the property), the portion of the property that later became the D.L. Mud site was used as a barium sulfate based drilling mud storage and formulating facility.

During operations of the facility prior to division of the property, the overall 25.56 acre facility consisted of three impoundments located on the northwest portion of the property now referred to as the GCVS site and 16 vertical drilling mud storage tanks located on the portion of the property now referred to as the D.L. Mud site. The tanks mostly contained drilling mud solids that had settled from oil-based and water-based drilling mud. Solids were primarily montmorillonite, barite, hematite, and rust from the tank walls. In addition, there were several buildings, including storage buildings, a residence, and a vehicle maintenance building, as well as three underground fuel storage tanks on the portion of the property that is now referred to as the GCVS site.

Following the division and sale of the property in 1980, GCVS operated its portion until 1984, mainly as a vacuum tank truck facility servicing the local oil and gas exploration and production industry. The D.L. Mud site remained relatively inactive after 1980. A citizen's complaint through the Vermilion Association to Protect the Environment (VAPE) led to site identification by the

U.S. Environmental Protection Agency (EPA) on June 27, 1980. As a result, an EPA Field Investigation Team (FIT) conducted a preliminary assessment and preliminary sampling inspection in July and September of 1980. This inspection concentrated on areas of concern that are now most associated with the GCVS site, however, at this time, the property was still operated as one facility.

On August 18, 1980, G.H. Fluid Services, Inc., then owner and operator of the 25.56 acre parcel which contained the D.L. Mud site, sent its first Notification of Hazardous Waste Activity to EPA. It reported the generation, transportation, treatment, storage and disposal of nonlisted hazardous wastes which were ignitable, corrosive and toxic. On February 21, 1983, Dow filed a Hazardous Waste Notification Form for the site property with the Louisiana Department of Natural Resources (LDNR) indicating it was a generator with no onsite disposal. Hazardous wastes generated were listed as diesel contaminated dirt and rubble, contaminated diesel liquid, contaminated diesel sludge and empty drums containing wallcote, fatty acids and tars. No permit was required to operate the facility, however, manifests were required for any offsite transportation or disposal of wastes.

On April 29, 1983, the site was inspected by the LDNR and a letter of warning was issued to Dow informing it that it was out of compliance with Louisiana Waste Management Program Rules and Regulations. Dow took steps to rectify the problems and on May 18, 1983, LDNR observed that all drums of waste had been removed and manifested, spills had been picked up and drummed for disposal, and the site had been regraded with a levee system installed around the tank area.

In October 1983, Dow submitted to the LDNR a certification of inactivity for the site. On May 23, 1984, the Louisiana Department of Environmental Quality (LDEQ) notified Dow that, based on its certification of inactivity, the facility would be classified as a non-handler of hazardous waste. On June 6, 1985, in response to citizen complaints, an EPA Potential Hazardous Waste Site Form was prepared for the site which was now under the ownership of D.L. Mud, Inc. It was noted on this form that there may have been some activities going on after the site had been declared inactive. On July 9 and 10, 1985, EPA conducted an inspection with sampling and on August 16, 1985, a EPA Identification and Preliminary Assessment Report was prepared. The Report indicates that D.L. Mud, Inc. was using the site to salvage equipment and tanks for its operations elsewhere in Louisiana. Midnight dumping was also indicated to have occurred on the site.

Based on the results from the July 9 and 10, 1985, sampling inspection and on a non-sampling inspection conducted on September 27, 1985, it was decided that final disposition of the site should be evaluated through the Hazardous Ranking Score (HRS) process. An Expanded Site Inspection (ESI) was performed during several site

inspections in 1987. The site information and sampling data collected during the ESI was used to determine that the site posed a significant environmental and human health risk. The site was proposed for inclusion on the National Priorities List (NPL) in June 1988 and was finalized on October 4, 1989, pursuant to Section 105 of CERCLA, as amended, qualifying the site for investigation and remediation under CERCLA.

At some point in 1985 or 1986, Dow/DSI, by way of agreement with D.L. Mud, Inc., agreed to take responsibility for the cleanup of the site in cooperation with LDEQ. Between April 18, 1986, and August 18, 1986, under the supervision of LDEQ, Dow/DSI constructed a security fence around the majority of the site. At the same time, Dow/DSI began development of a tank sampling, analysis, and disposal plan for the 16 onsite tanks.

From April 14, 1987, through July 11, 1987, Dow/DSI performed a remediation of the drilling mud storage tank farm under the supervision of LDEQ by completing the following tasks:

- Removal of the tank contents and associated soils, destruction by incineration, and disposal of ash in a hazardous waste landfill.
- Decontamination and demolition of the tanks, supports, and piping.
- Removal and disposal of approximately 800 cubic yards of contaminated soil from eight onsite areas, including tank pads, one "bare" area, and two areas identified by EPA in the southern portion of the site.
- Placement of clean offsite fill material onsite in the excavated areas.

The limits of excavation for the removal action were determined by an LDEQ representative using an HNu photoionization meter. Verification soil samples were collected from the eight excavated areas. On December 17, 1987, Dow/DSI submitted a Report of Decommissioning and Restoration of the D.L. Mud site which was approved by LDEQ on February 29, 1988. It should be noted that the information used by EPA to list the site on the NPL was gathered before the 1987 cleanup activities were completed.

In 1988, EPA identified over 200 potentially responsible parties (PRPs) for the site. In August of 1989, EPA Region 6 issued a General Notice Letter to these PRPs regarding their potential liability and a request for information. Special Notice letters were then issued to the PRPs in December 1989. The Special Notice Letter requested that the PRPs voluntarily perform or finance a Remedial Investigation/Feasibility Study (RI/FS). In response, Dow/DSI conducted the RI/FS pursuant to an Administrative Order on

Consent (AOC) signed on June 20, 1990. The objectives of the RI, completed in December 1992, were to: 1) confirm the efficacy of prior remedial actions performed at the site by Dow/DSI; and 2) determine the nature of residual site contamination (if any) and associated human health and environmental risks. The objectives of the FS, completed in November 1993, were to determine and evaluate alternatives for remedial action (if any) to prevent, mitigate or otherwise respond to or remedy any release or threatened release of hazardous substances, pollutants, or contaminants from the site.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The requirements of CERCLA Sections 113(k)(2)(B)(i-v) and 177, 42 U.S.C. §§9613(k)(2)(B)(i-v) and 9617, were met during the remedy selection process, as illustrated in the following discussion.

A series of community interviews near the site were conducted in May 1990. The interviews included a cross-section of the area residents and landowners, as well as the Abbeville-Vermilion Chamber of Commerce, Mayor Broussard of Abbeville, Louisiana, members of VAPE, and other civic groups. A site mailing list was developed through the community interview process and is continually updated as the site activities progress.

In October 1993, an informal Open House was held at the Abbeville General Hospital to discuss the findings of the RI/FS. Fact sheets summarizing the RI were mailed out to all individuals on the site mailing list in December 1993.

The RI/FS Reports and Proposed Plan for the D.L. Mud site were released to the Public on April 26, 1994. The documents were made available to the public in the Administrative Record File in the noted information repositories: Vermilion Parish Public Library, Abbeville, Louisiana; Louisiana Department of Environmental Quality, Baton Rouge, Louisiana; and the U.S. Environmental Protection Agency Region 6 Library, Dallas, Texas. A summary of the Proposed Plan and the notice of availability of these documents and Administrative Record File was published in the *Abbeville Meridional* and the *Kaplan Herald*. In addition, a fact sheet summarizing the Proposed Plan of Action for the D.L. Mud site was mailed to the site mailing list on April 26, 1994.

The EPA held a public comment period regarding the RI/FS, Proposed Plan and Administrative Record from April 29, 1994, through May 28, 1994. During this initial public comment period, a formal public meeting was held on May 10, 1994, at the Abbeville General Hospital. Representatives from the EPA presented the remedial alternatives, the EPA preferred alternative, and answered questions. All questions and comments were recorded to be included in the Responsiveness Summary.

A response to all comments received during this 30 day public comment period, either written or verbally expressed at the public meeting, is included in the Responsiveness Summary. The Responsiveness Summary is included as part of the ROD (Appendix #1).

This decision document presents the selected remedial action for the D.L. Mud site, in Vermilion Parish, Louisiana, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the NCP. The decision for this site is based on the Administrative Record. An index for the Administrative Record is included as Appendix #2 to the ROD.

IV. SCOPE AND ROLE OF RESPONSE ACTION

The remedy to address the identified threats at the D.L. Mud site under this ROD is addressed as one operable unit. This is the only and final operable unit planned for this site. As mentioned earlier, a State-lead removal action was completed in 1987 which addressed the majority of problems identified during the NPL listing process.

The studies undertaken at the D.L. Mud site have identified low level risks which require remedial actions to address. Low level risk materials are sources of contamination that could be kept in place by capping and pose a low risk. For example, the surface soils identified onsite with residual elevated levels of barium contamination are considered a low level risk because the associated risk is relatively low (less than an order of magnitude in comparison to accepted action levels) and because these residual contaminants could be kept in place with a capping remedy, thus eliminating the potential for migration or ingestion.

In addition, EPA has determined that there is an unknown potential risk related to the source materials identified in the subsurface soils in the former impoundment areas. This potential risk is related to the unknown capacity for these contaminants to migrate into the ground water and the unknown impact these contaminants would have on the quality of the ground water.

The remedial objective determined to be necessary at the Site is to preserve human health and the environment by eliminating or reducing identified and/or potential risks by preventing the ingestion of barium contaminated soils and by reducing the potential for migration of contaminants from both surface and subsurface soils to the ground water. Additional specific remedial objectives determined to be necessary at the D.L. Mud Site are:

- Primary: Preserving the Site for non-residential uses and reducing the potential for migration to ground water of site-specific contaminants.

- Secondary: Restoring the Site for unrestricted uses.

Future land use assumptions used to formulate the primary and secondary remedial objectives were based in part on two important factors. First, because the Site is presently an abandoned, light industrial use facility, with no human inhabitants and located next to the GCVS Superfund Site, it seems reasonable that this type of land use will continue. Second, because there currently are no land use restrictions affecting this property and residential areas are located nearby, it is possible that the property could be used as a residential location in the future.

V. SUMMARY OF SITE CHARACTERISTICS

The D.L. Mud site is situated on the Gulf of Mexico coastal plain and is generally flat. Topographic relief is less than 5 feet, at an approximate elevation of 10 feet above MSL. The site is divided into northern and southern portions by the abandoned, leveed irrigation canal that transects the D.L. Mud site south of the GCVS site. The northern portion of the D.L. Mud site is the former drilling mud blending area. This area is bounded on its eastern and southern sides by the levees associated with the former irrigation canal network.

The southern portion of the site is poorly drained, with slopes of one-half percent or less toward the south, and is bounded by a perimeter levee system. Grading in this portion of the site still reflects its former use as a rice field. The northern portion of the site contains three structures: one shed with a concrete slab, one concrete slab associated with a former shed, and one small concrete slab that was formerly a pump pad within the drilling mud blending tank building.

Features that have been added in the vicinity of the D.L. Mud site include two berms across the drainage ditch located on the western edge of the GCVS site. These berms were constructed during a 1990 EPA Interim Remedial Measure to provide a secondary impoundment to collect overflows from GCVS site impoundments. A six foot tall chain link fence was also added around the southwestern portion of the GCVS site during the 1991 EPA RI that was conducted at that site.

Vermilion Parish has a humid, subtropical climate. The mean annual precipitation is approximately 60 inches. Pan evaporation is approximately 60 inches per year. Potential evapotranspiration is reported to be between 45 and 48 inches per year and actual evapotranspiration is reported to be between 40 and 43 inches. The annual mean relative humidity is 75 percent. Although no temperature data were found for Abbeville, the mean temperature in nearby New Iberia was 69.4°F in 1990. Wind data collected at the Lafayette, Louisiana airport show winds to be predominantly

northerly or southerly. The highest wind speeds are typically reported from the south.

In 1990, Abbeville received approximately 47 inches of rainfall, which is about 14 inches below normal. Much of this variation can be attributed to below average rainfalls from late spring to late fall for the area. Although the area experiences extreme rainfall events, the entire D.L. Mud site has been determined to be above the 100-year floodplain.

SURFACE WATER

Regionally, surface drainage is from north to south. Because of low relief, this area is poorly drained, and ditches are used to promote drainage from agricultural land. These ditches eventually interconnect with major tidally influenced waterways such as the Vermilion River. Canals were also built in the Abbeville area and operated commercially for irrigation water transmission from the Vermilion River, which is a little over one mile east of the site. The canal located along the eastern site boundary was fed by the Vermilion River and used for commercial irrigation until the late 1970s. The canals have been replaced by wells as a source of irrigation water. In some areas, especially south of Abbeville, the Chicot Aquifer, which is the principal source of drinking and irrigation water in the area, is recharged by the Vermilion River. This recharge occurs during the summer and fall, with discharge of ground water to the river occurring during the spring. Aquifer recharge typically exceeds discharge to the river. Seepage from the Vermilion River along a ten mile section south of Abbeville is reported to be about 25 cubic feet per second.

There are no surface water monitoring stations between the D.L. Mud site and the Vermilion River. The United States Geological Survey (USGS) operates a gaging station on the Vermilion River at the town of Perry, approximately two miles east of the site. USGS records show that this gaging station is tidally influenced. Recorded discharges have ranged from a maximum positive flow of 15,800 cubic feet per second to a maximum negative flow of 2,800 cubic feet per second. Periods of little or no flow are also recorded.

The LDEQ lists the Vermilion River as not meeting its designated water quality uses for primary (swimming, skiing, and prolonged body contact) and secondary (fishing, wading, boating, and incidental/accidental body contact) recreation or for fish and wildlife support from its headwaters to the Intracoastal Waterway. From the Intracoastal Waterway to Vermilion Bay, the river partially supports fish and wildlife use. According to LDEQ, the Vermilion River suffers from dissolved oxygen depletion, elevated fecal coliform levels, and high turbidity.

Surface runoff from the northern portion of the D.L. Mud site collects in the unnamed drainage ditch that transects the GCVS site

and proceeds to the northeast where the ditch merges with Coulee Galleque. The Coulee Galleque continues east until it forms a confluence with Coulee Kenny, which flows southeasterly to the Vermilion River above the town of Perry. The southern portion of the site drains southward, eventually joining a highway ditch south of the site and ultimately flowing through the Noel Canal to the Vermilion River below the town of Perry. Figure #3 shows general drainage patterns from the D.L. Mud site.

REGIONAL GEOLOGY

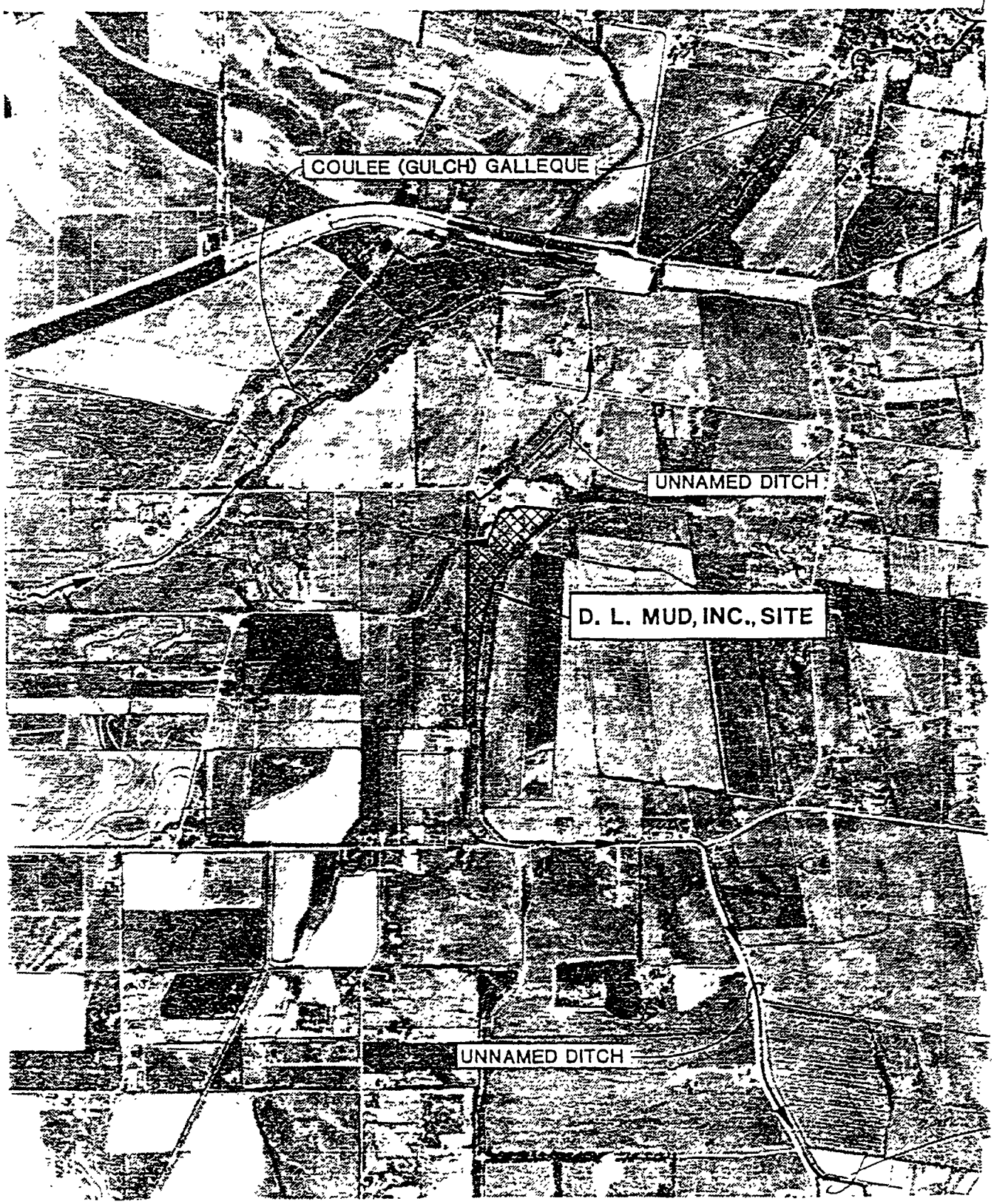
The D.L. Mud site is located within the Gulf Coastal Plain physiographic province. The area is west of the axis of the Mississippi structural trough and north of the Miocene Axis Gulf Coastal Geosyncline. Underlying the site are overlapping, coastal-thickening wedges of fluvial, deltaic, and marine sediments. These sediments are of the Pleistocene age and were deposited by the ancestral Mississippi River that derived sediment and flow from the central part of the North American Continent. These deposits consist of extensive beds of clay, sand, or sand and gravel extending to depths of greater than 2,000 feet offshore in the Gulf of Mexico. In the Abbeville area, these deposits extend to depths of about 1,000 feet.

Generally, the Pleistocene deposits have massive lenticular sands separated by laminated clays. These deposits have been intersected and reworked by the meander-belt streams which have formed relic channels, and point-bar deposits, which are overlain by back swamp clays. The back swamp clay (hardpan) typical of the near surface deposits of the rice field areas of southwest Louisiana forms a laterally extensive blanket from Lake Charles to Lafayette and southward. These low-permeability clays are generally 50 feet thick or less and may be overlain by topsoils.

The area topsoils (0-1 feet) are largely Patoutville silt loam formed from deposits of the Pleistocene Prairie Formation and are underlain by layers of clay, silty clay and sand. This nearly level to very gently sloping loamy soil (0 to 3 percent slope) has a medium acid, dark, grayish brown silt loam surface of five to eight inches. The subsurface layer is a strongly acid, grayish brown silt loam. The subsoil is a medium, acid dark grayish brown, silty clay loam. This soil is somewhat poorly drained, and runoff is medium. Because of poor drainage and engineering properties, use of the Patoutville soils is generally limited to agriculture. The United States Soil Conservation Service lists the potential for pasture, crop, and pine forest lands as high.

Geotechnical testing indicate that soils underlying the site are of low permeability. Of the six samples tested for permeability, five have values less than $1x10^{-7}$cm/sec, which is the maximum permeability acceptable for Resource Conservation and Recovery Act (RCRA) cap and cover systems. Soils examined during the drilling

Figure # 3



APPROXIMATE SCALE: 1"= 1425'

PHOTO DATE 2/24/90

of subsurface borings and wells indicate that alluvial deposits consisting of clay, silt, and sand exist to depths of at least 50 feet across the site. The shallow soils (to a depth of approximately 30 feet) were primarily clay and silty clay classified visually as CH under the Unified Soil Classification System. Below 30 feet are beds of fine quartz sand interbedded with silt and clay. The subsurface is generally saturated below approximately 20 feet.

REGIONAL HYDROGEOLOGY

The major hydrogeologic unit in the site vicinity is the Chicot Aquifer System. This aquifer has an areal extent of approximately 2000 square miles and is the principal source of ground water supply within the Abbeville area. The shallow sands of the upper Chicot Aquifer are generally considered unconfined, with a perched water table near land surface. The base of fresh water in the Chicot aquifer varies from 400 to 600 feet beneath ground level in the Abbeville area.

Ground water beneath the site was encountered at approximately 20 feet below the ground surface (-10.0 feet MSL) which is typical of conditions in the upper sand unit of the Chicot Aquifer in the Abbeville area. The direction of flow in the Abbeville area is toward the northwest at a gradient of approximately 0.0002 ft/ft resulting from the large cone of depression created by aquifer withdrawals from large pumping centers such as the cities of Lafayette and Lake Charles. Regional annual fluctuations in water levels for the upper sand of the Chicot aquifer range from one to two feet in the Abbeville area. In some areas, especially south of Abbeville, aquifer recharge by the Vermilion River occurs during the summer and fall, with discharge to the river during the spring. Assuming a hydraulic conductivity of 112 ft/day, a hydraulic gradient of 0.0002 ft/ft, and an intergranular porosity of 0.30, the estimated regional flow velocity in the vicinity of Abbeville would be 0.07 ft/day.

Water level measurements taken at D.L. Mud and GCVS site ground water monitoring wells show that ground water flow in the shallow sand is toward the north at a gradient of approximately 0.0002 ft/ft, which is typical for the Chicot aquifer in the Abbeville area. Small variations in water levels indicate that there may be some localized flow of ground water between the GCVS and D.L. Mud sites. This mounding/depression may be associated with the variability of permeabilities and recharge rates for the alluvial deposits and could potentially be influenced by the surface impoundments located on the GCVS site.

In accordance with EPA's Guidelines for Ground Water Classification under the EPA Ground Water Protection Strategy, (December 1986), the ground water beneath the site is classified as a Class IIB

ground water because the ground water is currently used or is potentially available for drinking water or other beneficial uses. Ground water in the area is used for drinking water purposes (there are at least 25 residential wells within one mile of the site) as well as for agricultural purposes (irrigation and crawfish ponds).

The ground water found at shallow depths (i.e., RI monitoring wells screened at 20 feet) is turbid from the clays and silts in the formation and would be inappropriate for drinking or irrigation because of the potential for plugging of pipes and fittings. While there is no impermeable barrier between the upper and lower reaches of the aquifer, ground water supply wells completed to deeper depths in this aquifer (i.e., 80 feet to 120 feet) are capable of producing water virtually free of visible solids.

KNOWN OR SUSPECTED SOURCES OF CONTAMINATION

The sources for the contamination that has been identified at this site are mostly related to the nature of the business that operated on the site. As mentioned earlier, this location was used as an oil field drilling mud formulation and restoration facility servicing the local oil and gas exploration and production industry, including operations conducted offshore in the Gulf of Mexico. Operations involved the use of numerous large tanks and pits used for mixing and storage of raw materials and wastes. In addition, the neighboring GCVS facility was a service facility for the oil and gas industry, concentrating on vacuum tank truck transportation operations. It is also known that illegal dumping at both Superfund sites occurred during the active life of the D.L. Mud and GCVS facilities.

The type of materials and wastes that were generated, stored or disposed of at this site are generally defined as "non-hazardous oilfield wastes" (NOW wastes) which are exempt from regulation under RCRA, the current federal law that regulates hazardous wastes. These wastes are generally regulated by the individual States in which they are generated. However, because these wastes contain hazardous substances, they can also be evaluated as potential problems and addressed under the Superfund program.

All known contaminant sources were removed from the site during the 1987 site remediation under the direction of the LDEQ. This action included:

- The removal and offsite incineration of any remaining drilling muds being stored in any of the 16 then existing product storage tanks and associated soils.

- The removal and offsite disposal of the 16 storage tanks, their bases and any associated roof, piping, etc.

- The removal and offsite disposal of areas of contaminated soils, located on the site, but associated with suspected fugitive dumping by undisclosed parties.

- The backfilling and grading of all excavations to conform to the natural lie of the land.

At the initiation of the RI in 1990, it was assumed that only residual contamination would remain at the site. During the RI, several subsurface areas were identified as potential "source areas" based on either visual and/or vapor identification of obviously contaminated materials not indicative of native soils.

CONTAMINATION CHARACTERIZATION

This section describes the nature and extent of residual contamination at the D.L. Mud site for the following media: surface soil and subsurface soil, ground water, surface water, and sediment. Subsurface soils have been subgrouped to include five distinct categories: four "source area" sample groups and a fifth "non-source area" sample group. Three source areas were identified during subsurface boring activities near monitor wells G-22 and G-23 and soil boring SB-30. The fourth source area was identified as a former impoundment area in April 1992 from a 1974 aerial photograph.

The nature of site residual related contamination was evaluated by a statistical comparison of onsite media analytical data to offsite (background) analytical data. A summary of the evaluation of the various media is presented in more detail in following subsections.

In general, inorganic parameters were detected in much greater frequency than organic parameters for both onsite and background samples. Typically, organic compounds were detected in one or two samples per media grouping for both onsite and background samples. The exceptions of this generality are for common laboratory (acetone, methylene chloride) and sampling (phthalates) contaminants. These data indicate that the nature of residual contamination is generally limited to inorganics, although organic residual contamination may exist at localized areas. The determination of the presence of chemical specific residual contamination was made by statistically comparing background sample sets to the onsite sample sets for each media evaluated at the site. If that chemical was found to be significantly higher onsite than in background, it was considered to be indicative of onsite residual contamination of that media. Not all contaminants of concern are contaminants that drive the risk or the need to conduct remedial actions at the site. The contaminants most critical to risk are discussed in detail in Section VI of this ROD.

Surface Soils

A total of 30 composite surface soil samples (0-1 feet) were collected to evaluate potential residual contamination during the RI (Figure #4). Sample locations were determined based on historical uses of the site and on a random, grid basis. Eight of these samples were background samples collected from soils of similar nature at privately owned farms north and northwest of the site (Figure #5).

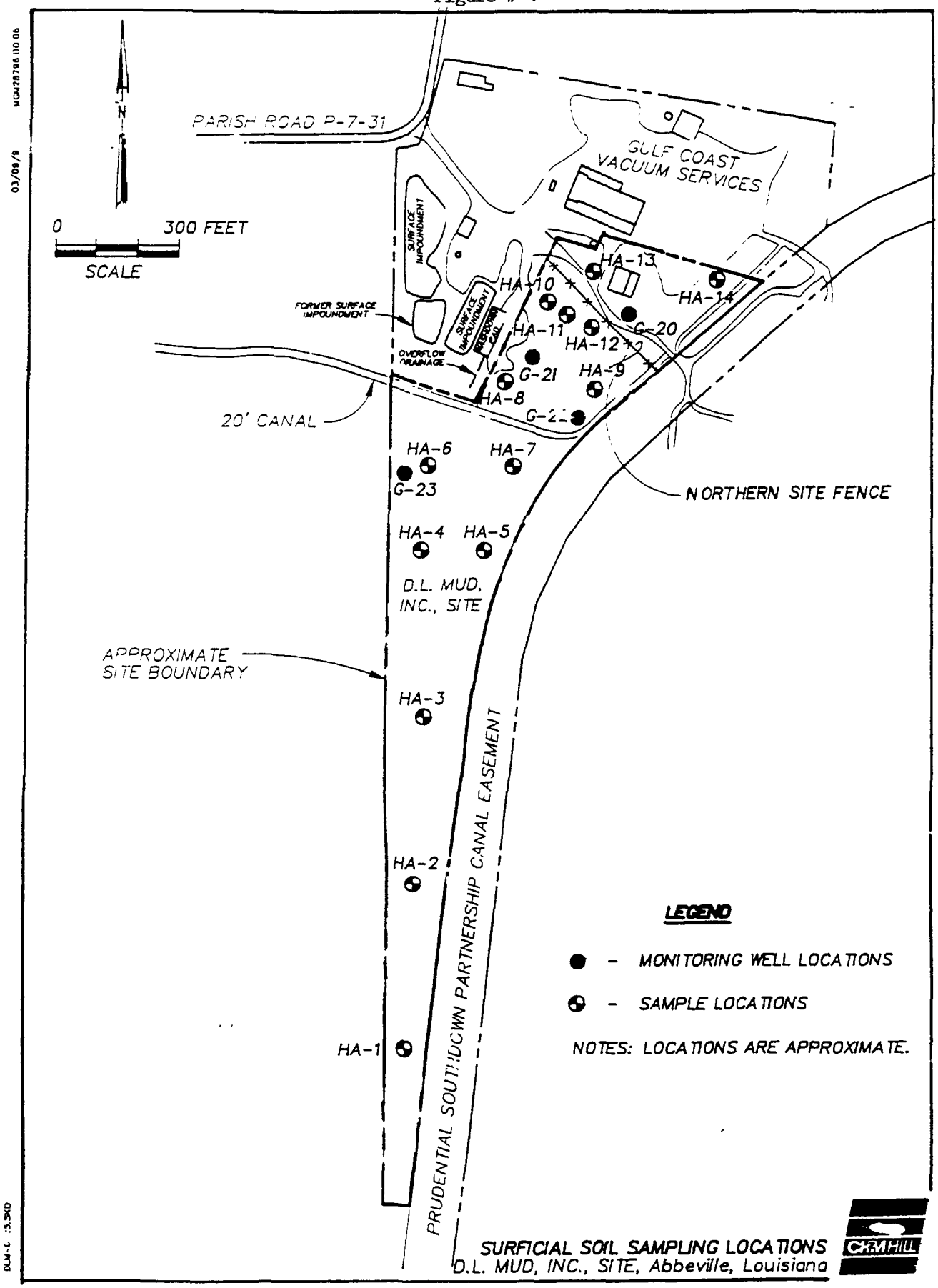
The onsite surface soil evaluation concentrated on two areas: the southern portion, which is the area below the bisecting canal that was generally not used during the operations at the site but which might have been the location of indiscriminate dumping; and the northern portion, which is above the bisecting canal and was the location of the operations area, storage tanks and focus of the 1987, State-lead cleanup.

Table #1 summarizes surface soil residual contaminant sample results above background values by sample location. Surface soil samples G-23 and HA-1 through HA-7 were used to evaluate the southern portion of the property. Ten inorganic compounds were reported above maximum background in this area. The results show that the number and concentration of inorganics generally decreased with distance from the canal that transects the property. The highest concentrations of inorganics are located near HA-4, HA-5 and HA-6 and decrease to background levels further south. In general, these data indicate that residual inorganics are located in the portion of the property closest to previous site activities.

Surface soil samples HA-8 through HA-14 and G-20 through G-22 were used to evaluate the impacts of D.L. Mud and GCVS operations on the northern portion of the property. Table #1 shows that a total of 10 inorganic compounds were detected in this area. Samples located within the former process area that was not excavated during the 1987 remedial activities at the site (HA-8, HA-10, HA-11, G-20, G-21, and G-22) show highest residual concentrations. Lower concentrations of inorganics were reported in the remaining samples.

The analytical data for surface soils indicate that residual inorganic contamination appears to be centered near the former storage tank area and also downstream of surface runoff from the GCVS site, with lesser concentrations occurring at a distance. In keeping with the former use of this area as a barium sulfate based drilling mud blending facility, barium is the most widespread residual contaminant. Figure #6 graphically illustrates the lessening of barium concentration at greater distances from the former storage tank area and the reported rodeo area located in the northeast portion of the GCVS site. In addition, testing was done to speciate the form of barium present in the surface soils.

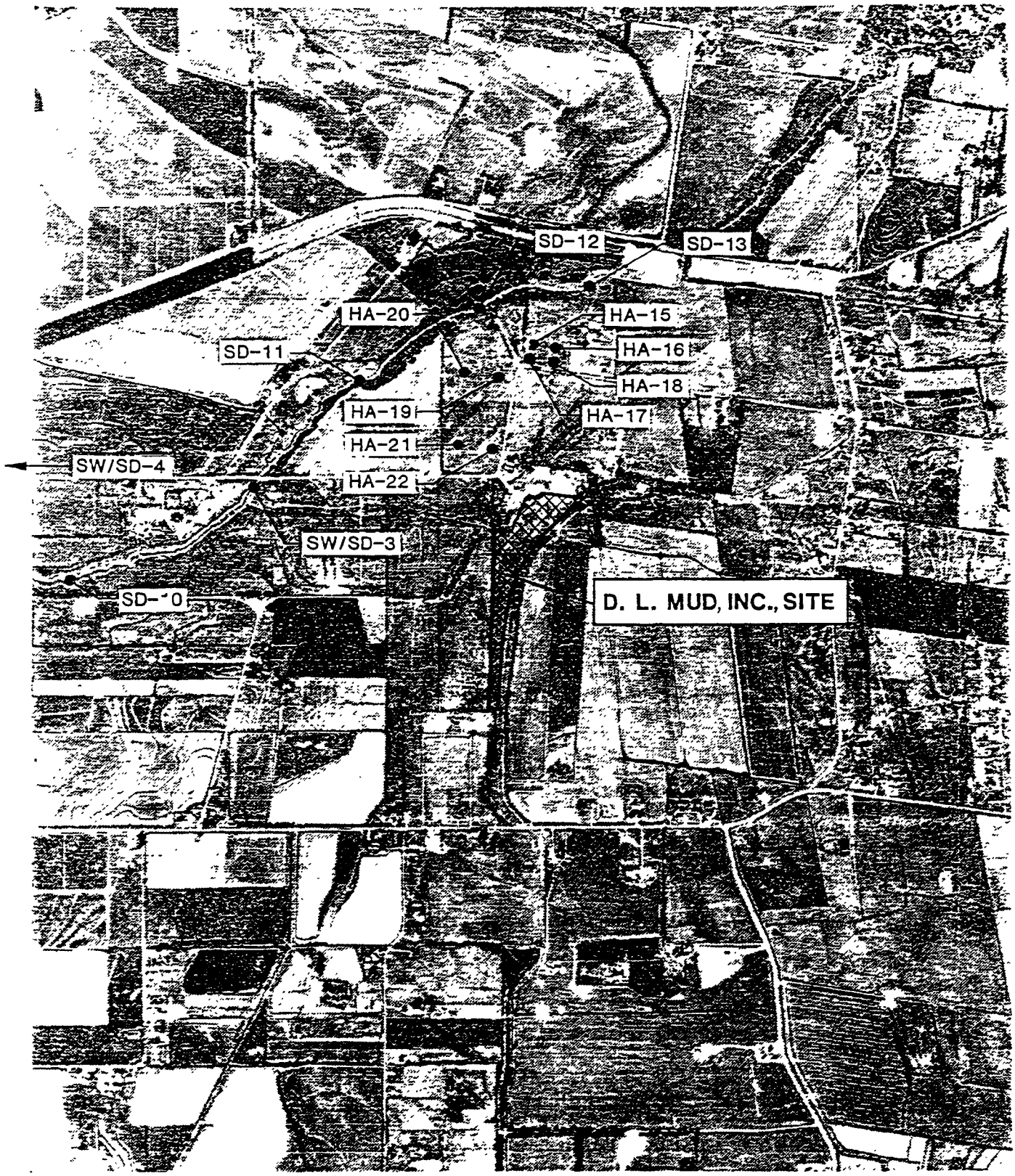
Figure # 4



SURFICIAL SOIL SAMPLING LOCATIONS
D.L. MUD, INC., SITE, Abbeville, Louisiana

CH2MHILL

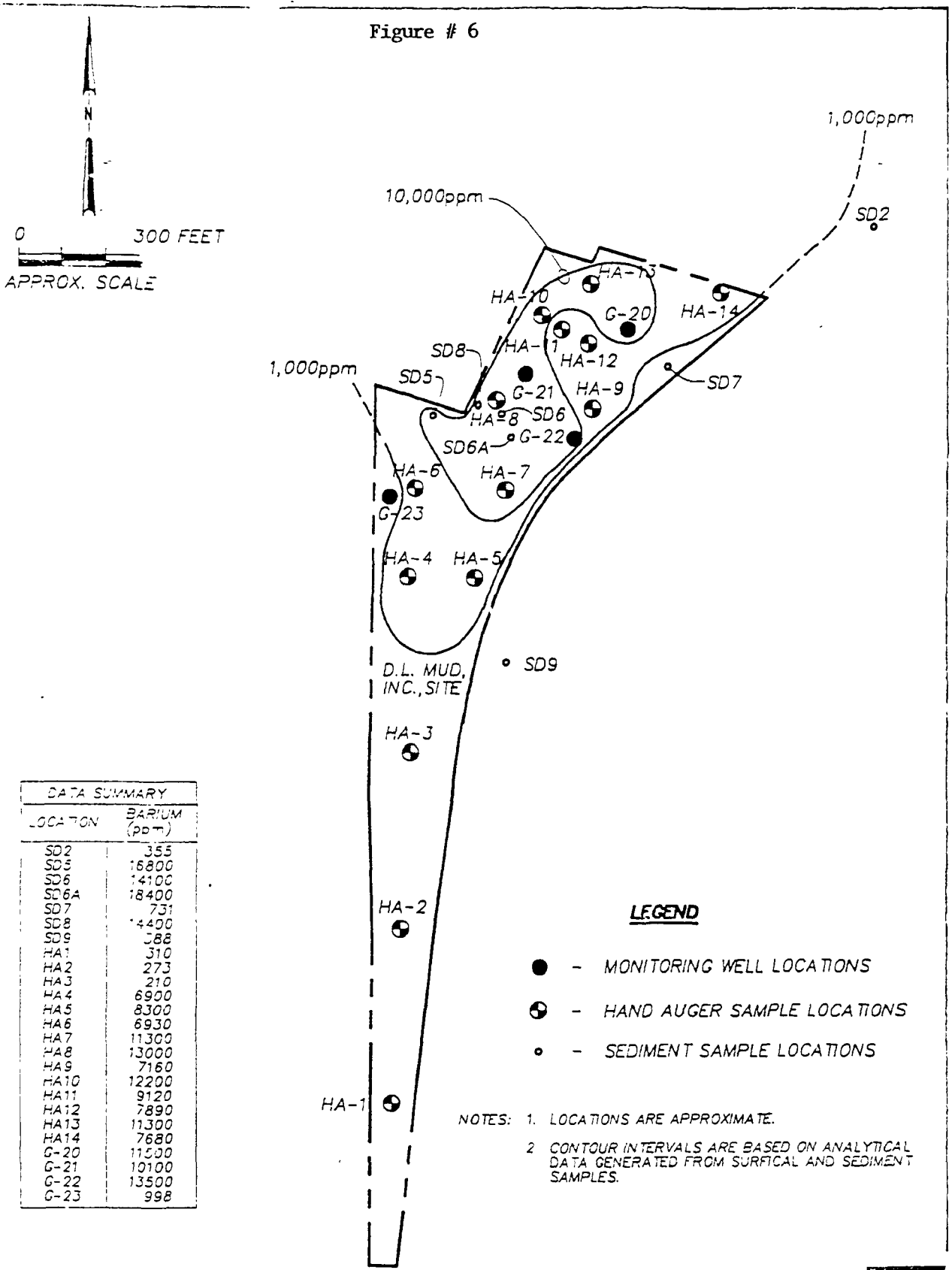
Figure # 5



APPROXIMATE SCALE: 1"= 1425'

PHOTO DATE 2/24/90

Figure # 6



DATA SUMMARY

LOCATION	BARIUM (ppm)
SD2	355
SD5	16800
SD6	14100
SD6A	18400
SD7	731
SD8	14400
SD9	388
HA1	310
HA2	273
HA3	210
HA4	6900
HA5	8300
HA6	6930
HA7	11300
HA8	13000
HA9	7160
HA10	12200
HA11	9120
HA12	7890
HA13	11300
HA14	7680
G-20	11500
G-21	10100
G-22	13500
G-23	998

CONTOUR INTERVALS OF BARIUM IN SURFICIAL SOIL
D.L. MUD, INC., SITE, Abbeville, Louisiana

CH2MHILL

Samples collected from the site showed that barium sulfate accounted for approximately 92 percent of the total barium present.

No organic contaminants were detected at concentrations above background in any of the surface soil samples.

Subsurface Soils

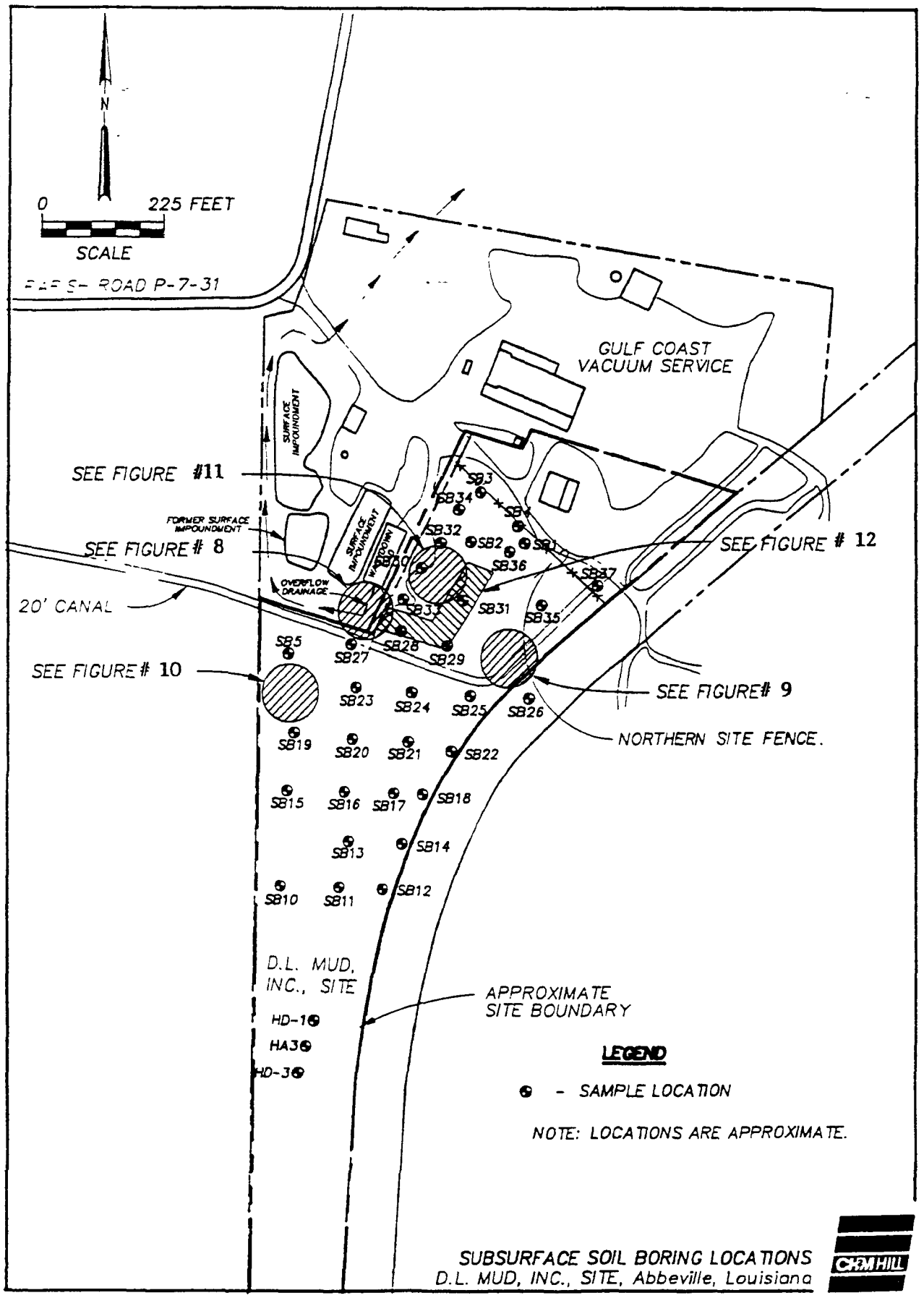
Numerous subsurface soil samples and soil borings were taken during the RI. The locations of these samples and borings were chosen based on several factors as discussed below. No subsurface soil background samples were collected. Comparisons with background were made using surface soil background results.

Five soil boring locations (SB-1, 2, 3, 4 and 5) and six trenching locations (TR-1, 2, 3, 4, 5, and 6) were established at the approximate points shown on Figures #7 and #12 to evaluate the risk associated with potential subsurface soil contamination in the former site process areas. Four of these locations (SB-1, SB-3, SB-4 and SB-5) were established to confirm soil excavation limits for the 1987 site remediation effort. The fifth soil boring (SB-2) was located to coincide with the approximate center of a potential surface impoundment tentatively identified by a 1975 EPA aerial photograph. The six locations for trenching were located to coincide with the approximate centers of six impoundments identified in an aerial photograph dated 1974 (Figure #13).

Eleven additional hand auger soil borings (D-7A through D-7G and SB-6 through SB-9) were completed to depths of approximately 10 feet at the approximate locations shown on Figure #8. These borings were completed to visually evaluate the extent of subsurface contamination under the adjacent GCVS site near the D.L. Mud site property line. No visual contamination was noted beneath the D.L. Mud property. No samples were collected for chemical analysis.

In addition, seventy three subsurface soil borings were completed to depths ranging from 3 to 15 feet deep. The borings were cored using the vibracore technique near wells G-22 (Figure #9) and G-23 (Figure #10) to evaluate the extent of two potentially contaminated areas identified by an EPA contractor and to address concern over the potential existence of other non-identified source areas onsite. The subsurface soils near well G-22 were investigated by the completion of fifteen borings. Eight borings were placed equidistantly around the well pad. Seven other boring locations were located based on field readings of organic vapors. The subsurface near well G-23 was investigated by a total of fifteen borings. Eight of the borings were located equidistantly around the well pad, and the remaining seven were located based on visual observations of darkened soil since no organic vapors were noted. Soil borings SB-10 through SB-37 were completed on a grid system at approximate 100 foot centers to supplement previous site soil

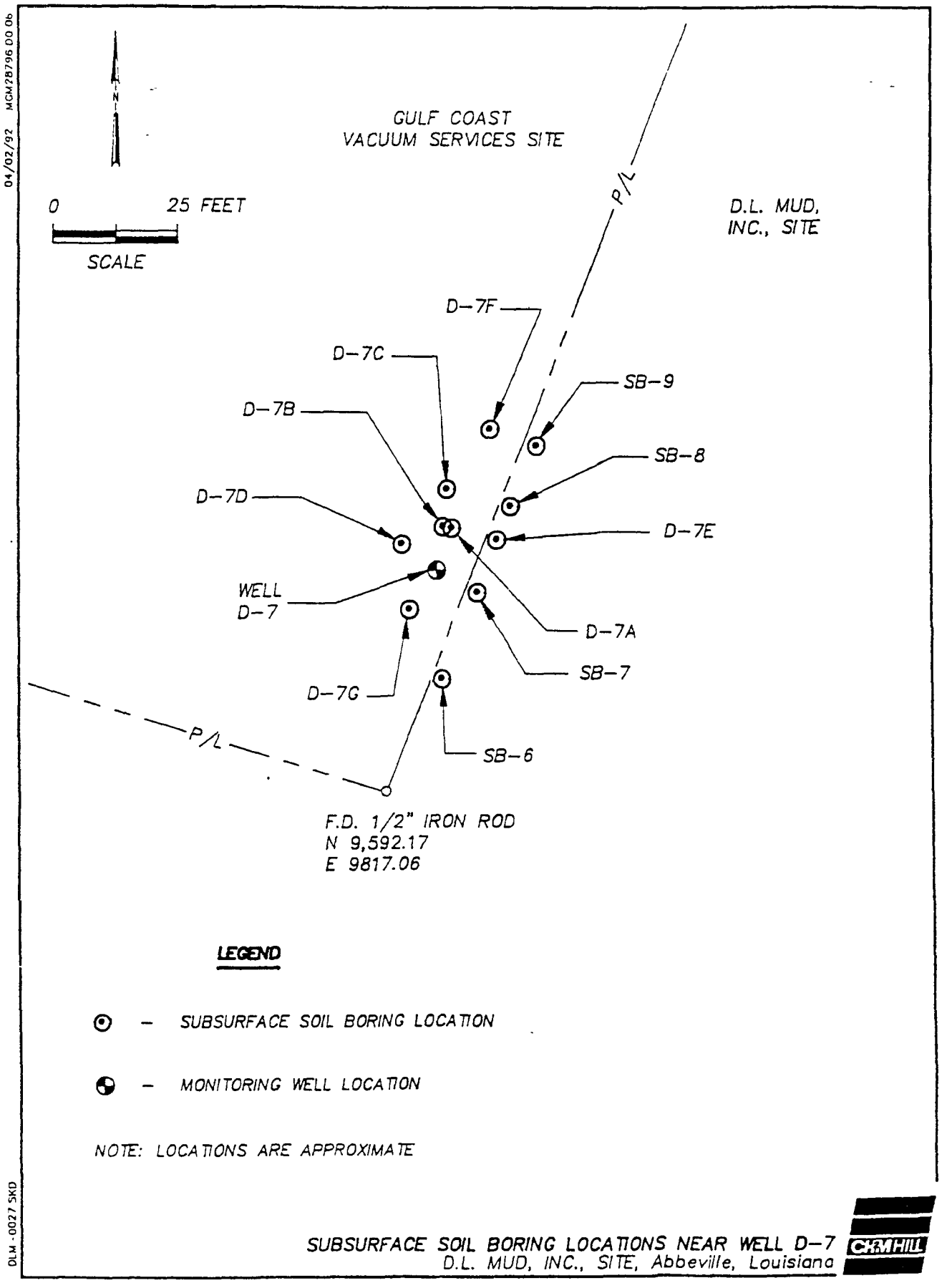
Figure # 7



SUBSURFACE SOIL BORING LOCATIONS
D.L. MUD, INC., SITE, Abbeville, Louisiana

CH2M HILL

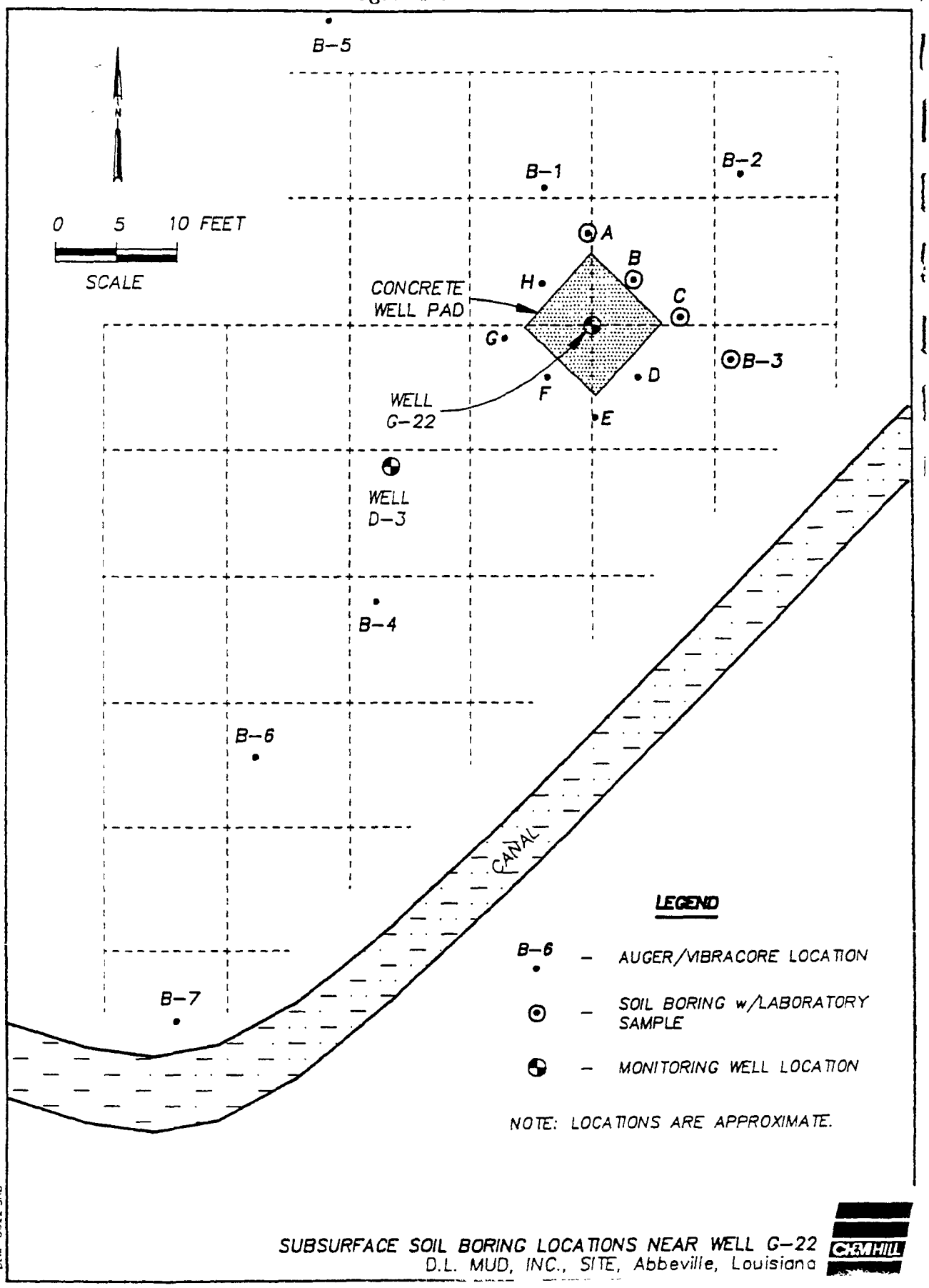
Figure # 8



SUBSURFACE SOIL BORING LOCATIONS NEAR WELL D-7
D.L. MUD, INC., SITE, Abbeville, Louisiana

CH2MHILL

Figure # 9



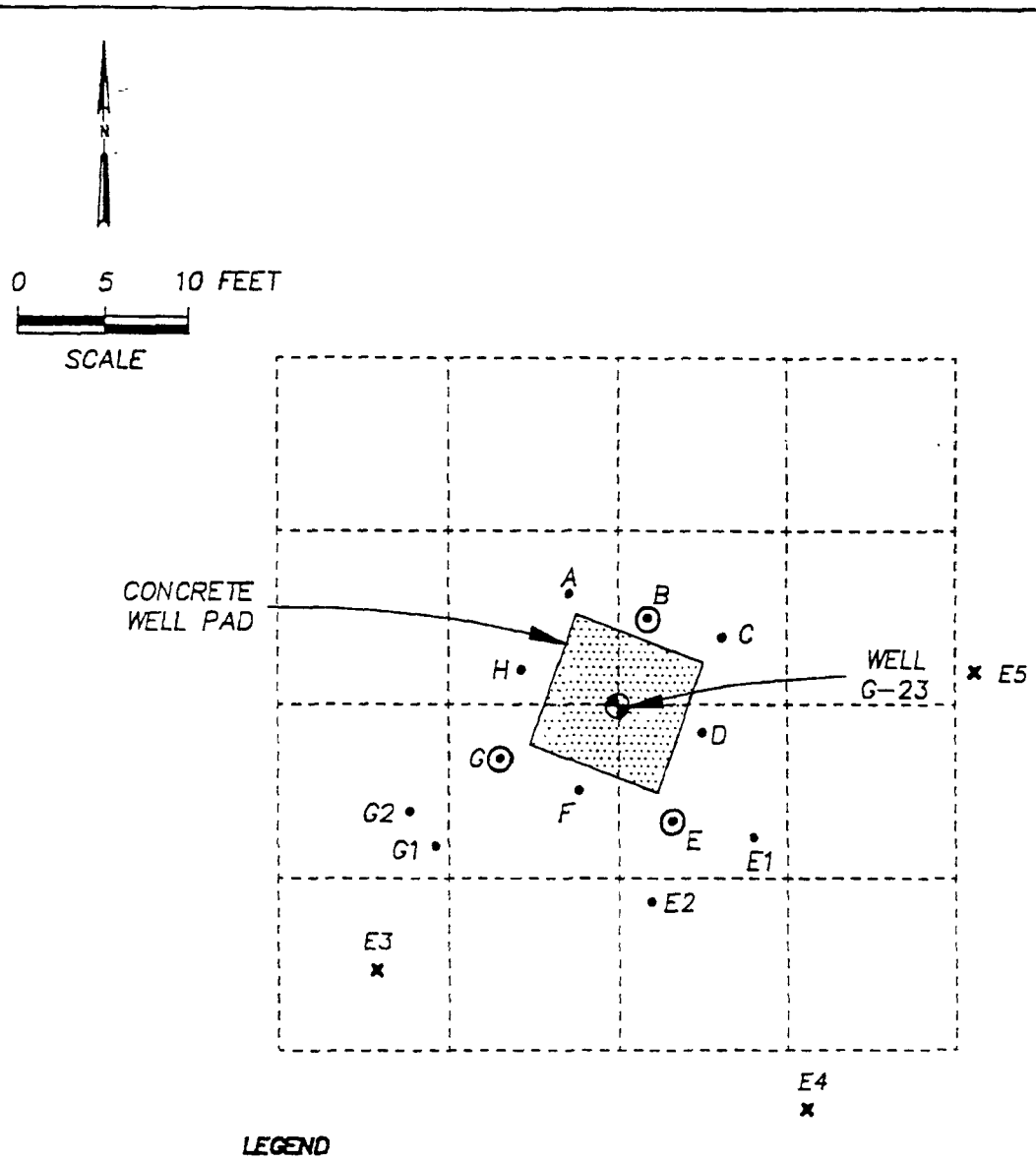
SUBSURFACE SOIL BORING LOCATIONS NEAR WELL G-22
D.L. MUD, INC., SITE, Abbeville, Louisiana

CH2MHILL

02/28/92 MGM28/96 00 06

BLM-0022 SKD

Figure # 10



LEGEND

E3 × — BORING (POSTHOLE) LOCATIONS

E1 • — VIBRACORE LOCATION

⊙ — SOIL BORING w/LABORATORY SAMPLE

◔ — MONITORING WELL LOCATION

NOTE: LOCATIONS ARE APPROXIMATE

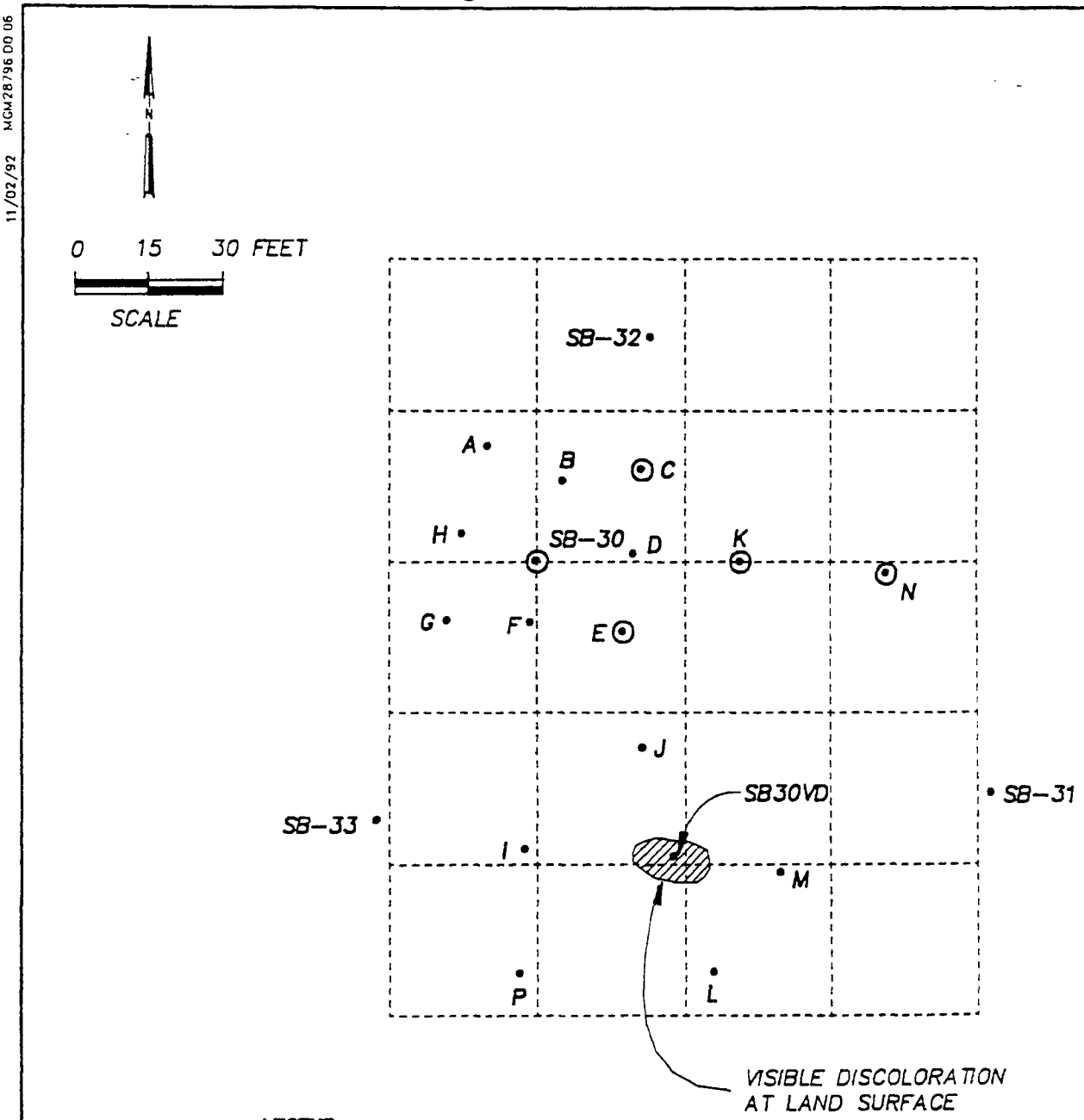
SUBSURFACE SOIL BORING LOCATIONS NEAR WELL G-23
D.L. MUD, INC., SITE, Abbeville, Louisiana

CH2MHILL

10/29/92 MGM28/96 DD 06

DLM-0023 SKD

Figure # 11



LEGEND

H – AUGER/VIBRACORE LOCATION

⊙ – SOIL BORING w/LABORATORY SAMPLE

NOTES: 1. VD=Visible Discoloration
2. LOCATIONS ARE APPROXIMATE

SUBSURFACE SOIL BORING LOCATIONS NEAR BORING SB-30
D.L. MUD, INC., SITE, Abbeville, Louisiana

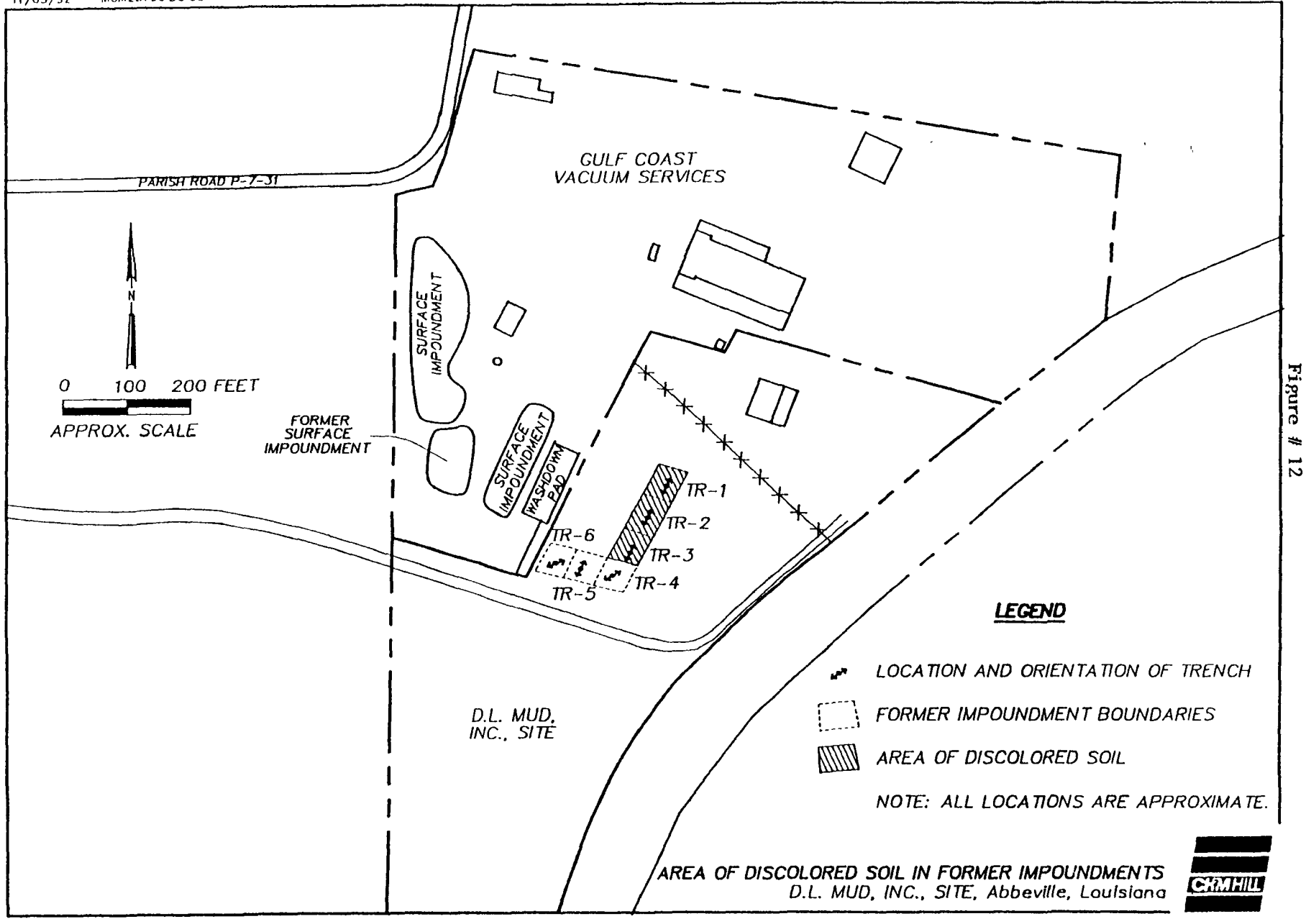
CH2MHILL

11/02/92 MGM28796 D0 06

DLM-0024 SKD

11/03/92 MGM28796 DO 06

DLM 0050.SKD

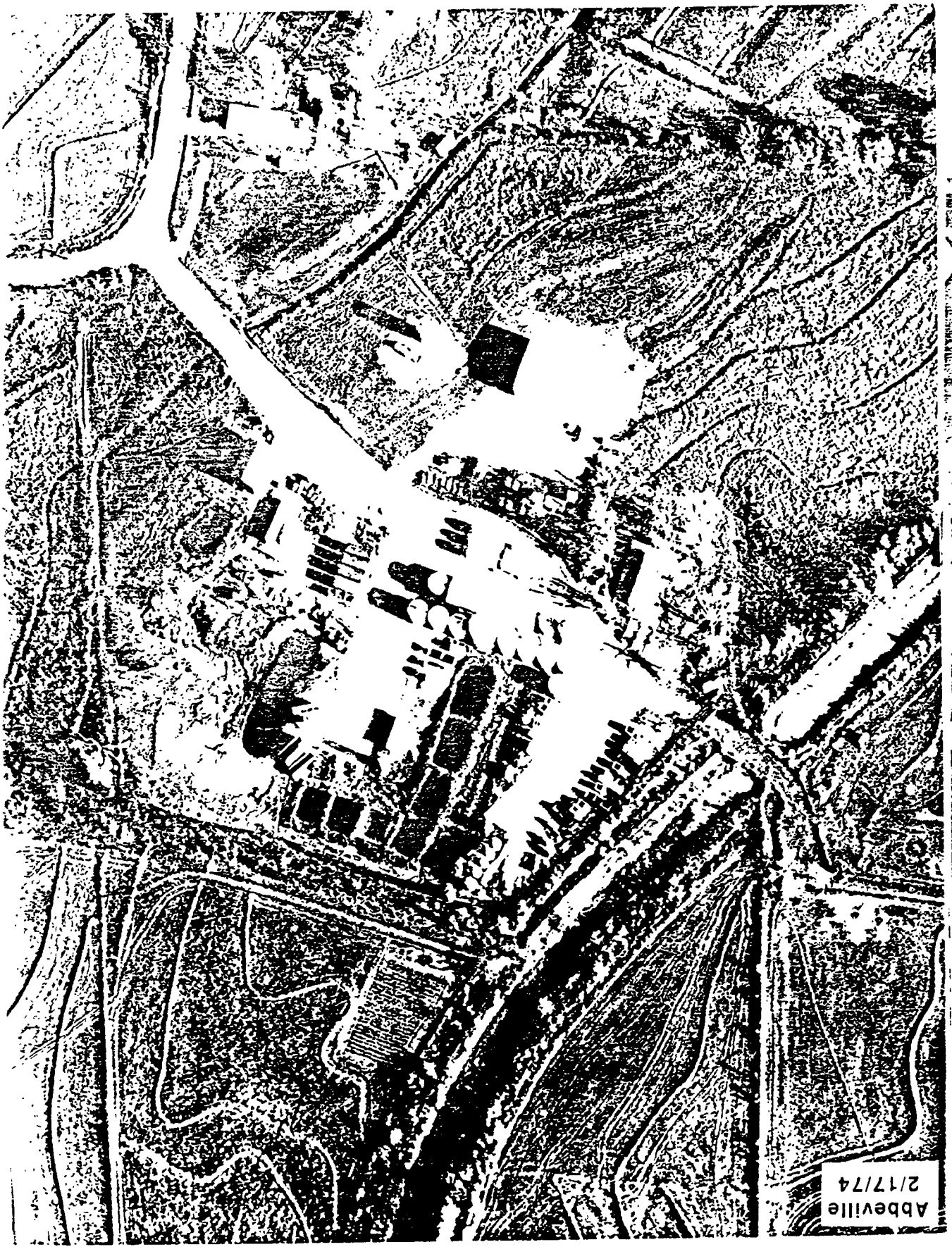


AREA OF DISCOLORED SOIL IN FORMER IMPOUNDMENTS
D.L. MUD, INC., SITE, Abbeville, Louisiana

CH2MHILL

Figure # 12

Figure #13



borings. An additional fifteen borings were placed near the location of SB-30 (Figure #11) in response to low level organic vapor readings and visual observations of darkened soil.

The following sections summarize subsurface soil results reported above background values for each sample location. Determination of the potential presence and extent of subsurface soil contamination is presented in six groupings according to the purposes of each investigation.

1) **Confirmatory Samples Collected Beneath Areas of Historical Use.** Subsurface soil samples SB-1, SB-3, SB-4, and SB-5 were analyzed to evaluate residual subsurface contamination beneath areas excavated during the 1987 site remediation. A comparison between the shallower and deeper samples from borings SB-1, SB-2, SB-3, SB-4, and SB-5 shows little difference between the analytical results with depth (see Table #2). This finding tends to indicate that the soils sampled are indicative of native materials.

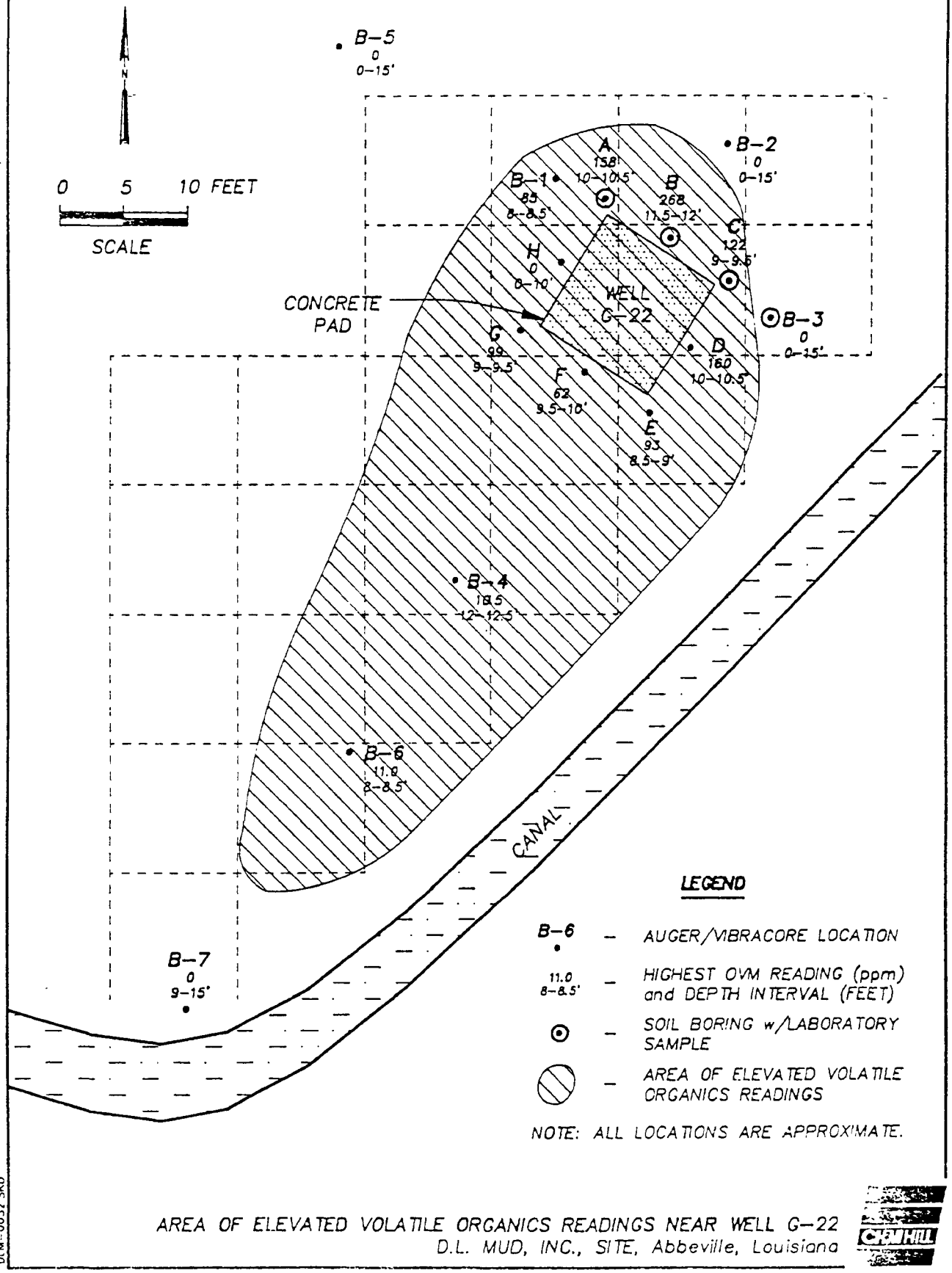
Sample SB-2 was collected to determine the presence of residual subsurface contamination from a surface impoundment tentatively identified from an EPA aerial photograph. No visible indication of waste material was noted during placement of this boring. However, the trenching activities discussed later did locate discolored soil near this boring.

Samples HA-3, HD-1 and HD-3 were collected from beneath the surface of an area in the southern portion of the site. It was felt that this area could have been used for waste disposal in the past. Table #2 shows that residual contaminants in deeper samples are approximately the same or decrease with depth. Therefore, it appears that there has been little impact on the subsurface of this portion of the site from historical operations.

2) **Samples Collected From Monitor Well Installation.** Results presented in Table #3 for subsurface soil samples collected from wells D-6, D-7, G-20 and G-21 while constructing new site monitoring wells show the presence of six residual inorganics above background concentrations. The wells with multiple samples with depth show a general trend of decreasing inorganics with depth.

3) **Area Near Well G-22.** Fifteen soil borings were completed near well G-22 (see Figure #9 and #14) to evaluate the extent of apparent subsurface contamination noted while installing the well. Field results show that the highest organic vapor monitor (OVM) reading was detected at boring G-22B. A concentration of 268 ppm was detected by OVM at a depth interval of 11.5 to 12.0 feet. The potentially contaminated soil did not display visible signs of contamination, but did have an odor similar to that of a petroleum product. A second round of borings extending to depths of 15 feet were augered/vibracored centered around boring G-22B to determine the lateral extent of contamination. The potentially contaminated

Figure # 14



AREA OF ELEVATED VOLATILE ORGANICS READINGS NEAR WELL G-22
D.L. MUD, INC., SITE, Abbeville, Louisiana

CH2M HILL

11/19/92 MGM28796 DD 06

DLM-0052 SKD

area was found to be bounded laterally within an area of approximately 3200 square feet. The potential contamination within this area was found between the depth interval of 3.0 to 14.0 feet with the highest organic vapor readings occurring between the depth interval of 6.5 to 12.5 feet.

Table #4 shows that "source" samples, collected from depth intervals of highest organic vapor readings, tend to show the presence of inorganics and organics above background concentrations. Five organics (2-methylnaphthalene, dibenzofuran, fluorene, naphthalene, and total xylenes) and two inorganics (beryllium and zinc) are reported above background for all source samples. Samples collected to bound the vertical and horizontal extent of contamination were generally found to have concentrations less than source area sample values for residual inorganics and without the presence of organic residual contaminants.

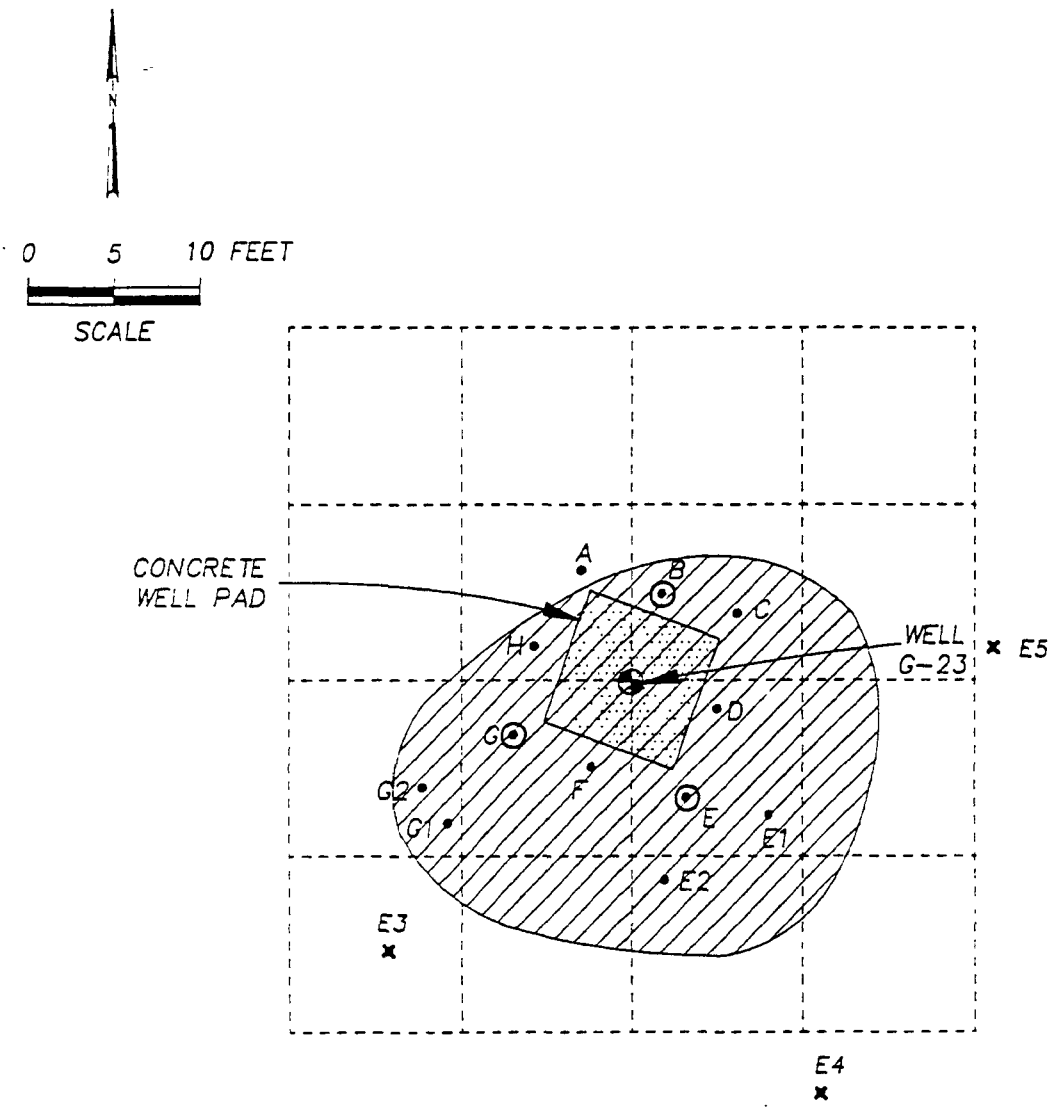
4) **Area Near Well G-23.** Field results indicate that of the fifteen borings completed near well G-23, the highest OVM reading was detected at boring G-23E (see Figures #10 and #15). A concentration of 0.4 ppm was detected by OVM at a depth interval of 2.0 to 2.5 feet. The potentially contaminated soil has a dark brown appearance. The potentially contaminated area was found to be bounded laterally within an area of approximately 1000 square feet and had a peaty nature. Due to the peaty nature of this material, organic vapor analyzer (OVA) readings could not be used to evaluate the extent of residual contamination since this instrument registered the presence of naturally occurring methane. The vertical extent of the potentially contaminated area was found between the depth interval of 2.0 to 3.0 feet.

Table #5 shows "source" samples collected from discolored soils near well G-23 to contain only inorganic residual contaminants above background values. Of the inorganics, only lead and mercury were reported above background for all source samples. Antimony, arsenic, and selenium were reported above background for one or more samples. Those samples collected to bound the vertical and horizontal extent of contamination show concentrations of residual contaminants below source sample values.

5) **Area Near SB-30.** Fifteen borings were augered/vibracored near SB-30 to determine the lateral and vertical extent of visible contamination (see Figures #11 and #16). OVA readings were detected in all borings near SB-30, with the exception of SB-30. There were no organic vapors detected by the OVM with the exception of SB-30.

SB-30 was found to have visible contamination as well as OVA and OVM readings as high as 660 and 0.9 ppm, respectively. The potentially contaminated area was found to be bounded laterally within an area of approximately 7000 square feet. The vertical extent of the potential contamination was found to range to a depth

Figure # 15



LEGEND

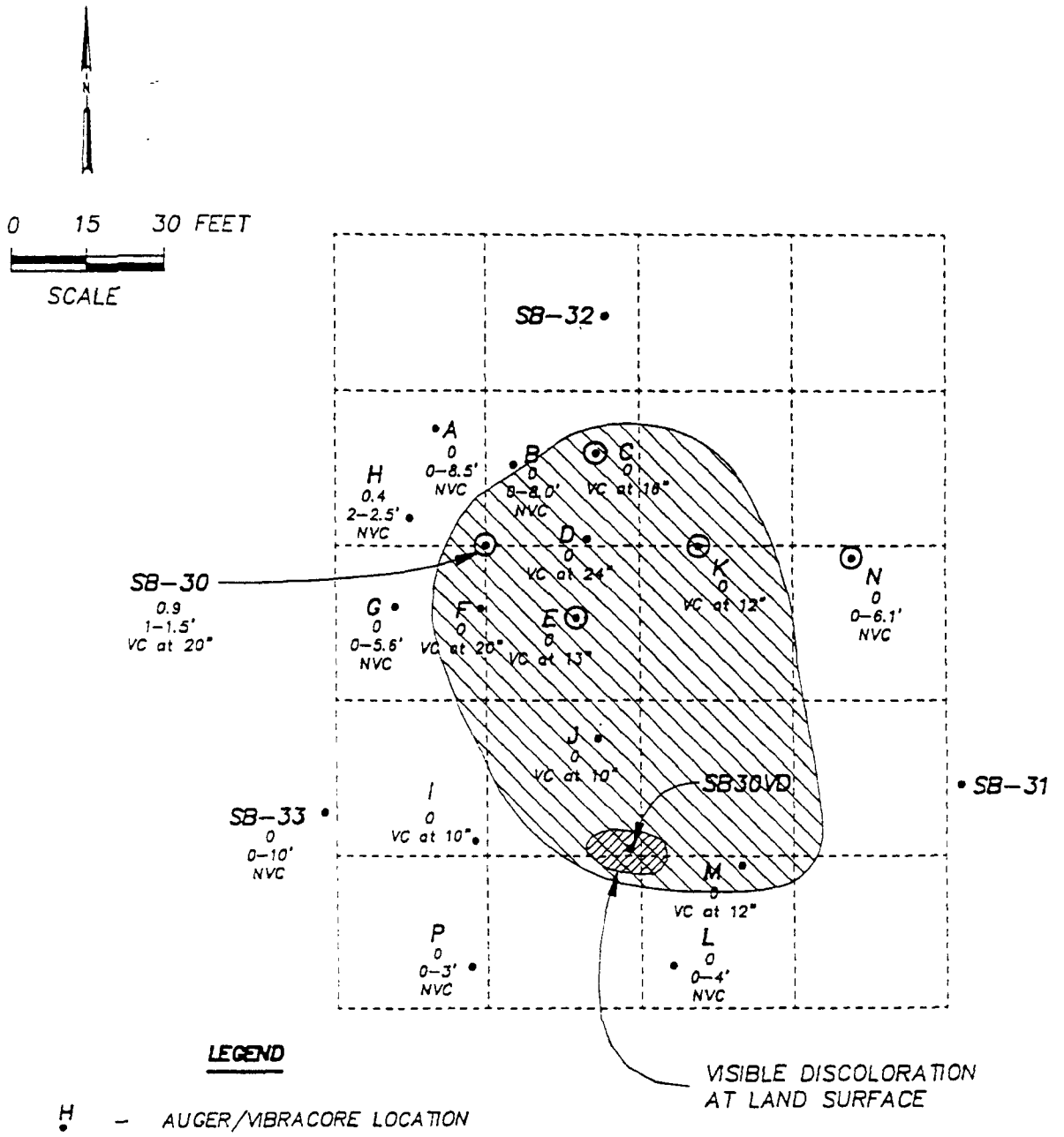
- AREA OF DISCOLORED SOIL
- E3 — BORING (POSTHOLE) LOCATIONS
- E1 — VIBRACORE LOCATION
- SOIL BORING w/LABORATORY SAMPLE
- MONITORING WELL LOCATION

NOTE: LOCATIONS ARE APPROXIMATE

AREA OF DISCOLORED SOIL NEAR WELL G-23
D.L. MUD, INC., SITE, Abbeville, Louisiana

CH2MHILL

Figure # 16



LEGEND

H • – AUGER/VIBRACORE LOCATION

⊙ – SOIL BORING w/LABORATORY SAMPLE

0.4 0-6' – HIGHEST OVM READING (ppm) and DEPTH INTERVAL (FEET).

NOTES:
1. VD=Visible Discoloration.
2. NVC=No Visible Contamination.
3. LOCATIONS ARE APPROXIMATE.

AREA OF DISCOLORED SOIL NEAR BORING SB-30
D.L. MUD, INC., SITE, Abbeville, Louisiana

CRAHILL

of 3.5 feet, with an outcrop of the substance located at land surface approximately 70 feet southeast of SB-30.

Table #6 shows that selenium and zinc are the only inorganics reported above background values for all "source" samples. Lead and mercury are also reported above background values but at lesser frequencies. Of the samples collected to bound the vertical and horizontal extent of contamination, reported concentrations of residual contaminants generally are below those for "source" samples.

6) **Former Impoundment Area.** Six trenches were completed in the area where six former impoundments were identified by EPA in April 1992 on an aerial photograph dated 1974 (Figure #13). The approximate centers of the former impoundments were field located to coincide with the approximate centers of the impoundments identified on the 1974 photograph. Discolored soil, OVA and OVM readings were detected in Trenches 1, 2, and 3. OVA readings ranged to 160 ppm in Trench 1, 320 ppm in Trench 2, and greater than 1000 ppm in Trench 3. OVM readings ranged to 16 ppm in Trench 1, 44 ppm in Trench 2 and 43 ppm in Trench 3. Trenches 3, 4 and 5 showed no signs of discolored soil.

Based on the 1974 aerial photograph and the results of trenching and boring activities in and around the impoundment area, the potentially contaminated area is estimated to be bounded laterally within an area of approximately 9600 square feet (see Figure #12). The vertical extent of the potential contamination was found to range from 3 to 8 feet.

Table #7 shows that the three trench "source" samples have residual contaminants that include three organics (2-methylnaphthalene, phenanthrene and total xylenes) and four inorganics (lead, mercury, sodium and zinc) reported above background values for all source samples. Lead, mercury and zinc were reported above background values for all source samples. The vertical extent of contamination in these three former impoundments was bounded by deeper soil samples that generally have reported values below background and source sample concentrations.

The above sampling results for this area were based on samples collected by Dow/DSI. During this sampling effort, EPA also collected samples from the trenched former impoundments. Almost exclusively, all results from EPA's sampling contained higher results than those reported above. In addition, EPA identified numerous Tentatively Identified Compounds (TICs) with concentrations as high as 762,300 ppb. Due to the disparate sampling results, it has been determined that a full and accurate characterization of the contamination in this area has not been completed.

Composite samples cclllected from Trenches 4, 5, and 6 show that subsurface samples from these areas do not exceed background concentrations for any residual contaminant.

Ground Water

A total of twelve onsite ground water monitoring wells were sampled as part of the RI (Figure #17). There were five existing wells (D-1,2,3,4,5), three new wells installed by Dow/DSI in 1990 (D-6,7,8), and four new wells installed by EPA in 1991 as part of the RI activities for the GCVS site (G-20,21,22, 23). Monitoring well D-8 was placed in the lower portion of the site and was used as the background well.

The statistical analysis of onsite and background ground water data did not identify any residual contaminants. However, certain samples were found to contain parameters above maximum contaminant levels for drinking water (MCLs). Table #8 shows that 3 inorganics (chromium, lead, selenium) and two organics (bis(2-ethylhexyl)phthalate, methylene chloride) were reported above MCLs.

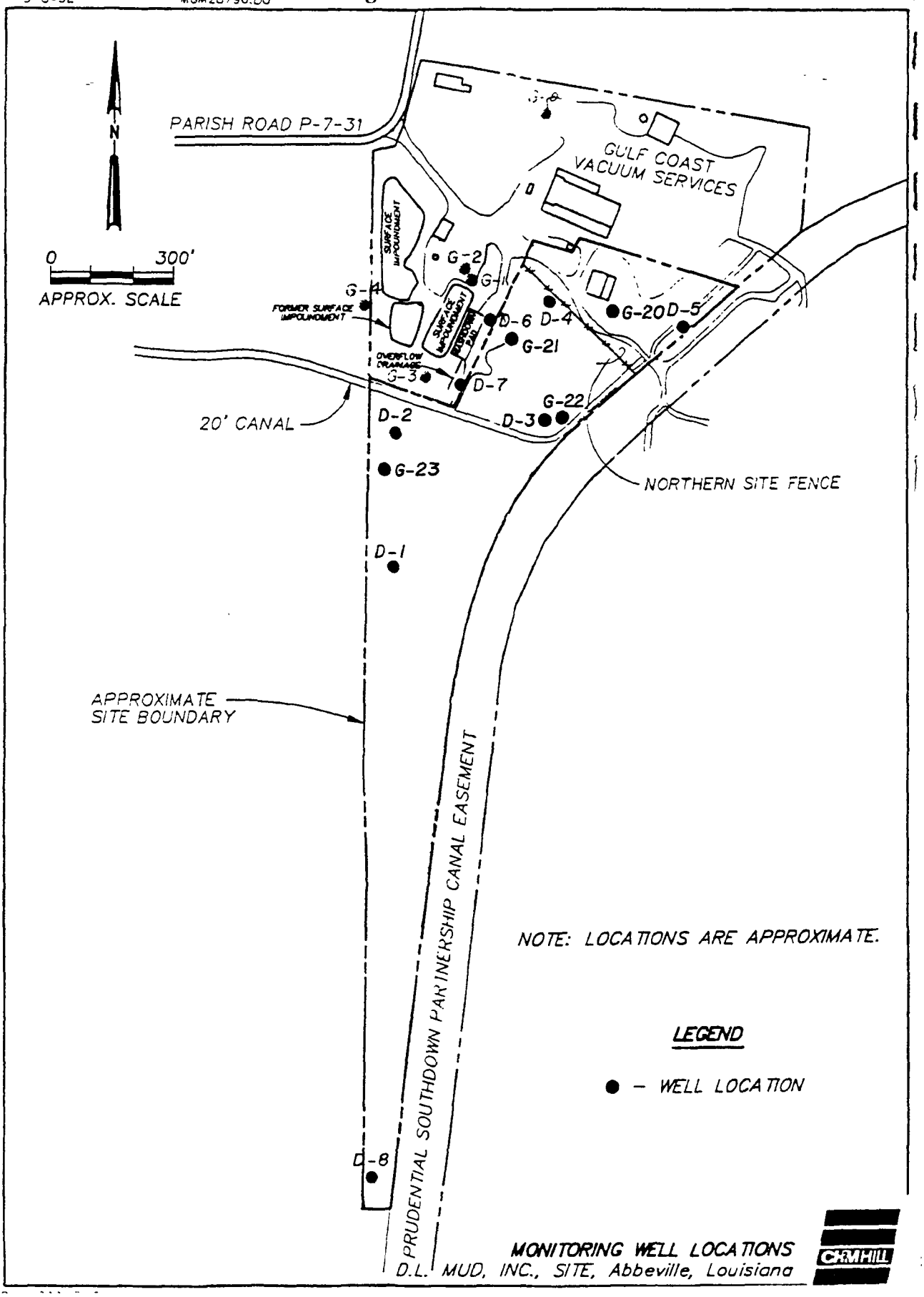
The presence of the organic compound bis(2-ethylhexyl)phthalate is attributed to field contamination. This compound is typically introduced from protective gloves used by sampling personnel. This determination is consistent with the analytical data that show that this compound was not detected above background concentrations consistently over multiple sampling episodes.

The presence of total chromium above background concentrations and MCLs was shown to be the result of collection and analysis of turbid ground water samples. This was shown by the use of a low disturbance sampling methodology employed to collect samples considered representative of the aquifer. The low chromium concentrations obtained using this more representative sampling method are directly related to low total suspended solids and turbidity measurements that result when using a low disturbance sampling procedure.

In addition to total chromium and bis(2-ethylhexyl)phthalate, lead, selenium, and methylene chloride were reported to be above MCLs. As discussed previously, the presence of total chromium and bis(2-ethylhexyl) phthalate are attributable to turbid samples and field contamination, respectively. All detections of methylene chloride have associated contamination of the laboratory sample blanks. All lead and selenium data (with the exception of lead in background well D-8) were generated from only one sampling episode (four samples out of a total of sixteen) conducted by EPA as part of the GCVS investigation. These data were estimated at low concentrations and also had laboratory quality assurance qualifiers attached to the data due to control limit problems with the analysis of associated matrix spike samples. Therefore, the

3-6-92 MGM28796.DO

Figure # 17



MONITORING WELL LOCATIONS
D.L. MUD, INC., SITE, Abbeville, Louisiana

CH2MHILL

presence of lead, selenium and methylene chloride above MCLs is not considered to be indicative of ground water contamination.

Surface Water and Sediment

Surface water and sediment sampling activities were conducted to evaluate potential impacts of the site on surface water quality and sediment characteristics. Both onsite and background samples were collected to assess these impacts. Onsite surface water samples were collected during or soon after rainfalls in December 1990 and January 1991. During the RI, onsite surface water was present only after heavy rains.

Nine surface water and nine sediment samples were collected in December, 1990 at the general locations shown on Figures #5 and #18. Four of these sample pairs (SW/SD-1, 2, 3, and 4) were initially considered background samples. However, the use of sample location SW/SD-2 was later changed from background to onsite due to the proximity of the GCVS site to this location.

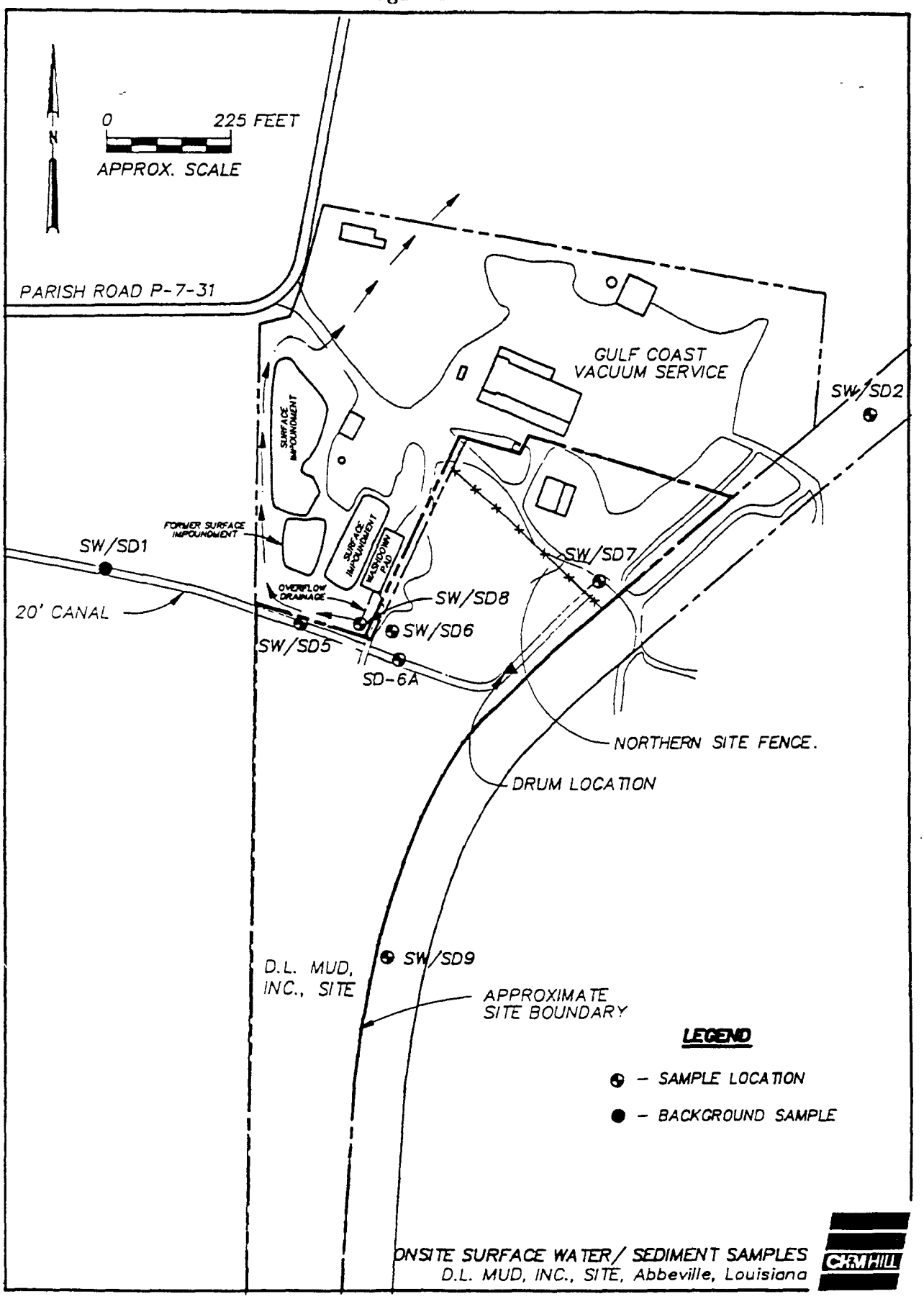
Five onsite surface water samples (SW-5, 6, 7, 8, and 9) were resampled in January 1991. An additional onsite sediment sample (SD-6A) was collected during this period. In April 1991, four additional background sediment samples were collected (SD-10, 11, 12 and 13).

The background locations were coordinated with the local Agricultural Stabilization and Conservation Service (ASCS) representative to locate areas with similar soil types and land uses. Samples SW/SD-1 and SW/SD-2 were collected from abandoned irrigation canals. Background sample pairs (SW/SD-3 and 4) and background sediment samples (SD-10, 11, 12 and 13) were collected from a nearby drainage ditch located upstream of surface runoff from the site.

Sample pairs SW/SD-5 and 7 were collected from the abandoned irrigation canal that crosses the D.L. Mud site. Sediment sample SD-6A was also collected from this abandoned canal. The impact of the GCVS discharge on existing site drainage was evaluated with sample pairs SW/SD-6 and SW/SD-8 which are located upstream and downstream, respectively, of the GCVS discharge. Sample pair SW/SD-9 was collected from the abandoned irrigation canal southeast of the former facility process area.

During the ninth sampling event, EPA's oversight contractor identified a drum in the onsite canal. Figure #18 shows the location of the drum. In March, 1992, one sediment sample was collected from the drum. This sample was collected only to characterize a potential waste for disposal. Therefore, EPA Contract Lab Program protocol was not utilized and no duplicates, spikes or equipment rinsate samples were collected. The contents

Figure # 18


0
225 FEET
APPROX. SCALE
PARISH ROAD P-7-31
GULF COAST
VACUUM SERVICE
SURFACE IMPOUNDMENT
SURFACE IMPOUNDMENT
WASHDOWN PAD
FORMER SURFACE IMPOUNDMENT
OVERFLOW DRAINAGE
SW/SD1
SW/SD2
SW/SD5
SW/SD6
SW/SD7
SW/SD8
SW/SD9
SD-6A
20' CANAL
NORTHERN SITE FENCE.
DRUM LOCATION
D.L. MUD, INC., SITE
APPROXIMATE SITE BOUNDARY
LEGEND
– SAMPLE LOCATION
– BACKGROUND SAMPLE
ONSITE SURFACE WATER/ SEDIMENT SAMPLES
D.L. MUD, INC., SITE, Abbeville, Louisiana
CRMHILL
11/03/92 MCM28796 DO.
DLM-0006 SKD

of the drum were found to be non-hazardous. The drum was later disposed of as a non-hazardous solid waste.

Surface water sampling results indicate that calcium in onsite surface water was determined to be the lone residual contaminant (significantly above background values), while barium, lead, and bis(2-ethylhexyl)phthalate were reported above MCLs. Seven inorganics (arsenic, chromium, copper, lead, nickel, silver and zinc) were reported at concentrations above federal ambient water quality criteria (AWQC). Table #9 presents a summary of these onsite surface water results. The organic compound bis(2-ethylhexyl)phthalate is a common sampling and laboratory contaminant and was not used at the site during its operational history. The three samples noted to contain this compound were also noted as having data qualifiers since this compound was also detected in the laboratory blank and the laboratory had instrument calibration problems during analysis of these samples.

Both barium and lead were detected above MCLs on one occasion at each of two locations (SW-6 and SW-8). Concentrations reported at SW-8 are greater than those reported at SW-6. Resampling showed both compounds at both locations to be below MCLs. Both locations that were affected are located in a drainage swale downstream of the former facility process area, with SW-8 located downstream of SW-6. The presence of calcium above background values is more widespread and tends to repeat for sequential sampling events. Acute freshwater AWQC for copper and zinc were exceeded at all onsite sample locations except SW-2 and by the maximum measured background concentration. Acute AWQC for lead was exceeded only at SW-8; while the AWQC for silver was exceeded at SW-5, SW-8 and SW-9. Chronic freshwater AWQC for copper and zinc were exceeded for all onsite locations except SW-2 and by background. All locations and background exceeded the chronic AWQC standards for lead.

Comparison of onsite data to background and MCL values indicates that there may be some residual inorganic impact on surface waters originating in the former process area and that the GCVS discharge, located upstream of the SW-8 location, may also have contributed to this contamination. Exceedances of AWQC standards are more widespread, but in general, similar impacts are shown by the acute AWQC standards. Chronic AWQC exceedances are typical for all (onsite and background) values.

Table #10 shows that analytical results for sediment residual contaminants are similar to those presented earlier for surface water. Residual contamination appears limited to inorganics; no organics were noted above background. No concentrations above background were noted for sample SD-7 for any analyte.

The extent of residual contamination at SD-5 and SD-6A is limited because of their location within diked areas. Results for SD-6 and SD-8 may reflect the impacts of previous facility operations, or

the impact of the GCVS site discharge, since these samples were collected from a drainage pathway downstream of the former location of storage and blending tanks and the GCVS discharge is located upstream of location SD-8. Concentrations of residual contaminants are higher at SD-8 than at the upstream location SD-6. The value reported at SD-9 for copper is marginally above the maximum background value of 22.6 mg/kg.

EXPOSURE ROUTES

The potential migration routes of residual contamination are ground water, surface water, and air. Airborne contaminants are not expected to be of concern for this site because of the nature of residual contaminants and the relatively low concentrations. In addition, the site cover, lack of disturbance, and relatively high moisture of the area help to minimize soil disturbance and the creation of aerosols.

The potential for migration of contaminants from the site is affected by two important hydrogeologic factors:

- The site soils are generally very low in permeability, and have medium values of organic content and cationic exchange capacity.

- The general ground water flow direction is to the north, with a low gradient and localized mounding resulting from large impoundments on the GCVS site.

Although the ground water pathway is considered to be a potential route of contaminant migration (such a situation already apparently exists at the adjacent GCVS Superfund Site), the low permeability of the soils tends to minimize vertical migration of contaminants from surface soil, subsurface soils, sediment, and surface water into the underlying ground water. These soils typically extend to depths of 30 feet, although a lens of silty sand was identified along the D.L. Mud and GCVS site property line at depths of approximately 20 feet below ground surface. Since the greatest soil depth noted to contain residual contaminants is approximately ten feet, a minimum of ten feet of native soil is present to mitigate contaminant transport to ground water. The relatively insoluble nature of the main residual contaminant in surface soils (barium sulfate) minimizes its potential for transport while the soil characteristics (medium cation exchange capacity and organic contents) tend to induce adsorption of other residual contaminants, thereby further retarding migration potential. It is more difficult to predict the potential for migration of contaminants identified in the former impoundment areas because the types and concentrations of these contaminants has not been fully characterized.

Since the ground water flow is northerly, contaminants, if introduced into the aquifer, could be transported in that direction. With a relatively low potentiometric gradient and flow rate of only 22 feet per year, site contaminants would take over one hundred years to reach the closest receptor, since the nearest active ground water well north of the D.L. Mud site is approximately one-half mile away. In that period of time, contaminants could be expected to be diluted by ground water dispersion, adsorbed to soil structure, or degraded by physicochemical or biological activity to a large extent. Both the D.L. Mud RI report and the GCVS RI report (EPA, 1992) show ground water mounding beneath the GCVS site that results in ground water flow from the GCVS impoundments toward the D.L. Mud site. This mounding further retards the movement of ground water from the D.L. Mud property to potential receptors.

The surface water pathway is also considered to be a potential route of contaminant migration. Site surface water runoff is to localized ditches, which is indicated by the presence of site-related contaminants in sediments in these ditches. However, the ditches are contained by levees that limit lateral migration of water and sediment borne contaminants. In addition, the evapotranspiration rate approximates rainfall, which prevents buildup of surface water, as evidenced by intermittent water in the ditches during the RI. Further, the residual contaminant and soil characteristics described above (insoluble nature, low permeability, medium cation exchange capacity and total organic carbon values and soil depth) assist in impeding the vertical migration of potential contaminants from the sediments and surface water to ground water.

Under current site conditions, there are no people who live or work onsite. Therefore, a trespasser is the most representative of the population most likely to be exposed onsite under current conditions. Potential exposure would be from direct contact, ingestion, and inhalation of site contaminants.

Future land use assumptions are based on two important factors. First, because the site is presently an abandoned light-industrial use facility, with no human inhabitants and located next to the GCVS Superfund Site, it seems reasonable that this type of land use will continue. Second, because there are currently no land use restrictions affecting this property and residential areas are located nearby, it is possible that the property could be used as a residential location in the future.

VI. SUMMARY OF SITE RISKS

A baseline risk assessment (BRA) was conducted to analyze the potential adverse health effects (both current and future) resulting from human exposure to hazardous substances in surface soil, subsurface soils, sediment, ground water and surface water at

the D.L. Mud site. The BRA provides the basis for taking action and indicates the exposure pathways that need to be addressed by the remedial action. It serves as the baseline indicating what risks could exist if no action were taken at the site. This section of the ROD reports the results of the BRA conducted for this site.

By definition, a BRA evaluates risk under the no-action alternative (that is, in the absence of any remedial actions to control or mitigate releases or exposures). The BRA for this site was prepared utilizing data from the RI. The methods used in the development of the risk assessment are based on general EPA guidance (Office of Emergency and Remedial Response. Risk Assessment Guidance for Superfund. Vol. I. Human Health Evaluation Manual (Part A), 1989, also known as "RAGS"), the NCP, and in accordance with site-specific guidance developed by Region VI. In addition, an environmental risk assessment was conducted to evaluate risks to environmental species. These reports can be found in the Administrative Record.

CHEMICALS OF POTENTIAL CONCERN

The nature and extent of inorganic and organic chemical constituents (IOCs) identified in the site media are discussed in Section V. of this ROD. Chemicals detected in low frequency were not considered to be representative of the nature and extent of residual contamination at the site. However, all IOCs identified in the site media were used to assess total site risk. Factors such as frequency of detection as well as nutritional benefit and comparisons with background concentrations were not initially considered when developing the list of chemicals of concern (COCs) for use in the BRA. The influence of these factors on the assessment of total site risk is discussed in the uncertainty section. Since risks associated with identified TICs are difficult to evaluate, they are not included in the quantitative assessment of total site risk. However, a qualitative discussion of TICs identified at the D.L. Mud site is presented below in the uncertainty subsection.

Table #11 presents the descriptive statistics (e.g., minimum and maximum detected value, mean estimation, upper confidence limit) of the IOCs detected on the site and in the background for the following media:

- Onsite ground water
- Onsite surface water
- Onsite surface soil
- Onsite sediment
- Onsite subsurface soil (non-"source" areas)
- Onsite source area near Well G-22 (subsurface soil)
- Onsite source area near Well G-23 (subsurface soil)
- Onsite source area near boring SB-30 (subsurface soil)

- Onsite impoundment area (subsurface soil)
- Background ground water
- Background surface water
- Background surface soil
- Background sediment

An exposure point concentration (used for risk calculations) is the arithmetic mean concentration of a chemical in a medium, averaged over the area in which exposure is expected to occur. Because of the uncertainty associated with the exposure point concentrations, the upper 95th confidence limit of the arithmetic mean (UCL95) is generally used to provide a degree of conservatism. If the calculated value of the UCL95 exceeded the maximum value used to calculate the UCL95 at an exposure point, then the maximum value (rather than the UCL95) was used. Chemicals which were analyzed for but not detected in a sample at a level higher than the normal detection limit were labeled as "undetected". For purposes of calculating exposure point concentrations, if a chemical was detected at least once in a medium, the chemical was assumed to be present in all samples of that medium, and non-detects were evaluated using one-half the "undetected" value.

EXPOSURE SCENARIOS EVALUATED

The D.L. Mud site exposure assessment (and subsequent baseline risk assessment) is based on the assumption that no further response actions are performed at the site and on the conservative assumption that unrestricted use of the site and its resources by adults and children is permitted. A potential current use exposure involving a trespasser is evaluated. Future use scenarios involving residential (includes agricultural use) and occupational use of the site are evaluated.

The D.L. Mud site is located in a rural area. Surrounding land use is generally agricultural, although residences are located within one mile of the site. It is estimated that up to 116 people live within the one mile study area surrounding the site. No threatened or endangered species have been reported in the study area.

Exposure pathway evaluations were made on the basis of site history, analytical results of the onsite and background samples, and exposure setting. These evaluations are presented in Table #12. Ground water, surface water, surface soil, sediment, and subsurface soil are considered the five potential secondary sources of exposure to residual contaminants. Subsurface soil is evaluated based on division into five areas of assessment: (a) four subsurface soil "source areas" which are areas of visible contamination and/or positive organic vapor readings (1. located near Well G-22; 2. located near Well G-23; 3. located near boring SB-30; 4. located in the former impoundment area) and (b) other subsurface soil samples without source area characteristics. A tertiary source of exposure to residual contaminants considered is

agricultural products (root and leafy vegetables, beef, and milk potentially contaminated by ground water and soil).

The routes of exposure considered are ingestion, dermal absorption, and inhalation. Under the current use scenario, incidental ingestion of surface soil and sediment by a trespasser is evaluated. Dermal absorption of contaminants from surface water, surface soil, and sediment by the trespasser receptor is also quantitatively assessed.

Ingestion of ground water, surface soil, sediment, and subsurface soil is quantitatively assessed for the residential adult, residential child, and occupational adult receptors. Ingestion of agricultural food products is quantitatively assessed for the residential receptor. Incidental ingestion of surface water is not considered because it was assumed that surface water conditions (mainly lack of water depth) preclude swimming. Dermal absorption of contaminants from ground water, surface water, surface soil, sediment, and subsurface soil by the residential and occupational receptors is also quantitatively assessed.

The magnitude of human exposures to the contaminants at the D.L. Mud site is described as the potential dose or intakes by each receptor. In general, standard exposure factors, as defined in the Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors (OSWER Directive 9285.6-03), were used for this determination. In addition, variability among individuals usually leads to a wide distribution of intake values. In most cases, input variables in the risk equation were chosen so that the resulting intake is about equal to the 95th percentile of the dose distribution curve. This is referred to as the Reasonable Maximum Exposure (RME). For future residential populations, the variables were also chosen to estimate the average (AVG) intake (about the 50th percentile of the distribution). This approach, commonly referred to as the "central tendency", provides a range of risk estimates, AVG to RME, for future residential exposures.

A central tendency exposure (CTE) is required for risk assessments and was to be included in the assessment of the hypothetical future residential child. However, using Region 6 exposure variables, the CTE and RME would be identical for soil ingestion by a child. Both the RME and CTE are the same for a child because both exposure assessments utilize a soil ingestion rate of 200 mg/day due to a lack of information indicating more appropriate values.

TOXICITY ASSESSMENT

The purpose of the toxicity assessment was to weigh available evidence regarding the potential for contaminants to cause adverse effects in exposed individuals. The toxicity assessment involved two steps: hazard identification and dose-response assessment. The hazard identification determined whether exposure to a chemical

could cause an increase in the incidence of a particular adverse health effect (carcinogenic or noncarcinogenic) and whether an adverse health effect would likely occur in humans. The second step, dose-response assessment, quantitatively evaluated the toxicity information and characterized the relationship between the dose of the chemical received and the incidence of adverse health effects in the exposed population.

Toxicity values (i.e., reference doses for non-carcinogens and slope factors for carcinogens) are used in the risk characterization to estimate the likelihood of adverse effects occurring in humans at different exposure levels and are specific to exposure routes. The EPA has established a weight-of-evidence classification system for carcinogens as follows:

* **Group A** - Human carcinogen
* **Group B1 or B2** - Probable human carcinogen; B1 indicates that limited data are available and B2 indicates sufficient evidence in animals and inadequate or no evidence in humans
* **Group C** - Possible human carcinogen
* **Group D** - Not classifiable as to human carcinogenicity
* **Group E** - Evidence of noncarcinogenicity for humans

Slope factors ("SFs") have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic contaminant(s) of concern. SFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound", reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. SFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans).

Reference doses ("RfDs") have been developed by EPA for indicating the potential for adverse health effects from exposure to contaminant(s) of concern exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of contaminant(s) of concern from environmental media (e.g., the amount of a contaminant(s) of concern ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans).

Of the residual contaminants identified in one or more samples collected from the D.L. Mud site, eleven are considered carcinogens when exposed orally and twelve are considered carcinogens when exposed through inhalation. Table #13 lists the chemical carcinogens for the oral and inhalation exposure routes and provides their weight-of-evidence classification.

Noncarcinogenic health effects include a variety of toxic effects on body systems ranging from renal toxicity (toxicity to the kidney) to central nervous system disorders. Noncarcinogenic health effects fall into two basic categories: acute toxicity and subchronic and chronic toxicity. Acute toxicity occurs after a single exposure (usually at high doses), and the effect is seen immediately. Chronic toxicity occurs after repeated exposure (usually at low doses), and the effect is seen weeks, months, or years after the initial exposure.

Chemicals causing noncarcinogenic effects (e.g., systemic toxins) also exhibit levels of exposure that can be tolerated by organisms without causing an observed health effect. It is believed that organisms have adaptive mechanisms that must be overcome before a toxic effect is manifested. Table #14 provides a summary of the characteristic noncarcinogenic effects and lists available RfD values and confidence categories for all verified RfDs for all of the chemicals of concern at the D.L. Mud site.

RISK CHARACTERIZATION

Human Health Risk

The risk of cancer from exposure to a chemical is described in terms of the probability that an individual exposed for his or her lifetime will develop cancer. Typically, cancer risks of $1x10^{-6}$ (one in a million) or lower are considered to be so small that they are of no practical concern. Higher cancer risk levels may be cause for concern, and EPA typically requires site remediation if risks exceed $1x10^{-4}$.

Evaluation of noncarcinogenic risk is accomplished by comparing a calculated intake with an acceptable intake for each chemical and for each pathway that contributes to a population's exposure. The ratio of the calculated intake versus the acceptable intake is termed the Hazard Index (HI). The HI is calculated by adding chemical-specific Hazard Quotients (HQs). An HI of 1.0 or more shows an intake greater than the acceptable level and indicates the need for remedial action.

The likely effect of exposures to lead contamination was estimated using EPA's Uptake/Biokinetic model (UBK). The UBK model predicts mean blood levels associated with multimedia exposure levels that are defined as site-specifically as possible. A significant amount of information is present in the scientific literature that

provides evidence of exposure-effect relationships extending to blood levels of 10 to 15 μg/dL in infants and young children. Using 10 μg/dL as a cutoff value, EPA has determined that it is desirable to have no more than five percent of the exposed population exceeding this level of concern. The UBK model used to assess risk from lead is restricted to the evaluation of a child in a residential setting, since a child is significantly more sensitive to the toxic effects of lead than an adult.

The following discussions summarize potential site risks by medium. Table #15 presents the carcinogenic risks and lists the chemicals primarily responsible for the risks for onsite and background exposures. Tables #16 presents potential noncarcinogenic health hazards and lists the chemicals (and their HQs) primarily responsible for the HIs.

Risks from Surface Soil - Health risks related to direct contact (or dermal absorption) of contaminants from surface soil adhering to exposed body surfaces were assessed. The excess lifetime cancer risks for onsite and background dermal exposures are similar for all receptors evaluated. The HIs for onsite and background dermal exposures are less than 1.0 for all receptors.

Incidental ingestion of surface soil was assessed for residential adults and children based on soil ingestion rates of 0.1 and 0.2 grams per day, respectively, and for a trespasser and occupational adults based on a rate of 0.05 grams per day. The conservative assumption is made in assessing total site risk that soil residual contaminants ingested by the human receptors are absorbed by the body with the same efficiency as chemicals dissolved in aqueous solution. The excess lifetime cancer risks related to incidental ingestion of surface soil are similar for onsite and background exposures for all receptors evaluated. The HI estimated for incidental ingestion of surface soil exceeds 1.0 for the residential child (3.8) and adult (4.2) onsite exposures. These HIs are dominated by the barium HQ calculated for the residential child exposure. The HI for incidental ingestion of soil by a trespasser and an occupational laborer is less than 1.0.

Risks from Subsurface Soils - Subsurface soil was evaluated based on division of the site into five areas for assessment: four subsurface soil contaminant "source areas" ("source area 1" or G-22 samples, "source area 2" or G-23 samples, "source area 3" or SB-30 samples, and "source area 4" or former impoundment area samples), which are areas of visible contamination and/or positive organic vapor readings (Figure #7) and all other subsurface soil (those samples without source area characteristics). Risks from subsurface source areas were based on the ratio of the source area to a typical rural residential lot size in the general area of the Site, such as the small subdivision located southeast of the D.L. Mud Site. Lots in this subdivision are approximately one acre in size. Therefore, an acre weighted risk (AWR) method is employed to

characterize risk associated with exposures to the source areas. Risk is weighted according to square footage of the source area and its area percentage to a typical one acre residential plot in the area of the Site.

The AWR cancer risks for incidental ingestion and dermal absorption of contaminants ranged from $3x10^{-5}$ to $3x10^{-6}$ for all the source areas for all three receptors evaluated. Cancer risks in subsurface soil source areas 1 through 4 exist primarily because of low levels of arsenic and beryllium. Cancer risks for incidental ingestion and dermal absorption of contaminants in nonsource area subsurface soils range from $3x10^{-5}$ to $3x10^{-6}$ for all three receptors evaluated.

Non-cancer HIs for incidental ingestion and dermal absorption of contaminants from nonsource area subsurface soil are less than 1.0 for all three receptors evaluated. The non-cancer AWRs for incidental ingestion and dermal absorption of contaminants by the residential child and the occupational adult are less than 1.0 for all source areas. For the residential adult, the non-cancer AWRs for incidental ingestion and dermal absorption of contaminants are less than 1.0 for source areas 1, 2, and 3; however, for source area 4 the non-cancer AWR is equal to 1.0 for an ingestion exposure. In this instance, the residential adult's non-cancer AWR is primarily due to 6-year ingestion exposure to barium during the adult's childhood, which results in an HQ of 0.9.

It should be noted that the risk calculation for the former impoundment area (source area 4) was calculated using data collected by Dow/DSI during the RI. As mentioned earlier, EPA split data from this area differed significantly and it is expected that the use of this data would result in higher overall potential risk than calculated. In addition, the fact that no specific risks were quantified in any of the obviously contaminated subsurface areas related to the former impoundment areas or near SB-30 is further questioned due mainly to the lack of specific information regarding the nature and concentration of individual contaminants that are present. For example, the TICs identified in these areas are reportedly high molecular weight aliphatic hydrocarbons that may be associated with crude oil, but individual compounds could not be identified with the routine chemical analysis methods that were used during the remedial investigation. The TIC concentrations of most concern are located in the area associated with the former impoundments. The number, concentration, and depth of these hydrocarbons pose a greater potential risk to the ground water than those found near SB-30.

Risks from Ground Water - Excess lifetime cancer risks from ground water ingestion and dermal absorption were the same for onsite and background exposures for the adult residential receptors. The cancer risks for ground water ingestion and dermal absorption by the residential child onsite are equal to the background risk. Excess lifetime cancer risks from ground water ingestion and dermal

absorption were the same for onsite and background exposures for the adult occupational receptors. In all ground water ingestion scenarios, both onsite and background, the cancer risk exists because of low levels of arsenic.

The HI exceed 1.0 for onsite and background ground water ingestion exposures for all receptors evaluated (residential adult, residential child, occupational laborer). The HQs of antimony, arsenic, and thallium are the major contributors to the HI for both onsite and background ground water ingestion by a residential adult and to the HI for both onsite and background ground water ingestion by an occupational adult. The HQ of antimony, arsenic, manganese, thallium, and barium are the major contributors to the HI for both onsite and background ground water ingestion by a residential child. The noncarcinogenic HI is significantly less than 1.0 for onsite and background exposures related to dermal absorption from ground water for all receptors evaluated.

Risks from Sediments - Health risks related to dermal absorption of contaminants from sediment adhering to exposed body surfaces were assessed. Excess lifetime cancer risks are less than 10^{-6} for onsite and background exposures for all receptors evaluated. The noncarcinogenic hazard index is significantly less than 1.0 for all dermal absorption of contaminants in sediment scenarios.

Incidental ingestion of sediment is assessed for adults and children based on soil ingestion rates of 0.1 and 0.2 grams per day, and for a trespasser and occupational adults based on a rate of 0.05 grams/day. Excess lifetime cancer risks are less than 10^{-6} for onsite and background exposures for all receptors evaluated. The noncarcinogenic hazard index is significantly less than 1.0 for all incidental ingestion of residual contaminants in sediment scenarios.

Cumulative Carcinogenic And Noncarcinogenic Risks - The excess lifetime cancer risks and hazard indices are summed across pathways to provide an estimate of total carcinogenic and noncarcinogenic risks at the site based on current trespasser exposures (Table #17), future residential exposures (Table #18) and future occupational exposures (Table #19). When totaling the residential and occupational scenarios, the greatest subsurface soil risk values were chosen from among the source and nonsource areas for the summation.

The cumulative cancer risk for trespasser exposures onsite is equal to the cumulative cancer risk from background exposures. The cumulative HI for occupational laborer exposures onsite is equal to the cumulative HI for background exposures. The cumulative cancer risk for residential adult exposures onsite is equal to the cumulative cancer risk from background exposures.

The cumulative HI for residential adult exposures onsite is greater than the cumulative HI for background exposures. Both onsite and offsite cumulative HIs are dominated by potential risks associated with the ingestion of ground water and surface soil. The onsite ground water risk was associated with a single detection of antimony and the surface soil risk is associated with the presence of residual barium.

Cumulative cancer risk for the child receptor is the same onsite as for background exposures, at an estimate of 10^{-4}. The child receptor's cumulative HI exceeds the background cumulative HI. The cumulative HI estimated for the onsite exposures potentially incurred by a child receptor is dominated by the ground water ingestion exposure route (due to the single antimony detection) and is influenced to a lesser extent by the incidental ingestion of surface soil exposure route (due to elevated residual barium concentrations).

The cumulative cancer risk for occupational exposures onsite is equal to the cumulative cancer risk from background exposures. The cumulative HI for occupational laborer exposures onsite is greater than the cumulative HI for background exposures. Both cumulative HIs are dominated by ingestion of ground water (due to the single antimony detection).

Uncertainties Associated With The Human Health Risk Calculation

There are a number of stages in the risk assessment process where precise evaluations are not possible. These include uncertainties regarding the true concentrations of chemicals in environmental media, the amount of contaminants taken in by humans and the likely health consequences of the resulting exposure. Risk assessment as a scientific activity is subject to general and site-specific uncertainty. General uncertainty is related to the discipline of risk assessment. Site-specific uncertainty is related to the area being assessed. Table #20 lists general and site-specific uncertainties, respectively, for D.L. Mud site risk assessment.

This assessment was also subject to uncertainties related to the following items:

- TICs
- Identification of substances used to assess risk.
- Toxicological assessment
- Bioavailability
- Exposure estimation
- Risk characterization

Split sampling results from the former impoundment area indicated the presence of a large concentration of TICs. The majority of the TICs are substituted benzenes and naphthalenes which are generally eye and skin irritants. Because the identities and concentrations

of the TICs are uncertain and the fact that they do not have associated toxicity factors (such as slope factors and RfDs), inclusion of these compounds in the quantitative risk assessment is not possible.

Other specific uncertainties that have significantly impacted the D.L. Mud risk assessment center on the use of the subchronic RfD for barium. Scientific debate continues regarding the merit of the existing subchronic RfD. For the purposes of this risk assessment, it has been decided to use the existing value in HEAST until such time that a final determination is rendered on the use of a different value if appropriate.

As noted in Table #20, some of these limitations may lead to an underestimate of risk, some are more likely to overestimate than underestimate risk and some introduce uncertainty that may either overestimate or underestimate risk. Consequently, the quantitative risk estimates derived for this site should be considered approximate, with a significant range of uncertainty and should be considered in risk management decisions.

Environmental Assessment

The ecological assessment was limited because of existing land use patterns and because the Environmental Assessment at the neighboring GCVS site estimated a minimal impact on the environment while possessing significantly worse contamination problems.

The site is coastal prairie with some mixed hardwoods near the canals. It is considered "prior converted cropland" and is not a jurisdictional wetland. The site is industrial, and the surrounding area is a mixture of residential, agricultural, and industrial development. Aquatic and terrestrial organisms would experience minimal exposure, because they avoid highly developed areas and because more suitable habitat is abundant nearby.

No listed or proposed threatened or endangered species have been found within one mile of the site. Aquatic and terrestrial organisms could be affected by direct contact with or ingestion of soil and sediment in isolated areas. There could be impacts to biota exposed to site surface water. However, the impacts would probably be minimal because site surface waters are intermittent and would produce limited exposures.

Risk Assessment Summary

The results of the Risk Assessment indicate that actual or threatened releases of hazardous substances from the D.L. Mud Site, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health, welfare, or the environment. These

threats are identified as the calculated noncarcinogenic risk to future residents from total barium in surface soils and to unknown risks potentially associated with the visually contaminated subsurface soils.

REMEDIAL ACTION OBJECTIVES AND GOALS

CERCLA and the NCP define remedial action objectives (RAOs) that are applicable to all Superfund sites. They relate to the statutory requirements for development of the remedy. Site-specific remediation goals relate to specific contaminated media and potential exposure routes and are used to identify target areas of remediation and contaminant concentrations. Site-specific remediation goals require an understanding of the contaminants in their respective media and are based upon the evaluation of risk to the public health and the environment and applicable or relevant and appropriate requirements (ARARs). These remediation goals are as specific as possible without unduly limiting the range of alternatives that can be developed for detailed feasibility evaluation.

The statutory scope of CERCLA was amended by SARA in 1986 to include:

- Refinement of goals for the degree of remedial action cleanup in that remedial actions "shall obtain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and of control of further releases at a minimum which assures protection of human health and the environment" (Section 121 (d)).

- Preference for remedial actions "in which treatment that permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants is a principal element" (Section 121(b)). The lead agency must publish an explanation if a permanent solution using treatment or recovery technologies to the maximum extent practicable is not selected.

- Requirements that the selected remedy comply with or attain the level of any "standard, requirement, criteria, or limitation under any Federal environmental law or any promulgated standard, requirement, criteria, or limitation under a State environmental or facility citing law that is more stringent than any Federal Standard, requirement, criteria, or limitation" (Section 121(d)(2)(A)).

In the NCP, 40 C.F.R. §300.430(a)(1), EPA explicitly defines the national objective, management principles, and expectations of the CERCLA program. The national objective of the CERCLA remedy

selection process is to "select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste."

EPA identified six general expectations to be considered in developing appropriate remedial alternatives in the CERCLA program:

- The use of treatment wherever practicable to address principal threats.
- The use of engineering controls (e.g., containment) for waste that poses a relatively low long-term threat or where treatment is impracticable.
- The use of the appropriate combination of treatment with engineering and institutional controls to achieve protection of human health and the environment.
- The appropriate use of institutional controls to supplement engineering controls for short- and long-term management to prevent or limit exposures.
- The use of innovative treatment technologies when such technologies offer potential for comparable or superior performance, lesser adverse effects, or lower cost.
- The return of ground water to usable, beneficial use wherever practicable within a reasonable period. Where restoration of ground water is impracticable, prevention of further plume migration, prevention of exposure, and further evaluation of risk reduction will be expected.

The studies undertaken at the D.L. Mud Site have identified low level risks which require remedial actions. Low level risk materials are sources of contamination that could be kept in place by capping and pose a low risk. For example, the surface soils identified onsite with residual elevated levels of barium contamination are considered a low level risk because the associated risk is relatively low (less than an order of magnitude in comparison to accepted action levels) and because these residual contaminants could be kept in place with a capping remedy, thus eliminating the potential for migration or ingestion.

In addition, EPA has determined that there is an unknown potential risk related to the source materials identified in the subsurface soils in the former impoundment areas. This potential risk is related to the unknown capacity for these contaminants to migrate into the ground water and the unknown impact these contaminants would have on the quality of the ground water.

The remedial objective determined to be necessary at the Site is to preserve human health and the environment by eliminating or

reducing identified and/or potential risks by preventing the ingestion of barium-contaminated soils and by reducing the potential for migration of contaminants from both surface and subsurface soils to the ground water. Additional specific remedial objectives determined to be necessary at the D.L. Mud Site are:

- Primary: Preserving the Site for non-residential uses and reducing the potential for migration to ground water of site-specific contaminants.
- Secondary: Restoring the Site for unrestricted uses.

The risk assessment conducted as part of the RI showed that future occupational and trespasser land use scenarios result in acceptable risk for surface and subsurface soils. Only a residential land use scenario results in future risks exceeding EPA's acceptance criteria. The potential residential pathway of concern is limited to surface soil ingestion.

The remediation goals, according to 40 C.F.R. §300.430 (e)(2)(i) "shall establish acceptable exposure levels that are protective of human health and the environment". The following requirements must be considered during the development of the remediation goals:

- Applicable or relevant and appropriate requirements (ARARs) related to:
  - acceptable exposure levels for systemic toxicants,
  - acceptable exposure levels for carcinogens,
  - technical limitations and
  - uncertainty factors.
- Maximum Contaminant Level Goals (MCLGs) established under the Safe Drinking Water Act that are set at levels above zero.
- MCLs when the MCLGs are set at zero or are not relevant and appropriate.
- When the attainment of chemical-specific ARARs will result in a cumulative risk in excess of $1x10^{-4}$.
- Water quality criteria established under the Clean Water Act.
- Alternate concentration limits (ACLs) may be established in accordance with CERCLA Section 121(d)(2)(B)(ii).
- Sensitive habitats of species protected under the Endangered Species Act.

As required by Section 121 of CERCLA, as amended, remedial actions must attain the levels or standards of control for hazardous substances, pollutants, or contaminants specified by the ARARs of federal environmental laws and state environmental and facility citing laws, unless waivers are obtained. According to EPA

guidance, remedial actions must also take into account non-promulgated "to be considered" criteria or guidelines if the ARARs do not address a particular situation.

ARARs are distinguished by the EPA as being either applicable to a situation or relevant and appropriate to it. Applicable requirements are standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, or other circumstance as defined in the NCP.

For a requirement to be applicable, the remedial action or the circumstances at the site must satisfy all the jurisdictional prerequisites of that requirement. For example, the minimum technology requirements for hazardous waste landfills under RCRA would be applicable if a new hazardous waste landfill were to be built.

Relevant and appropriate requirements are standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site so that their use is well suited to that particular site. Relevant and appropriate requirements are defined in the NCP, 40 C.F.R. §300.5. For example, while RCRA regulations are not applicable to closing in-place hazardous waste that was disposed of before 1980, RCRA regulations for landfill closure with hazardous substances in-place may be deemed relevant and appropriate.

The NCP, 40 C.F.R. §300.400(g)(2), specifies factors to consider in determining what requirements of other environmental laws are relevant and appropriate:

- The purpose of the requirement relative to the purpose of CERCLA
- The media regulated by the requirement
- The substance regulated by the requirement
- The actions or activities regulated by the requirement
- Variations, waivers, or exemptions of the requirement

- The type of place regulated and the type of place affected by the release or CERCLA action

- The type and size of facility or structure regulated by the requirement or affected by the release or contemplated by the CERCLA action

- Consideration of use or potential use of affected resources in the requirement

In some circumstances, a requirement may be relevant to the particular site-specific situation but not be appropriate because of differences in the purpose of the requirement, the duration of the regulated activity, or the physical size or characteristic of the situation it is intended to address. There is more discretion in the judgment of relevant and appropriate requirements than in the determination of applicable requirements.

As mentioned earlier in this section, the only identified concern at the D.L. Mud site is from ingestion of barium contaminated surface soil under the future residential exposure scenario. Barium has been identified as the only chemical of concern for surface soils as summarized in Table #21. The remediation goal for total barium in surface soils is 5,400 ppm. This is a risk based value which equates to an HI = 1 for potential residential receptors exposed to surface soils. At this concentration, approximately 19,350 cubic yards of surface soils (which have total barium concentrations above 5,400 ppm) need to be addressed.

A comparable media-specific remediation goal for the subsurface soil that has not been fully characterized but is obviously contaminated with the high molecular weight hydrocarbon TICs cannot be calculated using established risk assessment procedures. Through the use of modified risk assessment procedures, including additional sampling and analysis, it would be possible to better define the potential risks posed by the TICs and other contaminants contained in this area. The costs of conducting this additional evaluation is not deemed appropriate in comparison to the assumed volumes present at the site and estimated remediation costs. Therefore, remediation goals for the subsurface media will be based on visual observation and confirmatory sampling comparisons with pit closure requirements contained in Louisiana Statewide Order 29-B, Section 129.B.7. as specified below. It is estimated that approximately 1,100 cubic yards of subsurface soils may need to be addressed.

Louisiana 29-B Pit Closure Requirements

pH	6-9
Arsenic	10 ppm
Barium	40,000 ppm
Cadmium	10 ppm
Chromium	500 ppm
Lead	500 ppm
Mercury	10 ppm
Selenium	10 ppm
Silver	200 ppm
Zinc	500 ppm
Oil & Grease	< 1% dry weight

Although adverse impacts on the Site's ground water due to site-related contamination have not been identified, the remedial objective requires that the potential for migration of hazardous substances into the ground water should be eliminated. Therefore, no remedial goals are necessary for ground water, however, comparisons with applicable MCLs will be made as part of ground water monitoring activities conducted for purposes of ensuring that contaminants are not migrating into the ground water.

It is important to note that because the wastes found at the Site after the 1987 cleanup are not, by definition or characterization, "hazardous wastes" as defined by the RCRA, then RCRA is not an "applicable" ARAR. Therefore, there are no RCRA chemical-specific requirements and none of the alternatives evaluated during the FS will have to meet the RCRA Land Disposal Restrictions which only apply to "hazardous wastes" (this would change if RCRA hazardous wastes are identified or produced at the Site in the future). Several "action-specific" requirements of RCRA would be considered "relevant and appropriate" ARARs and are discussed individually with each affected alternative or in the comparative analysis and selected remedy sections of this ROD.

According to historical records regarding past operations, the wastes found at the Site consist mostly of NOW wastes presently regulated by the State of Louisiana under Louisiana Statewide Order No. 29-B. All of the following alternatives will have to meet appropriate provisions of this Statewide Order.

VII. DESCRIPTION OF ALTERNATIVES

A FS was conducted to develop and evaluate alternatives to meet the RAOs for the D.L. Mud site. Remedial alternatives were assembled from applicable remedial technology process options and were initially evaluated for effectiveness, implementability, and cost

based on engineering judgement. The alternatives selected for detailed analysis were evaluated and compared to the nine criteria required by the NCP (see Section VIII. of this ROD). As a part of the remedial alternative evaluation process, the NCP requires that a no-action alternative be considered at every site. The no-action alternative serves as a point of comparison for the other alternatives.

The following alternatives to address site contamination were evaluated in detail in the FS. The descriptions and evaluations of remedial alternatives included in this ROD address the surface soils contaminated with total barium and subsurface soils containing visual contamination. As described below, the remedial alternatives for each of these effected media are presented separately with the exception of the No Action and Institutional Controls Alternatives (Alts. #1 and #2). Alts. #3 and #4 address the surface soil barium problem and Alts. #5 and #6 address the subsurface visual contamination.

List of Evaluated Remedial Alternatives and Media Addressed

Alternative Evaluated	Area of Concern Addressed
Alt. #1 - No Action	Surface and Subsurface Soil Contamination
Alt. #2 - Institutional Controls	Surface and Subsurface Soil Contamination
Alt. #3 - Soil Capping	Surface Soil Contamination
Alt. #4 - Barium Treatment	Surface Soil Contamination
Alt. #5 - Biological Landfarming	Subsurface Soil Contamination
Alt. #6 - Excavation and Offsite Disposal	Subsurface Soil Contamination

For the reasons discussed in previous sections, the treatment of ground water is not being considered as an implementable response action and was not carried forward through the detailed development of alternatives. However, because some inorganic contaminants were detected in the ground water and several potential alternatives will result in wastes being left onsite in a disposal unit, a ground water monitoring program will be implemented in all of the evaluated alternatives.

As part of the ground water monitoring program that is included in each of the following alternatives (with the exception of the "No Action" alternative), use of existing ground water monitoring wells is planned. The possibility exists that the final design of an alternative's remedy will adversely impact the existing ground water monitoring system and will thus require a reevaluation of the need for additional wells. If future monitoring indicates the selected remedy does not prevent the potential for ingestion of contaminated ground water, EPA will investigate the need for active remediation of the ground water and would address resulting actions in another Operable Unit and ROD.

Finally, all alternatives that result in waste remaining onsite at levels that prohibit the future, unrestricted use of the property will trigger the statutory requirement for a 5-Year Review. This review is conducted every five years as a check to ensure that the implemented remedy is still protective and performing as designed.

A brief description of the six alternatives evaluated to address the contamination at the site follows.

Alternative #1 No Action

Capital Cost: $0
Operation and Maintenance: $0
Total Cost (1993 dollars): $0
Time of Implementation:
Design/Remedial Action: 0 months
Operation & Maintenance: 0 months

DESCRIPTION

Consideration of the No Action alternative is a requirement of the NCP. Under this alternative, no remedial measures would be taken to address the risks associated with the elevated barium concentrations in the surface soils or the unknown potential risks associated with the waste materials found in the subsurface soils. No provisions would be made to restrict Site access or restrict future use of the land or ground water. Because there would be no active remediation under this alternative, no action-specific ARARs are relevant and appropriate. Because hazardous substances would be left on site at levels potentially harmful to human health, statutory 5-Year Reviews [as required by the NCP §300.430(f)(5)(iii)(C)] will be conducted. This alternative will not meet either the primary or secondary remedial objective.

Alternative #2 Institutional Controls

Capital Cost: $17,000
Operation and Maintenance: $170,000
Total Cost (1993 dollars): $190,000
Time of Implementation:
Design/Remedial Action: 6 months
Operation & Maintenance: 30 years

DESCRIPTION

Institutional controls are a frequently considered alternative to "no-action" because the implementation of relatively simple restrictions may adequately reduce the threat of low-risk sites to an acceptable level. This alternative consists of access and use restrictions which will eliminate the possibility that the only exposure that has been identified as a potential risk at this Site, future residential, can occur. Alternative #2 would also provide ground water use restrictions and long-term ground water monitoring using existing wells to provide an early warning of any migration of substances from the soils to the ground water.

Assumptions for this alternative that were used to formulate the cost estimate are:

- Access restriction fence exists and only minor upgrading and future maintenance is needed.
- Ground water monitoring will be required.
- Notice in deed would be required to restrict future uses

The access and use restrictions described above would apply for both the barium contaminated surface soil and the contaminated subsurface soils presently found at the Site. The alternative could be implemented almost immediately, including fence upgrading and sign posting. Ongoing ground water monitoring and a 5-year review and reassessment of the adequacy of institutional controls would be elements of this alternative. Because there would be no active remediation under this alternative, no action-specific ARARs are relevant and appropriate. This alternative would meet the primary remediation objective but not the secondary remediation objective.

Alternative #3 Soil Capping

Capital Cost: $380,000
Operations and Maintenance: $157,000
Total Cost (1993 dollars): $540,000
Time of Implementation:
Design/Remedial Action: 24 months
Operation & Maintenance: 30 years

DESCRIPTION

The potential for contact with barium contaminated soil would be reduced below that for preceding alternatives by isolation with a protective soil cover. A 12-inch soil cap over the areas contaminated with total barium concentrations above 5,400 ppm (approximately 8 acres) is a cover system that would allow oxygen migration to the underlying barium contamination while reducing the potential for inadvertent contact with barium contaminated soil. The 12-inch thick soil cover would be revegetated with plants that are native to the area or suited to local growing conditions to control soil erosion and dust formation. Along with continued access to oxygen, gypsum (calcium sulfate) would be added to the soil to effect the gradual conversion of more soluble forms of barium into the less soluble form, barium sulfate, to lessen the potential for migration into the ground water.

This alternative would have a relatively low implementation cost and require a recurring cost for ground water monitoring to ensure that no migration of barium occurs. Monitoring would continue for a duration sufficient to confirm that barium remained immobile and/or that the soluble forms of barium were undergoing conversion to less soluble forms, a period at least 5 years beyond the 1-year implementation period. At the 5-year milestone, the effectiveness of the alternative would be reevaluated, and monitoring would continue for a suitable period. Additional institutional controls such as property deed notices/restrictions would be necessary to ensure that residential development at the Site does not occur. Action-specific ARARs such as RCRA capping requirements and Louisiana Statewide Order 29-B would be evaluated during the design process. This objective would meet the primary remediation objective but not the secondary remediation objective.

Alternative #4 Surface Soil Barium Treatment

Capital Cost: $430,000 - $11,220,000
Operation and Maintenance: $60,000 - $400,000
Total Cost (1993 dollars): $830,000 - $11,300,000
Time of Implementation:
Design/Remedial Action: 2 - 5 Years
Operation & Maintenance: 5 - 30 years

DESCRIPTION

Under this alternative, several treatment options were evaluated to eliminate the potential for exposure to barium contaminated surface soils and lesson the potential for barium migration into the ground water. The various treatment options evaluated included: Ex-situ Froth Flotation, In-situ Chemical Fixation, and Solidification/Stabilization.

Option A. The Ex-situ Froth Flotation process would be used to remove barium from the soil by adding various chemical reagents to finely screened, barium contaminated soils and passing it through a stream of fine bubbles to separate barium from more common soil constituents. The alternative involves the following steps:

- Construction of soil stockpile areas, treatment plant installation, with process monitoring facilities, and a personnel shelter
- Excavation of 18 inches of barium contaminated soils (approx. 39,000 cubic yards), screening to discard the oversize fraction, slurring and conditioning the remaining fines with flotation chemicals, soil flotation separation and cleaning, soil and barite dewatering and drying, oversize material disposal, cleaned soil placement, and recovered barium disposal
- Testing, monitoring, and cleanup verification
- Plant dismantling

The froth produced during this treatment process could possibly be a characteristic RCRA hazardous waste due to the high concentration of barium and other metals that would be collected. As such, several RCRA ARARs would be applicable including those that regulate storage, transportation, and disposal of characteristic

hazardous wastes. This option would meet the primary remediation objective and possibly the secondary remediation objective, depending on the final disposition of the recovered barium.

Option B. In-situ Chemical Fixation would be used to transform the more soluble forms of barium (e.g. barium carbonate) present in the surface soils into barium sulfate which is relatively insoluble. The potentially bioavailable barium carbonate may be converted into the inert barium sulfate using the innovative approach of irrigating the affected surface soils with a buffered sulfate solution that has a pH adjusted with dilute sulfuric acid in the 4.0 to 5.0 range. Only the top 18 inches would need to be treated. Application of the solution would convert barium carbonate into barium sulfate. The pH range of 4.0 to 5.0 is well within the tolerance range of most acid-tolerant crops, and these would be planted to control runoff, provide soil stability, and prevent dust generation between periodic applications of buffered sulfate.

The equipment that would be used includes readily available construction and agricultural machinery. Equipment requirements would include:

- Excavation equipment
- Rotary tiller or disc plow
- Crawler-type tractor
- Tractor-mounted spray equipment
- Buffering chemical(s)

In order to achieve barium carbonate/buffer solution contact, tractor and soil tilling equipment would be required because of the low permeability of the contaminated soil. Bench-scale treatability tests would be conducted to select the proper buffering solutions and to determine the reaction time required to set the waste. Leaching tests may be needed to verify the reduction in mobility of total barium.

This innovative technology involves sowing acid-tolerant crops (e.g., grasses), preparing and spray-irrigating buffered sulfate solution at a rate consistent with requirements of the crop, soil, and locale. The buffered sulfate solution may also contain supplemental trace nutrients. Leachable barium would be monitored in treated soil until the barium became biologically and environmentally unavailable to such a degree that the application of buffered sulfate solution could be discontinued. It is estimated the implementation time may be anywhere from three to five years, depending on local growing conditions. The Site could be converted to suitable uses consistent with protection of public health and the environment because the barium originally present as barium

carbonate would have been converted to insoluble barium sulfate. An extended ground water monitoring program would be implemented, and the effectiveness of the remedy would be assessed after 5 years. Chemical fixation would continue to meet the primary remediation goal of preserving the Site for industrial use. However, although the bioavailable barium carbonate will have been changed to nonbioavailable barium sulfate, the total amount of barium on site would remain the same; so this alternative would not meet the more conservative secondary remediation goal of unrestricted residential use.

Option C. The Solidification/Stabilization (S/S) treatment alternatives would reduce the potential for barium leaching because the barium contaminated soil would be bound in an aggregated matrix that reduces permeability to rain and applied water. The concentration of leachable barium would be reduced only slightly from the original soil concentration by virtue of the dilution effect of the binder (a pozzolanic portland cement).

Ex-situ stabilization is similar to the in-situ alternative except that the mixing of soil and binder is carried out in a mechanical device such as a pug mill or cement mixer as opposed to the in-place spreading of bulk cement and cement-soil tillage with disc harrows. The in-situ alternative would involve deep discing to mix the cement with the top 18 inches of soil where most of the barium is located. Mobile construction equipment would be used to deliver and spread the pozzolanic binder and moisten it after it is blended with the soil. Unlike in-situ stabilization, however, the ex-situ option requires preparation of a foundation; a stockpiling pad for the collected soil; mobile equipment to excavate the barium contaminated soil; stationary equipment to screen, mix, and transfer the soil and cement; and irrigation equipment to apply water for curing. The treated matrix would be placed back on the ground and moistened to initiate curing.

Bench-scale treatability tests would be conducted to select the proper additives and their ratios and to determine the curing time required to set the waste adequately. Leaching tests and compressive strength tests would be conducted to determine the integrity of the solid end product and verify the reduction in mobility of total barium. Critical parameters in stabilization treatment include the selection of stabilizing agents and other additives, the waste-to-additive ratio, mixing time, and curing conditions. All of these parameters are dependent on the chemical and physical characteristics of the hazardous substance.

Post-remedial ground water monitoring would be implemented, with an effectiveness review at five years after completion of the remedy.

Solidification/stabilization of the soils would continue to meet the primary remediation goal of preserving the Site for industrial use. Although the barite will have been stabilized, the total amount of barium onsite would remain the same, therefore this alternative would not meet the more conservative secondary remediation goal of unrestricted residential use. Appropriate action-specific ARARs contained in RCRA and/or Louisiana Statewide Order 29-B would be evaluated during the design process.

Note: as stated earlier, the next two Alternatives address the visually contaminated subsurface soils.

Alternative #5 Biological Landfarming

Capital Cost: $340,000
Operation and Maintenance: $69,700
Total Cost (1993 dollars): $410,000
Time of Implementation:
Design/Remedial Action: 2 - 5 years
Operation and Maintenance: 5 Years

DESCRIPTION

Although the subsurface soils associated with the former impoundments were not fully characterized, it is known that these materials contain a large amount of organic TICs. This alternative was evaluated to address the potential threats these TICs could pose on human health and the environment.

Nearly all organic compounds will undergo biologically induced decomposition under favorable conditions. An economical method of promoting biodegradation is through landfarming, in which hydrocarbon-containing soil is spread in a thin layer, nutrients are applied, and a vegetative cover is grown both to control wind and water erosion and to enhance the microhabitat to encourage microorganism growth and biodegradation of organic contaminants.

In this alternative, 1,100 cubic yards of hydrocarbon-containing subsoil would be excavated from its current location, mixed with gypsum to improve porosity and workability, spread onto a suitable surface, supplemented with essential nutrients, seeded with a crop, and irrigated. Periodically (at about four to six week intervals), the crop would be tilled with conventional farming equipment, and the soil would be replanted. The process would be repeated until hydrocarbon compound concentrations fell below yet-unspecified levels, at which time the treated soil would be replaced with a new charge of untreated soil, and the process would be repeated. (The

soil would be biotreated until it is proven that residual contaminants do not pose an actual and/or potential risk to future residents.) Excavation would be required for the construction of a lined storm water collection pond to store surface runoff from the land farm area. Water stored in the pond would be reapplied as irrigation water. It is anticipated that two soil turnovers would be required for adequate aeration and nutrient contact.

Land farming would be carried out in an area of at least 1/2 acre, and the time to treat 1,100 cubic yards probably would not exceed about four growing seasons, provided Site soil (silts and clays) proves workable. The use of larger plots would reduce the cleanup time, but the effort probably would require at least two years, irrespective of the area used. Ground water beneath the Site would be monitored, and the effectiveness would be evaluated after five years.

Equipment requirements would include:

- Excavation equipment
- Rotary tiller or disc plow
- Crawler-type tractor
- Irrigation pump, piping, and spray heads
- Nutrient injection pump, storage tank, and mixer

As with other biological processes, land farming would destroy the organic compounds, eliminating the perceived risk of these substances at the Site. Land farming requires a moderate capital and operating cost expenditure but carries no significant maintenance costs. No 5-year review would be required. Action-specific ARARs contained in Louisiana Statewide Order 29-B would apply to this alternative. This alternative would meet both the primary and secondary remediation objective.

Alternative #6 Excavation and Offsite Disposal

Capital Cost: $220,000
Operation & Maintenance: $0
Total Cost: $220,000
Time of Implementation:

Design/Remedial Action:	12 months
Operation and maintenance:	0 months

DESCRIPTION

Constituents that are consolidated in small areas lend themselves to excavation and placement in a suitable landfill if the volumes

and site conditions are favorable. Visually contaminated subsurface soils at the D.L. Mud Site appear to be consolidated in a relatively small area, making this alternative technically feasible. The total volume is estimated to be 1,100 cubic yards.

Assumptions used to develop the cost estimate are:

- A suitable landfill complying with EPA's CERCLA Offsite Policy is within 125 miles of the Site.
- Sampling is required to verify all contamination is removed.
- No operation or maintenance (O&M) costs are involved.

This alternative consists of providing access roads, locating a suitable landfill, obtaining the necessary mobile equipment, removing the soil from the Site, and placing it in the impoundment. Cleanup of the visually contaminated areas could be accomplished in less than one year at moderate capital and operating cost. The remedy would be permanent at the Site, but it would relocate the contaminated soils to another repository rather than eliminate the objectionable constituent(s) from the soil. No 5-year review would be required. This alternative meets both the primary and secondary remediation objectives.

Based on present information, the waste under this alternative to be excavated and disposed offsite is "non-hazardous", therefore, it is assumed that this material is suitable for, and will be disposed at, a RCRA, Subtitle D disposal facility. Such disposal facilities are not permitted to receive RCRA "hazardous wastes." In the event that a suitable RCRA, Subtitle D facility is not located within a 125 mile radius, then disposal at a RCRA, Subtitle C facility will be evaluated. If pre-disposal testing on this waste indicates that all or potions of the waste are RCRA "hazardous wastes," then disposal at a suitable Subtitle C facility, permitted to receive such wastes, will be required.

VIII. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

The EPA uses nine criteria to evaluate alternatives for addressing a Superfund site. These nine criteria are categorized into three groups: threshold, primary balancing, and modifying. The threshold criteria must be met in order for an alternative to be eligible for selection. The primary balancing criteria are used to weigh major tradeoffs among alternatives. The modifying criteria are taken into account after state and public comment is received on the Proposed Plan of Action.

NINE CRITERIA

The nine criteria used in evaluating all of the alternatives are as follows:

Threshold Criteria

Overall Protection of Human Health and the Environment addresses the way in which an alternative would reduce, eliminate, or control the risks posed by the site to human health and the environment. The methods used to achieve an adequate level of protection vary but may include treatment and engineering controls. Total elimination of risk is often impossible to achieve. However, a remedy must minimize risks to assure that human health and the environment are protected.

Compliance with ARARs, or "applicable or relevant and appropriate requirements," assures that an alternative will meet all related federal, state, and local requirements.

Primary Balancing Criteria

Long-term Effectiveness and Permanence addresses the ability of an alternative to reliably provide long-term protection for human health and the environment after the remediation goals have been accomplished.

Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment assesses how effectively an alternative will address the contamination on a site. Factors considered include the nature of the treatment process; the amount of hazardous materials that will be destroyed by the treatment process; how effectively the process reduces the toxicity, mobility, or volume of waste; and the type and quantity of contamination that will remain after treatment.

Short-term Effectiveness addresses the time it takes for remedy implementation. Remedies often require several years for implementation. A potential remedy is evaluated for the length of time required for implementation and the potential impact on human health and the environment during implementation.

Implementability addresses the ease with which an alternative can be accomplished. Factors such as availability of materials and services are considered.

Cost (including capital costs and projected long-term O&M costs) is considered and compared to the benefit that will result from implementing the alternative.

State Acceptance allows the State to review the proposed plan and offer comments to the EPA. A State may agree with, oppose or have no comment on the proposed remedy.

Community Acceptance allows for a public comment period for interested persons or organizations to comment on the proposed remedy. EPA considers these comments in making its final remedy selection. The comments are addressed in the responsiveness summary which is part of this ROD.

SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

The comparative analysis was conducted to evaluate the relative performance of each alternative, compared to the other alternatives, in relation to each specific evaluation criterion.

- Based on the RAOs, the no action (Alternative #1) alternative does not meet the protectiveness of human health and the environment criterion for risks to residential children, however, existing land use is protective of children's health. Institutional controls (Alternative #2) would control exposure through fencing and deed notices/restrictions to ensure that future residential use of the property does not occur. The froth flotation alternative (#4A) is somewhat more protective than the other alternatives because the barite is actually removed from the soil and taken off of the site. Soil capping is slightly less protective than froth flotation because, although the exposure pathway is blocked, the small amount of bioavailable barium is still in the bioavailable form at the end of the remedial action. The other three alternatives would treat the barium and reduce the mobility and potential for exposure; however, the total barium on the site would remain constant and so would not meet the RAO.

  For subsurface soils, the no action (#1) and institutional controls (#2) alternatives do not meet this criterion because the unknown risks will still be present and uncontrolled. The institutional controls could provide a limited level of protectiveness, however, the unknown nature of the contaminates make it difficult to ensure that appropriate controls are imposed to monitor this protectiveness. Both alternative #5 and #6 will provide a high level of protectiveness to human health and the environment.

- Based on the RAOs, all of the alternatives meet the compliance with ARARs criterion. The froth flotation alternative (#4A) has more restrictions and ARARs to meet than the other treatment alternatives because the froth created will probably classify as a RCRA "hazardous waste" and will need to be managed as such.

  Existing data (and perhaps new data) would need to be compared to the standards to see that the no action (#1) and institutional controls (#2) alternatives meet the criterion for subsurface soils. At present there is a State ARAR that lists limitations for pit closure that may not be met for the subsurface material in the former impoundment area.

- The no action alternative (#1) does not meet the long-term effectiveness and permanence criterion. Alternative #2, institutional controls, will meet this criterion by ensuring that future residential use of the property does not occur through the imposition of deed notices and restrictions. Soil capping (#3) is not as effective in the long-term as chemical fixation (#4B), or S/S (#4C) because soil capping leaves the bioavailable barium in the bioavailable state until the gypsum added as an amendment to the contaminated site soils converts barium carbonate into acid-insoluble barium sulfate. Chemical fixation (#4B) would chemically convert the bioavailable barium carbonate to a nonbioavailable state (barium sulfate); this conversion is essentially permanent. The S/S alternatives would immobilize the barium in the soil, but the long-term effectiveness is unknown due to potentially adverse effects from future environmental changes on the remaining solidified mass. The total mass of barium onsite remains constant for these three alternatives. Froth flotation (#4A) also treats the barium carbonate and removes it from the site so that no long-term maintenance or monitoring would be needed.

  For the subsurface soils the no action (#1) and institutional controls (#2) alternatives do not meet this criterion. Institutional controls will not necessarily meet this criterion because long-term effectiveness is difficult to evaluate given the unknown nature of the contaminants and associated risks that this subsurface soil possesses. Both landfarming (#5) and offsite disposal (#6) alternatives will meet this criterion.

- The previous remedial actions conducted by the State in 1987 removed and treated contaminated soils, reducing the toxicity and volume of the majority of contamination that was present at this site. For this ROD, the no action (#1) and institutional controls (#2) alternatives do not meet the reduction of toxicity, mobility, or volume criterion through additional treatment. Soil capping (#3) may reduce the mobility because the barite would not be on the surface of the soils, however, it would not affect toxicity or volume. The S/S alternative (#4C) would decrease the mobility and the toxicity, but would increase the volume by an estimated 25 percent. Froth flotation (#4A) would decrease the mobility, toxicity, and volume of the soils at the site over the long term; in the short term, this alternative will create a much more highly concentrated but low volume waste (froth) during soil treatment. Chemical fixation (#4B) would decrease the toxicity and mobility of the soils by converting the barium carbonate to barium sulfate; although the total mass of barium would remain the same, the mass of the toxic barium carbonate would be reduced.

  For subsurface soils, the no action (#1) and institutional controls (#2) alternatives do not meet this criterion. The offsite disposal alternative (#6) does not address toxicity, mobility, or volume of contaminants but rather moves the contaminants to another location without modification. Landfarming (#5) addresses toxicity, mobility, and volume by destroying the contaminants through biodegradation.

- Through proper controls processes during implementation, all of the alternatives meet the short-term effectiveness criterion through the use of fencing and other site access controls. The no action (#1) and institutional controls (#2) alternatives do not pose potential short-term risk to the community or workers during implementation. Of the active remedial alternatives, froth flotation (#4A) and ex situ S/S (#4C) would have the most risk to workers since the barium-containing soils would be excavated, treated ex situ, and then replaced in the excavation. A smaller risk to workers would be posed by the in situ treatment alternatives (#4B and #4C) since the soils would not be excavated. Soil capping (#3) would pose the least risk to workers and offsite residents since the soils would not be disturbed except by the placement of the clean soil on top.

All alternatives meet the this criterion for the subsurface source areas, although the landfarming (#5) and offsite disposal (#6) alternatives would pose a more potential risk since contaminated soils would be handled. The offsite disposal alternative would also pose a more potential risk to the community because contaminated soils would be moved through the community to the disposal facility.

- The no action (#1), institutional controls (#2), and capping (#3) alternatives are the most implementable and have the most proven technologies of the alternatives. Chemical fixation (#4B) is the next most implementable alternative; the equipment used for this treatment is that which is used for general agricultural farming. The S/S alternative (#4C) is slightly more difficult to implement; compared to chemical fixation, this alternative will require a fairly extensive treatability study to demonstrate stabilization effectiveness. The least implementable is froth flotation (#4A) which is a novel application of this technology.

  For subsurface soils, all of the alternatives are implementable. For landfarming (#5), treatability studies would need to be performed to ensure that effective and timely biodegradation of organic contaminants is possible. For offsite disposal (#6), a suitable disposal facility will need to be located to accept the contaminated soils.

- The no action (#1) and institutional controls (#2) alternatives are the least expensive alternatives. The next alternative in cost is soil capping (#3). After soil capping, the costs increase from chemical fixation (#4C) to in situ solidification (#4C) to ex situ solidification (#4C). Froth flotation (#4A) is by far the most expensive.

  For subsurface soils, the cost comparison from least to most expensive is as follows: no action (#1), institutional controls (#2), offsite disposal (#6), landfarming (#5).

- The Louisiana Department of Environmental Quality is in agreement with the selection of Alternative #2 and Alternative #6 as the preferred remedy for the D.L. Mud site (see Appendix #3).

- EPA solicited input from the community on the remediation alternatives proposed to address the contamination at the site. Input was received from both the local citizens and from Dow/DSI. Although not opposed to the preferred alternative, the local citizens expressed a preference for a more conservative alternative (Alternative #3) to address the residual barium in surface soils. Dow/DSI commented that the preferred alternatives (Alternative #2 & #6) were too conservative. A full listing of the comments received from the public on the Proposed Plan and EPA's responses is contained in the Responsiveness Summary section of this ROD (See Appendix #1).

IX. THE SELECTED REMEDY

Based on consideration of the requirements of CERCLA, the comparative analysis of alternatives, and public comments, the EPA has determined that a combination of Alternative #2 (Institutional Controls, Ground Water Monitoring) and Alternative #6 (Excavation and Offsite Disposal of Visually Contaminated Subsurface Soils) will best provide a cost effective remedy that is protective of human health and the environment.

As discussed in Section IV of this ROD, the specific RAOs determined to be necessary at the D.L. Mud site are to eliminate or reduce identified and/or potential risks by preventing the ingestion of barium-contaminated soils and by reducing the potential for migration of contaminants from both surface and subsurface soils to the ground water. The selected remedy will meet these objectives by:

- establishing and enforcing land use and deed notices/restrictions on the property to eliminate the potential for ingestion of barium contaminated surface soils by hypothetical future residents.

- excavating and disposing visually contaminated subsurface soils at an offsite disposal facility to eliminate the potential for migration of the contaminants into the ground water.

- monitoring ground water to ensure that waste excavation actions are successful and potential ground water degradation from residual surface soil contaminants does not occur.

Based on information currently available with respect to the evaluation criteria and the other alternatives, EPA believes the

preferred alternative provides the best approach to achieve the remedial objectives. This alternative will significantly reduce the risks from direct contact with site contaminants and eliminate the potential for future ground water contamination from existing subsurface contaminants by removing and disposing these contaminants offsite. The preferred alternative will provide long-term effectiveness as long as the land use and deed restrictions are in place to ensure that residential exposure scenarios are not realized. Although no risks were identified to trespassers, the existing fence that encloses the highest areas of site contamination will be mended and repaired, as needed, during O&M activities. This will ensure site security and discourage illegal disposal of wastes onsite such as has happened in the past. Fencing needs may change in the future depending upon activities at the adjacent GCVS site and on future non-residential uses at the D.L. Mud site.

Long-term ground water monitoring will be conducted to evaluate contaminant existence and movement and, if determined to be necessary, implement appropriate remedial response. There are no expected unmanageable short-term risks associated with this alternative. This alternative will also comply with all ARARs for excavation and offsite disposal of CERCLA hazardous substances.

The institutional controls alternative is considered more cost effective because the same degree of protectiveness to human health and the environment is realized at a much lower cost. Potential, low level risks from site contaminants were only identified under the hypothetical future onsite residential scenario. No risks were identified to existing offsite residents or hypothetical workers and trespassers. The active treatment alternatives are much less cost effective than the preferred alternative because, even after conducting the treatment processes, each would still require post-treatment remedial actions, monitoring and/or land use restrictions. EPA has concluded that these alternatives do not offer additional protection in line with the additional costs necessary to implement them.

In addition, some question remains as to the actual level of risk posed by the residual barium in the surface soils to hypothetical future residents. EPA is presently reviewing risk issues related to barium that could have a direct bearing on the volume of surface soils that need to be addressed and/or even on the need for remedial action. Imposing an Institutional Control/Ground Water Monitoring remedy provides flexibility in the event that changes are made in barium toxicity factors that would support a lower, acceptable risk from the residual barium in the surface soils.

The active measures (excavation and offsite disposal) proposed to address the unknown risks associated with the contaminated subsurface soils were deemed more appropriate than delaying the remedial decision so that additional, costly risk assessment efforts could be conducted in an effort to quantify the unknown risk. This course of action also meets the goal of the 1987 State-lead cleanup which called for the removal of visually contaminated soils.

As mentioned earlier, the majority of potential concerns identified by EPA during the NPL ranking of this site were addressed during the State-lead cleanup in 1987, employing treatment technologies that permanently and significantly reduced the volume, toxicity and mobility of site contaminants. This 1987 cleanup action included the offsite incineration of over 685 tons of contaminated liquids, wastes and contaminated soils at the Dow Chemical U.S.A. permitted hazardous waste facility in Plaquimine, Louisiana.

Although the selected alternative in this ROD does not in itself satisfy CERCLA's preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, the overall remedial action for this site (including the actions conducted in 1987) does meet this preference. It is not appropriate nor practicable to use treatment technologies that will permanently and significantly reduce the volume, toxicity or mobility of the relatively low levels of residual hazardous substances that remain at the site because they will not provide a greater overall, cost effective benefit to human health and the environment. CERCLA's program goals and expectations, as stated in §300.430 of the NCP, recognizes that institutional controls should be used for relatively low, long-term threats when more active treatment remedies are determined not to be practicable. The residual, low-level risks that will remain upon completion of this ROD's preferred remedy are minimal in comparison to the risks that existed at the site before the 1987 State-lead cleanup.

A more detailed description of the selected remedy follows with major cost assumptions provided in Appendix #4. It should be noted that certain engineering considerations of the remedy may change during the remedial design. Areas that are subject to change involve ground water monitoring locations and frequencies, subsurface soil excavation volumes and disposal locations, and fencing activities.

Engineering Remedial Design

♦ The engineering remedial action plans will include: Work Plan, Health and Safety Plan, Sampling and Analysis Plan, Quality Assurance Project Plan, and Operation and Maintenance Plan.

♦ The engineering remedial design will not include intermediate plans due to the simplistic nature of the remedial actions.

Site Preparation

♦ Limited site preparation activities will be necessary to complete the remedial action. Steps to be taken include minor vegetation clearing to assist in excavation and waste hauling activities, construction of decontamination facilities adequate to handle excavation and sampling equipment, and existing fence and gate repairs.

Subsurface Soil Excavation and Disposal

♦ The estimated volume of contaminated subsurface soils that will require excavation is 1,000 cubic yards. This volume may change during the remedial action based on confirmation sampling results. All visual contamination will be removed and confirmatory samples will be evaluated based on the State Pit Closure limitations as established in Table #22. The volumes required for backfill include the volumes of material necessary to fill the excavated areas up to existing ground levels.

Operation and Maintenance

♦ O&M costs assume an annual engineer's inspection and report of the condition of the site. Issues to be investigated concern the integrity of land-use restrictions, fencing, and ground water monitoring wells for a period of at least 30 years.

♦ The annual inspection will include ground water monitoring for TCL volatile organics, TCL base neutral/extractables and total and dissolved TAL metals. The monitoring will utilize existing wells. Results from the ground water monitoring will be included in the annual report with an additional ground water statistics report every five years. This report will analyze ground water monitoring results during the preceding five years, evaluating statistical trends and relationships with background data.

TREATMENT GOALS

Since active, onsite treatment of site contaminants is not a part of the selected remedy, media-specific treatment goals are not warranted. Excavation goals, as expressed in Table #22, for the visually contaminated subsurface soils will be monitored during and after excavation as part of confirmation sampling. In addition, the excavated material will be characterized to ensure disposal at an appropriate offsite facility. At present, the toxicity characteristic leachate procedure (TCLP) waste characterization is the most important parameter. RI sampling indicated that the contaminated subsurface soils were not RCRA hazardous wastes as defined by TCLP criteria which would allow the excavated material to be disposed at Subtitle D landfill. The selected disposal facility may impose additional waste characterization sampling before accepting the waste.

As mentioned earlier, ground water will be monitored annually for at least 30 years after completion of the remedial action as part of the O&M and 5-Year Review activities at this site. If at any time during this monitoring EPA determines that source treatment actions were ineffective in preventing ground water quality degradation which poses a risk to existing or future users, then additional investigative and treatment alternative actions will be implemented. These additional actions would be implemented under a separate Operable Unit and ROD.

Criteria to be evaluated will include statistical changes in ground water contaminant concentrations, the identification and characterization (including risk assessments) of contaminant plume(s) attributed to the site, and comparisons with appropriate drinking water standards. The ground water monitoring program will be developed during the Remedial Design and contained in the Operation and Maintenance Plan.

X. STATUTORY DETERMINATIONS

EPA's primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the environment. Section 121 of CERCLA also requires that the selected remedial action for the site comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws, unless a waiver is granted. The selected remedy must also be cost effective and utilize treatment or resource recovery technologies to the maximum extent practicable. The statute also contains a preference for remedies that include treatment as a principal element. The following sections discuss

how the selected remedy for the D.L. Mud site meets the statutory requirements.

Protection of Human Health and the Environment

In order to protect human health and the environment from the actual and/or potential threats identified at the site, the potential for harmful exposures that create those threats will be eliminated. The land use and deed restrictions will eliminate the potential for residential exposure to the low level risks associated with the residual barium in the surface soils. The visually contaminated subsurface soils will be removed and disposed of at an offsite facility eliminating the potential for these contaminants to migrate into the ground water or surrounding environment. Along with ground water monitoring and continuous 5-Year Reviews, these actions will provide long-term, permanent protection of human health and the environment.

Compliance With ARARs

Each component of the selected remedy will meet all applicable or relevant and appropriate requirements. The ARARs evaluated during the RI/FS as potentially applicable or relevant and appropriate are presented below. It is important to note that several of these ARARs are included in this discussion only because waste characterization activities may reveal that wastes to be excavated and disposed offsite are indeed RCRA characteristic hazardous wastes. At present, none of the wastes identified at the site are either a listed or characteristic RCRA hazardous waste.

Chemical-Specific ARARs

Chemical-specific ARARs regulate the release to the environment of hazardous substances having certain chemical or physical characteristics or materials containing specified chemical compounds. They are important in determining the extent of soil, sediment, and ground water requiring remediation as well as determining the residual levels of hazardous substances allowable after treatment.

Chemical-specific ARARs do not exist for soil for the contaminants at the site. The risk assessment evaluated to-be-considered criteria for soil and sediment including reference doses and potency factors. Noncarcinogenic residential risk due to ingestion of soil by a child was found to be 3.8. Because this value is above the 1.0 point of departure, target concentrations for soil, using risk-based criteria, are included as site-specific remedial goals.

Location-Specific ARARs

Location-specific ARARs are requirements that relate to the geographical position of the site. The primary location-specific ARARs relative to remedial action pertain to floodplain and wetlands. The entire site is outside the boundary of the 100-year floodplain and does not contain wetlands. Therefore, the requirements of RCRA 40 C.F.R. §264.18(b) and Executive Order 11988, Protection of Flood Plains, are not applicable or relevant and appropriate to actions on the site. These regulations, if applicable, would, for example, affect the citing of remedial facilities.

Action-Specific ARARs

Action-specific ARARs are requirements that define acceptable treatment and disposal procedures for hazardous substances. Important action-specific ARARs that may affect the development and conceptual arrangement of remedial alternatives are discussed below.

The definition of hazardous waste is critical in determining the status of RCRA requirements that apply to the residually contaminated soils at the D. L. Mud site. Since portions of the residually contaminated soils were generated and managed before the effective date of RCRA (November 1980), RCRA is not applicable unless waste material is excavated. RCRA requirements may be relevant and appropriate if wastes disposed of before November 1980 are defined as RCRA hazardous waste or are sufficiently similar to RCRA hazardous waste.

Based on review of the site history, EPA has not identified any RCRA listed hazardous wastes at the site. Since contaminated soils did not result from disposal of a listed hazardous waste, the RCRA mixture rule [40 C.F.R. §261.3(c)(2)(i)] does not apply. Soil samples from locations with the highest total barium concentrations detected were collected and analyzed during the RI; these samples did not exceed TCLP limits. Therefore, this regulation is not considered applicable.

RCRA land disposal restrictions (LDRs), 40 C.F.R. §268.41, prohibit land disposal of characteristic wastes unless constituents in the TCLP extract are below the concentration limits. Soil samples collected and analyzed during the RI did not exceed TCLP limits. Therefore, this regulation is not considered applicable.

Relevant and Appropriate State Standards

The following ARARs from the State of Louisiana are considered relevant and appropriate to the D. L. Mud site because of consideration of the specific factors listed in 40 C.F.R. §300.400(g)(a).

Louisiana Hazardous Waste Management Regulations. These regulations state standards for management of hazardous wastes. Since TCLP testing shows that residually contaminated soils do not exceed TCLP limits, these regulations are not considered relevant or appropriate.

Louisiana Statewide Order No. 29-B (LAC Title 43:Part XIX). These regulations govern the storage, treatment, and disposal of nonhazardous oil field wastes (NOW) generated from the drilling and production of oil and gas wells. The residually contaminated soils associated with former surface impoundments at the D. L. Mud site were generated as NOW, and the facility was not a disposal facility. Therefore, this regulation is not considered applicable. The closure requirements and offsite treatment and use requirements of these regulations are relevant and appropriate for the subsurface soils associated with the former surface impoundments.

Louisiana Discharge Air Pollution Control Standards. These regulations establish air quality standards and emissions limitations for any source of air emissions within the state. These regulations are relevant and appropriate for those alternatives where excavation could result in dust or other discharges to the air.

As discussed in EPA's August 1988 CERCLA Compliance with Other Laws Manual (EPA/540/G-89/006), action-specific ARARs should be refined as appropriate during remedial design.

Cost Effectiveness

EPA believes that the selected remedy is cost effective in mitigating the threat of direct contact and reducing the potential for ground water contamination from site wastes. Section 300.430(f)(ii)(D) of the NCP requires EPA to determine cost effectiveness by evaluating the following three of the five balancing criteria to determine overall effectiveness: long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost effective.

With the exception of the No Action Alternative (Alternative #1), all of the alternatives that address barium contaminated surface soils provide long-term effectiveness and permanence, if properly implemented and maintained. The selected alternative can be easily

implemented and effective in the shortest time period. Although the selected remedy does not provide a reduction of toxicity, mobility or volume through treatment, all of the other alternatives, with the exception of Alternative #4A (Ex-Situ Froth Flotation), will still require some form of post-RA land use restrictions and long-term monitoring because wastes will be left onsite. Alternative #4A is estimated to cost almost sixty times the selected remedy ($11,280,000 as compared to $190,000 for the selected remedy). This major increase in cost is not considered appropriate given the low level risks associated with the residual barium in the surface soils.

For the contaminated subsurface soils, only the selected remedy (Alternative #6, Excavation and Offsite Disposal) and Alternative #5 (Landfarming) provide long-term effectiveness and permanence. Alternatives #1 and #2 (No Action and Institutional Controls) do not provide long-term effectiveness because risks from the subsurface soil contamination has not been adequately characterized. Comparing the selected remedy with Alternative #5 shows that the selected remedy is much more implementable and effective in the short term and at a lower cost ($410,000 vs. $220,000).

Utilization of Permanent Solutions and Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

EPA believes the selected remedy represents the maximum extent to which permanent solutions and treatment/resource recovery technologies can be utilized in a cost effective manner for the D.L. Mud site.

Of those alternatives that are protective of human health and the environment, and comply with ARARs, EPA has determined that the selected remedy provides the best balance in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, costs, the statutory preference for treatment as a principal element, and taking into consideration State and community acceptance.

Preference for Treatment as a Principal Element

Treatment of the contaminated surface and subsurface soils was not found to be required or warranted at this time based on the low level risks associated with the residual barium contamination and on the unknown risks associated with the relatively small volume of localized contaminated subsurface soils. Although treatment is not warranted at this time, the overall remedial action for this site does meet the statutory preference for treatment as a principal element of the remedy. To address the source of contamination and remove the principal threat to human health and the environment, a State-lead cleanup was conducted at the site in 1987 as discussed

in Section V. This cleanup action included the removal and offsite incineration of wastes from several areas of the site.

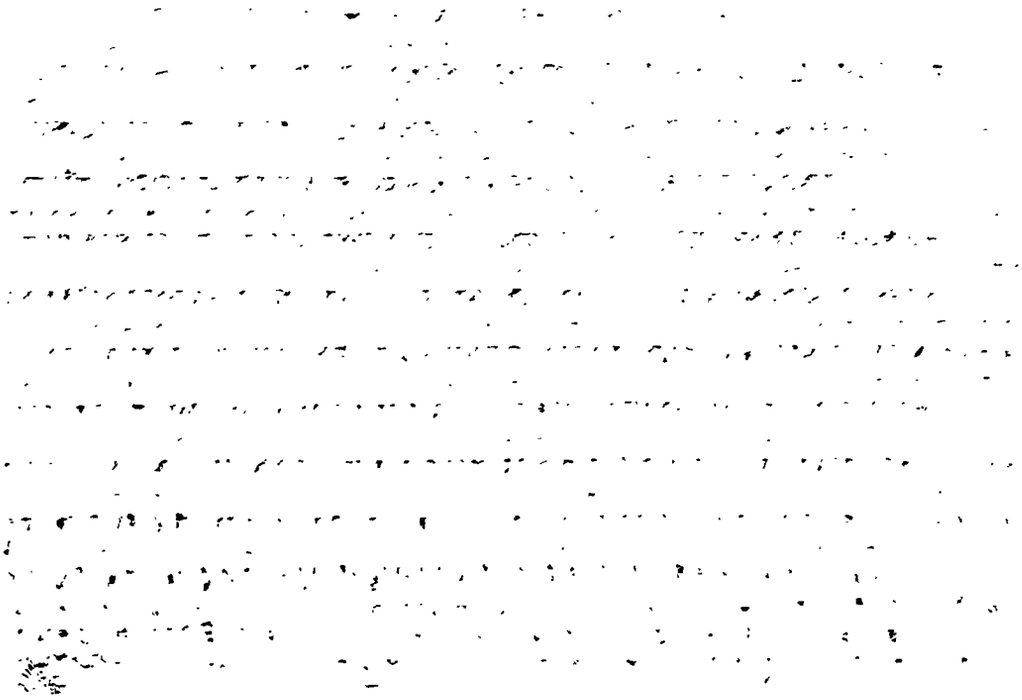
Because the selected remedy will result in hazardous substances remaining onsite above health based levels, a review will be conducted within five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

XI. DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan was released for public comment in April 1994. The Proposed Plan identified Alternative #2 and #6 , Institutional Controls, Subsurface Soil Excavation and Offsite Disposal and Ground Water Monitoring as the preferred alternative for the D.L. Mud site. EPA reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary.

Appendix #1

RESPONSIVENESS SUMMARY



THE RESPONSIVENESS SUMMARY

The Responsiveness Summary has been prepared to provide written responses to comments submitted regarding the Proposed Plan of Action for the D.L. Mud Superfund Site. The Summary is divided into two sections:

Section I: Background of Community Involvement and Concerns. This section provides a brief history of community interest and concerns raised during the remedial planning activities at the D.L. Mud site.

Section II. Summary of Major Comments Received. The comments (both oral and written) are summarized and EPA's responses provided.

I. BACKGROUND OF COMMUNITY INVOLVEMENT AND CONCERNS

Overall interest in the D.L. Mud site on the part of the local residents, local government officials, and the potentially responsible parties (PRPs) has been moderate.

Local citizen interest has been limited. The citizens are quite aware that the majority of concerns in the area can be traced to the neighboring Gulf Coast Vacuum Superfund Site. They also are aware that the 1987 State-lead cleanup of the site addressed most of the contamination problems at the site. The concerns about the D.L. Mud site appear to center on the desire to see that a full investigation of the site's condition is made before decisions are made to walk away from it. This concern is based on the fact that if EPA would rank the site on the NPL, then there must be grave environmental threats associated with it. Great care has been taken throughout the investigative process to ensure that all potential environmental threats are investigated.

Local government official interest has been limited as well. Although the site is not in the city of Abbeville, the Mayor has been kept abreast of ongoing activities. Several representatives of the Parish Police Jury have been both interested and helpful in planning activities and have attended several of the various community relations functions held in the area. The major concern that these local government officials have expressed through this process have concerned consistency with the other Superfund sites in the area and with the desire to see that EPA and its contractors use local services whenever possible.

A technical assistance grant (TAG) was awarded to the citizen's group called the Vermilion Association to Protect the Environment (VAPE) in 1990. Both VAPE and TAG technical advisor have been involved and helpful during the remedial planning activities. Recent concerns have been expressed regarding the opening of a

children's camp in the area and any impacts site activities might have on the camp and/or wandering campers might have on the site. Written comments received from VAPE during the public comment period are addressed in the next section.

PRP interest and involvement in the site has been much greater than the local citizens. Although there were over 100 PRPs identified at this site, only two former owner/operators have been directly involved with remedial planning activities, Dow Chemical and Dowell Schlumberger, Inc. (Dow/DSI). These two PRPs voluntarily conducted the Remedial Investigation and Feasibility Study (RI/FS) activities under the terms of a June 1990 Administrative Order on Consent. Correspondence between and meetings with Dow/DSI during this process generated several concerns to which EPA has appropriately responded. Official written comments received from Dow/DSI during the public comment period are addressed in the next section.

II. SUMMARY OF MAJOR COMMENTS RECEIVED

Public notice announcing the public comment period and opportunity for a public meeting was printed in the *Abbeville Meridional* and *Kaplan Herald*. The public comment period began on April 29, 1994, and ended on May 28, 1994. The formal public meeting was held on May 10, 1994, during which EPA answered questions about development of the RI/FS and remedial alternatives under consideration. A full account of the public meeting can be found in the public meeting transcript which is documented in the D.L. Mud Administrative Record.

The public comments received during the public comment period and EPA responses are summarized below.

ORAL COMMENTS RECEIVED DURING MAY 10, 1994 PUBLIC MEETING

1. COMMENT: What cleanup activities occurred in 1987 and how much did it cost?

RESPONSE: As summarized in Section II of the ROD, the 1987 cleanup activities conducted under the oversight of the State of Louisiana consisted of the following:

- Removal of the tank contents, destruction by incineration, and disposal of ash in a hazardous waste landfill.
- Decontamination and demolition of the tanks, supports, and piping.
- Removal and disposal of approximately 800 cubic yards of contaminated soil from eight onsite areas, including tank pads, one "bare" area, and two areas identified by EPA in the southern portion of the site.

- Placement of clean offsite fill material onsite in the excavated areas.

On December 17, 1987, Dow/DSI submitted a Report of Decommissioning and Restoration of the D.L. Mud site which was approved by LDEQ on February 29, 1988. A copy of this report can be found in the D.L. Mud Administrative Record. Information regarding the actual cost of these activities is not presently available to EPA.

2. COMMENT: It was mentioned during the public meeting that offsite contaminants were identified but this was not EPA's responsibility to address.

RESPONSE: Although EPA conducts a "baseline" risk assessment, remedial action decisions must also include an evaluation of onsite and offsite contaminant concentrations to help the risk manager determine the additional impact that onsite contamination is presently or potentially having on human health and the environment. As part of this evaluation, background samples are taken from locations that best describe the natural surrounding area. At times, common, naturally occurring contaminants are identified at these locations. It is beyond the scope of CERCLA to address contamination that is not a result of site activities or releases.

No significant offsite contamination was observed during the D.L. Mud investigation. If there were, this information would be transmitted to the local and State health officials.

3. COMMENT: What is the visually contaminated material that was found in the former impoundment area and what is the volume of this material?

RESPONSE: As mentioned in the ROD, this material has not been fully characterized although it is estimated that there is approximately 1,100 cubic yards of visually contaminated material and associated soils. No indications from historical records indicate what these pits were actually used for. Analytical results using standard methods have been inconsistent in its attempt to characterize the material, although it is apparent that the material is similar to other oilfield exploration and production wastes and products that have been identified at the neighboring Gulf Coast Vacuum and PAB Oil Superfund sites.

4. COMMENT: It is mentioned that the high ground water results for several inorganics is due to high turbidity and that when the sediments are removed, the high concentrations are eliminated. How does that effect drinking water for people that can not filter their ground water?

RESPONSE: After EPA conducted standard ground water sampling that indicated elevated levels of total chromium, additional sampling was conducted to try and identify the nature of this contamination. This additional sampling utilized a dedicated sampling procedure that would more replicate actual ground water conditions and pumping activities. Unfiltered results from this sampling method indicated that the chromium was part of the sediments that were analyzed with the ground water using the cruder sampling method and not an accurate description of ground water quality. It is believed that the dedicated sampling procedure is more representative of local drinking water scenarios.

No drinking water wells would be placed in the upper reaches of the Chicot Aquifer where the ground water samples were taken for the D.L. Mud site characterization. Samples taken from the deeper depths where surrounding citizens get there drinking water do not have the high turbidity that is associated with the D.L. Mud wells.

5. COMMENT: Could the chromium in the ground water come from material that was removed from the site during the 1987 cleanup activities?

RESPONSE: It is possible that the materials removed during the 1987 cleanup contained chromium because chromium is a constituent of common materials associated with the oilfield exploration industry. However, no relationship has been identified between any of the former source areas and the chromium in the ground water sediments.

6. COMMENT: After implementation of the remedy, what can the property be used for?

RESPONSE: The land use restrictions will prohibit residential and agricultural use of the property. The only potential risk that was identified during the risk assessment was to future residential children. Potential risks associated with agricultural use of the property was not quantified, therefore, the property will not be used for farming or grazing purposes either. This means that the property could only be used for industrial uses.

7. COMMENT: What type of offsite disposal facility will the excavated subsurface soils go to?

RESPONSE: Because the waste is not classified as a RCRA "hazardous waste", this material is subjected to the RCRA Subtitle D requirements as well as EPA's CERCLA Offsite Policy. If an appropriate Subtitle D landfill facility can not be found with a 125 mile radius of the site, then consideration will be given to use of a Subtitle C landfill. The use of any other offsite

treatment or disposal options could also be considered (such as offsite incineration at an approved facility) during the Remedial Design but the final decision would have to comply with the Offsite Policy.

The State of Louisiana will have an important role in determining the appropriate landfill to accept this waste. During the Remedial Design, the State will have to approve the proposed disposal facility before any material will be disposed offsite.

8. COMMENT: Will the site be de-listed from the NPL after the monitoring of the ground water and will the PRPs still be liable after it is?

RESPONSE: To de-list a site from the NPL, all remedial actions must be completed to ensure protection of human health and the environment. This site will be eligible for de-listing upon successful completion of the excavation and offsite disposal of the contaminated subsurface soils and institution of the land use and deed restrictions.

Ground water monitoring activities are to be conducted as part of Operation and Maintenance activities for at least 30 years. In addition, 5-Year Reviews will be conducted every five years to ensure that the remedial actions and institutional controls are still protective of human health and the environment. If at any time it is determined that the remedial actions implemented to protect human health and the environment are not successful, EPA has the discretion to place the site back on the NPL without having to re-rank it.

The NPL status of a site does not have any bearing on a PRP's liability. Therefore, if the site is de-listed and problems arise at a later time, EPA can pursue the PRPs to address these problems if appropriate.

9. COMMENT: Who will be conducting the Remedial Design and Remedial Action?

RESPONSE: EPA is going to make every effort to have the PRPs conduct the remedial activities at this site. In the event that voluntary conductance of the remedial activities is not obtained, several alternate enforcement options are available for consideration. EPA also has the authority to conduct the remedial actions using fund monies in the event PRPs fail to commit to conducting the remedial activities in a timely manner.

10. COMMENT: Will local services be used to conduct the remedial activities?

RESPONSE: Any and all inquiries for work at the site will be forwarded to the PRPs under the assumption that any future work will be let out under their direction if an agreement is reached whereby the they conduct the Remedial Design and Remedial Action. If EPA conducts the work using fund monies, then official Federal Acquisition regulations will be followed including formal bidding procedures.

The following comments were received in written form during the 30-day public comment period.

11. COMMENT: What happens after 30 years when the ground water is no longer monitored?

RESPONSE: The need for ground water monitoring is based on the concern that the potential exists for contaminants remaining onsite after the remedial action to migrate into the ground water. This monitoring will also be used to reassert that the initial determination that no ground water concerns exist that require remediation was correct. As stated in the ROD, the monitoring of ground water will be conducted at least for 30 years. The results of initial ground water monitoring will establish the need for additional ground water monitoring after 30 years. If it is determined that additional ground water monitoring is needed after 30 years then the O&M Plan will be amended to reflect this need. The time period for this monitoring of 30 years is established more for cost estimation purposes than on a scientific basis.

12. COMMENT: The Proposed Plan contains plans for long term ground water monitoring that would detect any changes in the current level of constituents in the ground water. The Plan should include provisions that would provide a mechanism for initiation of ground water remediation if the groundwater is impacted by the contaminants remaining onsite. In addition, sediment in the ground water was determined to cause the ground water to exceed MCL. If additional problems result from the sediment containing heavy metals, a mechanism should be included to address these problems.

RESPONSE: The ROD contains statements that will require the investigation and remediation, if appropriate, of any identified problems with ground water that arises as part of the post-RA ground water monitoring program. The need to conduct these additional activities will be based on the review of ground water data as it is developed. The review process will be developed as part of the O&M Plan and will look at contaminant concentrations and statistical changes over time as well as drinking water criteria. It is not necessary at this time to state what the remedial mechanism would be. This will be decided based on the particular circumstances that surround the decision to address newly identified ground water concerns.

13. COMMENT: According to the Proposed Plan, the preferred alternative will leave final barium levels on the D.L. Mud site at a much higher level than the final levels after treatment at the Gulf Coast Vacuum and PAB Oil sites. VAPE would like to encourage EPA to require Alternative #3, soil capping as the preferred alternative to address the barium contaminated surface soil.

RESPONSE: Although it is true that residual surface soil barium concentrations will be higher in certain locations than at the Gulf Coast Vacuum and PAB Oil Superfund Sites after treatment, the need to implement the soil capping remedy in lieu of institutional controls is not warranted.

First, the levels that will be left at D.L. Mud are not at concentrations that pose a high significant or principal threat to human health or the environment. The decision to implement S/S treatment at Gulf Coast Vacuum and PAB Oil on contaminated soils was not just based on the need to address barium but to address other contaminants as well, which taken together, pose a much more significant risk that the residual barium does at D.L. Mud. The implementation of institutional controls provides just as good a level of protectiveness to human health and the environment as does the soil capping alternative.

Second, even after treatment, the treated waste will be left onsite and institutional controls will be established at both Gulf Coast Vacuum and PAB Oil. These controls will prohibit every kind of future use in the areas of the site that contain the treated waste, including industrial uses, which will be possible at D.L. Mud under the land use restrictions presently considered. In addition, even after implementing the soil capping remedy, institutional controls would have to be established prohibiting future disturbances of the cap. Thus we would be conducting treatment for treatment sake, and not generating any additional protectiveness.

Finally, there remains some debate regarding the actual risk posed by the residual barium. This issue is presently being reviewed by EPA. If in the future, it is decided that existing risk assessment factors need to be adjusted which result in the lowering of potential risk calculations to below EPA action levels (i.e., Hazard Quotient <1.0), then the selected remedy will provide the most flexibility to react to this change, if appropriate.

14. COMMENT: The fencing at the D.L. Mud site does not currently extend to the northern property boundary. The area on the site north of the existing fence contains surface soil contaminated with barium above the action level of 5,400 ppm. This area should be surrounded by a fence and an alternative access road (which currently transverses this area unimpeded) should be provided.

RESPONSE: The fencing component of the remedy is included for

site security reasons and not risk abatement reasons. The site fence presently discourages site access to the former process area for trespassers and potential illegal dumping. As has been mentioned earlier, no potential risks have been identified to hypothetical trespassers or users of the property under any other scenario other than the future residential scenario. The decision to fence the northern area of the site is one which the current owners of the property must decide. If the decision is made to fence this area, then provisions for access to the neighboring property which presently transverses this area will be provided for.

15. COMMENT: The Proposed Plan calls for site access restrictions. When developing the appropriate restrictions, please remember to take into consideration the Woodmen of the World camp located west of the site. The restrictions must be adequate to prevent site access by the campers.

RESPONSE: The proposed plan and selected remedy call for land use restrictions which will be memorialized in deed restrictions. Although access restrictions are desirable for site security reasons, nothing on the site poses a potential risk to humans under any exposure scenario other than for hypothetical residents.

During the excavation activities, all care will be taken to eliminate potential risks to trespassers which might come into contact with temporarily exposed contaminants or physical hazards (i.e., open excavations). The existing fence is adequate to discourage trespassing in the excavation area. The cost of installing site access controls that will ensure the prevention of trespassers is not warranted given the lack of potential risks posed by site contaminants on these potential receptors.

16. COMMENT: A procedure should be established to monitor any onsite impacts to the D.L. Mud site caused by the remedial activities at the Gulf Coast Vacuum site. If contamination is detected, a process should be in place to provide site remediation.

RESPONSE: It is beyond the scope of this ROD to address contamination or releases that emanate from the Gulf Coast Vacuum site. The Gulf Coast Vacuum RODs adequately address the need to monitor their remedial activities to identify potential offsite migration of contaminants. If during ground water monitoring, 5-Year Reviews, or other O&M activities, it becomes obvious that additional contamination concerns exist at D.L. Mud, then source investigations of this contamination will be a part of the evaluation into the need for additional site remediation.

17. COMMENT: EPA should: implement a program to monitor the surrounding agricultural fields, grazing lands and aqua culture for

potential contamination from air emissions and surface water runoff from the site, establish continuous offsite monitoring stations to monitor the quality of the air during organic contaminant removal, and establish an ongoing program to monitor the quality of the water in individual water wells surrounding the site and provide the analytical results to the citizens on a timely basis.

RESPONSE: Nothing in the past investigations at this site indicate the need to conduct these suggested monitoring activities. Based on this collected data, the potential for offsite migration of site contaminants in levels that could be harmful to human health or the environment is limited at best. Onsite air monitoring will be conducted during the excavation of the organically contaminated subsurface soils.

18. COMMENT: **The citizens should be provided with opportunities to participate in the decision making process during the design and implementation phases of the remedial process.**

RESPONSE: The public will be kept abreast of all remedial design and remedial action activities through the use of public open houses and periodic updates. Input on remedial design and action specifics will be gathered on an as-needed-basis.

The following comments were received from Dow/DSI.

19. COMMENT: **The uncertainties associated with the barium hazard quotients calculated for the site make them overly conservative to be the sole basis for a risk management decision. These uncertainties include: 1) the use of a chronic RfD for short-term exposures, 2) use of an RfD derived from a NOAEL where no higher concentrations were tested, 3) use of the lifetime RfD for child exposures, when "the population most at risk is the adult male", 4) the use of an exposure approach that is not universally accepted within EPA Regions, and 5) the assumption that all barium in soil is equally as bioavailable as barium chloride in water.**

RESPONSE: In choosing the remedy for the D.L. Mud site, EPA considered all pertinent information that relates to the actual or potential risks associated with the site contaminants. The ROD acknowledges that uncertainties exist with the risk assessment (most notably the fact that the chronic and subchornic RfD for barium are the same) and the choice of institutional controls as the selected remedy is based partially on an evaluation of these uncertainties.

In response to the five general comments:

1) Risk Assessment Guidance for Superfund (RAGS), Part A, states that toxicological data from IRIS and HEAST should be used in conducting a risk assessment. HEAST contains a subchronic RfD for barium which was used for the short-term exposure assessment.

2) This comment relates to the specific approach EPA used in establishing the RfD values contained in IRIS and HEAST. EPA Region 6 does not establish the RfD values contained in IRIS and HEAST. The Region requested assistance from EPA's Environmental Criteria and Assessment Office (ECAO) to provide guidance on the use of the existing values in HEAST and the possibility of using an alternative value as proposed by the commentor. This request has been forwarded to the RfD Work Group whose function is to officially establish the values to be contained in these references. Until such time that an official response is acted upon by the RfD Work Group, ECAO recommended that the existing subchronic RfD for barium be used in the risk calculations at D.L. Mud (see Appendix #5 of the ROD).

3) As stated earlier, EPA used the existing subchronic RfD for the child, or short-term, risk exposure. This is in compliance with RAGS, Part A. It is not true that EPA used the chronic RfD value because "no subchronic RfD exists" as was stated in the comment letter. A subchronic RfD does exists and was used in the assessment. The merits of the subchronic RfD will be determined by the RfD Work Group.

4) The exposure approach employed by the Region in conducting the D.L. Mud risk assessment is in compliance with national guidance and with the spirit and intent of the June 1990, RI/FS Administrative Order on Consent (AOC). The agreed upon purpose of the AOC was to determine the threat to the public health, welfare, or environment caused by the release or threatened release of hazardous substances from the site. To do this, a baseline risk assessment was conducted which calculated a potential risk to hypothetical children residents due mainly to the potential ingestion of surface soils contaminated with residual barium. In calculating the baseline risk, RAGs, Part A, Section 8.2.2, discusses the importance of calculating the hazard index separately for chronic and subchronic exposure periods. The use of the integrated formula to determine "lifetime risks" for the purposes of establishing remediation goals is a separate function from conducting the baseline risk. As stated in the comment letter, the use of the integrated formula is not directly intended to calculate baseline risk.

Once it is established that a unacceptable potential risk exists to a hypothetical receptor (the future residential child), the process of developing the remediation goal is undertaken. The establishment of the 5,400 ppm remediation goal for barium in surface soils is based on a conservative approach using existing RfD values. The acceptable barium concentration under the lifetime exposure scenario (for oral ingestion only) is 19,000 ppm. Because there is an unknown additional risk due to the intake of barium through the agricultural uptake scenario, the actual acceptable barium concentration would be lower than 19,000 ppm. This lower value is unknown, therefore, the use of the more conservative value of 5,400

(which is the acceptable concentration for future residential child scenario) ppm is used. This will ensure protection of the lifetime residential adult under the agricultural scenario as well as the future residential child.

5) EPA has evaluated the concerns expressed by the commentor regarding bioavailability of barium in its different forms. It has been determined that the bioavailability of barium from barium sulfate contaminated soil is likely to be substantially less than 100%, but the site specific study (ChemRisk, 1992) does not provide data adequate to define an absorption value for adjusting the RfD value (see Appendix #6 of the ROD). In addition, the RfD Work Group will evaluate the recent decision to exempt barium sulfate from the reporting requirements of the Emergency Planning and Community Right-to-Know Act of 1986, and any impact this decision has regarding the issue of barium bioavailability.

20. COMMENT: In a recent OSWER Directive (9284.7-16, December 21, 1993), EPA states that ..."toxicological information other than that in IRIS may be brought to the Agency by outside parties. Such information should be considered along with data in IRIS in selecting toxicological values; ultimately, the Agency should evaluate risk based upon the best scientific judgement and consider all credible and relevant information available to it". During formulation of the proposed plan of action for the D.L. Mud site, new toxicological information regarding the subchronic toxicity of barium was made available to EPA. This new information is not reflected in the Proposed Plan of Action.

RESPONSE: All information that was submitted to EPA during the course of the RI/FS has been considered in selecting the remedy at the D.L. Mud site. All information submitted by Dow/DSI regarding the subchronic toxicity of barium was evaluated by not only the Region but also by ECAO. This review determined that although some uncertainty exists as to the merits of the existing subchronic RfD for barium, the continued use of this RfD is appropriate. Issues regarding the merits of the subchronic RfD are continuing to be evaluated by EPA. The selection of institutional controls has been partly influenced by the existence of this uncertainty and is direct evidence that the additional information submitted by Dow/DSI has been considered.

21. COMMENT: The cost of the selected remedy (excavation and offsite disposal to address the visually contaminated subsurface soils) is not adequately justified as far as the derived benefits to human health and the environment. The subsurface nature of this material and its nonmobil nature exclude pathways of exposure and potential resulting risks. The use of institutional controls is more appropriate for the perceived risks assumed to be posed by these subsurface materials.

EPA's proposed remedy for subsurface soils was based on the findings of the RI/FS process summarized in the Proposed Plan of Action. EPA's proposed remedy includes the incorporation of Alternative #6 which is the excavation and offsite disposal of the subsurface soils in question. This choice is based on the proposed plan which states the "No specific risks were quantified in any of the obviously contaminated subsurface areas...". In addition, the Proposed states that "A comparison of shallow and deep samples from the borings indicates that the residual impacts of former site operations on subsurface soils are limited to shallow depths..." and that Discrete EPA samples collected from beneath the former impoundment area generally indicate similar results...". The Proposed Plan also shows that the D.L. Mud site has not impacted ground water quality.

RESPONSE: The comment suggests that there is no risk from this material and thus no benefit in cleaning it up. As discussed in the ROD, the visually contaminated materials identified in the subsurface soils in the former impoundment area have not been adequately characterized so it is difficult to determine "the derived benefits to human health and the environment" resulting from the selected remedy. Although the sampling conducted on this material and on the site as a whole support the general statements regarding quantified risks and limited existing impacts on the surrounding soils and ground water, the lack of information regarding the nature of this material prohibits a determination on the future impacts these contaminants would have. In addition, the lack of quantified risks is due to the fact that this material contains a large amount of tentatively identified compounds that prohibit the quantification of their potential risk. EPA therefore strongly disagrees with this comment.

It was determined that the effort of investigating this material further to better ascertain the potential risks associated with it were not cost effective when considering the limited and localized volumes of visually contaminated materials that would need to be addressed by the selected remedy. This determination is also consistent with one of the goals of the 1987 cleanup action which was to remove all areas of visual contamination. The use of institutional controls to address the obviously contaminated subsurface soils was not chosen based on the evaluation of the nine criteria. Program goals as stated in the NCP expect EPA to use treatment to address principal threat or source areas in lieu of engineering or institutional control measures wherever practicable. Based on the unknown potential that this source material has, the high expected costs of further investigation and on the relatively low expected costs to implement the selected remedy, the selected remedy provides the most appropriate and practicable approach to address these materials.

FOR YOUR INFORMATION

The following is a list of maps not included in the administrative record due to the size of the documents (larger than 11"X 17"). The maps may be reviewed at U.S. EPA Region 6 upon request. Contact Mr. Jamie VanBuskirk (Enforcement Officer) at (214) 655-6767 for additional information.

"Survey Showing Monitoring Well Locations, Surface Soil Sampling Locations, Surface Water/Sediment Sample Locations and Subsurface Soil Sample Locations at the D.L. Mud and Gulf Coast Vacuum Sites", March 25, 1991 - Preliminary Site Characterization Summary

The following maps are located in LAD 981058019 Superfund Site File - SFSA Volume 2:

"Abbeville, LA 1978 Water Record Map - Section 36"
"Abbeville, LA Water Record Map - Section 20"
"Abbeville, LA 1978 Water Record Map - Section 19"
"City of Abbeville, LA - Corporate Limit Boundaries as of August 25, 1982"
"Abbeville, LA 1958 Water Record Map - Section 21"
"Abbeville, LA 1958 Water Record Map - Section 34"
"Abbeville, LA 1958 Water Record Map - Section 35"
"Abbeville, LA 1958 Water Record Map - Section 38"
"Abbeville, LA 1970 Water Record Map - Section 16"
"Abbeville, LA 1973 Water Record Map - Section 17"
"Abbeville, LA 1973 Water Record Map - Section 53"
"Abbeville, LA 1973 Water Record Map - Section 56"

I. CHRONOLOGICAL LISTING

Appendix #2

ADMINISTRATIVE RECORD INDEX

ADMINISTRATIVE RECORD INDEX

DRAFT

Final AR is in the
D.L. Mud File
AR Vol. 1

SITE NAME: D.L. MUD SUPERFUND SITE

SITE NUMBER: LAD 981058019

INDEX DATE: 02/08/94

SPECIAL NOTE TO THE READER

The potentially responsible parties' (PRPs) responses to the July 20, 1989 General Notice Letter and October 20, 1989 Special Notice Letter are located at the U.S. EPA Region 6 office, Dallas, TX due to the voluminous number of responses received from the PRPs. The notice letters may be found in the February 25, 1991 D.L. Mud Administrative Record (Document Nos. 000561-00634). Included as attachments to the letters are the names of PRPs receiving the notice letters.

Due to the circumstances related to the site, most of the response letters do not necessarily affect the selection of remedy. The PRPs' responses are in correlation to specific questions presented by EPA in the general and special notice letters.

Please contact Mr. Jamie VanBuskirk, Enforcement Officer, at (214) 655-6767, if you wish to view the response documents. If the reader wishes to learn more about the D.L. Mud Superfund Site, they may refer to the Gulf Coast Vacuum Administrative Record, the Gulf Coast Vacuum Remedial Investigation/Feasibility Study, and the Record of Decision for the Gulf Coast Vacuum Site. These documents are provided in microfiche form and paper copy and are located at the Vermilion Parish Library - Abbeville, LA and Louisiana Department of Environmental Quality - Baton Rouge, LA.

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 000907 - 000937
DOCUMENT DATE: 09/16/80
NUMBER OF PAGES: 031
AUTHOR: Hillol Ray, Environmental Engineer
COMPANY/AGENCY: Ecology & Environment, Inc.
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Site Inspection Report
DOCUMENT TITLE: "Potential Hazardous Waste Site Site Inspection Report"

DOCUMENT NUMBER: 000938 - 000938
DOCUMENT DATE: 10/04/85
NUMBER OF PAGES: 001
AUTHOR: Martha McKee, Chief, Superfund Site Assessment Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: William DeVille, Louisiana Department of Environmental Quality (LDEQ)
DOCUMENT TYPE: Cover Letter w/o Enclosures
DOCUMENT TITLE: Interim site inspection report from 07/09-10/85 site visit and sample analyses for Gulf Coast Vacuum and D.L. Mud

DOCUMENT NUMBER: 000939 - 000963
DOCUMENT DATE: 11/12/85
NUMBER OF PAGES: 025
AUTHOR: Andy Goldberg and Bill Corbin
COMPANY/AGENCY: Louisiana State University - Institute for Environmental Studies
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Site Inspection Report
DOCUMENT TITLE: "Potential Hazardous Waste Site Site Inspection Report"

DOCUMENT NUMBER: 000964 - 000995
DOCUMENT DATE: 12/11/85
NUMBER OF PAGES: 032
AUTHOR: Jairo Guevara, Field Investigation Team (FIT) Chemical Engineer
COMPANY/AGENCY: Ecology & Environment, Inc.
RECIPIENT: Keith Bradley, Region 6 Regional Project Officer (RPO), U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Sampling inspection at Gulf Coast Vacuum and D.L. Mud during 07/09-10/85

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 000996 - 000997
DOCUMENT DATE: 12/16/85
NUMBER OF PAGES: 002
AUTHOR: G.W. Guerra
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Tentative Disposition
DOCUMENT TITLE: "Potential Hazardous Waste Site Tentative Disposition"

DOCUMENT NUMBER: 000998 - 000998
DOCUMENT DATE: 12/31/85
NUMBER OF PAGES: 001
AUTHOR: Martha McKee, Chief, Superfund Site Assessment Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: T.B. McDonald, Dowell Schlumberger, Inc.
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Request that split sample results from lab analyses be forwarded to EPA Region 6 offices

DOCUMENT NUMBER: 000999 - 001002
DOCUMENT DATE: 01/07/86
NUMBER OF PAGES: 004
AUTHOR: G.F. Sievert, Manager of Safety and Loss Prevention and Materials Control
COMPANY/AGENCY: Dowell Schlumberger, Inc.
RECIPIENT: Martha McKee, Chief, Superfund Site Assessment Section, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Enclosures
DOCUMENT TITLE: Re: 11/12/85 letter sent to LDEQ and results of analytical work on samples taken during 07/09/85 site visit

DOCUMENT NUMBER: 001003 - 001004
DOCUMENT DATE: 01/30/86
NUMBER OF PAGES: 002
AUTHOR: Karen Young
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Myron Knudson, U.S. EPA Region 6
DOCUMENT TYPE: Record of Communication (ROC)/Attachment
DOCUMENT TITLE: Information on oilfield waste site near Abbeville, LA

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 001005 - 001005
DOCUMENT DATE: 07/08/86
NUMBER OF PAGES: 001
AUTHOR: EPA Staff
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Site Log
DOCUMENT TITLE: "Potential Hazardous Waste Site Log"

DOCUMENT NUMBER: 001006 - 001006
DOCUMENT DATE: 07/08/86
NUMBER OF PAGES: 001
AUTHOR: Martha McKee, Chief, Superfund Site Assessment Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Tentative Disposition
DOCUMENT TITLE: "Potential Hazardous Waste Site Tentative Disposition"

DOCUMENT NUMBER: 001007 - 001007
DOCUMENT DATE: 07/18/86
NUMBER OF PAGES: 001
AUTHOR: Martha McKee, Chief, Superfund Site Assessment Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: D.L. Mud, Inc., Houston, TX
DOCUMENT TYPE: Cover Letter w/o Enclosure
DOCUMENT TITLE: Re: 09/27/85 site inspection report and sample analysis

DOCUMENT NUMBER: 001008 - 001027
DOCUMENT DATE: 09/30/86
NUMBER OF PAGES: 020
AUTHOR: Jairo Guevara, FIT Chemical Engineer
COMPANY/AGENCY: Ecology and Environment, Inc.
RECIPIENT: Keith Bradley, Region 6 RPO, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum w/Attachments
DOCUMENT TITLE: Re: 06/16/86 sampling inspection

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 001028 - 001054
DOCUMENT DATE: 09/30/86
NUMBER OF PAGES: 027
AUTHOR: Jairo Guevara, FIT Chemical Engineer
COMPANY/AGENCY: Ecology and Environment, Inc.
RECIPIENT: Keith Bradley, Region 6 RPO, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Sampling inspection at D.L. Mud on 06/16/86

DOCUMENT NUMBER: 001055 - 001200
DOCUMENT DATE: 10/03/86
NUMBER OF PAGES: 146
AUTHOR: Jairo Guevara, FIT Chemical Engineer
COMPANY/AGENCY: Ecology and Environment, Inc.
RECIPIENT: Keith Bradley, RPO, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum w/Attachments
DOCUMENT TITLE: Analytical data from 07/09/85-07/10/85 FIT sampling inspection

DOCUMENT NUMBER: 001201 - 001202
DOCUMENT DATE: 02/09/87
NUMBER OF PAGES: 002
AUTHOR: Presley Hatcher, Acting Chief, Superfund Site Assessment Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Robert Lawrence, Inactive and Abandoned Sites Division, LDEQ
DOCUMENT TYPE: ROC
DOCUMENT TITLE: Re: Expanded Site Investigation

DOCUMENT NUMBER: 001203 - 001208
DOCUMENT DATE: 02/10/87
NUMBER OF PAGES: 006
AUTHOR: C.M. Maddin, Materials Control
COMPANY/AGENCY: Dowell Schlumberger, Inc.
RECIPIENT: William DeVille, Administrator, Inactive and Abandoned Sites Division, LDEQ
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Changed versions of 02/02/87 and 02/09/87 letters

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 001209 - 001277
DOCUMENT DATE: 04/20/87
NUMBER OF PAGES: 069
AUTHOR: FIT - Region 6
COMPANY/AGENCY: Ecology and Environment, Inc.
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Final Work Plan
DOCUMENT TITLE: "Expanded Site Inspection - Final Work Plan"

DOCUMENT NUMBER: 001278 - 001305
DOCUMENT DATE: 07/01/87
NUMBER OF PAGES: 028
AUTHOR: Environmental Monitoring Systems Laboratory, Office of Research and Development
COMPANY/AGENCY: U.S. EPA - Las Vegas, NV
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Aerial Photographic Analysis
DOCUMENT TITLE: "Aerial Photographic Analysis of Gulf Coast Vacuum and D.L. Mud" (See "For Your Information")

DOCUMENT NUMBER: 001306 - 001307
DOCUMENT DATE: 10/12/87
NUMBER OF PAGES: 002
AUTHOR: William DeVille, Administrator, Inactive and Abandoned Sites Division
COMPANY/AGENCY: LDEQ
RECIPIENT: Presley Hatcher, Acting Chief, Superfund Site Assessment Section, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Site work completed to date

DOCUMENT NUMBER: 001308 - 001346
DOCUMENT DATE: 12/17/87
NUMBER OF PAGES: 039
AUTHOR: C.M. Maddin, Materials Control
COMPANY/AGENCY: Dowell Schlumberger
RECIPIENT: William DeVille, Inactive and Abandoned Sites Division, LDEQ
DOCUMENT TYPE: Report - Volume 2
DOCUMENT TITLE: "Report of Decommissioning and Restoration of D.L. Mud Site"

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 001347 - 001347
DOCUMENT DATE: 01/20/88
NUMBER OF PAGES: 001
AUTHOR: Barry Nash, NPL Coordinator, Superfund Site Assessment Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Bob Myers, NPL Operations Section, U.S. EPA - Washington, D.C.
DOCUMENT TYPE: Memorandum w/o Attachment
DOCUMENT TITLE: Re: Special Study Waste Review

DOCUMENT NUMBER: 001348 - 001348
DOCUMENT DATE: 06/22/88
NUMBER OF PAGES: 001
AUTHOR: Allyn M. Davis, Director, Hazardous Waste Management Division
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Honorable Brady Broussard, Mayor of Abbeville, LA
DOCUMENT TYPE: Cover Letter w/o Enclosures
DOCUMENT TITLE: Notification that D.L. Mud, Gulf Coast Vacuum, and Pab Oil Sites are on the National Priority List of Superfund sites

DOCUMENT NUMBER: 001349 - 001349
DOCUMENT DATE: 09/29/88
NUMBER OF PAGES: 001
AUTHOR: Paul Conzelmann
COMPANY/AGENCY: Subra Company
RECIPIENT: Robert Layton Jr., P.E., Regional Administrator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Requests EPA notify him when they visit Gulf Coast Vacuum, Pab Oil, or D.L. Mud

DOCUMENT NUMBER: 001350 - 001350
DOCUMENT DATE: 10/17/88
NUMBER OF PAGES: 001
AUTHOR: Presley Hatcher, Acting Chief, Superfund Site Assessment Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: William DeVille, Administrator, Inactive and Abandoned Sites Division, LDEQ
DOCUMENT TYPE: Cover Letter w/o Enclosures
DOCUMENT TITLE: Final Expanded Site Inspection Reports for Pab Oil, Gulf Coast Vacuum, and D.L. Mud

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 001351 - 001355
DOCUMENT DATE: 06/26/89
NUMBER OF PAGES: 005
AUTHOR: Jairo Guevara, FIT Chemical Engineer
COMPANY/AGENCY: Ecology and Environment, Inc.
RECIPIENT: Ed Sierra, RPO, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum w/Attachments
DOCUMENT TITLE: Water level measurements in monitor wells taken on 06/21/89

DOCUMENT NUMBER: 001356 - 001356
DOCUMENT DATE: 10/05/89
NUMBER OF PAGES: 001
AUTHOR: Deborah Vaughn-Wright, Region 6 NPL Coordinator, Superfund Site Assessment Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Unspecified
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Re: Final Rule #6 and Final Resource Conservation and Recovery Act of 1976 Rule

DOCUMENT NUMBER: 001357 - 001357
DOCUMENT DATE: 10/13/89
NUMBER OF PAGES: 001
AUTHOR: Cathy Gilmore
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Summary of 09/21/89 meeting between EPA Region 6 and Vermilion Parish Police Jury on D.L. Mud, Gulf Coast Vacuum, and Pab Oil

DOCUMENT NUMBER: 001358 - 001358
DOCUMENT DATE: 03/07/90
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Sign-In Sheet
DOCUMENT TITLE: Sign-In Sheet for Remedial Investigation/Feasibility Study (RI/FS) negotiations meeting

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 001359 - 001361
DOCUMENT DATE: 03/09/90
NUMBER OF PAGES: 003
AUTHOR: Sydney Rooks, Attorney, Legal Department
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Dow Chemical Company requests 30-day extension of time to complete negotiation of Administrative Order on Consent for RI/FS

DOCUMENT NUMBER: 001362 - 001362
DOCUMENT DATE: 03/15/90
NUMBER OF PAGES: 001
AUTHOR: Sydney Rooks, Attorney, Legal Department
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Re: Negotiation of Administrative Order on Consent for RI/FS

DOCUMENT NUMBER: 001363 - 001363
DOCUMENT DATE: 03/22/90
NUMBER OF PAGES: 001
AUTHOR: Robert Layton Jr., P.E., Regional Administrator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Sydney Rooks, Attorney, Legal Department, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: EPA extends RI/FS negotiation period and moratorium for an additional 30 days until 04/13/90

DOCUMENT NUMBER: 001364 - 001365
DOCUMENT DATE: 05/18/90
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Summary of 05/11/90 meeting for Gulf Coast Vacuum, D.L. Mud, and Pab Oil Sites

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 001366 - 001379
DOCUMENT DATE: 05/25/90
NUMBER OF PAGES: 014
AUTHOR: Mark Ezell, Technical Assistance Team (TAT), Region 6
COMPANY/AGENCY: Ecology & Environment, Inc.
RECIPIENT: Michael Ryan, On-Scene Coordinator, Emergency Response Branch, U.S. EPA Region 6
DOCUMENT TYPE: Site Assessment Report
DOCUMENT TITLE: "Site Assessment Report on D.L. Mud, Inc."

DOCUMENT NUMBER: 001380 - 001381
DOCUMENT DATE: 07/03/90
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Notification of EPA Project Coordinator who is responsible for overseeing the RI/FS

DOCUMENT NUMBER: 001382 - 001390
DOCUMENT DATE: 08/02/90
NUMBER OF PAGES: 009
AUTHOR: Anthony Gardner, Regional TES 9 Manager
COMPANY/AGENCY: PRC Environmental Management, Inc. (PRC)
RECIPIENT: Karen Hartis, Regional Project Officer, Superfund Managment Branch, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Revised Work Plan for RI/FS Technical Oversight

DOCUMENT NUMBER: 001391 - 001419
DOCUMENT DATE: 08/15/90
NUMBER OF PAGES: 029
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence w/Attachments
DOCUMENT TITLE: EPA comments on RI Work Plan

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 001420 - 001462
DOCUMENT DATE: 09/01/90
NUMBER OF PAGES: 043
AUTHOR: Staff Consultants
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Dow Chemical Company/Dowell Schlumberger, Inc.
DOCUMENT TYPE: Response to Review Comments - Volume 4
DOCUMENT TITLE: "Response to EPA Review Comments Dated August 15, 1990"

DOCUMENT NUMBER: 001463 - 001530
DOCUMENT DATE: 10/01/90
NUMBER OF PAGES: 068
AUTHOR: Staff Consultants
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Dow Chemical Company/Dowell Schlumberger, Inc.
DOCUMENT TYPE: Final Work Plan - Volume 1
DOCUMENT TITLE: "Remedial Investigation Work Plan"

DOCUMENT NUMBER: 001531 - 001619
DOCUMENT DATE: 10/01/90
NUMBER OF PAGES: 089
AUTHOR: Staff Consultants
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Dow Chemical Company/Dowell Schlumberger, Inc.
DOCUMENT TYPE: Final Sampling/Analysis Plan - Volume 2
DOCUMENT TITLE: "Sampling and Analysis Plan Including Field Sampling Plan and Quality Assurance Project Plan"

DOCUMENT NUMBER: 001620 - 001700
DOCUMENT DATE: 10/01/90
NUMBER OF PAGES: 081
AUTHOR: Staff Consultants
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Dow Chemical Company/Dowell Schlumberger, Inc.
DOCUMENT TYPE: Final Health and Safety Plan - Volume 3
DOCUMENT TITLE: "Final Health and Safety Plan"

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 001701 - 001702
DOCUMENT DATE: 10/10/90
NUMBER OF PAGES: 002
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for September 1990

DOCUMENT NUMBER: 001703 - 001705
DOCUMENT DATE: 10/19/90
NUMBER OF PAGES: 003
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Formal approval of RI Work Plan on condition that minor changes made and incorporated into final Work Plan

DOCUMENT NUMBER: 001706 - 001707
DOCUMENT DATE: 10/31/90
NUMBER OF PAGES: 002
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Preliminary field sampling schedule - RI

DOCUMENT NUMBER: 001708 - 001709
DOCUMENT DATE: 11/09/90
NUMBER OF PAGES: 002
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for October 1990

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 001710 - 001710
DOCUMENT DATE: 11/29/90
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: ROC
DOCUMENT TITLE: Phone conversation with Gay Hanks (President - VAPEdisplay memoryfield activities

DOCUMENT NUMBER: 001711 - 001724
DOCUMENT DATE: 11/29/90
NUMBER OF PAGES: 014
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachments
DOCUMENT TITLE: Sample locations

DOCUMENT NUMBER: 001725 - 001751
DOCUMENT DATE: 11/30/90
NUMBER OF PAGES: 027
AUTHOR: Brett Padgett, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Report
DOCUMENT TITLE: "Quality Assurance Project Plan"

DOCUMENT NUMBER: 001752 - 001754
DOCUMENT DATE: 12/10/90
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for November 1990

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 001755 - 001763
DOCUMENT DATE: 01/03/91
NUMBER OF PAGES: 009
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Identification of potential source area - Gulf Coast Vacuum

DOCUMENT NUMBER: 001764 - 001774
DOCUMENT DATE: 01/04/91
NUMBER OF PAGES: 011
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Enclosures
DOCUMENT TITLE: Outline of Risk Assessment

DOCUMENT NUMBER: 001775 - 001776
DOCUMENT DATE: 01/15/91
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Comments on recent activities that have occurred regarding ongoing RI/FS

DOCUMENT NUMBER: 001777 - 001801
DOCUMENT DATE: 01/16/91
NUMBER OF PAGES: 025
AUTHOR: Brett Padgett, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Report
DOCUMENT TITLE: "Follow-Up Sampling - Quality Assurance Project Plan"

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 001802 - 001807
DOCUMENT DATE: 01/22/91
NUMBER OF PAGES: 006
AUTHOR: Brett Padgett, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Enclosure
DOCUMENT TITLE: Technical review on Potentially Responsible Parties (PRPs) RI Risk Assessment outline

DOCUMENT NUMBER: 001808 - 002010
DOCUMENT DATE: 01/28/91
NUMBER OF PAGES: 203
AUTHOR: Brett Padgett, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Report
DOCUMENT TITLE: "Field Oversight Report - Phase 1 Activities"

DOCUMENT NUMBER: 002011 - 002014
DOCUMENT DATE: 01/29/91
NUMBER OF PAGES: 004
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Outline of Risk Assessment

DOCUMENT NUMBER: 002015 - 002017
DOCUMENT DATE: 01/30/91
NUMBER OF PAGES: 003
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Memorandum on completion of field support activities - RI

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002018 - 002020
DOCUMENT DATE: 02/08/91
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for January 1991

DOCUMENT NUMBER: 002021 - 002109
DOCUMENT DATE: 02/13/91
NUMBER OF PAGES: 089
AUTHOR: Brett Padgett, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Report
DOCUMENT TITLE: "Field Oversight Report - Followup Sampling Activities"

DOCUMENT NUMBER: 002110 - 002125
DOCUMENT DATE: 02/22/91
NUMBER OF PAGES: 016
AUTHOR: Jacobs Engineering Staff
COMPANY/AGENCY: Jacobs Engineering Group, Inc.
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Revised Work Plan
DOCUMENT TITLE: "Community Relations"

DOCUMENT NUMBER: 002126 - 002126
DOCUMENT DATE: 03/07/91
NUMBER OF PAGES: 001
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Notice of additional sample collection

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002127 - 002129
DOCUMENT DATE: 03/11/91
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for February 1991

DOCUMENT NUMBER: 002130 - 002246
DOCUMENT DATE: 03/25/91
NUMBER OF PAGES: 117
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Preliminary Site Characterization Summary - RI

DOCUMENT NUMBER: 002247 - 002265
DOCUMENT DATE: 03/27/91
NUMBER OF PAGES: 019
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Summary Identification Contaminants and List of Proposed Indicator Chemicals - RI

DOCUMENT NUMBER: 002266 - 002271
DOCUMENT DATE: 04/01/91
NUMBER OF PAGES: 006
AUTHOR: EPA Staff
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public
DOCUMENT TYPE: Superfund Site Update Fact Sheet
DOCUMENT TITLE: "Remedial Investigations Underway"

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002272 - 002273
DOCUMENT DATE: 04/02/91
NUMBER OF PAGES: 002
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Additional background sample locations

DOCUMENT NUMBER: 002274 - 002274
DOCUMENT DATE: 04/04/91
NUMBER OF PAGES: 001
AUTHOR: Brett Padgett, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Review of "Preliminary Site Characterization Summary and Summary Identification Contaminants and List of Proposed Indicator Chemicals"

DOCUMENT NUMBER: 002275 - 002276
DOCUMENT DATE: 04/04/91
NUMBER OF PAGES: 002
AUTHOR: Brett Padgett, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Split sample data request

DOCUMENT NUMBER: 002277 - 002279
DOCUMENT DATE: 04/09/91
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for March 1991

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002280 - 002280
DOCUMENT DATE: 04/15/91
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Tim Knight, Inactive and Abandoned Sites Division, LDEQ
DOCUMENT TYPE: Correspondence w/o Enclosure
DOCUMENT TITLE: Request for review and comment on draft copy of PRP deliverable "Summary Identification Contaminants and List of Proposed Indicator Chemicals"

DOCUMENT NUMBER: 002281 - 002284
DOCUMENT DATE: 04/16/91
NUMBER OF PAGES: 004
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Re: Issues pertaining to D.L. Mud Site

DOCUMENT NUMBER: 002285 - 002296
DOCUMENT DATE: 04/19/91
NUMBER OF PAGES: 012
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Exposure Scenarios Technical Memorandum and Notification of Fate and Transport Models - RI

DOCUMENT NUMBER: 002297 - 002298
DOCUMENT DATE: 05/07/91
NUMBER OF PAGES: 002
AUTHOR: Ronald Ventola, Regulatory Functions Branch, Operations & Readiness Division
COMPANY/AGENCY: U.S. Army Corps. of Engineers
RECIPIENT: Dr. John Beaver, Life Systems, Inc.
DOCUMENT TYPE: Correspondence w/Enclosure
DOCUMENT TITLE: D.L. Mud is not in a wetland subject to Corps. of Engineers' jurisdiction

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002299 - 002307
DOCUMENT DATE: 05/07/91
NUMBER OF PAGES: 009
AUTHOR: Anthony Gardner, Regional TES 9 Manager
COMPANY/AGENCY: PRC
RECIPIENT: Karen Hartis, Regional Project Officer, Superfund Management Branch, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Revised Work Plan for RI/FS Technical Oversight (Cost documentation contained in the work plan is "Business Confidential" and is not included. See "Special Note to the Reader")

DOCUMENT NUMBER: 002308 - 002310
DOCUMENT DATE: 05/10/91
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for April 1991

DOCUMENT NUMBER: 002311 - 002312
DOCUMENT DATE: 05/13/91
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Comments on "Exposure Scenarios Technical Memorandum and Notification of Fate and Transport Models"

DOCUMENT NUMBER: 002313 - 002315
DOCUMENT DATE: 05/31/91
NUMBER OF PAGES: 003
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Submittal of "Toxicological and Epidemiological Memorandum"

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002316 - 002318
DOCUMENT DATE: 06/10/91
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for May 1991

DOCUMENT NUMBER: 002319 - 002320
DOCUMENT DATE: 06/12/91
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Approval of "Toxicological and Epidemiology Studies Memorandum"

DOCUMENT NUMBER: 002321 - 002321
DOCUMENT DATE: 06/21/91
NUMBER OF PAGES: 001
AUTHOR: Wilma Subra, President
COMPANY/AGENCY: Subra Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Request for copies of all information on Pab Oil and D.L. Mud

DOCUMENT NUMBER: 002322 - 002352
DOCUMENT DATE: 06/25/91
NUMBER OF PAGES: 031
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Enclosure
DOCUMENT TITLE: Background sampling results

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002353 - 002355
DOCUMENT DATE: 07/10/91
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for June 1991

DOCUMENT NUMBER: 002356 - 002356
DOCUMENT DATE: 07/11/91
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Wilma Subra, President, Subra Company
DOCUMENT TYPE: Correspondence w/o Enclosure
DOCUMENT TITLE: Data results collected from the site

DOCUMENT NUMBER: 002357 - 002358
DOCUMENT DATE: 08/09/91
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Re: RI

DOCUMENT NUMBER: 002359 - 002361
DOCUMENT DATE: 08/12/91
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for July 1991

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002362 - 002367
DOCUMENT DATE: 08/26/91
NUMBER OF PAGES: 006
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Facsimile Transmittal and Attachment
DOCUMENT TITLE: Corrected caution exchange capacity (CEC) data for soil samples

DOCUMENT NUMBER: 002368 - 002384
DOCUMENT DATE: 09/09/91
NUMBER OF PAGES: 017
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence w/Attachments
DOCUMENT TITLE: Draft RI and Risk Assessment comments

DOCUMENT NUMBER: 002385 - 002408
DOCUMENT DATE: 09/09/91
NUMBER OF PAGES: 024
AUTHOR: Brett Padgett, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Enclosure
DOCUMENT TITLE: Submittal of "Quality Assurance Project Plan"

DOCUMENT NUMBER: 002409 - 002411
DOCUMENT DATE: 09/10/91
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for August 1991

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002412 - 002420
DOCUMENT DATE: 10/08/91
NUMBER OF PAGES: 009
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachments
DOCUMENT TITLE: Summary of results from 09/09-10/91 sampling - RI

DOCUMENT NUMBER: 002421 - 002421
DOCUMENT DATE: 10/09/91
NUMBER OF PAGES: 001
AUTHOR: EPA Staff
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Sign-in Sheet
DOCUMENT TITLE: Sign-in sheet for 10/09/91 meeting regarding Draft RI Report

DOCUMENT NUMBER: 002422 - 002422
DOCUMENT DATE: 10/10/91
NUMBER OF PAGES: 001
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Notice of additional sampling - RI

DOCUMENT NUMBER: 002423 - 002426
DOCUMENT DATE: 10/10/91
NUMBER OF PAGES: 004
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for September 1991

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002427 - 002431
DOCUMENT DATE: 10/28/91
NUMBER OF PAGES: 005
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Followup of 10/09/91 meeting about RI

DOCUMENT NUMBER: 002432 - 002432
DOCUMENT DATE: 10/28/91
NUMBER OF PAGES: 001
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Notification to EPA that revised RI Report cannot be submitted in accordance with Administrative Order on Consent, Section VIII.23.E

DOCUMENT NUMBER: 002433 - 002439
DOCUMENT DATE: 11/11/91
NUMBER OF PAGES: 007
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachments
DOCUMENT TITLE: Progress Report for October 1991

DOCUMENT NUMBER: 002440 - 002465
DOCUMENT DATE: 11/12/91
NUMBER OF PAGES: 026
AUTHOR: Nancy Fagan, Geologist
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachments
DOCUMENT TITLE: Oversight activities from 10/24-29/91

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002466 - 002466
DOCUMENT DATE: 11/13/91
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Followup on recent phone conversations between EPA and CH2M Hill about additional work at the site

DOCUMENT NUMBER: 002467 - 002468
DOCUMENT DATE: 11/20/91
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: EPA disapproves of proposed work plan for additional field work submitted to EPA on 11/11/91

DOCUMENT NUMBER: 002469 - 002471
DOCUMENT DATE: 11/21/91
NUMBER OF PAGES: 003
AUTHOR: Ann Schober
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: ROC
DOCUMENT TITLE: Re: Gulf Coast Vacuum/D.L. Mud Sites - Adjacent canal sampling

DOCUMENT NUMBER: 002472 - 002484
DOCUMENT DATE: 11/22/91
NUMBER OF PAGES: 013
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Enclosure
DOCUMENT TITLE: Revised Work Plan for project completion - RI

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002485 - 002497
DOCUMENT DATE: 11/29/91
NUMBER OF PAGES: 013
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Enclosure
DOCUMENT TITLE: Work Plan for completion of RI

DOCUMENT NUMBER: 002498 - 002498
DOCUMENT DATE: 12/02/91
NUMBER OF PAGES: 001
AUTHOR: Brett Padgett, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: PRC will conduct split-sampling activities from 12/03-08/91

DOCUMENT NUMBER: 002499 - 002500
DOCUMENT DATE: 12/05/91
NUMBER OF PAGES: 002
AUTHOR: Joe Tieger
COMPANY/AGENCY: U.S. EPA
RECIPIENT: Regional Coordinators, U.S. EPA Regions 1-10
DOCUMENT TYPE: Memorandum w/Attachment
DOCUMENT TITLE: Re: Ecological Risk Assessments: Their Place in Records of Decision (RODs) and Cost Documentation

DOCUMENT NUMBER: 002501 - 002502
DOCUMENT DATE: 12/10/91
NUMBER OF PAGES: 002
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Corporation
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress report for November 1991

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002503 - 002505
DOCUMENT DATE: 12/16/91
NUMBER OF PAGES: 003
AUTHOR: Brett Padgett, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Minutes to 10/09/91 Risk Assessment meeting

DOCUMENT NUMBER: 002506 - 002507
DOCUMENT DATE: 12/20/91
NUMBER OF PAGES: 002
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Request for data generated from EPA activities and submission of split sample data

DOCUMENT NUMBER: 002508 - 002509
DOCUMENT DATE: 12/26/91
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Confirmation of 01/15/92 meeting

DOCUMENT NUMBER: 002510 - 002516
DOCUMENT DATE: 12/30/91
NUMBER OF PAGES: 007
AUTHOR: Nancy Fagan, PRC Geologist
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachments
DOCUMENT TITLE: Re: 12/13/91 visual inspection of canal

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002517 - 002584
DOCUMENT DATE: 12/31/91
NUMBER OF PAGES: 068
AUTHOR: Unspecified
COMPANY/AGENCY: Unspecified
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Guidance Documents
DOCUMENT TITLE: Miscellaneous guidance documents used in the selection of remedy for D.L. Mud

DOCUMENT NUMBER: 002585 - 002585
DOCUMENT DATE: 01/10/92
NUMBER OF PAGES: 001
AUTHOR: EPA Staff
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public
DOCUMENT TYPE: Superfund Site Update Fact Sheet
DOCUMENT TITLE: "Remedial Investigations Continue"

DOCUMENT NUMBER: 002586 - 002587
DOCUMENT DATE: 01/15/92
NUMBER OF PAGES: 002
AUTHOR: EPA Staff
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Meeting Agenda and Attachment
DOCUMENT TITLE: Agenda and sign-in list for RI meeting

DOCUMENT NUMBER: 002588 - 002592
DOCUMENT DATE: 01/15/92
NUMBER OF PAGES: 005
AUTHOR: EPA Staff
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Meeting Minutes
DOCUMENT TITLE: Minutes to PRP meeting

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002593 - 002595
DOCUMENT DATE: 02/10/92
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for January 1992

DOCUMENT NUMBER: 002596 - 002599
DOCUMENT DATE: 02/21/92
NUMBER OF PAGES: 004
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Fax Transmittal w/Attachment
DOCUMENT TITLE: Re: Sampling data

DOCUMENT NUMBER: 002600 - 002607
DOCUMENT DATE: 02/21/92
NUMBER OF PAGES: 008
AUTHOR: Tom Nelson
COMPANY/AGENCY: Sverdrup Corporation
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Facsimilie Transmittal w/Attachment
DOCUMENT TITLE: Re: Sampling data from Gulf Coast Vacuum

DOCUMENT NUMBER: 002608 - 002608
DOCUMENT DATE: 02/25/92
NUMBER OF PAGES: 001
AUTHOR: Garret Bondy, Chief, AR/LA Superfund Enforcement Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Don Draper, Director, Technical Support Center, Robert S. Kerr Research Laboratory, U.S. EPA
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Request for technical support

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002609 - 002615
DOCUMENT DATE: 02/25/92
NUMBER OF PAGES: 007
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Summary of discussions held between Dow Chemical Company and EPA during 01/15/92 meeting

as per call with Jane on 3/7/94

DOCUMENT NUMBER: 002616 - 002620
DOCUMENT DATE: 02/25/92
NUMBER OF PAGES: 005
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Summary of discussions held between Dow Chemical Company and EPA during 01/15/92 meeting

delete

DOCUMENT NUMBER: 002621 - 002758
DOCUMENT DATE: 02/28/92
NUMBER OF PAGES: 138
AUTHOR: Brett Padgett, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Enclosure
DOCUMENT TITLE: Submittal of "Field Oversight Report"

DOCUMENT NUMBER: 002759 - 002761
DOCUMENT DATE: 02/29/92
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Summary of 01/15/92 meeting - RI issues

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002762 - 002780
DOCUMENT DATE: 03/02/92
NUMBER OF PAGES: 019
AUTHOR: Carl Hickam, R.S., Senior Regional Representative
COMPANY/AGENCY: Agency for Toxic Substances and Disease Registry - Region 6
RECIPIENT: Allyn M. Davis, Director, Hazardous Waste Management Division, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: "Interim Preliminary Health Assessment"

DOCUMENT NUMBER: 002781 - 002781
DOCUMENT DATE: 03/05/92
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence w/o Attachment
DOCUMENT TITLE: Procedure for calculating agricultural portion of residential exposure scenario as discussed in 01/15/92 meeting and EPA's 02/25/92 letter

DOCUMENT NUMBER: 002782 - 002884
DOCUMENT DATE: 03/06/92
NUMBER OF PAGES: 103
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Enclosure
DOCUMENT TITLE: Data submittal and request for verification of inclusion of EPA samples

DOCUMENT NUMBER: 002885 - 002887
DOCUMENT DATE: 03/10/92
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for February 1992

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002888 - 002888
DOCUMENT DATE: 03/17/92
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: ROC
DOCUMENT TITLE: Re: Phone conversation with David Price (CH2M Hill) about collection of additional samples at empty drum area and for barium specification

DOCUMENT NUMBER: 002889 - 002892
DOCUMENT DATE: 03/19/92
NUMBER OF PAGES: 004
AUTHOR: Harold Underwood
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Fax Transmittal w/Attachment
DOCUMENT TITLE: Notice that Dow Chemical Company plans to collect additional samples to investigate barium sulfate in soils and drum found in onsite canal

DOCUMENT NUMBER: 002893 - 002893
DOCUMENT DATE: 03/24/92
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Acknowledgment of written notice from CH2M Hill about proposal to collect additional samples on 03/20/92

DOCUMENT NUMBER: 002894 - 002894
DOCUMENT DATE: 03/30/92
NUMBER OF PAGES: 001
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Request for copy of Gulf Coast Vacuum RI Report

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002895 - 002897
DOCUMENT DATE: 04/10/92
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for March 1992

DOCUMENT NUMBER: 002898 - 002908
DOCUMENT DATE: 04/15/92
NUMBER OF PAGES: 011
AUTHOR: Nancy Fagan, Geologist
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence and Attachment
DOCUMENT TITLE: Split-sampling and oversight visit

DOCUMENT NUMBER: 002909 - 002909
DOCUMENT DATE: 04/16/92
NUMBER OF PAGES: 001
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Oral notice given by CH2M Hill on 03/10/92 to EPA Region 6 and on 03/11/92 to EPA's contractor (as directed by EPA) about planned collection of additional samples

DOCUMENT NUMBER: 002910 - 002910
DOCUMENT DATE: 04/23/92
NUMBER OF PAGES: 001
AUTHOR: Brett Padgett, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Split sample data review

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002911 - 002914
DOCUMENT DATE: 05/11/92
NUMBER OF PAGES: 004
AUTHOR: Nancy Fagan, Geologist
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Minutes to 05/07/92 Risk Assessment meeting

DOCUMENT NUMBER: 002915 - 002917
DOCUMENT DATE: 05/11/92
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for April 1992

DOCUMENT NUMBER: 002918 - 002924
DOCUMENT DATE: 05/12/92
NUMBER OF PAGES: 007
AUTHOR: Wanda Hall, Data Package Supervisor
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Greg Goodman, P.E., Project Manager, CH2M Hill
DOCUMENT TYPE: Correspondence w/Enclosures
DOCUMENT TITLE: Re: Analytical data - LMG Laboratory No. 21501

DOCUMENT NUMBER: 002925 - 002932
DOCUMENT DATE: 05/14/92
NUMBER OF PAGES: 008
AUTHOR: Ghassan Khoury, Regional Toxicologist
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Re: Values of variables in intake equation for different exposure routes to be used in Risk Assessment

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002933 - 002937
DOCUMENT DATE: 05/15/92
NUMBER OF PAGES: 005
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Summary of 05/07/92 meeting - RI

DOCUMENT NUMBER: 002938 - 002942
DOCUMENT DATE: 05/15/92
NUMBER OF PAGES: 005
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Summary of 05/07/92 meeting - RI

DOCUMENT NUMBER: 002943 - 002944
DOCUMENT DATE: 06/01/92
NUMBER OF PAGES: 002
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Schedule for completion of RI

DOCUMENT NUMBER: 002945 - 002946
DOCUMENT DATE: 06/03/92
NUMBER OF PAGES: 002
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Information request from Gulf Coast Vacuum Site - D.L. Mud Site RI

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002947 - 002953
DOCUMENT DATE: 06/03/92
NUMBER OF PAGES: 007
AUTHOR: Terry O'Bryan, Chemical Assessment Desk, Office of Pollution Prevention and Toxics
COMPANY/AGENCY: U.S. EPA - Washington, D.C.
RECIPIENT: Ghassan Khoury, Regional Toxicologist, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum w/Attachment
DOCUMENT TITLE: Re: Bioavailability of barium sulfate

DOCUMENT NUMBER: 002954 - 002954
DOCUMENT DATE: 06/03/92
NUMBER OF PAGES: 001
AUTHOR: Ghassan Khoury, Regional Toxicologist
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Re: Surface soil and sediment data

DOCUMENT NUMBER: 002955 - 002963
DOCUMENT DATE: 06/08/92
NUMBER OF PAGES: 009
AUTHOR: Anthony Gardner, Regional TES 9 Manager
COMPANY/AGENCY: PRC
RECIPIENT: Karen Hartis, CERCLA Regional Project Officer, Superfund Management Branch, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Revised Work Plan for RI/FS Technical Oversight (Cost documentation contained in the work plan is "Business Confidential and is not included. See "Special Note to the Reader")

DOCUMENT NUMBER: 002964 - 002967
DOCUMENT DATE: 06/08/92
NUMBER OF PAGES: 004
AUTHOR: Anthony Gardner, Regional TES 9 Manager
COMPANY/AGENCY: PRC
RECIPIENT: Karen Hartis, CERCLA Regional Project Officer, Superfund Management Branch, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Revised Work Plan for RI/FS Technical Oversight (Cost documentation contained in the work plan is "Business Confidential" and is not included. See "Special Note to the Reader")

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002968 - 002970
DOCUMENT DATE: 06/10/92
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Progress Report for May 1992

DOCUMENT NUMBER: 002971 - 002976
DOCUMENT DATE: 06/24/92
NUMBER OF PAGES: 006
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence w/Attachments
DOCUMENT TITLE: Re: 1) Further investigative activities regarding former impoundments needed and 2) future schedule of RI/FS

DOCUMENT NUMBER: 002977 - 002977
DOCUMENT DATE: 06/29/92
NUMBER OF PAGES: 001
AUTHOR: Tom Nelson
COMPANY/AGENCY: Sverdrup Corporation
RECIPIENT: Ann Schober, U.S. EPA Region 6
DOCUMENT TYPE: Technical Memorandum
DOCUMENT TITLE: Historical aerial photograph (02/17/74) of Gulf Coast Vacuum and D.L. Mud Superfund Sites

DOCUMENT NUMBER: 002978 - 002980
DOCUMENT DATE: 07/01/92
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Response to 06/25/92 EPA letter

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002981 - 002983
DOCUMENT DATE: 07/10/92
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for June 1992

DOCUMENT NUMBER: 002984 - 002985
DOCUMENT DATE: 07/10/92
NUMBER OF PAGES: 002
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Response to EPA's 07/01/92 letter

DOCUMENT NUMBER: 002986 - 002993
DOCUMENT DATE: 07/17/92
NUMBER OF PAGES: 008
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Work Plan for additional EPA requested investigation and response to EPA's 06/25/92 letter

DOCUMENT NUMBER: 002994 - 002995
DOCUMENT DATE: 07/28/92
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Comments on proposed Work Plan revision

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 002996 - 002996
DOCUMENT DATE: 07/29/92
NUMBER OF PAGES: 001
AUTHOR: David Price
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/o Enclosure
DOCUMENT TITLE: Former impoundment structure area map

DOCUMENT NUMBER: 002997 - 002997
DOCUMENT DATE: 08/10/92
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: ROC
DOCUMENT TITLE: Phone conversation with CH2M Hill and Dow Chemical regarding health effects assessment summary tables

DOCUMENT NUMBER: 002998 - 003000
DOCUMENT DATE: 08/10/92
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for July 1992

DOCUMENT NUMBER: 003001 - 003002
DOCUMENT DATE: 08/12/92
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence w/o Attachment
DOCUMENT TITLE: Risk assessment issues

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 003003 - 003006
DOCUMENT DATE: 08/17/92
NUMBER OF PAGES: 004
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Revised Work Plan for additional EPA requested investigation

DOCUMENT NUMBER: 003007 - 003007
DOCUMENT DATE: 08/27/92
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Formal approval of revised Work Plan for additional trenching investigation

DOCUMENT NUMBER: 003008 - 003010
DOCUMENT DATE: 09/10/92
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for August 1992

DOCUMENT NUMBER: 003011 - 003014
DOCUMENT DATE: 09/11/92
NUMBER OF PAGES: 004
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/o Attachments
DOCUMENT TITLE: Response to 08/12/92 and 08/27/92 EPA letters

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 003015 - 003015
DOCUMENT DATE: 09/22/92
NUMBER OF PAGES: 001
AUTHOR: Ghassan Khoury, Regional Toxicologist
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Re: Bioavailability of barium sulfate

DOCUMENT NUMBER: 003016 - 003017
DOCUMENT DATE: 10/16/92
NUMBER OF PAGES: 002
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Resolution of outstanding risk assessment issues

DOCUMENT NUMBER: 003018 - 003048
DOCUMENT DATE: 10/20/92
NUMBER OF PAGES: 031
AUTHOR: Ghassan Khoury, Regional Toxicologist
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Joan Dollarhide, Office of Research and Development, U.S. EPA - Cincinnati, OH
DOCUMENT TYPE: Memorandum w/Attachment
DOCUMENT TITLE: Bioavailability of barium sulfate

DOCUMENT NUMBER: 003049 - 003061
DOCUMENT DATE: 10/20/92
NUMBER OF PAGES: 013
AUTHOR: Ghassan Khoury, Regional Toxicologist
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum w/Attachments
DOCUMENT TITLE: Re: Response to D.L. Mud letter "Resolution of Outstanding Risk Assessment Issues"

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 003062 - 003085
DOCUMENT DATE: 10/23/92
NUMBER OF PAGES: 024
AUTHOR: Mark Ezell, Environmental Scientist
COMPANY/AGENCY: PRC Environmental Management, Inc. (PRC)
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachments
DOCUMENT TITLE: Re: 08/31/92 - 09/01/92 site visit to perform split sampling and oversight of sampling activities

DOCUMENT NUMBER: 003086 - 003087
DOCUMENT DATE: 10/23/92
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Re: Risk Assessment

DOCUMENT NUMBER: 003088 - 003093
DOCUMENT DATE: 11/10/92
NUMBER OF PAGES: 006
AUTHOR: Nancy Fagan, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Enclosure
DOCUMENT TITLE: "D.L. Mud Former Pit Area Sample Data Differences"

DOCUMENT NUMBER: 003094 - 003152
DOCUMENT DATE: 11/10/92
NUMBER OF PAGES: 059
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for October 1992

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 003153 - 003153
DOCUMENT DATE: 11/23/92
NUMBER OF PAGES: 001
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Submission of RI Report

DOCUMENT NUMBER: 003154 - 003160
DOCUMENT DATE: 11/29/92
NUMBER OF PAGES: 007
AUTHOR: Joan Dollarhide, Office of Research and Development
COMPANY/AGENCY: U.S. EPA - Cincinnati, OH
RECIPIENT: Ghasson Khoury, Regional Toxicologist, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum w/Attachment
DOCUMENT TITLE: Evaluation of barium desorption pilot study and the relevance of desorption study to barium risk assessment

DOCUMENT NUMBER: 003161 - 003364
DOCUMENT DATE: 12/07/92
NUMBER OF PAGES: 204
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Cover Letter w/Report
DOCUMENT TITLE: RI Report

DOCUMENT NUMBER: 003365 - 003650
DOCUMENT DATE: 12/07/92
NUMBER OF PAGES: 286
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Appendixes
DOCUMENT TITLE: RI Report - Appendixes A-G

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 003651 - 004104
DOCUMENT DATE: 12/07/92
NUMBER OF PAGES: 454
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Appendix
DOCUMENT TITLE: RI Report - Appendix H

DOCUMENT NUMBER: 004105 - 004594
DOCUMENT DATE: 12/07/92
NUMBER OF PAGES: 490
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Appendixes
DOCUMENT TITLE: RI Report - Appendixes I-K

DOCUMENT NUMBER: 004595 - 004597
DOCUMENT DATE: 12/10/92
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for November 1992

DOCUMENT NUMBER: 004598 - 004601
DOCUMENT DATE: 01/05/93
NUMBER OF PAGES: 004
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Facsimile Transmittal w/Attachments
DOCUMENT TITLE: Re: Subchronic toxicity of barium chloride

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004602 - 004602
DOCUMENT DATE: 01/11/93
NUMBER OF PAGES: 001
AUTHOR: Ghassan Khoury, Regional Toxicologist
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Joan Dollarhide, Office of Research and Development, U.S. EPA - Cincinnati, OH
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Impact of the new study on the chronic and subchronic toxicity values of barium

DOCUMENT NUMBER: 004603 - 004604
DOCUMENT DATE: 01/11/93
NUMBER OF PAGES: 002
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for December 1992

DOCUMENT NUMBER: 004605 - 004609
DOCUMENT DATE: 01/22/93
NUMBER OF PAGES: 005
AUTHOR: Dennis W. Shelton, Toxicologist
COMPANY/AGENCY: CH2M Hill
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Development of a subchronic oral reference dose value (RfD) for barium

DOCUMENT NUMBER: 004610 - 004615
DOCUMENT DATE: 01/26/93
NUMBER OF PAGES: 006
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Development of a subchronic oral RfD value for barium

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004616 - 004616
DOCUMENT DATE: 01/26/93
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Harold Ethridge, Louisiana Department of Environmental Quality (LDEQ)
DOCUMENT TYPE: Cover Letter w/o Enclosures
DOCUMENT TITLE: Draft FS Report - Pab Oil and RI Report - D.L. Mud

DOCUMENT NUMBER: 004617 - 004625
DOCUMENT DATE: 02/03/93
NUMBER OF PAGES: 009
AUTHOR: Joan Dollarhide, Office of Research and Development
COMPANY/AGENCY: U.S. EPA - Cincinnati, OH
RECIPIENT: Ghassan Khoury, Regional Toxicologist, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum w/Attachment
DOCUMENT TITLE: Review of the Dietz et al. (1992) Study for RfD for Barium

DOCUMENT NUMBER: 004626 - 004627
DOCUMENT DATE: 02/10/93
NUMBER OF PAGES: 002
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for January 1993

DOCUMENT NUMBER: 004628 - 004628
DOCUMENT DATE: 02/16/93
NUMBER OF PAGES: 001
AUTHOR: Ghassan Khoury, Regional Toxicologist
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: ROC
DOCUMENT TITLE: Phone conference with Lynn Papa (U.S. EPA - Cincinnati, OH) about subchronic RfD toxicity value for barium

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004629 - 004629
DOCUMENT DATE: 02/16/93
NUMBER OF PAGES: 001
AUTHOR: Ghassan Khoury, Regional Toxicologist
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: ROC
DOCUMENT TITLE: Subchronic RfD toxicity value for Barium

DOCUMENT NUMBER: 004630 - 004630
DOCUMENT DATE: 03/01/93
NUMBER OF PAGES: 001
AUTHOR: Debra McKean
COMPANY/AGENCY: PRC
RECIPIENT: Nancy Fagan, Contractor Project Manager, PRC
DOCUMENT TYPE: Facsimilie Transmittal
DOCUMENT TITLE: Requested barium numbers

DOCUMENT NUMBER: 004631 - 004632
DOCUMENT DATE: 03/05/93
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Formal approval of RI Report subject to comments contained in letter

DOCUMENT NUMBER: 004633 - 004633
DOCUMENT DATE: 03/08/93
NUMBER OF PAGES: 001
AUTHOR: Brent Schindler, Attorney
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Freedom of Information Act request for EPA Region 6 and EPA - Cincinnati, OH documents dated post-12/08/92 about toxicity evaluation for barium

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004634 - 004635
DOCUMENT DATE: 03/10/93
NUMBER OF PAGES: 002
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for February 1993

DOCUMENT NUMBER: 004636 - 004636
DOCUMENT DATE: 03/19/93
NUMBER OF PAGES: 001
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Response to EPA's comments outlined in 03/09/93 letter regarding RI Report

DOCUMENT NUMBER: 004637 - 004638
DOCUMENT DATE: 03/26/93
NUMBER OF PAGES: 002
AUTHOR: Don Williams, Chief, Texas Superfund Remediation Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Joan Dollarhide, Office of Research and Development, U.S. EPA - Cincinnati, OH
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Evaluation of Subchronic RfD for Barium

DOCUMENT NUMBER: 004639 - 004644
DOCUMENT DATE: 04/01/93
NUMBER OF PAGES: 006
AUTHOR: CH2M Hill Staff
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Meeting Agenda and Attachments
DOCUMENT TITLE: "FS Options Meeting"

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004645 - 004646
DOCUMENT DATE: 04/05/93
NUMBER OF PAGES: 002
AUTHOR: Nancy Fagan, Contractor Project Manager
COMPANY/AGENCY: PRC
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Minutes to 04/01/93 meeting with Dow Chemical and CH2M Hill about proposed FS

DOCUMENT NUMBER: 004647 - 004647
DOCUMENT DATE: 04/07/93
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: ROC
DOCUMENT TITLE: Phone conference between EPA Region 6, Dow Chemical Company, and CH2M Hill as followup to 04/01/93 meeting

DOCUMENT NUMBER: 004648 - 004649
DOCUMENT DATE: 04/07/93
NUMBER OF PAGES: 002
AUTHOR: Joe Winkle, Regional Administrator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Bill Luthans, Superfund Enforcement Section, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Re: Lifting Recusal from Involvement in Pab Oil and D.L. Mud

DOCUMENT NUMBER: 004650 - 004652
DOCUMENT DATE: 04/12/93
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for March 1993

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004653 - 004654
DOCUMENT DATE: 04/12/93
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Re: 1) Followup on 04/01/93 meeting and 04/07/93 phone conversation about conductance of FS and 2) extension of due date for submittal of FS Work Plan until 04/23/93

DOCUMENT NUMBER: 004655 - 004668
DOCUMENT DATE: 04/23/93
NUMBER OF PAGES: 014
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Draft FS Work Plan

DOCUMENT NUMBER: 004669 - 004671
DOCUMENT DATE: 04/28/93
NUMBER OF PAGES: 003
AUTHOR: Greg Goodman, P.E. Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Facsimile Cover Sheet and Attachments
DOCUMENT TITLE: Re: Barium toxicological profiles

DOCUMENT NUMBER: 004672 - 004673
DOCUMENT DATE: 04/29/93
NUMBER OF PAGES: 002
AUTHOR: Brent Schindler, Attorney
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Nellie Shirer, Office of Regional Counsel (ORC), U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Comments regarding draft Administrative Order on Consent

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004674 - 004691
DOCUMENT DATE: 04/30/93
NUMBER OF PAGES: 018
AUTHOR: William Ripley, Certified Petroleum Geologist
COMPANY/AGENCY: Consultant
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Report
DOCUMENT TITLE: Investigation of barium as a trace element

DOCUMENT NUMBER: 004692 - 004695
DOCUMENT DATE: 05/06/93
NUMBER OF PAGES: 004
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Formal disapproval of the draft FS Work Plan

DOCUMENT NUMBER: 004696 - 004698
DOCUMENT DATE: 05/10/93
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for April 1993

DOCUMENT NUMBER: 004699 - 004699
DOCUMENT DATE: 05/14/93
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Harold Ethridge, Administrator, Inactive and Abandoned Sites Division, LDEQ
DOCUMENT TYPE: Cover Letter w/o Enclosures
DOCUMENT TITLE: Additional information relating to investigation of former impoundment area found at the site

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004700 - 004700
DOCUMENT DATE: 05/14/93
NUMBER OF PAGES: 001
AUTHOR: Ghassan Khoury, Regional Toxicologist
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Risk Assessment TICs Evaluation

DOCUMENT NUMBER: 004701 - 004716
DOCUMENT DATE: 05/19/93
NUMBER OF PAGES: 016
AUTHOR: Gary Diamond and Elena Mantis-Mercader
COMPANY/AGENCY: Syracuse Research Corporation
RECIPIENT: Joan Dollarhide, Office of Research and Development, U.S. EPA - Cincinnati, OH
DOCUMENT TYPE: Memorandum w/Attachment
DOCUMENT TITLE: Review of Subchronic and Chronic RfDs for Barium

DOCUMENT NUMBER: 004717 - 004733
DOCUMENT DATE: 05/28/93
NUMBER OF PAGES: 017
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence w/Attachment
DOCUMENT TITLE: Revised FS Work Plan

DOCUMENT NUMBER: 004734 - 004734
DOCUMENT DATE: 06/09/93
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: ROC
DOCUMENT TITLE: Phone conversation with W.J. Witt (Dow Chemical Company) regarding FS Work Plan

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004735 - 004736
DOCUMENT DATE: 06/10/93
NUMBER OF PAGES: 002
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: James VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for May 1993

DOCUMENT NUMBER: 004737 - 004738
DOCUMENT DATE: 06/18/93
NUMBER OF PAGES: 002
AUTHOR: John Rauscher, Regional Toxicologist
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Central tendency exposure and reasonable maxium exposure soil ingestion rate for residential child scenario used in RI Report

DOCUMENT NUMBER: 004739 - 004742
DOCUMENT DATE: 06/18/93
NUMBER OF PAGES: 004
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: EPA disapproves the revised FS Work Plan dated 05/28/93

DOCUMENT NUMBER: 004743 - 004758
DOCUMENT DATE: 06/25/93
NUMBER OF PAGES: 016
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Fascimile Cover Sheet and Attachment
DOCUMENT TITLE: Proposed rule exempting barium sulfate from toxic chemical reporting requirements

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004759 - 004759
DOCUMENT DATE: 06/28/93
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site File
DOCUMENT TYPE: Meeting Agenda
DOCUMENT TITLE: "D.L. Mud FS Work Plan Meeting"

DOCUMENT NUMBER: 004760 - 004773
DOCUMENT DATE: 06/30/93
NUMBER OF PAGES: 014
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Enclosure
DOCUMENT TITLE: Revised FS Work Plan

DOCUMENT NUMBER: 004774 - 004774
DOCUMENT DATE: 07/09/93
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Manager
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: EPA formally approves FS Work Plan

DOCUMENT NUMBER: 004775 - 004794
DOCUMENT DATE: 07/23/93
NUMBER OF PAGES: 020
AUTHOR: Don Williams
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Joan Dollarhide, Office of Research and Development, U.S. EPA - Cincinnati, OH
DOCUMENT TYPE: Memorandum w/Attachments
DOCUMENT TITLE: Review of Subchronic and Chronic RfDs for Barium

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004795 - 004796
DOCUMENT DATE: 08/10/93
NUMBER OF PAGES: 002
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for July 1993

DOCUMENT NUMBER: 004797 - 004834
DOCUMENT DATE: 08/11/93
NUMBER OF PAGES: 038
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter and Enclosure
DOCUMENT TITLE: "Final Screening Results Memorandum - D.L. Mud Site FS"

DOCUMENT NUMBER: 004835 - 004836
DOCUMENT DATE: 08/24/93
NUMBER OF PAGES: 002
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Submittal of EPA comments on "Final Screening Results Memorandum - FS"

DOCUMENT NUMBER: 004837 - 004840
DOCUMENT DATE: 08/27/93
NUMBER OF PAGES: 004
AUTHOR: Joan Dollarhide, Associate Director, Office of Research and Development
COMPANY/AGENCY: U.S. EPA - Cincinnati, OH
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum and Attachment
DOCUMENT TITLE: Review of Subchronic and Chronic RfDs for Barium

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004841 - 004842
DOCUMENT DATE: 09/10/93
NUMBER OF PAGES: 002
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: James VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for August 1993

DOCUMENT NUMBER: 004843 - 004844
DOCUMENT DATE: 09/13/93
NUMBER OF PAGES: 002
AUTHOR: Linda Papa, Office of Research and Development
COMPANY/AGENCY: U.S. EPA - Cincinnati, OH
RECIPIENT: Joan Dollarhide, Office of Research and Development, U.S. EPA - Cincinnati, OH
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Review of Subchronic/Chronic RfD for Barium

DOCUMENT NUMBER: 004845 - 004848
DOCUMENT DATE: 09/14/93
NUMBER OF PAGES: 004
AUTHOR: Joan Dollarhide, Office of Research and Development
COMPANY/AGENCY: U.S. EPA - Cincinnati, OH
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum w/Attachment
DOCUMENT TITLE: Review of Subchronic and Chronic RfDs for Barium

DOCUMENT NUMBER: 004849 - 004849
DOCUMENT DATE: 09/29/93
NUMBER OF PAGES: 001
AUTHOR: Greg Goodman, P.E., Project Manager
COMPANY/AGENCY: CH2M Hill
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/o Attachment
DOCUMENT TITLE: Re: Draft FS Report

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004850 - 004850
DOCUMENT DATE: 10/20/93
NUMBER OF PAGES: 001
AUTHOR: Kaplan Herald Staff Writer
COMPANY/AGENCY: The Kaplan Herald
RECIPIENT: Public
DOCUMENT TYPE: Notice
DOCUMENT TITLE: Re: 1) Record of Decision for Pab Oil and 2) Pab Oil and D.L. Mud Superfund Sites Open House - 10/26/93

DOCUMENT NUMBER: 004851 - 004851
DOCUMENT DATE: 10/21/93
NUMBER OF PAGES: 001
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Tim Knight, Administrator, Inactive and Abandoned Sites Division, LDEQ
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: EPA requests LDEQ's assistance and participation in preparing the ROD

DOCUMENT NUMBER: 004852 - 004852
DOCUMENT DATE: 10/24/93
NUMBER OF PAGES: 001
AUTHOR: Abbeville Meridional Staff Writer
COMPANY/AGENCY: Abbeville Meridional
RECIPIENT: Public
DOCUMENT TYPE: Notice
DOCUMENT TITLE: Open House for Pab Oil and D.L. Mud - 10/26/93

DOCUMENT NUMBER: 004853 - 004853
DOCUMENT DATE: 10/26/93
NUMBER OF PAGES: 001
AUTHOR: EPA Staff
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public
DOCUMENT TYPE: Sign-In List
DOCUMENT TITLE: Sign-In List for 10/26/93 Open House for Pab Oil and D.L. Mud

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004854 - 004855
DOCUMENT DATE: 10/27/93
NUMBER OF PAGES: 002
AUTHOR: Felicia Dugas, Staff Writer
COMPANY/AGENCY: Abbeville Meridional
RECIPIENT: Public
DOCUMENT TYPE: Newspaper Article
DOCUMENT TITLE: "Pab Oil site remedy, D.L. Mud discussed"

DOCUMENT NUMBER: 004856 - 004856
DOCUMENT DATE: 10/27/93
NUMBER OF PAGES: 001
AUTHOR: Janice Macomber, Acadiana Correspondent
COMPANY/AGENCY: Advertiser
RECIPIENT: Public
DOCUMENT TYPE: Newspaper Article
DOCUMENT TITLE: "Superfund cleanup plan presented for Pab site" D.L. Mud discussed ??

DOCUMENT NUMBER: 004857 - 004857
DOCUMENT DATE: 10/27/93
NUMBER OF PAGES: 001
AUTHOR: Acadiana Bureau Staff Writer
COMPANY/AGENCY: The Adocate
RECIPIENT: Public
DOCUMENT TYPE: Newspaper Article
DOCUMENT TITLE: "Superfund site cleanup may take 4 years" D.L. Mud discussed ??

DOCUMENT NUMBER: 004858 - 004858
DOCUMENT DATE: 10/27/93
NUMBER OF PAGES: 001
AUTHOR: Tim Knight, Administrator, Inactive and Abandoned Sites Division
COMPANY/AGENCY: LDEQ
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: LDEQ comments on FS Report

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004859 - 004865
DOCUMENT DATE: 11/04/93
NUMBER OF PAGES: 007
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: W.J. Witt, Manager, CERCLA Operations, Dow Chemical Company
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: EPA comments on the Draft FS Report

DOCUMENT NUMBER: 004866 - 004874
DOCUMENT DATE: 11/10/93
NUMBER OF PAGES: 009
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for October 1993

DOCUMENT NUMBER: 004875 - 004877
DOCUMENT DATE: 11/10/93
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for October 1993

DOCUMENT NUMBER: 004878 - 004901
DOCUMENT DATE: 11/10/93
NUMBER OF PAGES: 024
AUTHOR: Terry O'Bryan, Chemical Screening and Risk Assessment Division
COMPANY/AGENCY: U.S. EPA - Washington, D.C.
RECIPIENT: Ghassan Khoury, Regional Toxicologist, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum and Attachments
DOCUMENT TITLE: Re: 1) Request for structure-activity estimates and 2) 1989 "Structural Activity Relationships of Alkanes and Alkenes Report"

ADMINISTRATIVE RECORD INDEX

DRAFT

SITE NAME: D.L. MUD SUPERFUND SITE
SITE NUMBER: LAD 981058019

DOCUMENT NUMBER: 004902 - 004909
DOCUMENT DATE: 11/15/93
NUMBER OF PAGES: 008
AUTHOR: Jamie VanBuskirk, Project Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Joan Dollarhide, Office of Research and Development, U.S. EPA - Cincinnati, OH
DOCUMENT TYPE: Fascimile Cover Sheet and Attachments
DOCUMENT TITLE: Re: 1) 10/93 October progress report and 2) Memorandum "Review of the Subchronic RfD for Barium"

DOCUMENT NUMBER: 004910 - 004911
DOCUMENT DATE: 12/10/93
NUMBER OF PAGES: 002
AUTHOR: EPA Staff
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public
DOCUMENT TYPE: Site Update Fact Sheet
DOCUMENT TITLE: "Site Investigation Completed"

DOCUMENT NUMBER: 004912 - 004914
DOCUMENT DATE: 12/10/93
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for November 1993

DOCUMENT NUMBER: 004915 - 004917
DOCUMENT DATE: 01/10/94
NUMBER OF PAGES: 003
AUTHOR: W.J. Witt, Manager, CERCLA Operations
COMPANY/AGENCY: Dow Chemical Company
RECIPIENT: Jamie VanBuskirk, Project Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Attachment
DOCUMENT TITLE: Progress report for December 1993

Appendix #3

STATE OF LOUISIANA LETTER OF CONCURRENCE ON THE SELECTED REMEDY

State of Louisiana

Department of Environmental Quality

Edwin W. Edwards
Governor

William A. Kucharski
Secretary

September 1, 1994

RECEIVED
EPA REGION VI
94 SEP -9 AM 10:07
SUPERFUND BRANCH

Jamie VanBuskirk
Remedial Project Manager (6H-EA)
Region VI
U.S. Environmental Protection Agency
Dallas, TX 75202-2733

RE: Draft Record of Decision D.L. Mud Superfund Site

Dear Mr. VanBuskirk:

Personnel of the Louisiana Department of Environmental Quality Inactive and Abandoned Sites Division (LDEQ/IASD) have completed their review of the Draft Record of Decision dated August 12, 1994.

We are in agreement with the selected remedial actions for the D.L. Mud, Inc. Superfund Site and have no further comments on the Draft Record of Decision.

If you have any further questions, please contact Mr. Rich Johnson of this office at (504) 765-0487.

Sincerely.

Tim B. Knight
Administrator

TBK:RJ:jl

OFFICE OF LEGAL AFFAIRS AND ENFORCEMENT INACTIVE AND ABANDONED SITES DIVISION P.O. BOX 82282 BATON ROUGE, LOUISIANA 70884-2282

TELEPHONE (504) 765-0487 FAX (504) 765-0484

AN EQUAL OPPORTUNITY EMPLOYER

State of Louisiana

Department of Environmental Quality

Edwin W. Edwards
Governor

May 6, 1994

William A. Kucharski
Secretary

Jamie VanBuskirk
Remedial Project Manager (6H-EA)
U.S. Environmental Protection Agency
1445 Ross Ave. Suite 1200
Dallas, TX 7502-2733

RE: Proposed Plan of Action for D.L. Mud
Superfund Site, Vermilion Parish Louisiana

Dear Mr. VanBuskirk:

Personnel of the Louisiana Department of Environmental Quality (LDEQ) have completed their review of the Proposed Plan of Action for the D.L. Mud Superfund Site in Abbeville Louisiana, received on April 29, 1994.

We support the preferred alternatives for addressing the site contaminants which will meet the primary remedial objectives by combining Alternative #2 and Alternative #6. These alternatives will provide for institutional controls and the excavation and offsite disposal of contaminated subsurface soils.

If you have any questions, please contact Mr. Rich Johnson of this office at (504) 765-0487.

Sincerely,

Tim B. Knight
Administrator
Inactive and Abandoned Sites Division

TBK:RJ:jl

OFFICE OF LEGAL AFFAIRS AND ENFORCEMENT INACTIVE AND ABANDONED SITES DIVISION P.O BOX 82282 BATON ROUGE, LOUISIANA 70884-2282

TELEPHONE (504) 765-0487 FAX (504) 765-0484

Appendix #4

SELECTED ALTERNATIVE COST ESTIMATE

CH2M HILL
PROJECT: DOW MUD SITE-LOUISIANA
PROJECT NO: MGM28796.E0.FS
FILE NAME: DOWMUD1

CURRENT DATE: 22-Sep-93

YOUNG/HEDGLIN

ESTIMATED COST FOR BARIUM-CONTAINING SOIL AND TICS:
ALTERNATIVE 2, INSTITUTIONAL ACTIONS

DESCRIPTION	QUANTITY	UNIT	UNIT COST	EXTENSION
INITIAL COSTS				
Deed Restrictions (Property, Legal & Admin)	1	LS	$8,000.00	$8,000
Subtotal				$8,000
Scope Contingency	33%			$2,640
Subtotal				$10,640
Gen Reqmts (Misc.)	25%			$2,660
Construction Total				$13,300
Engineering	25%			$3,325
Total Initial Costs (Rounded)				$17,000
PRESENT WORTH OF O & M COSTS @ 8%				
Public Education	1	LS	$11,260	$11,260
Grdwater&Surface Monitoring(30 Yr@$14,000/Yr)	1	LS	$157,600	$157,600
Total Present Worth (Rounded)				$169,000
Total Present Worth of Remedial Action (Rounded)				$190,000

CH2M HILL
PROJECT: DOW MUD SITE-LOUISIANA
PROJECT NO: MGM28796.E0.FS
FILE NAME: DOWMUD1

CURRENT DATE: 22-Sep-93

YOUNG/HEDGLIN

ESTIMATED COST FOR TICS
ALTERNATIVE 6, LANDFILL

DESCRIPTION	QUANTITY	UNIT	UNIT COST	EXTENSION
INITIAL COSTS				
Excavate Contaminated Material	1,100	CY	$4.00	$4,400
Haul and Dispose Contaminated Material	1,100	CY	$50.00	$55,000
Imported Backfill Excavated Area	1,100	CY	$21.00	$23,100
Sampling	1	LS	$20,000.00	$20,000
Subtotal				$102,500
Scope Contingency	25%			$25,625
Subtotal				$128,125
Gen Reqmts (Mob/B&I/H&S)	25%			$32,031
Subtotal				$160,156
Bid Contingency	15%			$24,023
Construction Total				$184,180
Engineering	10%			$18,418
Contruction Management	7%			$12,893
Permitting & Legal	5%			$9,209
Total Initial Costs (Rounded)				$220,000
Total Present Worth of Remedial Action (Rounded)				$220,000

Appendix #5

JUNE 27, 1994 MEMO FROM ECAO REGARDING
SUBCHRONIC AND CHRONIC RfD FOR BARIUM

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE
CINCINNATI, OHIO 45268

'94 JUL -5 PM 2:10
SUPERFUND BRANCH

MEMORANDUM

DATE: June 27, 1994

SUBJECT: Review of Subchronic and Chronic RfDs for Barium (D.L. Mud Inc., LA)

FROM: Joan S. Dollarhide
Director
Superfund Health Risk Technical Support Center

TO: Jamie VanBuskirk
U.S. EPA
Region VI

This memorandum responds to your request for a review of issues raised in Comments on the Proposed Plan for D.L. Mud Site. Thank you for your patience while we attempted to resolve the questions surrounding the appropriate choice of critical study for the subchronic and chronic RfDs for barium. Although they have misinterpreted some of our earlier communications with you, the comments do raise some pertinent questions regarding barium. We have concluded that because of widely differing scientific judgement, we cannot resolve these issues in the forum of ECAO alone. Therefore, we plan to present these issues to the Agency's RfD/RfC Work Group for resolution. I will let you know when a date for the presentation has been scheduled.

Until the Work Group has evaluated the new data, I recommend that you continue using the value that has already been reviewed and verified by the Work Group: the RfD of 7E-2 mg/kg/day that is currently on IRIS. This value has also been adopted as the subchronic value on HEAST. Please let me know if you need additional information.

cc: L. Papa
J. Konz (5204G)

Printed on Recycled Paper

Appendix #6

INFORMATION ON BARIUM BIOAVAILABILITY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE
CINCINNATI, OHIO 45268

NOV 23 1992

SUBJECT: Barium (7440-39-3)(D.L. Mud Superfund Site/Louisiana)

FROM: Joan S. Dollarhide
Associate Director
Superfund Health Risk Technical Support Center
Chemical Mixtures Assessment Branch

TO: Ghasson Khoury
U.S. EPA
Region VI

RECEIVED
SUPERFUND
92 NOV 30 8:07

This memorandum is in response to your request for ECAO evaluation of the barium desorption pilot study and the relevance of the desorption study to barium risk assessment.

As discussed in the attached evaluation, the desorption study provides evidence that the bioavailability of barium from barium sulfate-contaminated soil is likely to be substantially less than 100%, but the study does not provide data adequate to define an absorption value for adjusting the RfD to a value representing the form that is mainly present on site, or to define a relative absorption factor for barium in soil versus in water. Note that the method recommended by RAGS HHEM Part A (U.S. EPA, 1989) for dealing with differences in absorption efficiencies between the medium of exposure and the media that are the basis for the RfD, when there are strong arguments for doing so, is to adjust the intake (not the RfD) by the ratio of absorption efficiency from soil to absorption efficiency appropriate for the RfD (pages 8-5, A-3 and A-4).

At the end of the attached evaluation, we discuss the possible use of the Metal Speciation Equilibrium Model (MINTEQ) to address the issues raised in our response. If you would like more information on the implementation of this approach, please feel free to contact the STSC at (513)569-7300.

If you have additional questions about this assessment please feel free to contact the STSC.

Attachment

cc: J. Dinan (OS-230)
B. Means (OS-230)
T. O'Bryan (OPPT)
C. Sonich-Mullin (ECAO-Cin)
J. Van Buskirk (Region VI)

Printed on Recycled Paper

Attachment

Barium

Evaluation of Barium Desorption Pilot Study

This study was performed and reported by ChemRisk (1992) at the request of Dow Chemical. The study quantifies desorption of total barium from soil samples containing low and high concentrations (510 and 16,000 mg/kg, respectively) of barium under conditions intended to simulate the human gastric environment. It is stated that soil material was "...taken from an area impacted by barium sulfate." Based on this statement it is possible that the test samples were from the Superfund site, but this needs to be clarified.

An aqueous HCl solution of pH ½1.4 (0.04M) was used as the extraction medium. As indicated in the ChemRisk (1992) report, this pH is representative of gastric fluid pH (normal = <2.0) as reported in Appendix 3 of Clinical Diagnosis by Laboratory Methods (Davidsohn and Henry, 1974). An extraction ratio of 200 mg soil to 50 ml acid solution was chosen to reflect conditions in children. Although 200 mg/day is the default value for incidental soil ingestion by children 1-6 years old (U.S. EPA, 1989), it is uncertain whether 50 ml is an appropriate corresponding fluid volume. ChemRisk (1992) states that "...50 ml is a volume within the range of normal gastric fluid volumes (under basal conditions) for children (20-100 ml; Clinical Diagnosis by Laboratory Methods, 1974)." The basis for this statement appears to be an entry in Appendix 3 reporting that the normal value for fasting residual gastric fluid volume is 20-100 ml, but no age group is specified. Chapter 16 in the same book (Davidsohn and Henry, 1974) indicates that the fasting volume of gastric contents ranges from approximately 50-100 ml, and James (1957) assumes that the volume of fasting stomach contents is 50 ml. Neither Davidsohn and Henry (1974) or James (1957) specifically provide age data. Based on discussions related to these and other gastric data in the aforementioned books, however, it is more reasonable to assume that the reported gastric fluid volumes are for adults; 50 ml may or may not be a reasonable maximum volume in children. Other available reference sources provided no information on gastric fluid volumes in children (Oberhelman, 1968; Davenport, 1971; Guyton, 1981; ICRP, 1981; Johnson et al., 1987; Rotterdam and Enterline, 1989). Ideally, soil ingestion and gastric fluid volumes for children and for adults should be tested. An extraction ratio of 100 mg soil (default daily ingestion value for adults) to 100 ml acid solution (reasonable maximum adult fasting gastric fluid volume) may give a higher percentage extraction of barium, and hence could yield a higher soil ingestion exposure estimate and therefore a higher hazard quotient.

The soils were extracted with the acid solution for 1 hour at 37½C with gentle agitation. The extraction time apparently is intended to represent gastric residence. The basis for the

selection of the 1 hour time is unclear as the only statement in the ChemRisk (1992) report ["A large meal (comprising a majority of gastric capacity) is retained in the stomach for up to 4 hours...] cannot be verified using the cited reference (Davidsohn and Henry, 1974). Studies conducted by Oberhelman (1968) using food to which barium was added showed emptying times of 4-5 hours in normal subjects (apparently adult), but no additional information on these studies was reported. Oberhelman (1968) also indicates that other studies (no additional information reported) have showed emptying times ranging from 3-6 hours in normal adult subjects (i.e., without gastrointestinal disease). Data discussed by Davenport (1971) indicate that most of a meal was cleared from the stomach within 1-2 hours. These variations in emptying time are not surprising because rate of emptying is influenced by various factors, particularly the volume, osmotic pressure and chemical composition of the meal (Davenport, 1971). Fat content, for example, has a pronounced effect on emptying time and meals composed largely of fat can remain in the stomach for up to 20 hours (Davenport 1971). Based on the available information, the 1 hour extraction time appears to be a low estimate of emptying time. It would have been informative if a longer extraction time (or times) was tested because it is likely this would give a more conservative soil ingestion exposure estimate and hazard quotient for the same reasons as a decrease in soil/acid extraction ratio as discussed above.

The extraction conditions are obviously a simplistic simulation of actual gastric conditions. Gastric fluid, for example, is a complex solution containing digestive and nondigestive enzymes, mucus, electrolytes, serum proteins and miscellaneous substances in addition to hydrochloric acid (Davidsohn and Henry, 1974). Large meals can increase stomach content volume (e.g., to 1000 ml) and, by a dilution effect, pH of the gastric content to as high as 5 (James, 1957; Brunton, 1990). In general, however, the approach seems reasonable for a pilot study, although the specific conditions that were used do not appear to be conservative as discussed above.

Other aspects of the study are adequate for a pilot study. The quality control report indicates that the study was carefully performed and recoveries and precision were good. This was even true for the high concentration samples where the amounts desorbed were 2.4 and 2.5%. The reason for 2.4/2.6% desorption from the high concentration samples compared with 19% from the low concentration samples is not explained. Little information is available in the literature on the adsorption and desorption of barium. However, barium may form specific bonds with soil components as well as interact through nonspecific columbic or electrostatic interactions (Rai and Zachara, 1984). Interactions are particularly strong with iron and manganese oxides. The two soil samples used in the pilot study may have had very different properties which could explain why barium was more tightly bound (lower desorption) in the high concentration sample. Considering the large difference in desorption from the two soils, it would have been useful if the study included characterized soils and

more soil samples. However, the results of the study as performed appear to be valid.

Relevance of the Desorption Study to Barium Risk Assessment

According to the introduction section of the ChemRisk (1992) report, the intent of the desorption study is to develop the data necessary to enable adjustment of the soil ingestion exposure estimate to match the RfD which is based on data from drinking water ingestion. However, understanding the ChemRisk (1992) approach in using these data is complicated somewhat by imprecise, misleading and sometimes synonymous use of the terms absorption, bioavailability and uptake, as well as some incomplete reporting of information. For example, ChemRisk (1992) states that the RfD "...was based on the study conducted by Wones et al. (1990) that administered barium chloride in drinking water to 11 male volunteers." In fact, the RfD is based on both this study and an epidemiology study by Brenniman and Levy (1984). As discussed in U.S. EPA (1992), Brenniman and Levy (1984) compared human mortality and morbidity rates in populations ingesting elevated barium levels in their drinking water to populations ingesting very little or no barium. Although the NOAEL on which the RfD is based (10 mg Ba/L or 0.21 mg Ba/kg/day) is the same in both studies, the form of barium in the drinking water in the Brenniman and Levy (1984) study is not defined.

ChemRisk (1992) cites only part of the guidelines that specifically address adjustment for medium of exposure [Appendix A (Section A.3, pages A-3 and A-4) of RAGS HHEM Part A (U.S. EPA, 1989)]. This part of the guidelines indicates that estimates of the relative absorption efficiencies of a substance in the different media are needed for the adjustment. ChemRisk (1992) fails to acknowledge, however, the rest of these guidelines which state "In the absence of a strong argument for making this adjustment or reliable information on relative absorption efficiencies, assume that the relative absorption efficiency between food or soil and water is 1.0." ChemRisk (1992) also does not acknowledge that Chapter 8 (Section 8.1, page 8-5) of RAGS more strongly states that although adjustment for medium of exposure is occasionally appropriate, it is "...not generally recommended unless there is a strong argument for doing so." As discussed below, the desorption study provides informative preliminary data but an insufficient basis for deriving actual adjustment values.

Adjusting for differences between the RfD based on barium chloride and other soluble forms of barium in water to water-insoluble barium sulfate in soil involves considering both bioavailability and absorption. Bioavailability is an important concern in this assessment because only the barium sulfate that desorbs from soil in the gastrointestinal tract will be available for absorption (i.e., bioavailable). The hazard quotient (ratio of soil ingestion exposure dose to RfD) therefore has to reflect relative bioavailabilities as well as relative absorption

efficiencies of the different forms of barium between the media. The soil desorption values are essentially bioavailability adjustment factors and are potentially useful for adjusting the numerator (exposure dose) of the Hazard Quotient. The denominator (RfD) of the Hazard Quotient needs no adjustment for bioavailability because bioavailability (particularly of barium chloride) from drinking water can be assumed to be 100%. This essentially is the approach taken by ChemRisk (1992) except that the adjustment is erroneously referred to as an absorption adjustment. The desorption study provides no data on oral absorption of barium sulfate from soil, and does not consider existing data on absorption of barium compounds by oral and other routes. As mentioned above, the OPPT Bioavailability/Absorption Review of Barium Sulfate (6/3/92 memo) concluded that there is little, if any, difference in the gastrointestinal absorption of barium by rats from oral administration of a solution of barium chloride or suspension of barium sulfate in water. Based on this in vivo evidence of similar oral absorption of barium chloride and sulfate (McCauley and Washington, 1983), no adjustment is needed for relative absorption of the different forms of barium in the Hazard Quotient (i.e., the relative absorption is 1).

We have taken the position in previous assessments that the Agency's RfDs and other toxicity values are medium-specific for water, diet or gavage vehicle only when specified and that adjustment for ingestion of chemicals in soil is necessary only when data clearly show a difference between absorption from soil versus water, diet or gavage scenarios. As for many other chemicals, the Agency has not explicitly discussed medium specificity in deriving the RfD for barium. The RfD applies to total barium, but its derivation does not consider toxicity from media other than water or from barium sulfate (or other poorly water soluble barium compounds) because relevant data were not available. As discussed above, there is no evidence indicating that oral absorption of barium from barium chloride or sulfate substantially differs at the low doses anticipated in environmental exposure situations. The desorption study provides information suggesting that bioavailability of barium sulfate from soil is much less than that from water. However, as previously discussed, EPA guidelines clearly indicate that adjustment for medium of exposure is not generally recommended unless there is a strong argument for doing so. In general, study limitations as discussed above indicate that, at this time, although data from the pilot study suggest that adjustment for medium of exposure may be appropriate, the data are not conclusive and are not adequate for quantifying an actual bioavailability factor for barium sulfate in soil.

One of the main problems with the pilot study is the nonconservative approach taken by ChemRisk (1992) in designing the experiment, particularly in the selection of extraction ratio and time, and the lack of information regarding the soil samples tested. If only one combination of extraction ratio and time could be tested, it would have been far more appropriate to select conservative conditions as the basis for possible

adjustment of the exposure dose. The wide range of extraction efficiencies, 2.4/2.6% and 19%, is problematic because soils with only two concentrations of barium were tested, only two soil samples per concentration were tested, and soil types were not characterized. ChemRisk (1992) concluded that there appears to be a concentration and/or extractant volume dependence to the extraction efficiencies, but soil properties could explain the variation as discussed above. Additionally, it is unclear if the soil samples were from the actual site.

Additional uncertainties and limitations of the pilot study include the following: 1) Speciation of the desorbed barium was not determined. Speciation may be different for barium desorbed from barium sulfate-contaminated soil than for barium from the chloride or sulfate in water and bioavailabilities of all species may not be the same. 2) Desorption was quantified in simulated gastric fluid, whereas absorption will occur in the small intestine, which has a very different chemical environment. This limitation could be addressed by adding a neutralization step to the extraction procedure to simulate the intestinal environment.

Consideration might be given to using EPA's Metal Speciation Equilibrium Model (MINTEQ) to explore both of the above limitations along with the problem of soil type. This model has been applied to predicting speciation of metals (e.g. lead) in the gastrointestinal tract. Given certain assumptions about which barium species would be substrates for transport in the gastrointestinal epithelium, MINTEQ could be used to estimate relative bioavailabilities of barium compounds in chemically characterized soil types.

References

Brenniman, G.R. and P.S. Levy. 1984. Epidemiological study of barium in Illinois drinking water supplies. In: Advances in Modern Environmental Toxicology IX, E. J. Calabrese, R.W. Tuthill and L. Condie, Ed. Princeton Scientific Publications, Princeton, NJ. pp. 231-240.

Brunton, L.L. 1990. Agents for gastric acidity and peptic ulcers: Antacids. In: The Pharmacological Basis of Therapeutics, 8th ed, A. Goodman Gilman, T.W. Rall, A.S. Nies and P. Taylor, Eds. Pergamon Press, New york. p. 905.

ChemRisk. 1992. Barium desorption study summary. Prepared by ChemRisk, A division of McLaren/Hart, Cleveland, OH. September 9, 1992.

Davenport, H.W. 1977. Gastric digestion and emptying; absorption. In: Physiology of the Digestive Tract, 3rd ed., Year Book Medial Publishers Inc, Chicago. pp. 165-168.

Davidsohn, I. and J.B. Henry. 1974. Clinical Diagnosis by Laboratory Methods, 15th ed. W.B. Saunder Co, Philadelphia. pp.

887-904, 1387.

Guyton, A.C. 1981. Textbook of Medical Physiology, 6th ed. W.B. Saunders Co, Philadelphia.

ICRP. 1981. Report of the Task Group on Reference Man. International Commission on Radiological Protection Publication No. 23. Pergamon Press, Oxford.

James, A.H. 1957. The effects of eating on gastric acidity. In: The Physiology of Gastric Digestion. Edward Arnold Publishers Ltd., London. pp. 44-46.

Johnson, L.R., J.C. Christensen, M.J. Jackson, E.D. Jacobson and J.H. Walsh, Eds. 1987. Physiology of the Gastrointestinal Tract, Second Edition. Volumes 1 and 2. Raven Press, NY.

McCauley, P.T. and I.S. Washington. 1983. Barium bioavailability as the chloride, sulfate, or carbonate salt in the rat. Drug Chem. Toxicol. 6(2): 209-217.

Oberhelman, H.A., Jr. 1968. Gastric secretion and motility, In: Physiological Principles of Gastric Surgery. Charles C Thomas Publisher, Springfield, IL. pp. 17-20, 40.

Rai, D. and J. M. Zachara. 1984. Chemical Attenuation Rates, Coefficients, and Constants in Leachate Migration. Volume 1: A Critical Review. Prepared by Battelle Pacific Northwest Laboratories, Richland, WA for the Electric Power Research Institute, Palo Alto, CA. EPRI EA-3356. DE84-009432. pp. 6-1 - 6-6.

Rotterdam, H. and H.T. Enterline. 1989. Physiology. In: Pathology of the Stomach and Duodenum. Springer-Verlag, London.

U.S. EPA. 1989. Risk Assessment Guidance for Superfund. Volume I. Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington, DC. EPA/540/1-89/001.

U.S. EPA. 1992. Integrated Risk Information System (IRIS). Online. Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH.

Wones, R.G., B.L. Stadler and L.A. Frohman. 1990. Lack of effect of drinking water barium on cardiovascular risk factor. Environ. Health Perspect. 85: 1-13.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 3 1992

MEMORANDUM

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

SUBJECT: Bioavailability of Barium Sulfate

FROM: Terry O'Bryan (TS-778) Terry O'Bryan
Chemical Assessment Desk
Office of Pollution Prevention and Toxics

TO: Ghassan Khoury (6H-SR)
Hazardous Waste Management Division
EPA Region 6

RECEIVED
92 JUN -4 PM 1:23
SUPERFUND

This is in response to your 5/28/92 inquiry on barium sulfate. I understand that barium is driving the risk assessment at a Region 6 Superfund site (barium accounts for 92% of the soil contaminants at the site). There is an IRIS reference dose (RfD) for barium chloride, but the PRP questions its applicability to the much less soluble barium sulfate.

In 1989, Dr. Leonard Keifer of the then Office of Toxic Substances evaluated the bioavailability of barium sulfate in response to a petition to delist this chemical from the Toxics Release Inventory. The evaluation indicates that there is little, if any, difference in absorption at low doses following oral administration. Barium sulfate is believed to be converted to barium chloride in the stomach. Differences would be likely following massive doses because of the much lower water solubility of barium sulfate. However, for the doses for which we have data barium sulfate is absorbed from the GI tract to approximately the same extent as barium chloride. In the McCauley and Washington (1983) study which reported similar absorption rates for the two salts, the administered oral dose was 0.5 mL/100g b.w of 10 mg/L of Ba solution OR 5 μ/kg. No comparative oral absorption data exist for higher doses, but clinical data indicate significant uptake within four hours. Consequently, the slower absorption rate of barium sulfate relative to barium chloride would seem to have more relevance to acute exposure situations rather than chronic exposures, the basis for the RfD.

Absorption rates differ between the two salts following inhalation exposure, but measured differences are less than one order of magnitude. Attached is a copy of Leonard Keifer's evaluation. He has not done any additional work on this topic, but you can reach him at (202) 260-1548 if you have questions.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 8 1989

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

MEMORANDUM

SUBJECT: Bioavailability/Absorption Review of Barium Sulfate in Response to a Petition to Delist the Material from the Toxic Emissions Inventory

FROM: Leonard C. Keifer, Ph.D.
Chemist
Metabolism/Structure Activity Section
Toxic Effects Branch
Health and Environmental
Review Division (TS-796)

TO: Flora Chow
Technical Integrator
Chemical Review and Evaluation Branch
Health and Environmental
Review Division (TS-796)

THRU: Pauline Wagner
Section Chief
Metabolism/Structure Activity Section
Toxic Effects Branch
Health and Environmental
Review Division (TS-796)

I. INTRODUCTION

Barium sulfate ($BaSO_4$, CAS No. 7727-43-7) is a solid with low water solubility (2.46 mg/L @ 25°C). The molecular weight is 233.

A water-soluble barium (Ba) compound used in several studies to compare the bioavailability of Ba from its salts is barium chloride ($BaCl_2$) with water solubility of 375,000 mg/L (375 g/L) @ 26°C and molecular weight of 208.

II. CONCLUSIONS

The barium ion from $BaSO_4$ is absorbed slowly into the animal system as the compound dissolves. This bioavailability has been observed following intramuscular injection, oral dosing, and inhalation or intratracheal instillation. Following intratracheal

instillation in rats, approximately 1.3% of the Ba from a dose of 2.8 μg of $BaSO_4$ was absorbed via solubilization. From in vivo and in vitro studies with freshly precipitated and heat treated $BaSO_4$ the physical form of the $BaSO_4$ appears to have a profound influence on the amount of Ba available from the compound. For small doses of $BaSO_4$ administered orally there is little, if any, difference in the amount of Ba absorbed when compared to the much more water soluble $BaCl_2$. When massive doses of $BaSO_4$ (60 to 400 g) were given orally to human subjects as a contrast medium for x-ray diagnoses approximately 10 to 100 μg of Ba above background was excreted in the urine in 24 hours.

III. BASES FOR CONCLUSIONS

Thomas et al. (1973) studied the solubility (or more appropriately the bioavailability) of Ba from several of its salts in vivo in the rat using the radioisotope ^{133}Ba. The compounds of interest were the chloride, sulfate, and an aluminosilicate clay containing Ba fused at 1,100°C. The compounds, with the exception of the chloride, were aerosolized, collected on a membrane filter, resuspended in distilled water, and 0.5 mL of the suspension was injected into the right hind leg of rats. The clay was used as an example of a Ba compound from which Ba was not expected to be available. The authors measured the rate at which ^{133}Ba left the injection site. ^{133}Ba from $BaCl_2$ was gone from the injection site within 3 days whereas ^{133}Ba from the clay migrated from the injection site with a halflife of approximately 1,390 days (3.8 years) or nearly twice the average lifespan of the rat. Intermediate between these two extremes was $BaSO_4$ with a halflife of 26 days. The authors also calculated the dissolution rate for the clay and $BaSO_4$ in terms of grams dissolved per cm^2 of surface of the particles injected per day: $BaSO_4$, 6.9×10^{-7} g/cm^2/day, and clay, 2.3×10^{-8} g/cm^2/day.

Cuddihy et al. (1974) exposed groups of three beagle dogs via inhalation to aerosols of $BaCl_2$, freshly precipitated $BaSO_4$, heat treated $BaSO_4$, or Ba fused in clay; exposure conditions were not reported. In addition they collected samples of the aerosols on membrane filters for use in an in vitro dissolution study. The collected aerosol particles were placed between two membrane filters and placed into simulated blood plasma. The samples were placed into fresh solvent after 4 hours and thereafter at frequent intervals for 20 days. The clay samples were subsequently placed into fresh solvent every 10 days from day 20 to day 50 and then every 50 days to a total of 125 days.

The $BaCl_2$ in the in vitro study dissolved with a halflife of approximately 1 hour while the clay dissolved with a halflife of 430 days. The $BaSO_4$ samples had halflives intermediate between the $BaCl_2$ and the clay, values were not reported. After 20 days approximately 40% of the heat treated and 7% of the freshly precipitated $BaSO_4$ remained on the filter. By comparison essen-

4/

tially none of the ^{133}Ba from $BaCl_2$ remained of the filter after 1 day and 80% of the ^{133}Ba from the clay remained on the filter after 125 days (Cuddihy et al., 1974).

In the in vivo portion of the study Cuddihy et al. (1974) showed that for $BaCl_2$ approximately 50% of the initial body burden of ^{133}Ba (amount not reported) was translocated to the skeleton by day 16. For $BaSO_4$, approximately 35% of the ^{133}Ba from freshly precipitated and 20% from heat treated compound was translocated to the skeleton by day 16; at the same time approximately 5% of freshly precipitated and approximately 30% of heat treated compound remained in the lung. By comparison only approximately 2% of the ^{133}Ba from the clay was translocated to the skeleton in 16 days and approximately 50% remained in the lung. Even at 500 days less than 5% of the ^{133}Ba from the clay had translocated to the skeleton while nearly 10% remained in the lung. It should be kept in mind, especially for the two forms of $BaSO_4$, that there is the possibility that at least some of the ^{133}Ba in the skeleton may have been absorbed from the GI tract since we do not know the exact method of exposure and at least a portion of the initial body burden could have been swallowed during or immediately after exposure.

Takahashi and Patrick (1987) administered a suspension of $^{133}BaSO_4$ in mannitol to 26 male Fischer 344 rats via intratracheal intubation; the average dose was 2.8 μg of $BaSO_4$ per rat. Rats were killed at intervals up to 24 weeks post-administration. The trachea, in two pieces divided 5 mm below the tracheostomy; the bronchi including the tracheal bifurcation; the larynx including the pharynx; the lung lobes; the thoracic and cervical lymph nodes; and the remaining carcass were collected when each rat was killed. The halflife for clearance from the lower half (caudal) of the trachea was 88 days and that from the upper half (cranial, including the site of the tracheostomy) was 66 days. The percentage of the initial dose of ^{133}Ba present in the trachea was highest at week one: caudal, 0.41 ± 0.13%, and cranial, 4.0 ± 1.2%. The percent of the dose present in the larynx, bronchi, and lymph nodes were also highest (but lower than that present in the trachea) at week one. In contrast the percent of dose reached a maximum (1.3%) in the lung at 4 weeks post-administration. The amount of ^{133}Ba in all of these tissues decreased steadily over the remainder of the study. The percentage of the dose present in the remaining carcass reached a maximum of approximately 1.3% at 4 weeks post-administration and remained constant throughout the remainder of the study; the study authors attributed this to the translocation of some of the ^{133}Ba to the skeleton although they did not specifically analyze bone for the presence of ^{133}Ba. According to the authors, clearance from the trachea does not necessarily indicate solubilization of the $BaSO_4$ since only 0.001 to 0.003% of the dose was present in the blood of rats at 24 hours and 30 days, respectively, while greater than 90% of the dose was cleared from the trachea over the same period. It was, however, pointed out by

the authors that the percentage of the dose translocated to the bones was via the solubilized Ba ion.

McCauley and Washington (1983) dosed fed male Sprague-Dawley rats with either $BaCl_2$ or $BaSO_4$ labeled with ^{131}Ba and fasted rats with ^{131}Ba labeled $BaCl_2$; doses were 0.5 mL/100g body weight of 10 mg/L of ^{131}Ba solution. Within 15 minutes of dosing the blood Ba level in the fasted rats dosed with $BaCl_2$ was at a maximum (0.35 expressed as counts per minute(CPM)/mL blood divided by administered CPM/g body weight; by 4 hours postdosing the Ba level had fallen to approximately 50% of the maximum level. The blood Ba level in fed rats dosed with $BaCl_2$ reached a maximum (0.28) at 60 minutes postdosing. In fed rats dosed with $BaSO_4$ the blood Ba level reached a maximum (0.19) at 60 minutes postdosing and was approximately 80 - 90% of the levels reached in the $BaCl_2$-dosed rats. Ba levels in the eye, an organ known to accumulate Ba, were nearly the same for $BaCl_2$- and $BaSO_4$-dosed rats after 60 minutes (0.48 CPM/g eye/admin. CPM/g body weight); at 120 min the Ba level in the eye for the $BaCl_2$-dosed rats had increased to a level of 0.68 and that for the $BaSO_4$-dosed rates to 0.52. Although data in terms of percent of administered dose were not presented, the authors concluded that $BaCl_2$ and $BaSO_4$ at the doses used in this study are absorbed to approximately the same extent from the rat GI tract, presumably by conversion of $BaSO_4$ to $BaCl_2$ in the stomach.

In the course of conducting GI tract X-ray diagnoses on 10 patients, Mauras et al. (1983) studied the absorption of Ba as indicated by both increased Ba levels in the blood and increased Ba levels in 24-hour urine samples. Each patient was given 350 g of $BaSO_4$ in 220 mL of water (210 g of Ba ion). Blood was drawn prior to administration of the $BaSO_4$ and at 0.5, 1, 2, 4, 8, and 24 hours post-administration. In addition a 24-hour urine sample was collected before and one after administration of the $BaSO_4$. Statistical significance was determined using the method of Wilcoxon. The average blood Ba level before administration was 0.76 µg/L; levels were not significantly increased until 4 (2.53 µg/L, significance at 1%) and 8 (1.31 µg/L, significance at 5%) hours after administration. Average pre-administration urine Ba levels were 4.2 µg/24h; average post-administration levels were 13.4 µg/24h (significant at 1%).

In a separate study using radio-opaque contrast materials, Claval et al. (1987) administered six different contrast formulations orally and four were administered rectally to patients. $BaSO_4$ content of the contrast materials ranged from 57.5 g to 400 g per dose. Urine was collected for 24 hours post-administration. For all of the formulations administered orally the Ba excretion in the urine, expressed on a per gram of administered Ba basis, was fairly constant; the range was 0.16 µg/g of Ba administered to 0.26 µg/g of Ba. For the formulations administered rectally the Ba excretion in the urine was approximately an order of magnitude less than for the orally-administered formulations; the range was 0.023

$\mu g/g$ of Ba to 0.096 $\mu g/g$ of Ba. These results suggest that passage through the stomach increases the bioavailability of Ba, presumably by conversion of a small amount of $BaSO_4$ to $BaCl_2$.

high conc. of $BaSO_4$

REFERENCES

Cuddihy RG, Hall RP, Griffith WC. 1974. Inhalation exposures to barium aerosols: Physical, chemical and mathematical analysis. Health Phys. 26:405-416.

Claval JP, Lorillot ML, Buthiau D, Gerbet D, Heitz F, Galli A. 1987. Absorption intestinale du baryum lors d'explorations radiologiques. Therapie 42:239-243.

Mauras Y, Allain P, Roques MA, Caron C. 1983. Ètude de l'absorption digestive du baryum après l'administration orale du sulfate de baryum pour exploration radiologique. Therapie 38:107-118.

McCauley PT, Washington IS. 1983. Barium bioavailability as the chloride, sulfate, or carbonate salt in the rat. Drug Chem. Toxicol. 6(2):209-217.

Takahashi S, Patrick G. 1987. Long-term retention of ^{133}Ba in the rat trachea following local administration as barium sulfate particles. Rad. Res. 110:321-328.

Thomas RG, Ewing WC, Catron DL, McClellan RO. 1973. In vivo solubility of four forms of barium determined by scanning techniques. Amer. Ind. Hyg. Assoc. J. 34(8):350-359.

Appendix #7

TABLES

LIST OF TABLES

TABLE #1 - SURFACE SOIL SAMPLING RESULTS SUMMARY

TABLE #2 - SUBSURFACE SOIL SAMPLING RESULTS FROM AREAS OF HISTORICAL USE

TABLE #3 - SUBSURFACE SOIL SAMPLING RESULTS FROM MONITORING WELL INSTALLATION

TABLE #4 - SUBSURFACE SOIL SAMPLING RESULTS NEAR WELL G-22

TABLE #5 - SUBSURFACE SOIL SAMPLING RESULTS NEAR WELL G-23

TABLE #6 - SUBSURFACE SOIL SAMPLING RESULTS NEAR BORING SB-30

TABLE #7 - SUBSURFACE SOIL SAMPLING RESULTS FROM THE FORMER IMPOUNDMENT AREA

TABLE #8 - GROUND WATER SAMPLING RESULTS SUMMARY

TABLE #9 - SURFACE WATER SAMPLING RESULTS SUMMARY

TABLE #10 - ONSITE SEDIMENT SAMPLING RESULTS SUMMARY

TABLE #11 - CHEMICALS DETECTED ONSITE USED IN THE RISK ASSESSMENT

TABLE #12 - POTENTIAL EXPOSURE PATHWAYS

TABLE #13 - CARCINOGENIC POTENCIES (ORAL SLOPE FACTORS)

TABLE #14 - NONCARCINOGENIC REFERENCE DOSES

TABLE #15 - SUMMARY OF POTENTIAL CARCINOGENIC RISKS

TABLE #16 - SUMMARY OF POTENTIAL NONCARCINOGENIC RISKS

TABLE #17 - CUMULATIVE POTENTIAL RISKS - TRESPASSER

TABLE #18 - CUMULATIVE POTENTIAL RISKS - FUTURE RESIDENTIAL

TABLE #19 - CUMULATIVE POTENTIAL RISKS - OCCUPATIONAL

TABLE #20 - D.L. MUD RISK ASSESSMENT UNCERTAINTIES

TABLE #21 - CHEMICALS OF CONCERN FOR SURFACE SOILS

Table #1

SURFACE SOIL SAMPLING RESULTS SUMMARY

Table # 1

Surficial Soil Samples Above Maximum Background Surficial Soil Concentrations

Parameters	Maximum Background	G-20 (0-1)	G-21 (0-1)	G-22 (0-1)	G-23 (0-1)	HA-1 (0-1)	HA-2 (0-1)	HA-3 (0-1)	HA-4 (0-1)	HA-5 (0-1)	HA-6 (0-1)	HA-7 (0-1)	HA-8 (0-1)	HA-9 (0-1)	HA-10 (0-1)	HA-11 (0-1)	HA-12 (0-1)	HA-13 (0-1)	HA-14 (0-1)
Inorganics (mg/kg)																			
ARSENIC	6.6	11.5	8.2	6.8	9		7.7	16.6	12	10.5	18.9	7.4	7.9	8.4	7.7	16	11.6	7.7	9.4
BARIUM	662	11500	10100	13500	998				6900	8300	6930	11300	13000	7160	12200	9120	7890	11300	7680
CALCIUM	3540	9080	64700						6560	7260	9170		110000	39700	70700	65200	18500	97500	44500
CHROMIUM (TOTAL)	17.4	21.1	31.7	32.2	17.7		18.2	21.1	115	153	188	30	46.8	20.9	53.5	58.2	99.4	47	54.7
COBALT	10.6			14.3					13.4	13.9	13.6	16.9	26.5	13.3	15.9		11.1	11.8	12.5
COPPER	13.8	25.2	27.3	20.4				14.1	42	52.9	71	13.8	28.5	14.9	23	25.8	29.9	22.2	28.4
LEAD	27.1	89.2	136	148				71.8	502	390	643	242	153	56.1	151	287	609	190	270
NICKEL	10	16	19.1		10			11.5	13.3	11.7	13.1		21.4		17			10.4	7.5
SILVER	1.6FJB						1.7F		2.4	1.8F	2.5		1.6FJB		1.9FJB	2.8JB	2.6JB	1.9	2.4
ZINC	37.1	181	331	197	259				827	1080	1350	123	816	249	954	920	1380	463	754

Blank space indicates parameter was either below the method detection limit or the parameter was below the maximum background concentration detected

B - Blank contamination

F - Inorganic data below contract required quantitation limit

J - Estimated value

Table # 1

Table #2

SUBSURFACE SOIL SAMPLING RESULTS FROM AREAS OF HISTORICAL USE

Table # 2

Subsurface Soil Concentrations Above Background Surficial Soil Values

for Confirmatory Boring Samples

Parameters	MAX BKGD	HA-3(2-3)	HA-3(4-5)	HD-01(2-3)	HD-01(4-5)	HD-03(2-3)	HD-03(4-5)	SB-1(1.5-3.5)	SB-1(8-10)	SB-2(3-5)	SB-2(8-10)	SB-3(1.5-3.5)	SB-3(8-10)	SB-4(2-4)	SB-4(8-10)	SB-5(3-5)	SB-5(8-10)
Inorganics (mg/kg)																	
ALUMINUM	14200	25000		23600		17500	21700	17000	17400	17000		25700	19500	25300	18200	18100	16300
BERYLLIUM	0.61B	1.1	0.7	0.97XJ		0.62XJ	0.66XJ	0.94F	1.1F	0.94F	0.75F	1F	2.1	1.1F	0.98F	0.83F	2.2
CHROMIUM (TOTAL)	17.4	27.5	45.9	28.4		18	22.3	19.8	21.8	19.9		27.6	26.3	25.4	21.9	22.7	21.4
IRON	22100	24000		40800			22400	23100				28000	27800	26200			26800
MAGNESIUM	1260	2240	1370	2230		1840	1910	1910	3930	1770	2060	2730	5610	2620	3030	1970	4760
NICKEL	10	21	14.6	18		13	13.5	16.9	16.8	16.3		22.8	34.1	25.8	19.2	12.9	35

Results presented on dry-weight basis

Blank values indicate the parameter is below background concentration

J - Estimated value

X - Estimated value, pH out of range

F - Inorganic data below contract required quantitation limit

B - Blank contamination

Table # 2

Table #3

SUBSURFACE SOIL SAMPLING RESULTS FROM MONITORING WELL INSTALLATION

Table # 3

Subsurface Soil Concentrations Above Background Surficial Soil Values for Monitoring Well Samples

Parameters	Maximum Background	D-6(17-18)	D-7(15-18)	G-20(2-3)	G-20(5-6)	G-21(2-3)	G-21(5-6)
Inorganics (mg/kg)							
ALUMINUM	14200		14500	21900		22400	14200
BERYLLIUM	0.61B	0.77F	1F	0.78F	0.65F	0.86F	0.87F
CHROMIUM (TOTAL)	17.4	18.6JSD	19.1JSD	19.4		19.2J	20.4J
IRON	22100		23000			24900J	26400
MAGNESIUM	1260	3120	4780	1830	1730	1910	1440
NICKEL	10	14.9	29.6	16.3	11.1	20.9J	

Results presented on dry-weight basis

Blank space indicates parameter was below maximum background value.

J - Estimated value

S - Matrix spike recoveries - outside control limits

D - Inorganics - Duplicate control limits exceeded

F - Inorganic data below contract required quantitation limit

B - Blank contamination

Table #4

SUBSURFACE SOIL SAMPLING RESULTS NEAR WELL G-22

Table # 4

Subsurface Samples
Near Well G-22
Above Maximum Background Surficial Soil Concentrations

Parameters	Maximum Background	"Source" Samples				Extent Samples				
		G-22 (8.6-9.6)	G-22-A (8-10.5)	G-22-B (10-12)	G-22-C (8-10)	G-22 (2-3)	G-22 (5-6)	G-22-A (13.5-14.5)	G-22-B (14-15)	G-22-B3 (8-10)
Inorganic (mg/kg)										
ANTIMONY			9.7JS	9.9JS	9.6JS			9.6JS		
BERYLLIUM	0.61B	1.1	1.1F	1F	1.1F	1.1	0.68F			
IRON	22100					24500				
ZINC	37.1	44.7	51.8JS	60.9JS	71.7JS	51.7		47.2	69.6JS	
Inorganics(μg/kg)										
2-METHYLNAPHTHALENE	47JC	5200E	2400	5300R	1300					
DIBENZOFURAN		470	350J	1300R	220J					
FLUORENE		660	500JC	1900R	340JS					
NAPHTHALENE		1200	600	1600R	170J					
TOTAL XYLENES		180	52	48	6J					2J

Blank space indicates parameter was either below the method detection limit or the parameter was below the maximum background concentration detected.

J - Estimated value

C - Instrument calibration problem

E - Interference problem

B - Blank Contamination

S - Matrix spike recoveries-outside control limits

F - Inorganic data below contract required quantitation limit

R - Rejected

Table # 4

Table #5

SUBSURFACE SOIL SAMPLING RESULTS NEAR WELL G-23

Table # 5

Subsurface Samples
Near Well G-23
Above Maximum Background Surficial Soil Concentrations

Parameters	Maximum Background	"Source" Samples				Extent Samples				
		G-23(1-2)	G-23-B(0.8-1.8)	G-23-G(4.0-5.0)	G-23-E(1.5-2.5)	G-23(2-3)	G-23(5-6)	G-23-B(3.5-4.5)	G-23-E(3.5-4.5)	G-23-G(6.0-7.0)
Inorganics (mg/kg)										
ANTIMONY				10.3						
ARSENIC	6.6	11.7	16.1		18.5JS	9.1		11.6JS	11.4JS	
LEAD	27.1	528	397	34.9JD	608JD					
MERCURY		0.42	0.83	0.087F	1.6			0.082F	0.15	0.098F
SELENIUM	0.6UJS	1J								

Blank space indicates parameter was either below the method detection limit or the parameter was below the maximum background concentration detected.

J - Estimated value

S - Matrix spike recoveries--outside control limits

D - Inorganics-duplicate control limits exceeded

Table # 5

Table #6

SUBSURFACE SOIL SAMPLING RESULTS NEAR BORING SB-30

Table # 6

Subsurface Samples
Near Boring SB-30
Above Maximum Background Surficial Soil Concentrations

Parameters	Maximum Background	"Source" Samples			Extent Samples		
		SB-30-2	SB-30-E(1.5-2.5)	SB30K(1.0-2.0)	SB-30-5	SB30K(4.5-6.0)	SB30N(0-2.0)
Inorganics (mg/kg)							
LEAD	27.1	98.4JSD		69JSD			40.7JSD
MERCURY		0.19		0.18			0.14
SELENIUM	0.6UJS	0.99F	1F	0.64F			1.4
ZINC	37.1	79 1JS	125JS	77.2JS	58.4JS		63.2JS

Results presented on dry-weight basis

J - Estimated value

S - Matrix spike recoveries - outside control limits

D - Inorganics - duplicate limits exceeded

Table # 6

Table #7

SUBSURFACE SOIL SAMPLING RESULTS FROM THE FORMER IMPOUNDMENT AREA

Table # 7

Subsurface Samples in
Former Impoundment Area
Above Maximum Background Surficial Soil Concentrations

Parameters	Maximum Background	"Source" Samples			Extent Samples					
		TR1_(5)	TR2_(4)	TR3_(7)	TR1(7)	TR2(6)	TR3(9)	TR4COMP	TR5COMP	TR6COMP
Inorganics (mg/kg)										
LEAD	27.1	58.1	34.7	40.9						
MERCURY		0.2	0.1	0.2	0.1					
SODIUM	1150		1460JB	1260JBF						
ZINC	37.1	52.6JDE	60.7JDE	66.9JDE			52.2JDE			
Organics(μg/kg)										
2-METHYLNAPHTHALENE	47J	660	590J	180J						
PHENANTHRENE		180J	480J	220J						
TOTAL XYLENES		3J		9	9					

Blank space indicates parameter was either below the method detection limit or the parameter was below the maximum background concentration detected.

J - Estimated value

B - Blank contamination

D - Inorganics - duplicate control limits exceeded

E - Interference problem

Table # 7

Table #8

GROUND WATER SAMPLING RESULTS SUMMARY

Table # 8

Unfiltered Groundwater Concentrations Above MCLs

Parameters	MCL	D-1		D-2		D-3		D-4		D-5		D-6		D-8			G-20	G-21	G-22	G-23
	(µg/L)	Dec 90	Jan 91	Jan 91	Jan 91	Dec 90	Jan 91	Dec 90	Jan 91	Sep 91	Oct 91	Dec 90	Jan 91	Dec 90	Oct 91	Apr 91	Oct 91	Oct 91	Oct 91	Oct 91
Inorganics (µg/L)																				
CHROMIUM, TOTAL	100	459	413			593		238	852	490			259							
LEAD	15[1]													18	17JS		59JS	29JS	55JS	31JS
SELENIUM	10										11JS				13JS				13JS	
Organics (µg/L)																				
BIS(2-ETHYLHEXYL)PHTHALATE	4[2]			17C																3J
METHYLENE CHLORIDE	5[2]							10B								27B				

1 - EPA Action Level

2 - Proposed MCL

Blank spaced indicate concentrations below MCLs

J - Estimated value

S - Matrix spike recoveries outside control limits

B - Blank contamination

Table # 8

Table #9

SURFACE WATER SAMPLING RESULTS SUMMARY

Table # 9

Unfiltered Surface Water Concentrations Above MCLs or Background Maximum Values																
Parameters	Maximum Background	Federal Freshwater AWQC(µg/L)		MCL	SW - 2		SW - 5		SW - 6		SW - 7		SW - 8		SW - 9	
	(µg/L)	Acute	Chronic	(µg/L)	Dec 90	Jan 91	Dec 90	Jan 91	Dec 90	Jan 91	Dec 90	Jan 91	Dec 90	Jan 91	Dec 90	Jan 91
Inorganics (µg/L)																
ARSENIC	3F	360	190	50		NA			4.7F				6 5F			3.9F
BARIUM	150F	--	--	2000		NA			2040				6090			
CALCIUM	12200	--	--	--		NA	20300		29500	28100	19600	17100	33900	26700	28900	
CHROMIUM	8F	984	117	100		NA	12 2		17 2		13.6		63.9	8.8F		
COPPER	14.7F	9.22	6.54	--		NA	16F	14 3F	16.7F	10F	30.4	13.4F	30.7	11.2F	9.1F	21.9F
LEAD	4.6	33.8	1.32	15[1]	2.8F	NA	14 2	2 1F	21.3	9.3	6.6	2.5F	66 3	9.9	1 5FJS	2F
NICKEL	12 9F	789	87.7	--		NA	15.8F	16F		14.6F	22.5F				49.3	22 6F
SILVER		1.23	--	50		NA	5.3F						5.8F		6.1F	
ZINC	76 4JB	65.0	58 9	--		NA	405		299	175	89.4	184	705	171	178	
Organics (µg/L)																
BIS(2-ETHYLHEXYL)PHTHALATE				4[2]		NA	7JCB	NA	5JCB	NA		NA	6JCB	NA		NA

-- Not applicable

NA = Not Analyzed

Blank entries indicate concentrations below MCLs or maximum background values

1 - EPA action level

2 - Proposed MCL

J - Estimated value

C - Instrument calibration problem

B - Blank contamination

F - Inorganic data below contract required quantitation limit

Table # 9

Table #10

ONSITE SEDIMENT SAMPLING RESULTS SUMMARY

Table # 10

Onsite Sediment Samples Above Maximum Background Sediment Concentrations

Parameters	Maximum Background	Station ID					
		SD-2	SD-5	SD-6	SD-6A	SD-8	SD-9
Inorganics (mg/kg)							
ARSENIC	5.6		6.7	9.4	7.2JS	10.5	
CADMIUM		1.7F	1.5FJB	2.1		13.5	
COPPER	22.6	22.7JBDE	24.5JB	25.3JB	23.4	56.8	23.9JB

Blank space indicates parameter was either below the method detection limit or the parameter was below the maximum background concentration detected.

B - Blank contamination

D - Inorganics—duplicate control limits exceeded

E - Interference problem

F - Inorganic data below contract required quantitation limit

J - Estimated value

S - Matrix spike recoveries-outside control limits

Table #11

CHEMICALS DETECTED ONSITE USED IN THE RISK ASSESSMENT

Table # 11

Chemical Constituents Identified in Onsite Groundwater

Inorganic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ALUMINUM	19	18	95%	33	52500	10401	181495	ug/L
ANTIMONY	19	1	5%	65	65	20	23	ug/L
ARSENIC	19	18	95%	1.1	43	18	59	ug/L
BARIUM	19	19	100%	212	1430	490	661	ug/L
BERYLLIUM	19	2	11%	1.2	3.1	0.6	0.8	ug/L
CADMIUM	19	1	5%	3.6	3.6	1.7	1.9	ug/L
CALCIUM	19	19	100%	40800	349001	82672	109643	ug/L
CHROMIUM	52	21	40%	11	852	71	275	ug/L
COBALT	19	8	42%	9.0	43	8.4	14	ug/L
COPPER	19	18	95%	8.3	68	21	32	ug/L
IRON	19	19	100%	98	80500	9698	32818	ug/L
LEAD	19	11	58%	1.7	59	14	69	ug/L
MAGNESIUM	19	19	100%	9660	145000	28967	41610	ug/L
MANGANESE	19	19	100%	170	4900	1303	2140	ug/L
NICKEL	19	14	74%	12	412	82	214	ug/L
POTASSIUM	19	19	100%	1390	13200	4769	6758	ug/L
SELENIUM	19	4	21%	8.2	13	2.7	4.8	ug/L
SILVER	14	5	36%	4.9	6.6	3.3	4.4	ug/L
SODIUM	19	19	100%	74400	229999	114711	134868	ug/L
THALLIUM	19	8	42%	1.0	51	13	89	ug/L
VANADIUM	19	13	68%	5.4	129	16	38	ug/L
ZINC	19	14	74%	14	81	39	65	ug/L

Organic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ACETONE (2-PROPANONE)	19	2	11%	11	18	6.8	9.1	ug/L
BENZOIC ACID	19	1	5%	2.0	2.0	27	36	ug/L
BIS(2-ETHYLHEXYL)PHTHALATE	19	6	32%	1.0	17	5.8	7.8	ug/L
BROMODICHLOROMETHANE	19	1	5%	1.0	1.0	2.4	2.7	ug/L
BROMOFORM	19	1	5%	5.0	5.0	2.6	2.8	ug/L
CARBON TETRACHLORIDE	19	1	5%	1.0	1.0	2.4	2.7	ug/L
DI-N-BUTYL PHTHALATE	19	2	11%	1.0	1.0	5.0	6.5	ug/L
DI-N-OCTYL PHTHALATE	19	1	5%	0.2	0.2	5.9	8.9	ug/L
DIBROMOCHLOROMETHANE	19	2	11%	3.0	4.0	2.6	2.7	ug/L
DIETHYL PHTHALATE	19	2	11%	5.0	11	5.5	6.0	ug/L
METHYLENE CHLORIDE	19	12	63%	1.0	11	2.1	3.6	ug/L

Metal parameters are reported as total metals.

(a) Minimum detected value:Positive detections only.

(b) Estimation of the mean of the log normal distribution.

Table # 11 (cont'd)

Chemical Counstituents Identified in Onsite Surface Water

Inorganic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ALUMINUM	11	11	100%	1010	15100	4059	8747	ug/L
ARSENIC	11	9	82%	1.9	6.5	2.9	5.7	ug/L
BARIUM	11	11	100%	89	6090	889	3963	ug/L
BERYLLIUM	11	1	9%	1.7	1.7	0.6	0.8	ug/L
CADMIUM	11	1	9%	3.6	3.6	1.7	2.0	ug/L
CALCIUM	11	11	100%	7440	33900	22073	31823	ug/L
CHROMIUM	11	5	45%	8.8	64	11	31	ug/L
COBALT	11	3	27%	6.2	12	4.6	6.7	ug/L
COPPER	11	11	100%	6.2	31	17	23	ug/L
IRON	11	11	100%	810	9230	3351	5845	ug/L
LEAD	11	11	100%	1.5	66	13	47	ug/L
MAGNESIUM	11	11	100%	2470	10500	4311	5641	ug/L
MANGANESE	11	11	100%	40	3850	881	5563	ug/L
NICKEL	11	6	55%	15	49	16	28	ug/L
POTASSIUM	11	11	100%	3100	23600	9699	15205	ug/L
SILVER	11	3	27%	5.3	6.1	3.0	4.2	ug/L
SODIUM	11	11	100%	3760	9930	6298	7518	ug/L
VANADIUM	11	7	64%	5.4	18	7.3	13	ug/L
ZINC	11	11	100%	19	705	241	678	ug/L

Organic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
BIS(2-ETHYLHEXYL)PHTHALATE	6	4	67%	3.0	7.0	5.5	7.4	ug/L
DIETHYL PHTHALATE	6	1	17%	2.0	2.0	5.4	8.8	ug/L

Metal parameters are reported as total metals.

(a) Minimum detected value:Positive detections only.

(b) Estimation of the mean of the log normal distribution.

Table # 11 (cont'd)

Chemical Constituents Identified in Onsite Surficial Soil

Inorganic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ALUMINUM	21	21	100%	3360	17000	9371	11073	mg/kg
ANTIMONY	20	2	10%	6.6	13	4.4	5.3	mg/kg
ARSENIC	18	18	100%	4.3	19	10	12	mg/kg
BARIUM	19	19	100%	210	13500	12870	39626	mg/kg
BERYLLIUM	21	21	100%	0.3	1.2	0.6	0.7	mg/kg
CADMIUM	21	11	52%	0.8	6.9	2.3	4.3	mg/kg
CALCIUM	21	21	100%	808	110000	43240	141566	mg/kg
CHROMIUM	21	21	100%	15	188	53	76	mg/kg
COBALT	21	21	100%	6.1	26	12	14	mg/kg
COPPER	21	21	100%	12	71	26	32	mg/kg
IRON	21	21	100%	10800	29400	17749	19990	mg/kg
LEAD	18	18	100%	14	643	265	615	mg/kg
MAGNESIUM	21	21	100%	717	1790	1296	1447	mg/kg
MANGANESE	21	21	100%	293	1420	686	805	mg/kg
MERCURY	18	9	50%	0.1	1.2	0.3	0.5	mg/kg
NICKEL	20	20	100%	6.3	21	11	13	mg/kg
POTASSIUM	21	21	100%	203	1330	952	1175	mg/kg
SELENIUM	18	1	6%	0.6	0.6	0.3	0.3	mg/kg
SILVER	20	14	70%	0.8	2.8	1.5	2.4	mg/kg
SODIUM	21	8	38%	181	1010	1268	7209	mg/kg
THALLIUM	18	4	22%	0.2	20	0.4	1.0	mg/kg
VANADIUM	20	20	100%	14	47	26	30	mg/kg
ZINC	21	21	100%	24	1380	706	1582	mg/kg

Organic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
2-METHYLNAPHTHALENE	18	1	6%	47	47	337	563	ug/kg
4-METHYLPHENOL	18	1	6%	53	53	336	541	ug/kg
BENZO(A)PYRENE	18	1	6%	70	70	333	529	ug/kg
BENZOIC ACID	14	2	14%	490	710	1906	3629	ug/kg
BIS(2-ETHYLHEXYL)PHTHALATE	18	15	83%	77	900	432	730	ug/kg
DI-N-BUTYL PHTHALATE	18	9	50%	42	71	268	643	ug/kg
DIETHYL PHTHALATE	18	1	6%	34	34	344	587	ug/kg
DIMETHYL PHTHALATE	18	1	6%	30	30	345	596	ug/kg
INDENO(1,2,3-C,D)PYRENE	18	1	6%	47	47	337	547	ug/kg
METHYLENE CHLORIDE	4	1	25%	140	140	46	394832	ug/kg
NAPHTHALENE	18	3	17%	18	49	356	727	ug/kg
PHENANTHRENE	18	1	6%	170	170	336	516	ug/kg
PHENOL	18	2	11%	220	380	352	528	ug/kg
PYRENE	18	1	6%	200	200	338	506	ug/kg

Non-aqueous sample concentrations are based on dry weight.

Metal parameters are reported as total metals.

(a) Minimum detected value:Positive detections only.

(b) Estimation of the mean of the log normal distribution.

Table # 11 (cont'd)

Chemical Constituents Identified in Onsite Sediment

Inorganic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ALUMINUM	7	7	100%	9360	18100	14118	17593	mg/kg
ARSENIC	7	7	100%	1.8	11	6.5	13	mg/kg
BARIUM	7	7	100%	355	18400	21269	4.0E+06	mg/kg
BERYLLIUM	7	7	100%	0.5	0.9	0.7	0.8	mg/kg
CADMIUM	7	4	57%	1.5	14	2.8	25	mg/kg
CALCIUM	7	7	100%	1320	12800	4165	12398	mg/kg
CHROMIUM	7	7	100%	13	97	45	126	mg/kg
COBALT	7	7	100%	6.9	20	15	21	mg/kg
COPPER	7	7	100%	11	57	27	44	mg/kg
IRON	7	7	100%	10300	22800	14953	18700	mg/kg
LEAD	7	7	100%	15	390	97	899	mg/kg
MAGNESIUM	7	7	100%	1090	2150	1609	2022	mg/kg
MANGANESE	7	7	100%	267	631	420	584	mg/kg
MERCURY	7	1	14%	0.7	0.7	0.2	0.4	mg/kg
NICKEL	7	7	100%	5.1	20	14	21	mg/kg
POTASSIUM	7	7	100%	948	2100	1724	2180	mg/kg
SILVER	7	4	57%	1.7	2.7	1.5	3.0	mg/kg
SODIUM	7	4	57%	1290	2210	1312	3619	mg/kg
VANADIUM	7	7	100%	19	39	28	36	mg/kg
ZINC	7	7	100%	48	2420	521	10354	mg/kg

Organic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
BENZOIC ACID	7	1	14%	510	510	3103	15290	ug/kg
BIS(2-ETHYLHEXYL)PHTHALATE	7	6	86%	240	790	864	2842	ug/kg
DI-N-BUTYL PHTHALATE	7	4	57%	75	120	489	5096	ug/kg

Non-aqueous sample concentrations are based on dry weight.

Metal parameters are reported as total metals.

(a) Minimum detected value:Positive detections only.

(b) Estimation of the mean of the log normal distribution.

Table # 11 (cont'd)

Chemical Constituents Identified in Onsite Subsurface Soil Without " Source" Areas

Inorganic Parameters	Total Analyses	Positive Detects	Detection Frequency	Arithmetic Mean	Minimum	Maximum	Arithmetic 95th UCL	Units
ALUMINUM	41	41	100%	16272.44	5880.00	25700.00	17796.09	mg/kg
ANTIMONY	36	5	14%	3.81	5.90	10.90	4.53	mg/kg
ARSENIC	35	35	100%	5.24	0.39	11.60	6.07	mg/kg
BARIUM	41	41	100%	484.31	67.40	5940.00	738.93	mg/kg
BERYLLIUM	41	41	100%	0.86	0.23	2.20	0.96	mg/kg
CADMIUM	41	2	5%	0.36	0.41	3.10	0.48	mg/kg
CALCIUM	41	41	100%	3115.12	1070.00	45700.00	4918.97	mg/kg
CHROMIUM (TOTAL)	41	41	100%	19.64	8.50	45.90	21.43	mg/kg
COBALT	41	40	98%	7.46	0.28	22.20	8.74	mg/kg
COPPER	41	40	98%	13.27	4.60	22.40	14.64	mg/kg
IRON	41	41	100%	20515.37	7470.00	40800.00	22380.37	mg/kg
LEAD	35	35	100%	12.94	4.60	40.70	15.01	mg/kg
MAGNESIUM	41	41	100%	2263.90	1140.00	5610.00	2532.77	mg/kg
MANGANESE	41	41	100%	394.62	19.20	1720.00	486.26	mg/kg
MERCURY	35	10	29%	0.07	0.02	0.15	0.08	mg/kg
NICKEL	41	41	100%	16.37	5.80	35.00	18.20	mg/kg
POTASSIUM	41	41	100%	1098.80	295.00	2550.00	1246.52	mg/kg
SELENIUM	35	5	14%	0.33	0.37	1.40	0.39	mg/kg
SILVER	41	13	32%	0.60	0.81	1.70	0.74	mg/kg
SODIUM	41	36	88%	667.18	304.00	1420.00	749.12	mg/kg
SULFUR	1	1	100%	17000.00	17000.00	17000.00		ug/kg
THALLIUM	35	4	11%	0.18	0.22	0.29	0.20	mg/kg
VANADIUM	41	41	100%	30.87	10.80	52.90	33.42	mg/kg
ZINC	41	41	100%	61.82	17.00	788.00	92.73	mg/kg

Organic Parameters	Total Analyses	Positive Detects	Detection Frequency	Arithmetic Mean	Minimum	Maximum	Arithmetic 95th UCL	Units
1,2-DICHLOROETHENE (TOTAL)	23	2	9%	4.09	1.00	2.00	4.69	ug/kg
2-BUTANONE (MEK)	23	6	26%	25.43	7.00	160.00	42.38	ug/kg
2-METHYL-,1-(1,1-DIMETHYLETHYL)-2-M	1	1	100%	340.00	340.00	340.00		ug/kg
4,8,12-TRIMETHYL-3,7,8-TRIDECATRIEN	1	1	100%	650.00	650.00	650.00		ug/kg
ACENAPHTHENE	33	1	3%	196.94	39.00	39.00	205.51	ug/kg
ACETONE (2-PROPANONE)	30	2	7%	9.27	7.00	9.00	11.11	ug/kg
ANTHRACENE	33	1	3%	196.70	31.00	31.00	205.67	ug/kg
BENZO(A)ANTHRACENE	33	1	3%	197.85	69.00	69.00	204.92	ug/kg
BENZO(K)FLUORANTHENE	33	1	3%	198.58	93.00	93.00	204.47	ug/kg
BENZO-(B)FLUORANTHENE	33	1	3%	197.97	73.00	73.00	204.84	ug/kg
BIS(2-ETHYLHEXYL)PHTHALATE	33	14	42%	303.18	210.00	1200.00	377.50	ug/kg
CARBON DISULFIDE	22	1	5%	4.23	1.00	1.00	4.83	ug/kg
CHRYSENE	33	1	3%	198.09	77.00	77.00	204.77	ug/kg
CYCLOHEXANE, 1,1,2-TRIMETHYL	1	1	100%	7.00	7.00	7.00		ug/kg
DI-N-BUTYL PHTHALATE	37	3	8%	166.72	44.00	51.00	185.94	ug/kg
DI-N-OCTYL PHTHALATE	33	2	6%	191.82	27.00	43.00	203.91	ug/kg
DIFTALONE	1	1	100%	3000.00	3000.00	3000.00		ug/kg
FLUORANTHENE	33	1	3%	201.21	180.00	180.00	203.39	ug/kg
FLUORENE	33	1	3%	196.64	29.00	29.00	205.71	ug/kg
INDENO(1,2,3-C,D)PYRENE	33	1	3%	197.39	54.00	54.00	205.21	ug/kg
METHYLENE CHLORIDE	31	3	10%	8.27	5.00	48.00	10.79	ug/kg
PHENANTHRENE	33	2	6%	194.85	30.00	140.00	204.32	ug/kg
PYRENE	33	1	3%	201.52	190.00	190.00	203.48	ug/kg
TOLUENE	23	4	17%	29.67	110.00	200.00	50.54	ug/kg
TOTAL XYLENES	23	3	13%	4.15	2.00	3.00	4.73	ug/kg

Table # 11 (cont'd)

Chemical Constituents Identified in "Source" Samples near Well G-22

Inorganic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ALUMINUM	4	4	100%	16100	17200	16579	17183	mg/kg
ANTIMONY	3	3	100%	10	10	10	10	mg/kg
ARSENIC	4	4	100%	1.7	4.2	3.5	7.4	mg/kg
BARIUM	4	4	100%	127	153	139	153	mg/kg
BERYLLIUM	4	4	100%	1.0	1.1	1.1	1.1	mg/kg
CADMIUM	4	1	25%	2.5	2.5	0.8	359	mg/kg
CALCIUM	4	4	100%	2520	3170	2716	3116	mg/kg
CHROMIUM	4	4	100%	17	20	18	20	mg/kg
COBALT	4	4	100%	7.3	12	10	14	mg/kg
COPPER	4	4	100%	12	14	13	14	mg/kg
IRON	4	4	100%	17900	19800	18829	19891	mg/kg
LEAD	4	4	100%	8.7	21	14	28	mg/kg
MAGNESIUM	4	4	100%	3190	3470	3329	3479	mg/kg
MANGANESE	4	4	100%	208	397	282	440	mg/kg
NICKEL	4	4	100%	17	22	19	22	mg/kg
POTASSIUM	4	4	100%	1280	1450	1353	1456	mg/kg
SELENIUM	4	1	25%	0.4	0.4	0.2	0.6	mg/kg
SODIUM	4	4	100%	412	586	531	673	mg/kg
THALLIUM	4	1	25%	0.2	0.2	0.2	0.2	mg/kg
VANADIUM	4	4	100%	20	24	23	25	mg/kg
ZINC	4	4	100%	45	72	58	77	mg/kg

Organic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
1,1,1-TRICHLOROETHANE	4	1	25%	3.0	3.0	7.1	77	ug/kg
1,1,2,2-TETRACHLOROETHANE	4	1	25%	16	16	11	136	ug/kg
2-METHYLNAPHTHALENE	4	4	100%	1300	5200	2906	11584	ug/kg
4-CHLORO-3-METHYLPHENOL(PCMC)	4	1	25%	110	110	181	295	ug/kg
ACENAPHTHENE	4	1	25%	160	160	192	222	ug/kg
BENZENE	4	1	25%	4.0	4.0	7.3	51	ug/kg
CARBON DISULFIDE	4	1	25%	4.0	4.0	7.3	51	ug/kg
DIBENZOFURAN	4	4	100%	220	1000	534	2499	ug/kg
ETHYLBENZENE	4	3	75%	8.0	260	104	2.4E+08	ug/kg
FLUORENE	4	4	100%	340	1400	753	3220	ug/kg
NAPHTHALENE	4	4	100%	170	1700	1132	56637	ug/kg
PHENANTHRENE	4	4	100%	590	2100	1138	4390	ug/kg
PYRENE	3	2	67%	53	73	117	1227	ug/kg
TOTAL XYLENES	4	4	100%	6.0	180	109	668	ug/kg

Non-aqueous sample concentrations are based on dry weight.

Metal parameters are reported as total metals.

(a) Minimum detected value:Positive detections only.

(b) Estimation of the mean of the log normal distribution.

Table # 11 (cont'd)

Chemical Constituents Identified in "Source" Samples near Well G-23

Inorganic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ALUMINUM	3	3	100%	231	15000	27305	6.8E+21	mg/kg
ANTIMONY	1	1	100%	10	10	10	(c)	mg/kg
ARSENIC	3	3	100%	12	18	16	27	mg/kg
BARIUM	4	4	100%	96	8920	13767	1.1E+11	mg/kg
BERYLLIUM	4	2	50%	0.2	0.3	0.2	161	mg/kg
CADMIUM	4	2	50%	4.1	8.3	6.4	1.0E+06	mg/kg
CALCIUM	4	4	100%	76	10400	18868	3.7E+11	mg/kg
CHROMIUM	4	3	75%	15	157	364	2.7E+12	mg/kg
COBALT	4	3	75%	4.2	7.0	5.5	223	mg/kg
COPPER	4	3	75%	11	64	90	3.4E+08	mg/kg
IRON	4	4	100%	236	22400	67308	1.5E+06	mg/kg
LEAD	4	4	100%	35	608	639	393860	mg/kg
MAGNESIUM	4	4	100%	39	1790	3303	6.6E+08	mg/kg
MANGANESE	4	4	100%	4.4	597	1880	4.8E+12	mg/kg
MERCURY	4	4	100%	0.1	1.6	1.0	398	mg/kg
NICKEL	4	3	75%	13	18	21	97549	mg/kg
POTASSIUM	4	3	75%	415	932	1332	2.3E+08	mg/kg
SELENIUM	4	3	75%	0.5	1.0	0.6	7.8	mg/kg
SILVER	4	2	50%	1.0	1.8	0.9	13	mg/kg
SODIUM	4	1	25%	927	927	550	4.0E+06	mg/kg
THALLIUM	4	3	75%	0.4	0.8	0.6	3.7	mg/kg
VANADIUM	4	3	75%	15	30	74	5.9E+08	mg/kg
ZINC	4	4	100%	5.1	1510	4235	3.2E+12	mg/kg

Organic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value	Maximum Detected Value	Mean Estimation (a)	UCL 95%	Units
1,2-DICHLOROETHENE (TOTAL)	4	1	25%	4.0	4.0	4.2	6.7	ug/kg
2-BUTANONE (MEK)	4	1	25%	13	13	8.1	16	ug/kg
ACETONE (2-PROPANONE)	4	1	25%	7.0	7.0	6.3	140	ug/kg
TRICHLOROETHYLENE	4	1	25%	3.0	3.0	3.9	6.6	ug/kg

Non-aqueous sample concentrations are based on dry weight.

Metal parameters are reported as total metals.

(a) Minimum detected value:Positive detections only.

(b) Estimation of the mean of the log normal distribution.

(c) UCL 95% not applicable to a population of 1.

Table # 11 (cont'd)

Chemical Constituents Identified in "Source" Samples Near Boring SB-30

Inorganic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ALUMINUM	3	3	100%	10900	16400	13838	22320	mg/kg
ANTIMONY	3	1	33%	10	10	6.5	33	mg/kg
ARSENIC	3	3	100%	5.4	7.3	6.1	9.0	mg/kg
BARIUM	3	3	100%	522	4910	2860	9.1E+07	mg/kg
BERYLLIUM	3	3	100%	0.5	0.6	0.6	0.7	mg/kg
CADMIUM	3	2	67%	0.5	1.4	0.8	10806	mg/kg
CALCIUM	3	3	100%	1880	3310	2567	5854	mg/kg
CHROMIUM	3	3	100%	21	22	21	23	mg/kg
COBALT	3	3	100%	1.7	5.6	3.9	108	mg/kg
COPPER	3	3	100%	12	15	14	17	mg/kg
IRON	3	3	100%	10800	18300	14956	32565	mg/kg
LEAD	3	3	100%	25	98	71	7091	mg/kg
MAGNESIUM	3	3	100%	859	1250	1052	1629	mg/kg
MANGANESE	3	3	100%	468	1020	709	3118	mg/kg
MERCURY	3	2	67%	0.2	0.2	0.2	55	mg/kg
NICKEL	3	3	100%	4.6	11	8.9	80	mg/kg
POTASSIUM	3	3	100%	864	1130	1015	1325	mg/kg
SELENIUM	3	3	100%	0.6	1.0	0.9	1.9	mg/kg
SODIUM	3	2	67%	482	582	462	1784	mg/kg
VANADIUM	3	3	100%	20	34	28	60	mg/kg
ZINC	3	3	100%	77	125	95	209	mg/kg

Organic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
2-BUTANONE (MEK)	3	1	33%	27	27	14	205.1	ug/kg
CARBON DISULFIDE	3	1	33%	6.0	6.0	4.1	18	ug/kg
PHENANTHRENE	1	1	100%	340	340	340	(c)	ug/kg
TOLUENE	3	1	33%	4.0	4.0	3.3	4.9	ug/kg
TOTAL XYLENES	3	3	100%	2.0	7.0	4.3	145	ug/kg

Non-aqueous sample concentrations are based on dry weight.
Metal parameters are reported as total metals.
(a) Minimum detected value:Positive detections only.
(b) Estimation of the mean of the log normal distribution.
(c) UCL 95% not applicable to a population of 1.

Table # 11 (cont'd)

Chemical Constituents Identified in "Source" Samples from Impoundment Area

Inorganic Parameters	Total Analyses	Positive Detects	Detection Frequency	Arithmetic Mean	Minimum	Maximum	Arithmetic 95th UCL	Units
ALUMINUM	3	3	100%	14216.67	6[illegible]50	20300.00	26607.51	mg/kg
ARSENIC	3	3	100%	9.17	4.40	12.00	16.17	mg/kg
BARIUM	3	3	100%	3540.00	2440.00	5140.00	5930.11	mg/kg
BERYLLIUM	3	3	100%	0.60	0.42	0.74	0.88	mg/kg
CALCIUM	3	3	100%	1790.00	1610.00	1910.00	2057.62	mg/kg
CHROMIUM (TOTAL)	3	3	100%	29.73	16.50	41.00	50.58	mg/kg
COBALT	3	3	100%	9.97	6.80	11.90	14.63	mg/kg
COPPER	3	3	100%	14.53	11.50	16.50	19.03	mg/kg
IRON	3	3	100%	16900.00	10500.00	20100.00	26243.95	mg/kg
LEAD	3	3	100%	44.57	34.70	58.10	65.00	mg/kg
MAGNESIUM	3	3	100%	1323.33	600.00	1830.00	2407.32	mg/kg
MANGANESE	3	3	100%	622.00	583.00	679.00	707.08	mg/kg
MERCURY	3	3	100%	0.14	0.07	0.19	0.25	mg/kg
NICKEL	3	3	100%	13.33	5.10	18.90	25.60	mg/kg
POTASSIUM	3	3	100%	847.33	404.00	1140.00	1505.57	mg/kg
SODIUM	3	3	100%	1204.00	892.00	1460.00	1689.71	mg/kg
VANADIUM	3	3	100%	26.07	20.20	31.30	35.47	mg/kg
ZINC	3	3	100%	60.07	52.60	66.90	72.16	mg/kg

Organic Parameters	Total Analyses	Positive Detects	Detection Frequency	Arithmetic Mean	Minimum	Maximum	Arithmetic 95th UCL	Units
2-BUTANONE (MEK)	1	1	100%	16.00	16.00	16.00		ug/kg
2-METHYLNAPHTHALENE	3	3	100%	476.67	180.00	660.00	913.80	ug/kg
DIBENZOFURAN	1	1	100%	100.00	100.00	100.00		ug/kg
ETHYLBENZENE	1	1	100%	13.00	13.00	13.00		ug/kg
FLUORENE	1	1	100%	100.00	100.00	100.00		ug/kg
NAPHTHALENE	1	1	100%	50.00	50.00	50.00		ug/kg
PHENANTHRENE	3	3	100%	293.33	180.00	480.00	567.94	ug/kg
TOTAL XYLENES	2	2	100%	6.00	3.00	9.00	24.94	ug/kg

Table # 11 (cont'd)

Chemical Constituents Identified in Background Groundwater

Inorganic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ALUMINUM	4	4	100%	221	16700	6882	3.1E+10	ug/L
ARSENIC	4	4	100%	4.6	41	16	821	ug/L
BARIUM	4	4	100%	303	508	380	522	ug/L
BERYLLIUM	4	1	25%	1.8	1.8	0.8	4.0	ug/L
CALCIUM	4	4	100%	79900	87300	82603	86946	ug/L
CHROMIUM	5	4	80%	6.2	78	36	5341	ug/L
COBALT	4	1	25%	13	13	5.4	68	ug/L
COPPER	4	3	75%	7.5	44	21	52892	ug/L
IRON	4	4	100%	4540	35600	13156	609219	ug/L
LEAD	4	2	50%	17	18	24	1.3E+08	ug/L
MAGNESIUM	4	4	100%	28900	34500	30702	34091	ug/L
MANGANESE	4	4	100%	678	1500	937	1818	ug/L
NICKEL	4	2	50%	16	35	17	376	ug/L
POTASSIUM	4	4	100%	2350	8550	4215	18196	ug/L
SELENIUM	4	1	25%	13	13	4.3	1915	ug/L
SILVER	3	1	33%	5.1	5.1	3.2	38	ug/L
SODIUM	4	4	100%	83400	93800	90492	97117	ug/L
THALLIUM	4	2	50%	1.4	50	23	3.5E+08	ug/L
VANADIUM	4	1	25%	47	47	15	81086	ug/L
ZINC	4	3	75%	15	109	62	3.4E+06	ug/L

Organic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ACETONE (2-PROPANONE)	4	2	50%	2.0	43.0	17	893065	ug/L
BIS(2-ETHYLHEXYL)PHTHALATE	4	3	75%	1.0	3.0	3.3	21	ug/L
CARBON DISULFIDE	4	2	50%	2.0	2.0	2.3	2.7	ug/L
DIETHYL PHTHALATE	4	1	25%	3.0	3.0	5.0	8.3	ug/L
METHYLENE CHLORIDE	4	2	50%	2.0	27.0	11	666929	ug/L

Metal parameters are reported as total metals.

(a) Minimum detected value:Positive detections only.

(b) Estimation of the mean of the log normal distribution.

Table # 11 (cont'd)

Chemical Constituents Identified in Background Surface Water

Inorganic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ALUMINUM	3	3	100%	3630	6670	4921	12323	ug/L
ARSENIC	3	3	100%	2.3	3.0	2.6	3.4	ug/L
BARIUM	3	3	100%	99	150	134	235	ug/L
CADMIUM	3	1	33%	3.7	3.7	2.3	25	ug/L
CALCIUM	3	3	100%	10500	13400	11829	15034	ug/L
CHROMIUM	3	3	100%	6.9	8.0	7.6	8.8	ug/L
COBALT	3	2	67%	8.3	10	7.8	278	ug/L
COPPER	3	3	100%	12	15	13	16	ug/L
IRON	3	3	100%	3050	4790	3979	6751	ug/L
LEAD	3	3	100%	1.8	4.6	3.8	43	ug/L
MAGNESIUM	3	3	100%	3630	4200	3970	4609	ug/L
MANGANESE	3	3	100%	125	2170	1233	5.4E+12	ug/L
NICKEL	3	1	33%	13	13	8.5	44	ug/L
POTASSIUM	3	3	100%	7820	9470	8491	10336	ug/L
SODIUM	3	3	100%	4610	22600	18578	2.7E+07	ug/L
VANADIUM	3	3	100%	7.7	13	10	22	ug/L
ZINC	3	3	100%	15	76	42	21939	ug/L

Metal parameters are reported as total metals.

(a) Minimum detected value:Positive detections only.

(b) Estimation of the mean of the log normal distribution.

No organic parameters were detected.

Table # 11 (cont'd)

Chemical Constituents Identified in Background Surficial Soil

Inorganic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ALUMINUM	8	8	100%	8460	14200	12131	13835	mg/kg
ARSENIC	8	8	100%	2.6	6.6	4.4	5.5	mg/kg
BARIUM	8	8	100%	138	662	290	446	mg/kg
BERYLLIUM	8	8	100%	0.4	0.6	0.5	0.6	mg/kg
CALCIUM	8	8	100%	721	3540	1750	2978	mg/kg
CHROMIUM	8	8	100%	10	17	14	16	mg/kg
COBALT	8	8	100%	4.8	11	6.5	7.9	mg/kg
COPPER	8	8	100%	10	14	12	13	mg/kg
IRON	8	8	100%	12500	22100	14907	16999	mg/kg
LEAD	8	8	100%	12	27	18	22	mg/kg
MAGNESIUM	8	8	100%	739	1260	1017	1149	mg/kg
MANGANESE	8	8	100%	287	863	485	630	mg/kg
NICKEL	8	8	100%	4.5	10	6.8	8.4	mg/kg
POTASSIUM	8	8	100%	724	1170	912	1040	mg/kg
SILVER	8	3	38%	1.2	1.6	0.8	1.4	mg/kg
SODIUM	8	7	88%	691	1150	963	1467	mg/kg
VANADIUM	8	8	100%	24	41	31	35	mg/kg
ZINC	8	8	100%	21	37	28	31	mg/kg

Organic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
BENZO-(B)FLUORANTHENE	8	1	13%	59	59	187	269	ug/kg
BENZOIC ACID	8	4	50%	190	540	763	1538	ug/kg
BIS(2-ETHYLHEXYL)PHTHALATE	8	8	100%	57	460	269	804	ug/kg
CHRYSENE	8	1	13%	51	51	188	290	ug/kg
DI-N-BUTYL PHTHALATE	8	1	13%	47	47	184	289	ug/kg
FLUORANTHENE	8	1	13%	100	100	188	229	ug/kg

Non-aqueous sample concentrations are based on dry weight.

Metal parameters are reported as total metals.

(a) Minimum detected value:Positive detections only.

(b) Estimation of the mean of the log normal distribution.

Table # 11 (cont'd)

Chemical Constituents Identified in Background Sediments

Inorganic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
ALUMINUM	6	6	100%	12700	26000	17404	22179	mg/kg
ARSENIC	6	6	100%	1.4	5.6	3.2	5.2	mg/kg
BARIUM	6	6	100%	185	851	554	1164	mg/kg
BERYLLIUM	6	6	100%	0.7	1.0	0.8	0.9	mg/kg
CALCIUM	6	6	100%	2270	3100	2714	3016	mg/kg
CHROMIUM	6	6	100%	14	32	20	27	mg/kg
COBALT	6	6	100%	6.7	11	8.7	10	mg/kg
COPPER	6	6	100%	20	23	21	22	mg/kg
IRON	6	6	100%	11200	25200	15364	20359	mg/kg
LEAD	6	6	100%	11	33	20	29	mg/kg
MAGNESIUM	6	6	100%	1620	2420	1878	2137	mg/kg
MANGANESE	6	6	100%	303	840	499	692	mg/kg
NICKEL	6	6	100%	8.3	17	11	14	mg/kg
POTASSIUM	6	6	100%	1160	2300	1732	2251	mg/kg
SILVER	6	2	33%	1.9	2.1	1.2	2.2	mg/kg
SODIUM	6	4	67%	1150	2120	1340	3027	mg/kg
VANADIUM	6	6	100%	24	45	30	37	mg/kg
ZINC	6	6	100%	34	86	62	85	mg/kg

Organic Parameters	Total Analyses	Positive Detections	Detection Frequency	Minimun Detected Value (a)	Maximum Detected Value	Mean Estimation (b)	UCL 95%	Units
BENZO(A)PYRENE	6	2	33%	170	210	284	393	ug/kg
BENZOIC ACID	6	3	50%	230	1400	1569	5512	ug/kg
BIS(2-ETHYLHEXYL)PHTHALATE	6	6	100%	380	830	628	813	ug/kg
DI-N-BUTYL PHTHALATE	6	3	50%	81	93	202	533	ug/kg
PYRENE	3	1	33%	71	71	339	2.3E+06	ug/kg

Non-aqueous sample concentrations are based on dry weight.

Metal parameters are reported as total metals.

(a) Minimum detected value:Positive detections only.

(b) Estimation of the mean of the log normal distribution.

Table #12

POTENTIAL EXPOSURE PATHWAYS

Table # 12

Potential Exposure Pathways

Contaminant Source	Release Mechanism	Transport Medium	Exposure Point	Exposure Route	Receptor
Groundwater	1 Direct contact	None	Onsite/BKGD	1a. Ingestion	a,b,c
				1b Dermal absorption	a,b,c
	2 Volatilization	Air	Onsite/BKGD	2a Inhalation (shower/bath)	a,b,c (qualitative)
Surface Water	1. Direct contact	None	Onsite/BKGD	1a Dermal absorption (wading)	a,b,c,d
	2. Volatilization	Air	Onsite/BKGD	2a Inhalation	a,b,c,d (qualitative)
Surficial Soil	1 Direct contact	None	Onsite/BKGD	1a Ingestion	a,b,c,d
				1b. Dermal absorption	a,b,c,d
	2 Dust release	Air	Onsite/BKGD	2a Particulate inhalation	a,b,d (qualitative) c
	3. Volatilization	Air	Onsite/BKGD	3a Inhalation of vapors	a,b,c,d (qualitative)
Sediment	1. Direct contact	None	Onsite/BKGD	1a. Ingestion	a,b,c,d
				1b. Dermal absorption	a,b,c,d
Subsurface Soil	1. Direct contact	None	Onsite/BKGD	1a Ingestion	a,b,c
				1b. Dermal absorption	a,b,c
Agricultural Products	1. Direct contact	Plant and Animal Uptake	Onsite/BKGD	1a. Ingestion	a,b

BKGD - Background

a future residential child

b. future residential adult

c. future occupational adult

d current trespasser (7-16 yrs)

Table # 12

Table #13

CARCINOGENIC POTENCIES (ORAL SLOPE FACTORS)

Table # 13

Carcinogenic Potencies (Oral Slope Factors)

	ORAL ROUTE:				INHALATION ROUTE:			
Chemical	Weight of Evidence	Slope Factor (mg/kg day)-1	Source (a)	Date	Weight of Evidence	Unit Risk (ug/m3)-1	Source (a)	Date
Arsenic	A	1.75	IRIS	6/1/90	A	4.3E-03	IRIS	9/1/91
Benzene	A	0 029	IRIS	1/1/91	A	8.3E-06	HEAST	1/1/91
Beryllium	B2	4.3	IRIS	1/1/91	B2	2.4E-03	HEAST	1/1/91
bis(2 Ethylhexyl)phthalate	B2	0 014	IRIS	5/1/90	B2	-	IRIS	5/1/90
Bromodichloromethane	B2	0.13	IRIS	10/1/90	B2	-	IRIS	10/1/90
Bromoform	B2	0.0079	IRIS	1/1/91	B2	1.1E-06	HEAST	1/1/91
Cadmium	-	-	-	-	B1	1.8E-03	IRIS	6/1/90
Carbon tetrachloride	B2	0.13	IRIS	1/1/91	B2	1.5E-05	HEAST	1/1/91
Chromium III	-	-	-	-	-	-	-	-
Chromium VI	-	-	-	-	A	1.2E-02	IRIS	6/1/90
Lead	B2	-	IRIS	7/1/90	B2	-	IRIS	7/1/90
Methylene chloride	B2	0.0 75	IRIS	1/1/91	B2	4.7E-07	HEAST	1/1/91
Nickel, soluble salts	-	-	-	-	A	2.4E-04	HEAST	1/1/91
PAHs	B2/C	5.8	b	-	B2/C	1.7E-03	b	-
1,1,2,2 Tetrachloroethane	C	0.2	IRIS	1/1/91	C	5 8E-05	HEAST	1/1/91
Trichloroethene	B2	0 011	HEAST	1/1/91	B2	4 9E-06	HEAST	1/1/91

a. Sources of Toxicity Values:
IRIS - Integrated Risk Information System. U.S. EPA
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. USEPA

b. U.S. EPA 1992. Based on Benzo(a)pyrene.

c. Based on refinery dust.

Table # 13

Table #14

NONCARCINOGENIC REFERENCE DOSES

Table 14

Reference Doses (RfDs)

	ORAL ROUTE				INHALATION ROUTE			
Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	Date	Critical Effect	Reference Concentration (RfC) mg/m3	Source (a)	Date	Critical Effect
Acenaphthene	0 06	IRIS(I)	1/1/91	Hepatotoxicity	-	-	-	-
Acetone	0 1	IRIS	7/1/90	Increased liver and kidney weight and nephrotoxicity	-	-	-	-
Antimony	0 0004	IRIS	8/1/88	Reduced lifespan, altered blood chemistry	-	-	-	-
Anthracene	0 3	IRIS	1/1/91	-	-	-	-	-
Arsenic	0 0003	IRIS	9/1/91	Keratosis and hyperpigmentation	-	-	-	-
Barium	0 07	IRIS	8/1/90	Increased blood pressure	0 0005	HEAST	1/1/91	Fetotoxicity
Benzoic acid	4	IRIS	8/1/88	Irritation, malaise	-	-	-	-
Beryllium	0 005	IRIS	1/1/91	None observed for soluble beryllium salts	-	-	-	-
bis(2 Ethylhexyl)phthalate	0 02	IRIS	6/1/90	Increased relative liver weight	-	-	-	-
Bromodichloromethane	0 02	IRIS	10/1/90	Renal cytomegaly	-	-	-	-
Bromoform	0 02	IRIS	1/1/91	Liver effects	-	-	-	-
2 Butanone (MEK)	0 05	HEAST	1/1/91	Fetotoxicity	0 3	HEAST	1/1/91	CNS
Cadmium	0 0005 c	IRIS	8/1/90	Renal damage	-	IRIS	8/1/90	Cancer
Carbon disulfide	0 1	IRIS	2/1/88	Malformations, fetal toxicity	0 01	HEAST	1/1/91	Fetal toxicity
Carbon tetrachloride	0 0007	IRIS	1/1/91	Liver lesions	-	-	-	-
Chromium III	1	IRIS	8/1/88	Hepatotoxicity	0 000002	HEAST	1/1/91	Nasal mucosa atrophy
Chromium VI	0 005	IRIS	8/1/90	Not defined	0 000002	HEAST	1/1/91	Nasal mucosa atrophy
Copper	0 037 b	HEAST	1/1/91	Local GI irritation	-	-	-	-
Di n butylphthalate	0 1	IRIS	9/1/90	Increased mortality	-	-	-	-
trans-1,2 Dichloroethene	0 02	IRIS	1/1/88	Increased serum alkaline phosphatase	-	-	-	-
cis 1,2 Dichloroethene	0 01	HEAST	1/1/91	Decreased hematocrit and hemoglobin	-	-	-	-
Diethyl phthalate	0 8	IRIS (I)	7/1/90	Reduced terminal body weight	-	-	-	-
Dimethyl phthalate	1	HEAST	1/1/91	Minor effect on growth, some nephritic involvement	-	-	-	-
Di-n-octyl phthalate	0 02	HEAST	1/1/91	Elevated kidney and liver weight, increased SGOT and SGPT	-	-	-	-
Ethylbenzene	0 1	IRIS	8/1/88	Hepatotoxicity and nephrotoxicity	1	HEAST	1/1/91	Developmental toxicity
Fluoranthene	0.04	IRIS	12/1/90	Nephropathy, liver weight and hematological changes	-	-	-	-
Fluorene	0 04	IRIS	12/1/90	Hematological changes (decreased RBC)	-	-	-	-
Lead	- d	IRIS	7/1/90	CNS effects	-	HEAST	1/1/91	CNS effects
Manganese	0.1	IRIS	12/1/90	CNS	0 0004	HEAST	1/1/91	CNS
Mercury (inorganic)	0.0003	HEAST	1/1/91	Kidney effects	0 0003	HEAST	1/1/91	Neurotoxicity
Methylene chloride	0 06	IRIS	1/1/91	Liver toxicity	3	HEAST	1/1/91	-
Naphthalene	0 004	HEAST	1/1/91	Ocular and internal lesions	-	-	-	-
Nickel, soluble salts	0 02	IRIS	8/1/90	Decreased body and organ weights	-	IRIS	8/1/90	Cancer
Phenol	0 6	IRIS	3/1/91	Reduced fetal body weight	-	-	-	-
Pyrene	0 03	IRIS	1/1/91	Renal effects	-	-	-	-
Selenium	0 005	IRIS	9/1/91	hair and nail loss; dermatitis	-	-	-	-
Thallium	0 00007	HEAST	1/1/91	Increased SGOT and serum LDH levels, alopecia	-	-	-	-
Toluene	0 2	IRIS	8/1/90	CNS effects	2	HEAST	1/1/91	CNS effects, eye and nose irritation
1,1,1-Trichloroethane	0 09	HEAST	1/1/91	Hepatotoxicity	1	HEAST	1/1/91	Hepatotoxicity
Vanadium	0 007	HEAST	1/1/91	None observed	-	-	-	-
Xylenes	2	IRIS	7/1/88	Hyperactivity, decreased body weight, increased mortality	0.3	HEAST	1/1/91	CNS effects, nose and throat irritation
Zinc	0 2	HEAST	1/1/91	Anemia	-	-	-	-

a. Sources of Toxicity Values:

IRIS - Integrated Risk Information System U.S. EPA

HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. USEPA

b. The RfD was calculated from proposed drinking water standard of 1 3 mg/l assuming 2 liters of water consumed per day for 70 years

c. 0 0005 mg/kg/day cadmium for water; 0 001 mg/kg/day for food (HEAST).

d. EPAs RfD work group considers it inappropriate to develop an RfD for inorganic lead

Table # 14

Table #15

SUMMARY OF POTENTIAL CARCINOGENIC RISKS

Table # 15

Carcinogenic Risks for a Trespasser

				Onsite						Background						
Exposure Route	Onsite Cancer Risk	Background Cancer Risk		Chemical *	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(1) Surface water dermal absorption	5E-08	1E-08		(a)											
(2) Surface soil ingestion	7E-07	4E-07		(a)											
(3) Surface soil dermal absorption	1E-06	8E-07		(a)											
(4) Sediment ingestion	9E-08	1E-07		(a)											
(5) Sediment dermal absorption	8E-08	2E-07		(a)											

ND = nondetection

* Chemicals driving major portion of cancer risk are indicated.

(a) Chemical cancer risk < or = 1E-06

Table # 15

Table # 15 (cont'd)

Carcinogenic Risks for a Residential Adult

	Onsite								Background					
Exposure Route	Onsite Cancer Risk	Back-ground Cancer Risk		Chemical *	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(1) Groundwater ingestion	9E-04	9E-04		Arsenic	9E-04	19	95%	43	59	8E-04	4	100%	41.20	821	ug/L
				Beryllium	4E-05	19	11%	3.1	0.8	9E-05	4	25%	1.80	4 0	ug/L
				BEHP	1E-06	19	32%	17	7.8	5E-07	4	75%	3.00	21	ug/L
(2) Groundwater dermal absorption	3E-06	3E-06		Arsenic	3E-06	19	95%	43	59	3E-06	4	100%	41	821	ug/L
(3) Surface water dermal absorption	8E-08	3E-08		(a)											
(4) Surface soil ingestion	1E-05	6E-06	(24 yrs)	Arsenic	1E-05	18	100%	19	12	4E-06	8	100%	6.6	5.5	mg/kg
	4E-05	2E-05	(30 yrs)	Beryllium	1E-06	21	100%	1.2	0.7	1E-06	8	100%	0.6	0.6	mg/kg
(5) Surface soil dermal absorption	1E-05	7E-06	(24 yrs)	Arsenic	5E-06	18	100%	19	12	2E-06	8	100%	6.6	5.5	mg/kg
	2E-05	1E-05	(30 yrs)	Benzo[a]pyrene	3E-06	18	6%	70	529	ND					ug/kg
				Indeno[1,2,3-cd]pyrene	2E-06	18	6%	47	547	ND					ug/kg
(6) Sediment ingestion	2E-07	1E-07	(24 yrs)	(a)											
	7E-07	4E-07	(30 yrs)												
(7) Sediment dermal absorption	1E-07	2E-07	(24 yrs)	(a)											
	2E-07	3E-07	(30 yrs)												
(8) Subsurface soil ingestion (b) (source 1/G22)	8E-06	6E-06	(24 yrs)	Arsenic	3E-06	4	100%	4.2	7.4	4E-06	8	100%	6.6	5.5	mg/kg
	3E-05	2E-05	(30 yrs)	Beryllium	2E-06	4	100%	1.1	1.1	1E-06	8	100%	0.6	0.6	mg/kg
(9) Subsurface soil ingestion (b) (source 2/G23)	8E-06	6E-06	(24 yrs)	Arsenic	2E-05	3	100%	18	27	4E-06	8	100%	6.6	5.5	mg/kg
	3E-05	2E-05	(30 yrs)												

Table # 15 (cont'd)

Table # 15 (cont'd)

Carcinogenic Risks for a Residential Adult

				Onsite						Background					
Exposure Route	Onsite Cancer Risk	Back-ground Cancer Risk		Chemical *	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
10) Subsurface soil ingestion (b) (source 3/SB30)	8E-06 3E-05	6E-06 2E-05	(24 yrs) (30 yrs)	Arsenic Beryllium	6E-06 1E-06	3 3	100% 100%	7.3 0.6	9.0 0.7	4E-06 1E-06	8 8	100% 100%	6.6 0.6	5.5 0.6	mg/kg mg/kg
11) Subsurface soil ingestion (b) (source 4/TR)	8E-06 3E-05	6E-06 2E-05	(24 yrs) (30 yrs)	Arsenic Beryllium	1E-05 1E 06	3 3	100% 100%	12 0.74	16.17 0.88	4E-06 1E-06	8 8	100% 100%	6.6 0.6	5.5 0.6	mg/kg mg/kg
12) Subsurface soil ingestion (without source areas)	8E-06 3E-05	6E-06 2E-05	(24 yrs) (30 yrs)	Arsenic Beryllium	5E-06 2E-06	35 41	100% 100%	12 2.2	6.1 1.0	4E-06 1E-06	8 8	100% 100%	6.6 0.6	5.5 0.6	mg/kg mg/kg
13) Subsurface soil dermal absorption (b) (source 1/G22)	2E-05 3E-05	7E-06 1E-05	(24 yrs) (30 yrs)	Arsenic Beryllium	2E-06 1E 06	4 4	100% 100%	4.2 1.1	7.4 1.1	2E-06 6E-07	8 8	100% 100%	6.6 0.6	5.5 0.6	mg/kg mg/kg
14) Subsurface soil dermal absorption (b) (source 2/G23)	2E-05 3E-05	7E-06 1E-05	(24 yrs) (30 yrs)	Arsenic	8E-06	3	100%	18	27	2E-06	8	100%	6.6	5.5	mg/kg
(15) Subsurface soil dermal absorption (b) (source 3/SB30)	2E-05 3E-05	7E-06 1E-05	(24 yrs) (30 yrs)	Arsenic	6E-06	3	100%	18	27	2E-06	8	100%	6.6	5.5	mg/kg
(16) Subsurface soil dermal absorption (b) (source 4/TR)	2E-05 3E-05	7E-06 1E-05	(24 yrs) (30 yrs)	Arsenic	5E 06	3	100%	12.00	16.17	2E-06	8	100%	6.6	5.5	mg/kg

Table # 15 (cont'd)

Table # 15 (cont'd)

Carcinogenic Risks for a Residential Adult

Exposure Route	Onsite Cancer Risk	Back-ground Cancer Risk		Onsite Chemical *	Onsite Chemical Specific Cancer Risk	Onsite Total Analyses	Onsite Detection Frequency	Onsite Maximum Detected Value	Onsite UCL 95%	Background Chemical Specific Cancer Risk	Background Total Analyses	Background Detection Frequency	Background Maximum Detected Value	Background UCL 95%	Units
(17) Subsurface soil dermal absorption (without source areas)	2E-05	7E-06	(24 yrs)	Arsenic	3E-06	35	100%	12	6	2E-06	8	100%	6.6	5.5	mg/kg
	3E-05	1E-05	(30 yrs)	Beryllium	1E-06	41	100%	2.2	1.0	6E-07	8	100%	0.6	0.6	mg/kg
				Benzo[a]anthracene	3E-06	33	3%	69	205	ND					ug/kg
				Benzo[b]fluoranthene	3E-06	33	3%	73	205	2E-06	8	13%	59	269	ug/kg
				Benzo[k]fluoranthene	3E-06	33	3%	93	204	ND					ug/kg
				Chrysene	3E-06	33	3%	77	205	2E-06	8	13%	51	290	ug/kg
				Indeno[1,2,3-cd]pyrene	2E-06	33	3%	54	205	ND					ug/kg
(18) Ingestion of root & leafy vegetables, beef, and milk (c)	2E-05	2E-08	(c)	Benzo[a]pyrene	2E-06					ND					
				Indeno[1,2,3-cd]pyrene	4E-06					ND					
				Methylene chloride	1E-05					6E-13					

ND = nondetection

* *Chemicals driving major portion of cancer risk are indicated.*

(a) Chemical cancer risk < 1E-06

(b) Acre weighted risk: Risk is weighted according to square footage of source area and its percentage of a one acre plot; it is equal to the hazard index of source area x acre percentage plus the hazard index of non-source area x 1 minus acre percentage. The square footage of source area 1 is equal to 7% of an acre, source area 2 is 2% of an acre, source area 3 is 16% of an acre, and source area 4 is 22% of an acre.

(c) Agricultural products risk: Risk of adverse health effects after ingestion of chemically contaminated root and leafy vegetables, beef and milk; chemical intake rates are calculated based on chemicals detected in soil and groundwater, the estimated risk is the sum of 6 years of exposure as a child and 24 years as an adult.

Table # 15 (cont'd)

Table # 15 (cont'd)

Carcinogenic Risks for a Residential Child

			Onsite					Background					
Exposure Route	Onsite Cancer Risk	Background Cancer Risk	Chemical *	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(1) Groundwater ingestion	4E 04	4E-04	Arsenic	4E 04	19	95%	43	59	4E-04	4	100%	41	821	ug/L
			Beryllium	2E-05	19	11%	3.1	0.7	4E-05	4	25%	1.8	4.0	ug/L
(2) Groundwater dermal absorption	1E 06	1E-06	Arsenic	1E 06	19	95%	43	59	1E-06	4	100%	41	821	ug/L
(3) Surface water dermal absorption	3E-08	1E-08	(a)											
(4) Surface soil ingestion	3E-05	1E-05	Arsenic	2E-05	18	100%	19	12	1E-05	8	100%	6.6	5.5	mg/kg
			Beryllium	3E-06	21	100%	1.2	0.7	3E-06	8	100%	0.6	0.6	mg/kg
(5) Surface soil dermal absorption	6E-06	4E-06	Arsenic	3E-06	18	100%	19	12	1E-06	8	100%	6.6	5.5	mg/kg
			Benzo(a)pyrene	1E-06	18	6%	70	529	ND					ug/kg
			Indeno(1,2,3-cd)pyrene	1E-06	18	6%	47	547	ND					ug/kg
(6) Sediment ingestion	5E-07	3E-07	(a)											
(7) Sediment dermal absorption	7E-08	1E-07	(a)											
(8) Subsurface soil ingestion (b) (source 1/G22)	2E-05	1E-05	Arsenic	8E-06	4	100%	4.2	7.4	1E-05	8	100%	6.6	5.5	mg/kg
			Beryllium	5E-06	4	100%	1.1	1.1	3E-06	8	100%	0.6	0.6	mg/kg
(9) Subsurface soil ingestion (b) (source 2/G23)	2E-05	1E-05	Arsenic	4E-05	3	100%	19	27	1E-05	8	100%	6.6	5.5	mg/kg
			Beryllium	1E-06	4	50%	0.3	161	3E-06	8	100%	0.6	0.6	mg/kg

Table # 15 (cont'd)

Table # 15 (cont'd)

Carcinogenic Risks for a Residential Child

			Onsite						Background					
Exposure Route	Onsite Cancer Risk	Back-ground Cancer Risk	Chemical *	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(10) Subsurface soil ingestion (b) (source 3/SB30)	2E-05	1E-05	Arsenic	1E-05	3	100%	7.3	9.0	1E-05	8	100%	6.6	5.5	mg/kg
			Beryllium	3E-06	3	100%	0.6	0.7	3E-06	8	100%	0.6	0.6	mg/kg
(11) Subsurface soil ingestion (b) (source 4/TR)	2E-05	1E-05	Arsenic	2E-05	3	100%	12.00	16.17	1E-05	8	100%	6.6	5.5	mg/kg
			Beryllium	3E-06	3	100%	0.74	0.88	3E-06	8	100%	0.6	0.6	mg/kg
(12) Subsurface soil ingestion (without source areas)	2E-05	1E-05	Arsenic	2E-05	35	100%	12	6.1	1E-05	8	100%	6.6	5.5	mg/kg
			Beryllium	5E-06	41	100%	2.2	1.0	3E-06	8	100%	0.6	0.6	mg/kg
(13) Subsurface soil dermal absorption (b) (source 1/G22)	9E-06	4E-06	Arsenic	1E-06	4	100%	4.2	7.4	5E-05	8	100%	6.6	5.5	mg/kg
(14) Subsurface soil dermal absorption (b) (source 2/G23)	1E-05	4E-06	Arsenic	5E-06	3	100%	19	27	5E-05	8	100%	6.6	5.5	mg/kg
(15) Subsurface soil dermal absorption (b) (source 3/SB30)	9E-06	4E-06	Arsenic	2E-06	3	100%	7.3	9.0	5E-05	8	100%	6.6	5.5	mg/kg
(16) Subsurface soil dermal absorption (b) (source 4/TR)	9E-06	4E-06	Arsenic	3E-06	3	100%	12.0	16.2	5E-05	8	100%	6.6	5.5	mg/kg

Table # 15 (cont'd)

Table # 15 (cont'd)

Carcinogenic Risks for a Residential Child

			Onsite					Background					
Exposure Route	Onsite Cancer Risk	Background Cancer Risk	Chemical *	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(17) Subsurface soil dermal absorption (without source areas)	1E 05	4E 06	Arsenic	2E-06	35	100%	12	6.1	1E-06	8	100%	6.6	5.5	mg/kg
			Benzo[a]anthracene	1E-06	33	3%	69	205	ND					ug/kg
			Benzo[b]fluoranthene	2E-06	33	3%	73	205	1E-06	8	13%	59	269	ug/kg
			Benzo[k]fluoranthene	2E-06	33	3%	93	204	ND					ug/kg
			Chrysene	2E-06	33	3%	77	205	1E-06	8	13%	51	290	ug/kg
			Indeno[1,2,3-cd]pyrene	1E 06	33	3%	54	205	ND					ug/kg

ND = nondetection

(a) Chemical cancer risk < 1E-06

* Chemicals driving cancer risk are indicated.

(b) Acre weighted risk: Risk is weighted according to square footage of source area and its percentage of a one acre plot; it is equal to the hazard index of source area x acre percentage plus the hazard index of non-source area x 1 minus acre percentage. The square footage of source area 1 is equal to 7% of an acre, source area 2 is 2% of an acre, source area 3 is 16% of an acre, and source area 4 is 22% of an acre.

Table # 15 (cont'd)

Table # 15 (cont'd)

Carcinogenic Risks for an Occupational/Industrial Laborer

			Onsite						Background					
Exposure route	Onsite Cancer Risk	Back-ground Cancer Risk	Chemical *	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(1) Groundwater ingestion	3E-04	3E-04	Arsenic	3E-04	19	95%	43	1696	3E-04	4	100%	41	822	ug/L
			Beryllium	1E-05	19	11%	3.1	0.7	3E-05	4	25%	1.8	3E+25	ug/L
(2) Groundwater dermal absorption	2E-06	2E-06	Arsenic	2E-06	19	95%	43	1696	2E-06	4	100%	41	822	ug/L
(3) Surface water dermal absorption	7E-08	2E-08	(a)											
(4) Surface soil ingestion	4E-06	2E-06	Arsenic	4E-06	18	100%	19	12	2E-06	8	100%	6.6	5.5	mg/kg
(5) Surface soil dermal absorption	8E-06	5E-06	Arsenic	4E-06	18	100%	19	12	2E-06	8	100%	6.6	5.5	mg/kg
			Benzo[a]pyrene	2E-06	18	6%	70	529	ND					ug/kg
			Indeno[1,2,3-cd]pyrene	1E-06	18	6%	47	547	ND					ug/kg
(6) Occupational inhalation of dust	5E-08	1E-08	(a)											
(7) Sediment ingestion	1E-07	7E-08	(a)											
(8) Sediment dermal absorption	1E-07	2E-07	(a)											
(9) Subsurface soil ingestion (b) (source 1/G22)	3E-06	2E-06	Arsenic	1E-06	4	100%	4.2	7.4	2E-06	8	100%	6.6	5.5	mg/kg

Table # 15 (cont'd)

Table # 15 (cont'd)

	Onsite							Background					
Exposure route	Onsite Cancer Risk	Back-ground Cancer Risk	Chemical *	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(10) Subsurface soil ingestion (b) (source 2/G23)	3E-06	2E-06	Arsenic	6E-06	3	100%	19	27	2E-06	8	100%	6.6	5.5	mg/kg
(11) Subsurface soil ingestion (b) (source 3/SB30)	3E-06	2E-06	Arsenic	2E-06	3	100%	7.3	9.0	2E-06	8	100%	6.6	5.5	mg/kg
(12) Subsurface soil ingestion (b) (source 4/TR)	3E-06	2E-06	Arsenic	4E-06	3	100%	12.0	16.2	2E-06	8	100%	6.6	5.5	mg/kg
(13) Subsurface soil ingestion (without source areas)	3E-06	2E-06	Arsenic	2E-06	35	100%	12	6.1	2E-06	8	100%	6.6	5.5	mg/kg
(14) Subsurface soil dermal absorption (b) (source 1/G22)	9E-06	5E-06	Arsenic	1E-06	4	100%	4.2	7.4	2E-06	8	100%	6.6	5.5	mg/kg
(15) Subsurface soil dermal absorption (b) (source 2/G23)	1E-05	5E-06	Arsenic	6E-06	3	100%	19	27	2E-06	8	100%	6.6	5.5	mg/kg
(16) Subsurface soil dermal absorption (b) (source 3/SB30)	9E-06	5E-06	Arsenic	2E-06	3	100%	7.3	9.0	2E-06	8	100%	6.6	5.5	mg/kg

Table # 15 (cont'd)

Table # 15 (cont'd)

Carcinogenic Risks for an Occupational/Industrial Laborer

			Onsite						Background					
xposure route	Onsite Cancer Risk	Back-ground Cancer Risk	Chemical *	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Chemical Specific Cancer Risk	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
17) Subsurface soil dermal absorption (b) (source 4/TR)	9E-06	5E-06	Arsenic	4E-06	3	100%	12	16.17	2E-06	8	100%	6.6	5.5	mg/kg
18) Subsurface soil dermal absorption (without source areas)	1E-05	5E-06	Arsenic	2E-06	35	100%	12	6.1	2E-06	8	100%	6.60	5.46	mg/kg
			Benzo[a]anthracene	2E-06	33	3%	69	205	ND					ug/kg
			Benzo[b]fluoranthene	2E-06	33	3%	73	205	2E-06	8	13%	59	269	ug/kg
			Benzo[k]fluoranthene	3E-06	33	3%	93	204	ND					ug/kg
			Chrysene	2E-06	33	3%	77	205	1E-06	8	13%	51	290	ug/kg
			Indeno[1,2,3-cd]pyrene	1E-06	33	3%	54	205	ND					ug/kg

ND = nondetection

* Chemicals driving major portion of cancer risk estimate are indicated.

a) Chemical cancer risk < 1E-06

b) Acre weighted risk: Risk is weighted according to square footage of source area and its percentage of a one acre plot; it is equal to the hazard index of source area x acre percentage plus the hazard index of non-source area x 1 minus acre percentage. The square footage of source area 1 is equal to 7% of an acre, source area 2 is 2% of an acre, source area 3 is 16% of an acre, and source area 4 is 22% of an acre.

Table # 15 (cont'd)

Table #16

SUMMARY OF POTENTIAL NONCINOGENIC RISKS

Table # 16

Noncarcinogenic Risks for a Trespasser

	Onsite							Background					
Exposure Route	Onsite Hazard Index	Background Hazard Index	Chemical *	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(1) Surface water dermal absorption	0.003	0.001	(a)											
(2) Surface soil ingestion	0.06	0.01	(a)											
(3) Surface soil dermal absorption	0.06	0.01	(a)											
(4) Sediment ingestion	0.01	0.001	(a)											
(5) Sediment dermal absorption	0.01	0.001	(a)											

ND Nondetection

* Chemicals driving major portion of risk or hazard estimate are indicated.

(a) Hazard Index < 1

Noncarcinogenic Risks for a Residential Adult

Exposure Route	Onsite Hazard Index	Back-ground Hazard Index		Onsite Chemical *	Onsite Hazard Quotient	Onsite Total Analyses	Onsite Detection Frequency	Onsite Maximum Detected Value	Onsite UCL 95%	Background Hazard Quotient	Background Total Analyses	Background Detection Frequency	Background Maximum Detected Value	Background UCL 95%	Units
(1) Groundwater ingestion	26.5	24.5		Antimony	1.55	19	5%	65	23	ND					ug/L
				Arsenic	3.90	19	95%	43	59	3.76	4	100%	41	821	ug/L
				Thallium	19.80	19	42%	51	89	19.73	4	50%	50	3.5E+08	ug/L
				Manganese	0.59	19	100%	4900	2140	0.41	4	100%	1500	1818	ug/L
(2) Groundwater dermal absorption	0.09	0.06		(a)											
(3) Surface water dermal absorption	0.002	0.0005		(a)											
(4) Surface soil ingestion	0.40 4.20	0.05 0.60	(24 yrs) (30 yrs)	(a)											
(5) Surface soil dermal absorption	0.22 0.73	0.03 0.10	(24 yrs) (30 yrs)	(a)											
(6) Sediment ingestion	0.01 0.10	0.001 0.01	(24 yrs) (30 yrs)	(a)											
(7) Sediment dermal absorption	0.01 0.02	0.0007 0.003	(24 yrs) (30 yrs)	(a)											
(8) Subsurface soil ingestion (b) (source 1/G22)	0.10 0.80	0.05 0.60	(24 yrs) (30 yrs)	(a)											
(9) Subsurface soil ingestion (b) (source 2/G23)	0.09 0.90	0.05 0.60	(24 yrs) (30 yrs)	(a)											

Table # 16 (cont'd)

Noncarcinogenic Risks for a Residential Adult

Exposure Route	Onsite Hazard Index	Background Hazard Index		Onsite Chemical *	Onsite Hazard Quotient	Onsite Total Analyses	Onsite Detection Frequency	Onsite Maximum Detected Value	Onsite UCL 95%	Background Hazard Quotient	Background Total Analyses	Background Detection Frequency	Background Maximum Detected Value	Background UCL 95%	Units
(10) Subsurface soil ingestion (b) (source 3/SB30)	0.10 0.99	0.05 0.60	(24 yrs) (30 yrs)	(a)											
(11) Subsurface soil ingestion (b) (source 4/TR)	0.10 1.02	0.05	(24 yrs) (30 yrs)	(a)											
(12) Subsurface soil ingestion (without source areas)	0.08 0.80	0.05 0.60	(24 yrs) (30 yrs)	(a)											
(13) Subsurface soil dermal absorption (b) (source 1/G22)	0.04 0.14	0.03 0.10	(24 yrs) (30 yrs)	(a)											
(14) Subsurface soil dermal absorption (b) (source 2/G23)	0.04 0.14	0.03 0.09	(24 yrs) (30 yrs)	(a)											
(15) Subsurface soil dermal absorption (b) (source 3/SB30)	0.05 0.15	0.03 0.09	(24 yrs) (30 yrs)	(a)											

Table # 16 (cont'd)

Table # 16 (cont'd)

Noncarcinogenic Risks for a Residential Child

			Onsite					Background					
Exposure Route	Onsite Hazard Index	Background Hazard Index	Chemical *	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(1) Groundwater ingestion	61.9	57.2	Antimony	3.61	19	5%	65	23	ND					ug/L
			Arsenic	9.10	19	95%	43	59	8.78	4	100%	41	821	ug/L
			Manganese	1.37	19	100%	4900	2140	0.96	4	100%	1500	1818	ug/L
			Thallium	46.21	19	42%	51	89	46.03	4	50%	50	3.5E+08	ug/L
			Vanadium	0.35	19	68%	129	38	0.43	4	25%	47	81086	ug/L
			Barium	0.60	19	100%	1430	661	0.46	4	100%	508	522	ug/L
(2) Groundwater dermal absorption	0.2	0.1	(a)											
(3) Surface water dermal absorption	0.004	0.001	(a)											
(4) Surface soil ingestion	3.8	0.5	Barium	2.47	19	100%	13500	39626	0.08	8	100%	662	446	mg/kg
			Arsenic	0.51	18	100%	19	12	0.23	8	100%	6.6	5.5	mg/kg
(5) Surface soil dermal absorption	0.5	0.07	(a)											
(6) Sediment ingestion	0.09	0.01	(a)											
(7) Sediment dermal absorption	0.01	0.002	(a)											

Table # 16 (cont'd)

Table # 16 (cont'd)

Noncarcinogenic Risks for a Residential Adult

				Onsite						Background					
Exposure Route	Onsite Hazard Index	Background Hazard Index		Chemical *	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(16) Subsurface soil dermal absorption (b) (source 4/TR)	0.05 0.20	0.03 0.09	(24 yrs) (30 yrs)												
(17) Subsurface soil dermal absorption (without source areas)	0.04 0.14	0.03 0.10	(24 yrs) (30 yrs)	(a)											
(18) Ingestion of root & leafy vegetables, beef, and milk (c)	0.10	0.001	(c)	(a)											

ND Nondetection

* Chemicals driving major portion of risk or hazard estimate are indicated.

(a) Hazard Index < 1

(b) Acre weighted risk: Risk is weighted according to square footage of source area and its percentage of a one acre plot; it is equal to the hazard index of source area x acre percentage plus the hazard index of non-source area x 1 minus acre percentage. The square footage of source area 1 is equal to 7% of an acre, source area 2 is 2% of an acre, source area 3 is 16% of an acre, and source area 4 is 22% of an acre.

(c) Agricultural products risk: Risk of adverse health effects after ingestion of chemically contaminated root and leafy vegetables, beef and milk; chemical intake rates are calculated based on chemicals detected in soil and groundwater; the estimated risk is the sum of 6 years of exposure as a child and 24 years as an adult.

Table # 16 (cont'd)

Table # 16 (cont'd)

Noncarcinogenic Risks for a Residential Child

Exposure Route	Onsite Hazard Index	Background Hazard Index	Onsite Chemical *	Onsite Hazard Quotient	Onsite Total Analyses	Onsite Detection Frequency	Onsite Maximum Detected Value	Onsite UCL 95%	Background Hazard Quotient	Background Total Analyses	Background Detection Frequency	Background Maximum Detected Value	Background UCL 95%	Units
(8) Subsurface soil ingestion (b): (source 1/G22)	0.7	0.5	(a)											
(9) Subsurface soil ingestion (b) (source 2/G23)	0.8	0.5	Barium	1.63	4	100%	8920	1.1E+11	0.08	8	100%	662	446	mg/kg
			Antimony	0.33	1	100%	10	(c)	ND					mg/kg
			Arsenic	0.79	3	100%	19	27	0.23	8	100%	6.6	5.5	mg/kg
			Cadmium	0.21	4	50%	8.3	1.0E+06	ND					mg/kg
			Thallium	0.16	4	75%	0.9	3.7E+00	ND					mg/kg
(10) Subsurface soil ingestion (b) (source 3/SB30)	0.9	0.5	Antimony	0.31	3	33%	10	33	ND					mg/kg
			Arsenic	0.31	3	100%	7.3	9.0	0.23	8	100%	6.6	5.5	mg/kg
			Barium	0.90	3	100%	4910	9.1E+07	0.08	8	100%	662	446	mg/kg
			Manganese	0.13	3	100%	1020	3.1E+03	0.08	8	100%	863	630	mg/kg
(11) Subsurface soil ingestion (b) (source 4/TR)	0.9	0.5	Barium	0.94	3	100%	5140	5930	0.08	8	100%	662	446	mg/kg
			Arsenic	0.51	3	100%	12	16						
(12) Subsurface soil ingestion (without source areas)	0.7	0.5	Antimony	0.15	36	14%	11	4.5	ND					mg/kg
			Arsenic	0.26	35	100%	12	6.1	0.23	8	100%	6.6	5.5	mg/kg
			Barium	0.14	41	100%	5940	739	0.08	8	100%	662	446	mg/kg
(13) Subsurface soil dermal absorption (b) (source 1/G22)	0.1	0.07	(a)											
(14) Subsurface soil dermal absorption (b) (source 2/G23)	0.1	0.07	(a)											
(15) Subsurface soil dermal absorption (b) (source 3/SB30)	0.1	0.07	(a)											

Table # 16 (cont'd)

Table # 16 (cont'd)

Noncarcinogenic Risks for a Residential Child

			Onsite						Background					
Exposure Route	Onsite Hazard Index	Background Hazard Index	Chemical *	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(16) Subsurface soil dermal absorption (b) (source 4/TR)	0.2	0.07	(a)											
(17) Subsurface soil dermal absorption (without source areas)	0.1	0.07	(a)											

ND Nondetection

* Chemicals driving major portion of risk or hazard estimate are indicated.

Background surface soil samples are used as surrogate background *subsurface soil values*

(a) Hazard Index < 1

(b) ACRE WEIGHTED RISK: Risk is weighted according to square footage of source area and its percentage of a one acre plot; it is equal to the hazard index of source area x acre percentage plus the hazard index of non-source area x 1 minus acre percentage. The square footage of source area 1 is equal to 7% of an acre, source area 2 is 2% of an acre, source area 3 is 16% of an acre, and source area 4 is 22% of an acre.

(c) UCL not applicable to a sample population size of 1.

Table # 16 (cont'd)

Table # 16 (cont'd)

Noncarcinogenic Risks for an Occupational/Industrial Laborer

			Onsite					Background					
posure Route	Onsite Hazard Index	Back-ground Hazard Index	Chemical *	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
) Groundwater ingestion	9.5	8.8	Arsenic	1.39	19	95%	43	59	1.34	4	100%	41	821	ug/L
			Thallium	7.07	19	42%	51	89	7.05	4	50%	50	3.5E+08	ug/L
			Antimony	0.55	19	5%	65	23	ND					ug/L
) Groundwater dermal absorption	0.07	0.05	(a)											
) Surface water dermal absorption	0.002	0.0005	(a)											
) Surface soil ingestion	0.1	0.02	(a)											
) Surface soil dermal absorption	0.2	0.02	(a)											
) Occupational inhalation of dust	0.01	0.002	(a)											
) Sediment ingestion	0.005	0.0006	(a)											
) Sediment dermal absorption	0.005	0.0007	(a)											
) Subsurface soil ingestion (b) (source 1/G22)	0.03	0 02	(a)											

Table # 16 (cont'd)

Table # 16 (cont'd)

Noncarcinogenic Risks for an Occupational/Industrial Laborer

			Onsite						Background					
Exposure Route	Onsite Hazard Index	Background Hazard Index	Chemical *	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(10) Subsurface soil ingestion (b) (source 2/G23)	0.03	0.02	(a)											
(11) Subsurface soil ingestion (b) (source 3/SB30)	0.04	0.02	(a)											
(12) Subsurface soil ingestion (b) (source 4/TR)	0.04	0.02	(a)											
(13) Subsurface soil ingestion (without source areas)	0.03	0.02	(a)											
(14) Subsurface soil dermal absorption (b) (source 1/G22)	0.03	0.02	(a)											
(15) Subsurface soil dermal absorption (b) (source 2/G23)	0.03	0.02	(a)											
(16) Subsurface soil dermal absorption (b) (source 3/SB30)	0.04	0.02	(a)											

Table # 16 (cont'd)

Table # 16 (cont'd)

Noncarcinogenic Risks for an Occupational/Industrial Laborer

			Onsite						Background					
Exposure Route	Onsite Hazard Index	Background Hazard Index	Chemical *	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Hazard Quotient	Total Analyses	Detection Frequency	Maximum Detected Value	UCL 95%	Units
(17) Subsurface soil dermal absorption (b) (source 4/TR)	0.04	0.02	(a)											
(18) Subsurface soil dermal absorption (without source areas)	0.03	0.02	(a)											

ND Nondetection

* Chemicals driving major portion of risk or hazard estimate are indicated.

(a) Hazard Index < 1

(b) Acre weighted risk: Risk is weighted according to square footage of source area and its percentage of a one acre plot; it is equal to the hazard index of source area x acre percentage plus the hazard index of non-source area x 1 minus acre percentage. The square footage of source area 1 is equal to 7% of an acre, source area 2 is 2% of an acre, source area 3 is 16% of an acre, and source area 4 is 22% of an acre.

Table # 16 (cont'd)

Table #17

CUMULATIVE POTENTIAL RISKS - TRESPASSER

Table # 17

Trespasser Cumulative Carcinogenic and Noncarcinogenic Risk Across Pathways*

	Onsite		Background	
	Cancer Risk	HI	Cancer Risk	HI
Surface Water Dermal Absorption	5E-08	0.003	1E-08	0.001
Surficial Soil Dermal Absorption	7E-07	0.06	4E-07	0.01
Surficial Soil Ingestion	1E-06	0.06	8E-07	0.01
Sediment Ingestion	9E-08	0.01	1E-07	0.001
Sediment Dermal Absorption	8E-08	0.01	2E-07	0.001
CUMULATIVE ACROSS PATHWAYS	2E-06	0.1	2E-06	0.02

Notes:

* Risks based on all chemicals with at least one positive detection and a verified toxicity value.

HI = Hazard Index (Noncarcinogenic Risk)

Table #18

CUMULATIVE POTENTIAL RISKS - FUTURE RESIDENTIAL

Table # 18

Residential Cumulative Carcinogenic and Noncarcinogenic Risk Across Pathways*

	Onsite				Background			
	Adult		Child		Adult		Child	
	Cancer Risk	HI	Cancer Risk	HI	Cancer Risk	HI	Cancer Risk	HI
Groundwater Ingestion	9E-04	26 5	4E-04	61 9	9E-04	24 5	4E-04	57 2
Groundwater Dermal Absorption	3E-06	0 09	1E-06	0 2	3E-06	0 06	1E-06	0 1
Surface Water Dermal Absorption	8E-08	0 002	3E-08	0 004	3E-08	0 0005	1E-08	0 001
Surficial Soil Dermal Absorption	2E-05	0 7	6E-06	0 5	1E-05	0.1	4E-06	0 07
Surficial Soil Ingestion	4E-05	4 2	3E-05	3 8	2E-05	0 6	1E-05	0 5
Sediment Ingestion	7E-07	0 1	5E-07	0 09	4E-07	0 01	3E-07	0 01
Sediment Dermal Absorption	2E-07	0 02	7E-08	0 01	3E 07	0 003	1E-07	0 002
Subsurface Soil Ingestion	3E-05	1.0	2E-05	0 9	2E-05	0 6	1E-05	0 5
Subsurface Soil Dermal Absorption	3E-05	0 2	1E 05	0 1	1E-05	0 09	4E-06	0 07
Ingestion of root & leafy vegetables, beef and milk	2E-05	0 1			2E 08	0.001		
CUMULATIVE ACROSS PATHWAYS	1E-03	32 9	5E-04	67 5	1E-03	26.0	4E-04	58 5

Notes:
* Risks based on all chemicals with at least one positive detection
HI = Hazard Index (Noncarcinogenic Risk)

Table # 18

Table #19

CUMULATIVE POTENTIAL RISKS - OCCUPATIONAL

Table # 19

Occupational Cumulative Carcinogenic and Noncarcinogenic Risk Across Pathways*

	Onsite		Background	
	Cancer Risk	HI	Cancer Risk	HI
Groundwater Ingestion	3E-04	9 5	3E 04	8 8
Groundwater Dermal Absorption	2E-06	0 07	2E-06	0 05
Surface Water Dermal Absorption	7E-08	0 002	2E-08	0 0005
Surficial Soil Dermal Absorption	8E-06	0 2	5E-06	0 02
Surficial Soil Ingestion	4E-06	0 1	2E 06	0 02
Occupational Inhalation of Dust	5E-08	0 01	1E 08	0 002
Sediment Ingestion	1E-07	0 005	7E-08	0 0006
Sediment Dermal Absorption	1E-07	0 005	2E-07	0 0007
Subsurface Soil Ingestion	3E-06	0 04	2E-06	0 02
Subsurface Soil Dermal Absorption	1E-05	0 04	5E-06	0 02
CUMULATIVE ACROSS PATHWAYS	3E-04	10 0	3E-04	8.9

Notes.
* Risks based on all chemicals with at least one positive detection
HI = Hazard Index (Noncarcinogenic Risk)

Table #20

D.L. MUD RISK ASSESSMENT UNCERTAINTIES

Table # 20

General Uncertainty Factors

Uncertainty Factor	*Effect of Uncertainty*	Comment
Use of cancer slope factors.	May overestimate risks	Slopes are upper 95th percent confidence limits derived from the linearized model. Considered unlikely to underestimate true risk.
Risks/doses within an exposure route assumed to be additive.	May over- or underestimate risks	Does not account for synergism or antagonism.
Toxicity values derived primarily from animal studies.	May over- or underestimate risks	Extrapolation from animal to humans may induce error because of differences in absorption, *pharmacokinetics, target organ, enzyme profiles,* and population variability.
Toxicity values derived primarily from high doses, most exposures are at low doses.	May over- or underestimate risks	Assumes linearity at low doses. Tends to have conservative exposure assumptions.
Toxicity values.	May over- or underestimate risks	Not all values represent the same degree of certainty. All are subject to change as new evidence becomes available.
Affect of absorption.	*May over- or underestimate* risks	The assumption that absorption is equivalent across species is implicit in the derivation of the critical toxicity values. Absorption may vary with species and age.
Affect of applying critical toxicity values to soil exposures.	May overestimate risks	Assumes bioavailability of contaminants sorbed onto soil is the same as delivered in lab studies. Contaminants delivered in studies may be more bioavailable.

Table # 20

Table # 20 (cont'd)

Site Specific Uncertainty Factors

Uncertainty Factor	Effect of Uncertainty	Comment
Some routes of exposure were not quantified.	May underestimate risks	Inhalation of volatile and semivolatile organics not quantitatively evaluated.
Exposure assumptions.	May over- or underestimate risks	Assumptions regarding media intake, population characteristics, and exposure patterns may not characterize exposures.
Exposures assumed constant over time.	May overestimate risks	Does not account for environmental fate, transport, or transfer which may decrease concentration.

Table # 20 (cont'd)

Table #21

CHEMICALS OF CONCERN FOR SURFACE SOILS

Table # 21

SURFACE SOILS

CHEMICAL	ONSITE Detection Frequency	ONSITE Maximum Detected Value	ONSITE Detected Value UCL	BACKGROUND Maximum Detected Value	BACKGROUND UCL	ONSITE Excess Lifetime Cancer[a]	BACKGROUND Excess Lifetime Cancer[a]	Hazard Quotient (Daily Intake/RFD)	ONSITE Blood Lead Level[b] (% Above 10 µg/dL)	BACKGROUND Blood Lead Level[b] (% Above 10 µg/dL)	GCVS Clean Up Level
						EPA Action Levels					
						> 1E-04	> 1E-04	> 1	> 5%	> 5%	--
Inorganics (ppm)											
Arsenic	100%	19	12	6.6	5.5	2E-05	1E-05	0.5	--	--	16
Barium	100%	13,500	39,626	662	446	--	--	2.5	--	--	5400
Chromium	100%	188	76	17	16	--	--	0.001	--	--	--
Lead	100%	643	615	27	22	--	--	--	3.87%	3.08%	--
Nickel	100%	21	13	10	8.4	--	--	0.008	--	--	--
Zinc	100%	1,380	1,582	37	31	--	--	0.09	--	--	--
Organics (ppb)											
Bis(2-Ethylhexyl) Phthalate	83%	900	730	460	804	7E-08	4E-08	0.002	--	--	--
Naphthalene	17%	49	727	ND	--	--	--	0.0005	--	--	--
Phenol	11%	380	528	ND	--	--	--	0.00003	--	--	--

Notes:

[a] Values for adult and child were compared, and the greater number of the two is reflected in the table.
[b] EPA's definition of acceptability is a lead concentration in soil that results in no more that 5 percent of an exposed population having a blood lead level > 10 µg/dL.

UCL = Upper confidence limit
RFD = Reference dose

Table # 21