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LITIGATION TECHNICAL SUPPORT AND SERVICES

Rocky Mountain Arsenal

FINAL PHASE I CONTAMINATION ASSESSMENT REPORT SITE 26-6: BASIN F (Version 3.3)

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PREPARED BY

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

Harding Lawson Associates Midwest Research Institute
(Prepared under Task 19)

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THIS FINAL REPORT DOCUMENTS THE PHASE I CONTAMINATION SURVEY OF SITE 26-6, BASIN F.

56 SAMPLES FROM 22 BORINGS WERE ANALYZED FOR VOLATILE AND SEMIVOLATILE ORGANICS AND METALS. A WIDE SPECTRUM OF METALS, VOLATILE ORGANIC COMPOUNDS, AND ORGANOCHOLORINE PESTICIDES WAS DETECTED IN THE SAMPLES. CONTAMINATED SOIL BENEATH THE LINER GENERALLY COINCIDED WITH AREAS OF POOR LINER INTEGRITY. CONTAMINANTS WERE DETECTED AT SHALLOW DEPTHS IN ADJACENT AREAS WHERE THE LINER WAS INTACT, SUGGESTING MIGRATION LATERALLY ALONG THE LINER/SOIL INTERFACE FROM AREAS WHERE THE LINER WAS DAMAGED.

AN EXTENSIVE PHASE II PROGRAM IS RECOMMENDED TO ASSESS THE EXTENT OF SOIL CONTAMINATION OUTSIDE THE BASIN F FENCE AND TO DETERMINE IF AIRBORNE PARTICLES EMANATING FROM BASIN F HAVE AFFECTED SECTION 26 SOIL QUALITY. THE VOLUME OF POTENTIALLY CONTAMINATED MATERIAL PRESENT IS ESTIMATED AT 405,000 TO 605,000 BANK CUBIC YARDS.

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EXECUTIVE SUMMARY

SITE 26-6: BASIN F

Site 26-6, Basin F, is in the north-central portion of Section 26 on Rocky Mountain Arsenal (RMA). Basin F is an asphalt-lined evaporative disposal basin that was used for disposal of Shell Chemical Company and U.S. Army hazardous and nonhazardous wastebearing effluent between 1956 and 1981.

On the basis of site history, geophysical exploration was not warranted at this site.

Site 26-6 was investigated under Task 6 in the fall of 1985 and the summer of 1986. During this investigation, 56 soil samples were collected for chemical analysis at depths of 0.7 to 40 feet (ft) from 22 locations within and outside the basin. All samples collected within the basin were obtained below the asphalt liner. Samples from the borings contained a variety of volatile organic compounds, organochlorine pesticides, and metals (copper, zinc, and chromium) at concentrations within or above the indicator ranges. The highest concentrations of target analytes were detected along the eastern boundary. Numerous target analytes were detected at depths of 4 to 5 ft or less in the southern part of the basin. In the western part of the basin and along the northern perimeter, target analytes were undetected or detected only in low concentrations in shallow soil less than 4 ft deep. Numerous nontarget compounds were detected in all but two borings. The presence of nontarget compounds generally corresponded to intervals where target compounds were detected.

An interim response is planned for Basin F, during which all fluid will be pumped out and stored for treatment, and the overburden soil, liner, and soil underlying the liner will be excavated. This material will then be stabilized by solidification and/or absorption, piled into three lined subcells, and immediately covered by a synthetic liner and clay cap. An adjacent double-lined surface impoundment will be constructed to intercept and treat any leachate emanating from the waste pile. Following this, the entire site will be regraded, sealed with a low permeability clay cap, covered with top soil, and revegetated. The final remediation plan will be

designed upon completion of the Phase II and subsequent feasibility study investigations. The following Phase II activities to support final remedial action plan selection are proposed: (1) 16 soil borings to be drilled outside the basin perimeter ranging in depth from 10 ft to water table (approximately 40 ft), (2) collection of 25 surficial soil samples at various distances from the basin along primary wind vectors to identify any wind-borne contamination, and (3) drilling of approximately 28 soil borings to yield as many as 105 soil samples from the basin interior. Drilling of the interior soil borings will be the responsibility of the contractor performing the interim response action. Sample analysis will be performed under a separate USATHAMA contract for laboratory services. Phase II activities outside the basin will be coordinated with the interim response activities to assure that field work progresses as efficiently as possible.

The volume of potentially contaminated Basin F subliner soil, liner, and overburden that may be removed during interim response activities was estimated at 405,000 to 605,000 bank cubic yards. The Phase II soil investigations to be conducted during performance of the interim response action will determine remaining contamination.

SITE 26-6: BASIN F

1.0 PHYSICAL SETTING

1.1 LOCATION

Basin F is in the north-central portion of Section 26 at Rocky Mountain Arsenal (RMA) (Figure 26-6-1). Basin F is a manmade reservoir enclosed by dikes and lined with asphalt 3/8 inch thick. The basin occupies approximately 93 acres.

1.2 GEOLOGY

Basin F was emplaced in a natural depression where the ground surface elevation decreases from east to west and south to north. Earthen dikes were raised around the perimeter to form a basin with an average depth of 10 feet (ft).

The shallow sediments in this area are Recent to Pleistocene alluvium, characterized by a fine- to medium-grained sand layer which varies in thickness from less than 1 ft to as much as 15 ft. A clayey-silt to clayey-sandy-silt to clayey-sand layer underlies the surface layer and may be as much as 20 ft thick. Underlying this unit is a coarse sand containing discrete gravel lenses. The latter sand unit, referred to as the Slocum Alluvium, which makes up much of the near surface aquifer under RMA, is saturated in the lower portions in the vicinity of Basin F (WES, 1979, RIC#81266R15).

Below the alluvial aquifer lies the Denver Formation. Contact between the two units throughout much of RMA is marked by the appearance of a weathered claystone or shale layer, often referred to as "bedrock". The Denver Formation is nonmarine in origin and contains interbedded layers of clay, indurated claystone, silts, sands, lignite, and lenses of siltstone and sandstone. The base of the Denver Formation is described by a "buffer zone" of fine-grained montmorillonitic shale approximately 75 to 100 ft thick. Total thickness of the Denver Formation averages about 250 ft in this area. As a unit, the Denver Formation dips to the southeast at about 100 ft per mile and strikes roughly N10°E. Local variations in dip induced by structural or stratigraphic features are possible. Near the upper reaches

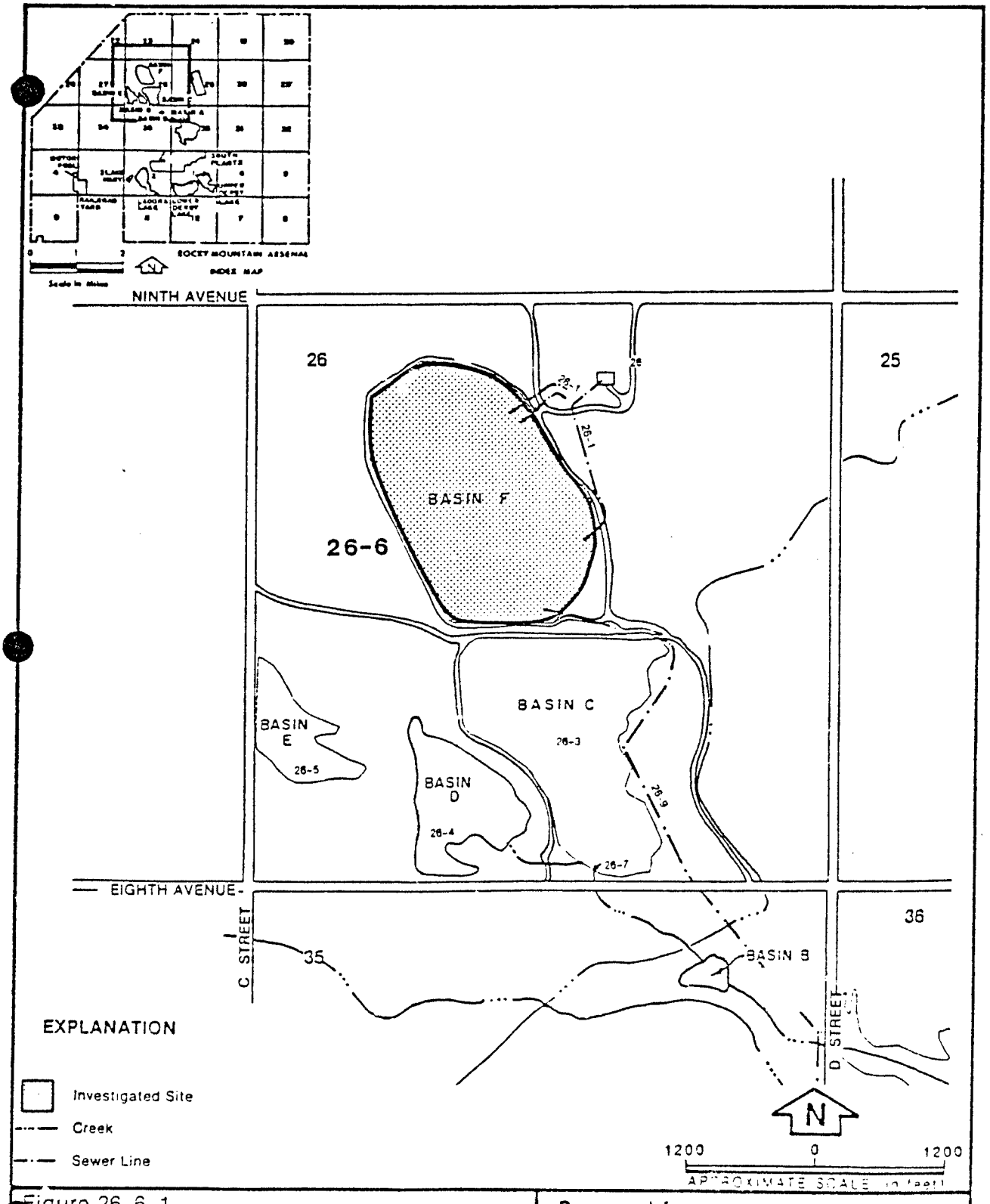

Figure 26-6-1
SITE LOCATION MAP
SITE 26-6
ROCKY MOUNTAIN ARSENAL
SOURCE: ESE, 1987

Prepared for:
U.S. Army Program Manager's Office
For Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

of the formation are two sand trends (WES, 1979, RIC#81266R15), which subcrop beneath the alluvium in the vicinity of Basin F. A general overview of the stratigraphy underlying Basin F is presented in the 1982 report by May (RIC#82295R01, cross sections B-B' and G-G').

Borings completed during the Phase I investigation encountered alluvial material consisting primarily of sandy and clayey silt and silty and clayey sand. Interbedded with these materials were occasional layers of silty and sandy clay. Borehole 4629 encountered several layers of sand and gravel separated by thin lenses of clay. A detailed boring log for Borehole 4629 showing the typical stratigraphy underlying Basin F is presented in Figure 26-6-2.

1.3 HYDROLOGY

Basin F is situated in a natural depression, the perimeter of which is defined by the 5,200 ft above mean sea level (ft msl) contour (Figure 26-6-3). East of the Basin F boundary, the ground surface slopes gradually to the north-northwest; west of the Basin F boundary, the topography slopes to the west. Basins C, D, and E lie to south and southwest. Regional surface water flow in the southern half of Section 26 is primarily directed toward Basins C, D, and E. Elsewhere, flow is primarily to the north and northwest. Earthen dikes surrounding Basin F effectively prevent runoff from entering or leaving the basin.

The aquifers of concern at RMA are contained within the alluvium and the Denver Formation. The Denver Aquifer is a complex system described by relatively thin, discontinuous, lens-shaped, weakly cemented sandstone and fine- to medium-grained sandy units interbedded with relatively impermeable claystone and shale. The sands are water-bearing zones, although fractures and lignite coal seams within clay layers may also act as conduits for ground water flow.

Numerous studies have addressed the ground water conditions in Section 26. Most recently, Environmental Science and Engineering, Inc. (ESE) investigated RMA-wide ground water quality and quantity as part of Task 4 (ESE, 1986, RIC#86317R01). Figure 26-6-4 presents March 1986 water table

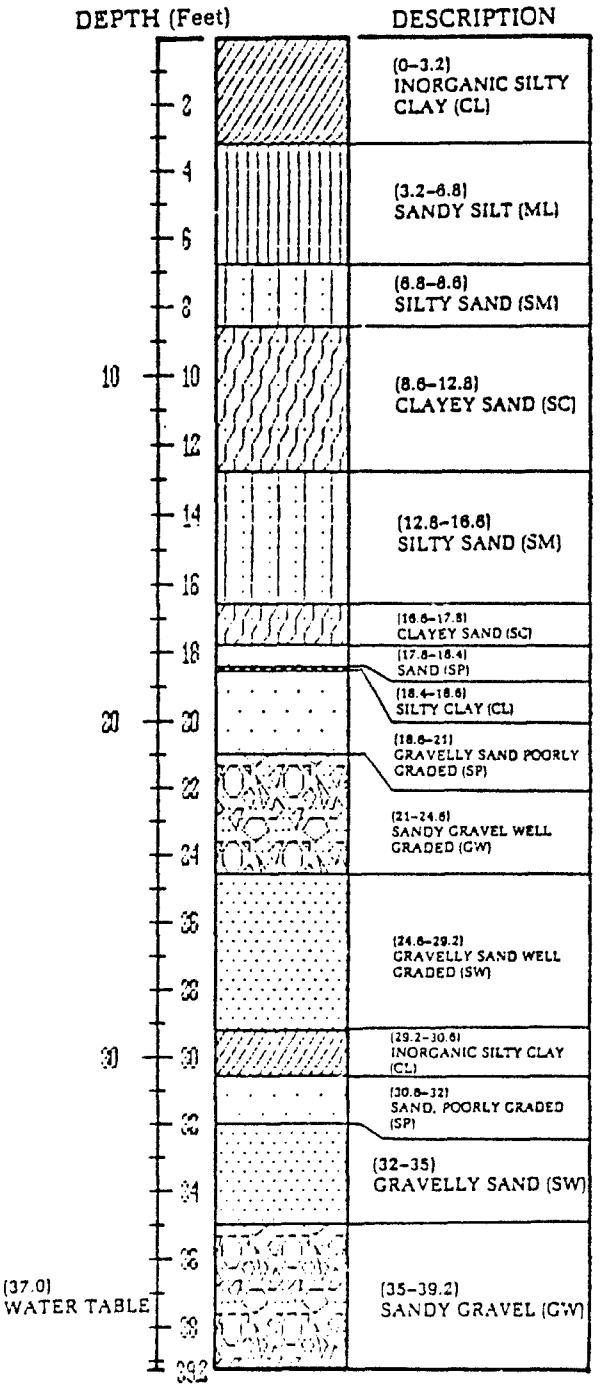

Figure 26-6-2
FIELD BORING PROFILE FOR BORING 4629

SOURCE: ESE, 1987

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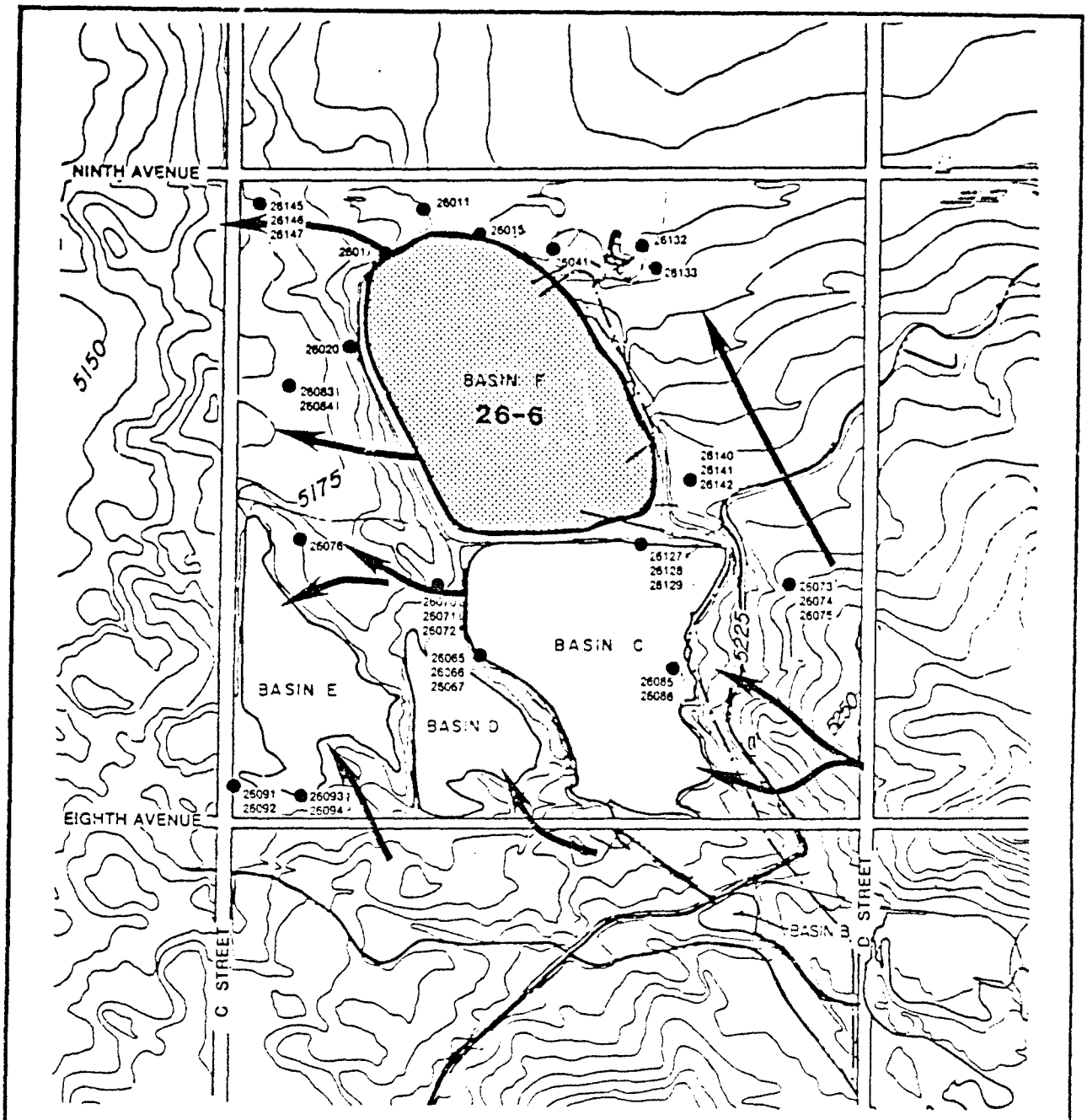

Figure 26-6-3
REGIONAL TOPOGRAPHY,
SITE 26-6
ROCKY MOUNTAIN ARSENAL
SOURCE: ESE, 1987

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Aberdeen Proving Ground, Maryland

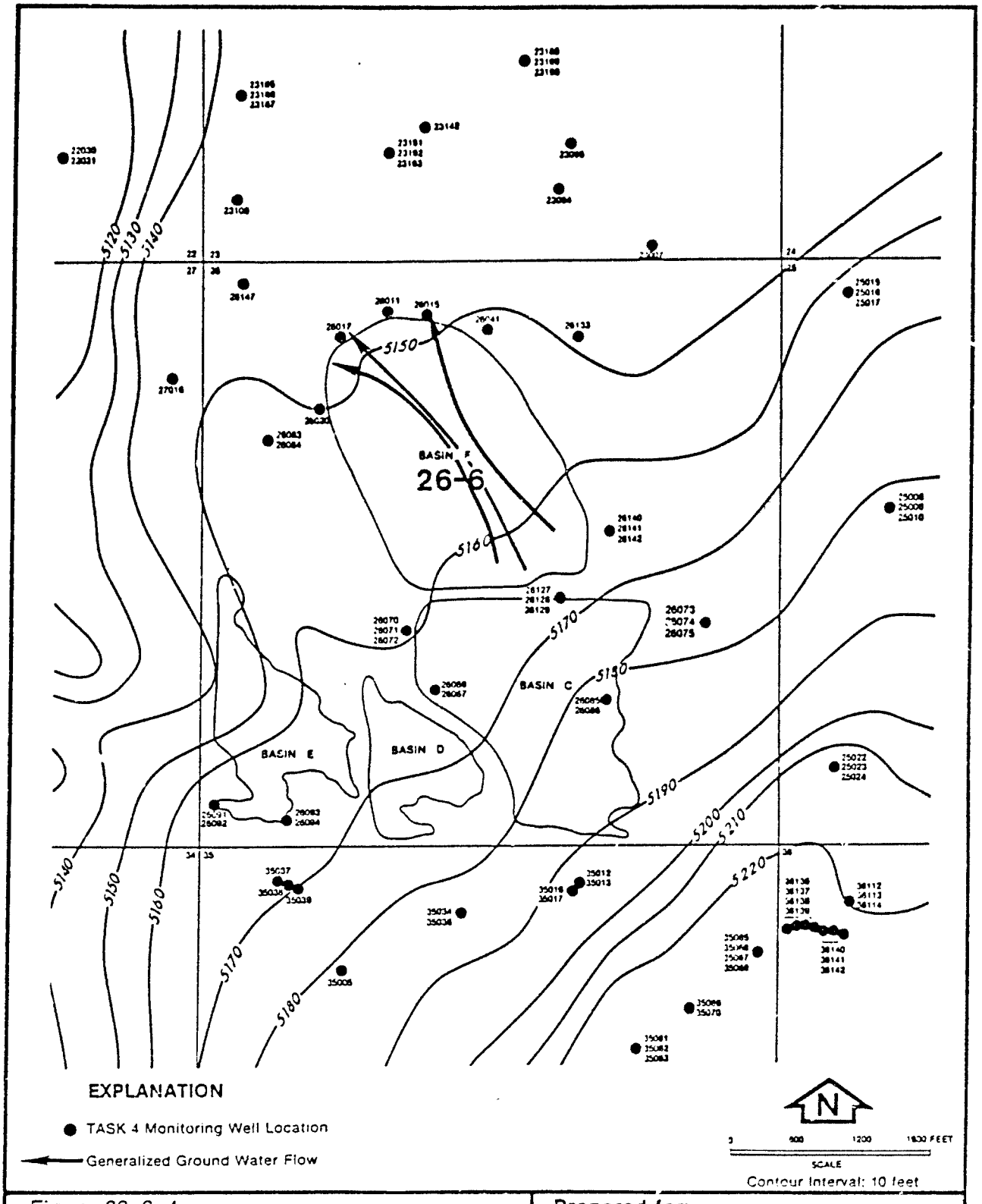

Figure 26-6-4
REGIONAL GROUND WATER FLOW
SITE 26-6
ROCKY MOUNTAIN ARSENAL
SOURCE: ESE, 1986

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For Rocky Mountain Arsenal
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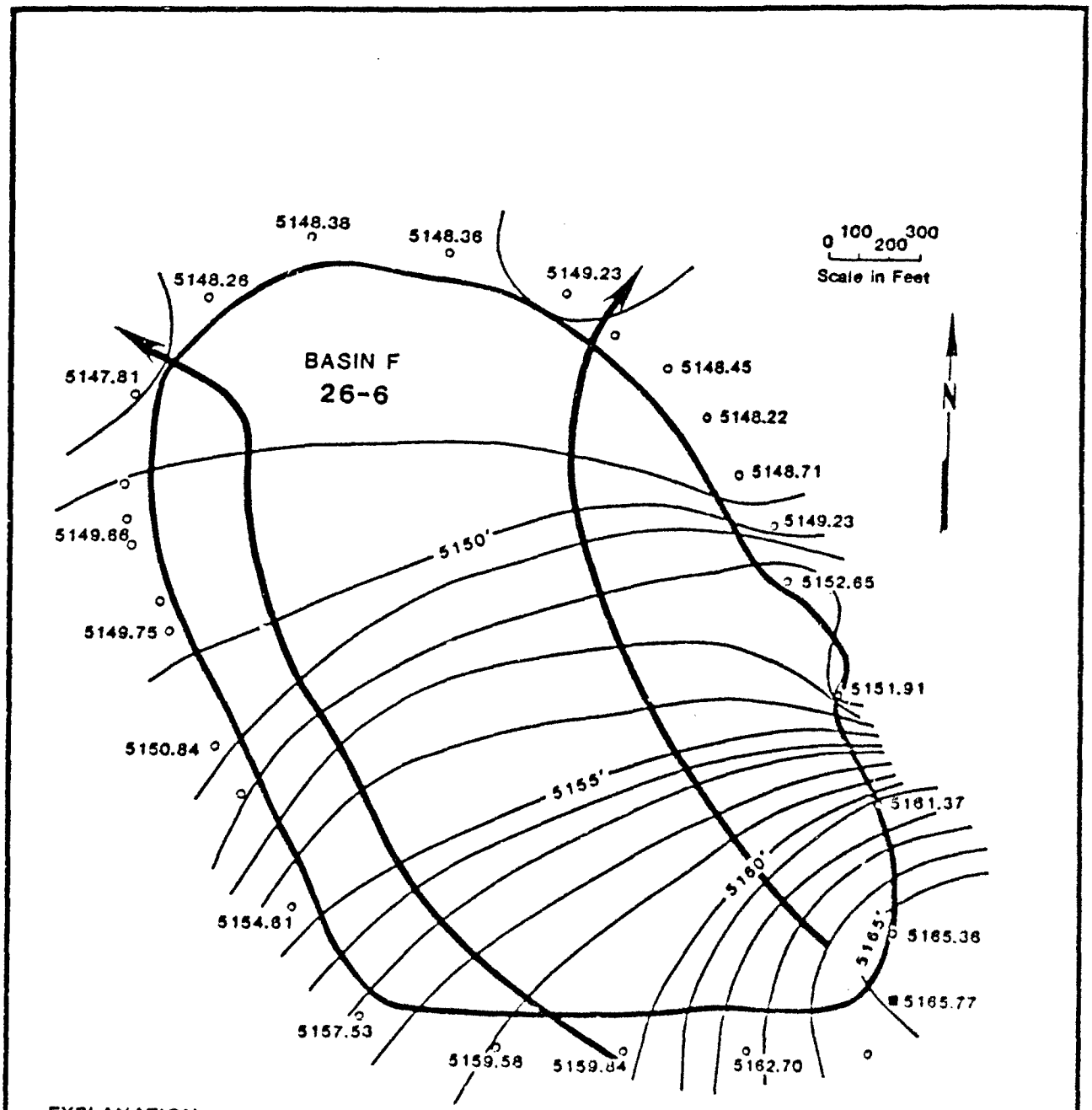
elevations as determined from data collected during this task. As the figure indicates, water table elevations across the site ranged from approximately 5,165 ft msl to 5,148 ft msl, or about 35 to 45 ft below ground surface. Ground water flow is generally to the north and northwest. Historical ground water quality is discussed in Section 2.3.

In 1977, the Geohydrology Division of the Contamination Control Directorate at RMA (RMA, 1978b, RIC#81266R51) installed 27 alluvial monitoring wells along the basin perimeter to evaluate the local ground water quality and hydraulic gradient (Figure 26-6-5). Twenty-six wells were completed at the base of the alluvium, the twenty-seventh well extended 40 ft below the alluvial/bedrock contact (total depth:76 ft). Figure 26-6-5 presents water table elevations as determined in the 1977 study. The 1977 data are nearly identical to the March 1986 elevations. The water table contours indicate that the principal flow component beneath Basin F is directed to the north-northwest until near the northern boundary, where a ground water divide redirects flow to the north-northeast and northwest (RMA, 1978b, RIC#81266R51).

Local water table gradients vary between 0.04 and less than 0.002 according to the 1977 study (RMA, 1978b, RIC#81266R51). The average gradient is about 0.01. The steepest gradient occurs in the southeast corner of Basin F and gradually decreases to the north-northwest. The 1977 study suggests that the steeper gradient is due to the relatively impermeable nature of the fine- to medium-grained upper bedrock sand underlying the coarse sand and gravel of the alluvial aquifer, thus resulting in a higher flow volume traveling through the alluvium. As the hydraulic gradient decreases, the upper Denver Formation sands become thicker and more permeable, thereby increasing the potential for interchange between the two aquifers. The report concludes that the alluvial aquifer and the Denver aquifer are hydraulically connected beneath most of the basin.

In 1979, the U.S. Army Corps of Engineers Waterways Experiment Station (WES) investigated the relationship between the alluvial and Denver aquifers in the vicinity of Basin F (WES, 1979, RIC#81266R15). As part of this study, four deep soil borings (DB-1 through DB-4) were drilled at locations shown



EXPLANATION

Contour Interval: 1 Foot

○ Alluvial Monitoring Well

■ Bedrock Monitoring Well

Basin F. Boundary

Generalized Ground Water Flow

Figure 26-6-5
ALLUVIAL MONITORING WELL LOCATIONS
WATER TABLE ELEVATIONS (1977), SITE 26-6
GEOHYDROLOGY DIVISION INVESTIGATION
SOURCE: RMA, 1979, RIC#81266R51

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in Figure 26-6-6. Data from these borings were used to select intervals in the Denver Formation suitable for screening as monitor wells. Four water-bearing zones were identified: the uppermost zone, Sand Trend A, was encountered in Boring DB-4 and isolated in Monitor Well DB-4-1; the lower zones, Sand Trends B and C, were screened in Wells DB-1-1, DB-1-2, DB-2-1, DB-3-1, DB-4-2, and DB-4-3; and the deepest zone, situated in the clay/shale "buffer zone" near the Denver/Arapahoe contact, was screened in Well DB-2-2. Piezometric levels in the Denver wells were compared against levels in nearby alluvial wells as summarized below:

Deep Well Number	Location	Screened Interval	Comparison of Denver-Alluvial Piezometric Level	Alluvium-Denver Formation Connection
DB-4-1	Southeast of Basin F	Upper Denver Sand Trend A	Coincident	Alluvial aquifer and Upper Denver Sand hydraulically connected.
DB-4-2	Southeast of Basin F	Lower Denver Sand Trend B	20 ft below alluvial	Not hydraulically connected
DB-4-3	Southeast of Basin F	Lower Denver Sand Trend B	20 ft below alluvial	Not hydraulically connected
DB-1-1	Southwest of Basin F	Lower Denver Sand Trend B	14 ft below alluvial	Not hydraulically connected
DB-1-2	Southwest of Basin F	Lower Denver Sand Trend C	14 ft below alluvial	Not hydraulically connected.
DB-2-1	Northwest of Basin F	Lower Denver Sand Trend C	7 to 12 ft below alluvial	Not hydraulically connected
DB-2-2	Northwest of Basin F	Buffer Zone	40 ft below alluvial	Not hydraulically connected
DB-3-1	Northeast of Basin F	Lower Denver Sand Trend B	Coincident	Alluvial aquifer and Upper Denver Sand Trend B hydraulically connected.
DB-3-2	Northeast of Basin F	Lower Denver Sand Trend B	Coincident	Alluvial aquifer and Upper Denver Sand Trend B hydraulically connected.

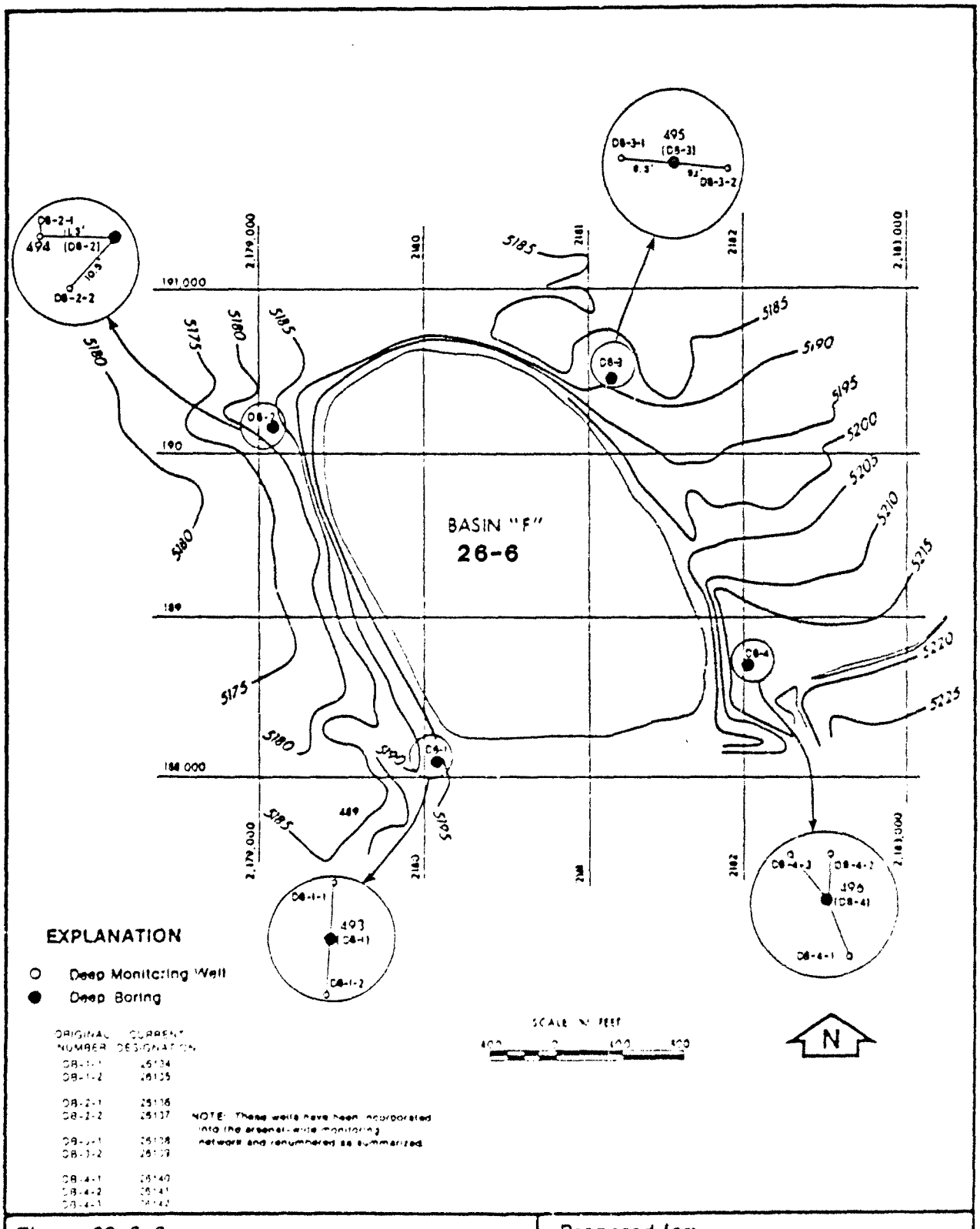

Figure 26-6-6
BEDROCK MONITORING WELL LOCATIONS, SITE 26-6

SOURCE: WES, 1979

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The WES (1979, RIC#81266R15) study concluded that the alluvial aquifer and Upper Denver Sand Trend A intersect hydraulically southeast of Basin F and continue to interact downgradient underneath and beyond the basin. Lower Denver Sands B and C are not hydraulically connected to the alluvial aquifer south of Basin F, but eventually intersect the alluvium in the downgradient and updip (Denver Formation) direction to the north and northeast of Basin F (WES, 1979, RIC#81266R15).

One Phase I soil boring drilled at Basin F penetrated to the water table. Boring 4629 encountered water at a depth of about 38 ft, which translates to an estimated water table elevation of 5,155.5 ft msl. This elevation is in agreement with estimates given in Figures 26-6-4 and 26-6-5.

2.0 HISTORY

2.1 CONSTRUCTION AND USE OF BASIN F

Basin F may be not only the most the thoroughly investigated, but also the most controversial site at RMA. A large number of period reports speak to numerous historical concerns related to the operation of the basin. Voluminous, albeit fragmentary and incomplete records, detail selected aspects of basin usage. At the same time, many of those facets of basin history most pertinent to the current investigation of soil and ground water contamination remain obscure and, therefore, the subject of considerable debate and controversy. The following summary was derived from RMA records and documents obtained through the RMA Resource Information Center. Because of the large number of documents used in the preparation of this section, specific citations are designated by number rather than by inclusion at appropriate points within the text of the section. A complete numbered list of references is presented in Section 4.2.

2.1.1. Design Considerations

Basin F, a 92.7 acre disposal pond equipped with a catalytically blown asphalt liner and 12-inch protective earthen blanket, was built by the Army between July and December 1956. 1/ The probable primary motivating factor in the decision to undertake this project was a growing apprehension on the part of the Army that seepage through subsurface soils of liquid waste discharged into unlined basins in large volumes over time was the principal cause of the pollution occurring in the alluvial aquifer northwest of RMA. The choice of a lined evaporation pond as opposed to a deep disposal well or other method of disposal followed a year of intensive investigation and reflected a belief in solar evaporation as the most feasible and cost-effective means for the elimination of large volumes of contaminated liquid waste. 2/ Whether or not Basin F, at the time of its construction, was viewed as a final disposal facility or as an interim storage unit to be used pending development of an ultimate system of disposal is not clear. 3/ The decision to use catalytically blown asphalt as a sealant for the basin rather than another of several possible lining materials was based not only upon considerations of cost, ease of application and minimum maintenance requirements but also on the Army's judgment that chemicals potentially deleterious to the proposed liner were present in liquid waste discharges in

insufficient concentrations to produce harmful effects. 4/ This judgment was formulated in 1955 following consultations with the Bureau of Reclamation and the Asphalt Institute, and chemical analyses of then current liquid waste discharges performed by the Ralph M. Parsons Co. and RMA. 5/ The capacity of Basin F [240,000,000 gallons (gals.)] as finally built to contain current and projected volumes of contaminated liquid waste from Army and lessee--principally Shell--chemical operations presupposed a restriction of basin effluent discharges to a combined total flow of less than 150 gallons per minute (gpm) and an annual average rate of evaporative loss of 2 gpm/acre. 6/

2.1.2. Construction Details

Basin F was built at a cost of approximately $607,200 on the site of a large natural depression with no documented previous history of disposal use located immediately north of Basin C in Section 26. 7/ Contour grading and the construction of earthen-fill dikes on the western, northwestern, northern and northeastern sides of the site produced a basin in the shape of an irregular oval, approximately 1,000 ft by 2,900 ft in linear dimensions, sloping in depth from 5 ft in the southeast corner to 15 ft in the northwest quadrant. Relatively high natural elevations precluded the necessity of dikes along the southern, southeastern, and eastern perimeters of the basin. Following rolling and dragging to assure a compacted subsurface, catalytically-blown asphalt, heated to a temperature of +400 F, was spread over the earthen floor of the basin using conventional spray equipment, and extended to a point 12 inches below the crest of the surrounding inclined dike embankments and shoreline. Overlapping application and multiple layering achieved through three successive passes produced a tight seal and the requisite 1/4-inch to 3/8-inch membrane thickness. The finished liner was covered with a 12-inch protective earthen blanket. The backfilling of shoreline areas and the installation of gravel riprap on entire dike embankments with the exception of the west and northwest perimeter served to inhibit the potential destructive effects of wind-induced wave action. 8/ Eight- and ten-inch underground gravity flow sealed-joint vitrified clay sewer laterals were installed, linking Basin F to the terminal points of the chemical sewer lines from the Chlorine Plant, the Shell manufacturing area and the Sarin (GB) complex. To prevent erosion of the soil blanket and

possible damage to the liner at the point of discharge to the basin, a concrete slab (4 ft x 6 ft x 6 inches) was placed beneath the chemical sewer outfall. On October 27, 1956, Basin F began receiving flows from the 1727 sump in the GB complex. By the first week in December 1956, final work on the dikes and connecting sewer laterals was complete and all contaminated liquid waste was being discharged to Basin F. 9/

2.1.3 Synopsis of Operations

Basin F was used continuously between December 1956 and December 1981 for the solar evaporation of contaminated liquid wastes. After December 1956, no other evaporative basins at RMA were employed for this purpose, with one exception. In the spring and summer of 1957, Basin A and Basin C were used for liquid waste containment on a temporary basis while damage to the liner of Basin F and its protective soil covering was repaired. 10/ Until 1978, solar evaporation of ponded effluents remained the principal method employed at RMA for the elimination of large volumes of liquid waste, notwithstanding the utilization of a pressure injection deep well between March 1962 and February 1966 and the implementation in 1973 and 1977, by the Army and Shell, respectively, of alternative spray drying and incineration disposal technologies. With the exception of GB Agent demilitarization wastes, spray dried to packaged salts, and those Shell effluent streams either diverted to other disposal facilities, withdrawn before discharge, or incinerated through the Denver Effluent Treatment System, most contaminated liquid wastes generated between December 1956 and March 1978 by Army and Shell chemical operations were deposited in Basin F. 11/ Following the termination on March 31, 1978 of all basin disposal by Shell, the Army continued to discharge contaminated liquid wastes to Basin F as follows: until June 1980, from phosgene transfer, laboratory, and laundry operations; and until December 31, 1981, from hydrazine blending activities on an intermittent basis. 12/

2.1.4 Flow Sources and Volumes

Between December 1956 and December 1981, in addition to rainfall and contaminated liquid wastes, Basin F received effluent flows from a variety of other sources. Chemical sewer-transported surface water run-off from the South plants, in particular, entered the basin throughout much of the period

despite numerous recommendations and projects for its elimination. 13/ Beginning in December 1956, contaminated liquid wastes in Basin A were drained to Basin F through a siphon-pipeline system connected to the GB chemical sewer lateral at Manhole No. 5-1. The project was completed in September 1957, notwithstanding its temporary suspension during repairs to Basin F. Thereafter, until the summer of 1960, the Army drained surface water accumulations in Basin A to Basin F by means of a ditch and sump, also connected to the GB chemical sewer lateral at Manhole No. 5-1. 14/ At various times ground water seeping into the basements of Buildings 422 and 742A was discharged through the chemical sewer to Basin F. 15/ In May 1975, the Army began pumping contaminated water from the North Bog to Basin F on an intermittent basis. Although the introduction in August 1975 of spray aeration reduced the quantities transferred, the pumping continued at least until the end of the year. 16/

For the most part, the capacity of Basin F was sufficient to contain effluent discharge volumes. On three occasions, however, the basin filled nearly to the point of overflow. Critical fill points were reached in 1962, and again, despite the concurrent operation of the deep disposal well, in the winter and spring of 1965. Between 1975 and 1976, Basin F for a third time filled to the limit of its holding capacity. 17/

Incomplete and unreliable measurement data preclude more than provisional estimates of the volumes of contaminated liquid wastes discharged either by the Army or Shell to Basin F or of the relative shares of the various influent streams in situations of near basin overflow. Flow meters used to measure liquid waste discharges to the basin from the Army and Shell manufacturing areas were notoriously inaccurate and frequently inoperative for long periods of time. 18/ Despite reporting requirements, as of the fall of 1960, the Army possessed only fragmentary information on rates of liquid discharge to the basin dating from February 1957. 19/ Between 1964 and 1974, no records were maintained of effluent flows from the 1727 sump in the GB complex. 20/ In 1976, only the flow meters on the east and west sewer laterals from the Shell manufacturing area yielded accurate readings. 21/

In addition, the quantities of effluent and surface water drained between 1956 and 1960 from Basin A to Basin F were estimated, but not measured. No attempts were made to measure surface runoff into the chemical sewer or the volumes of contaminated water and ground water seepage pumped from the North Bog and Buildings 422 and 742A. 22/

A very approximate picture of the rise and fall, over time of the volumes of liquids contained in Basin F can be obtained by estimating volumetric content on the basis of liquid level elevations. However, the figures referenced below were computed at year's end and neither account for fluctuations in volume in the course of a calendar year nor provide enlightenment on the relative contributions from the various contributory flow sources at specific points in time.

Year	Elevation-Feet	Million Gallons
1957	5196.09	132
1958	5197.14	158
1959	5197.22	161
1960	5198.62	200
1961	5199.32	223
1962	5196.96	156
1963	5196.83	151
1964	5197.05	157
1965	5197.25	162
1966	5196.00	130
1967	5196.52	143
1968	5195.70	122
1969	5196.08	132
1970	5195.46	117
1971	5194.63	95
1972	5195.47	117
1973	5196.25	135
1974	5196.59	144
1975	5197.99	183
1976	5198.00	184
1977 (Nov)	5197.30	163

23/

2.1.5 Hazardous Chemical Disposals

Hazardous chemicals known to have been present in discharges of liquid waste to Basin F over time from Army chemical operations at RMA have included, but are not necessarily limited to acetylene tetrachloride, ammonium chloride, asbestos, carbon tetrachloride, N,N^1-dichloro-bis-(2,4,6-trichlorophenyl) urea (CC2), chromic acid, cyanogen chloride, Freon 113, hydrazine, hydrochloric acid, isopropanol, nitric acid, nitrosodimethylamine, potassium

chlorate, red phosphorus, sodium chlorate, sodium fluoride, sodium hydroxide, sodium hypochlorite, sulfuric acid, tetrachloroethylene, unsymmetrical dimethyl hydrazine (UDMH), and zinc oxide. 24/

Similarly, hazardous chemicals, known to have been present in discharges of liquid waste to Basin F over time from Shell manufacturing and processing activities have included, but are not necessarily limited to acetaldehyde, acetic acid, acetone, acetonitrile, aldrin, aldrite, allyl chloride, alphaaminoisobutyeonitride, ammonium chloride, ammonium sulfite, Azodrin impurities, benzene, carbon tetrachloride, chloral, chloral impurities, chlorine impurities, chlorine 1-chloroethylbenzene, chloroform, chloroform-rich organics, p-chlorophenylmethyl sulfide (CPMS) (SC9636), SD9636 impurities, p-chlorophenylmethyl sulfone ($CPMSO_2$) (SD1300), cuprous sulfate, cyclohexane, cyclohexanone, cyclopentadiene, Dibrom, dichloromethane, dicyclopentadiene (DCPD), dieldrin, dieldrin impurities, diketene, dipropylamine (DPA), endrin, endrin impurities, heptachlorobicycloheptene, heptane, hexachlorobicycloheptadiene (601), hexachlorocyclopentadiene (CL6CP), hexane, hydrochloric acid, hydrogen peroxide, isodrin, isodrin impurities, isopropanol, methanol, dimethyl disulfide (DMDS), methyl isobutyl ketone (MIBK), methyl mercaptan (MEP), methylthioacetaldoxione (MSAO), MSAO impurities, p-nitro sodium phenolate (PNSP), nudrin, Phosdrin, sodium hydroxide, sodium hypochlorite, sodium mythylate, sodium nitrate, sodium nitrite, sulfuric acid, sulfuryl chloride, toluene, trimethyl phosphite, Vapona (DDVP), vinyl chloride, and xylene. 25/

2.1.6 Repairs,_Modifications,_Surveillance_of_Membrane_Integrity

In early December 1956, an inspection of Basin F revealed erosion of the soil blanket protecting the liner immediately below the sewer outfall caused by contaminated liquid waste flows. Between late December 1956 and early January 1957, eroded areas of the protective blanket were repaired and a strip of crushed rock riprap 12 inches wide and 36 ft long was placed in the path of flow beneath the sewer outfall to prevent further damage to the blanket. 26/

In April 1957, wind-induced wave action on the surface of Basin F washed away portions of the protective soil blanket along the basin dike

embankments and fractured the liner at the water line for a length of 1,320 ft along the northwestern and northern perimeter. Repairs were made as follows: an undetermined quantity of effluent was pumped from Basin F to Basin C, lowering the liquid level in the basin by 2 ft; damaged areas of the liner were resealed as necessary: 6 inches of gravel and 12 inches of crushed rock and flagstone riprap were placed on the affected dike embankments to prevent similar damage in the future. By August 1, 1957, repairs had been completed and the effluent temporarily contained in Basin C had been drained to Basin F. Between May 1 and June 20, 1957, contaminated liquid wastes generated by Army and Shell operations were discharged to Basin A. 27/

In the summer of 1964, the Army built an earthen-fill dike across the southeast corner of Basin F creating a 1,000,000 gals surge Basin, F-1. Upon completion, liquid waste discharged from the chemical sewer bypassed Basin F and flowed directly to the deep well pretreatment facility instead of mixing, as previously, with effluent already in the basin. The purpose of the modification was to improve deep well operating efficiency both by accelerating settling and by minimizing the time available for the growth of unfilterable bacterial organisms in the contents of the effluent. 28/ Changes in the locations of the chemical sewer outfall and the overflow spillway to Basin F, suggested in 1965 as a way to increase the rate of flow of liquid waste through F-1, were never made. 29/

Whether or not a project proposed in early 1970 to extend the sewer outfall beyond the dike separating Basin F and F-1 was implemented at the time is not known. 30/ Between April and June 1975, following a study by the State of Colorado which postulated leakage in the chemical sewer in the vicinity of the outfall to Basin F, Shell personnel extended the sewer outfall pipe 450 ft into Basin F proper. 31/ In 1977, funding for a project designed to replace the dike (discovered to be leaking) separating Basin F from F-1 with a new dike immediately east of the existing dike and to remove the gravity sewer line from F-1 to the deep well pretreatment facility was denied by higher Army authority. 32/

During the years Basin F was in operation, the Army employed a variety of measures in an effort to maintain surveillance over the general condition of the liner and to detect possible leakage into the subsurface soils and alluvial aquifer. By early 1962, levels of chloride concentration in six wells (117, 73, 118, 3A, 62, 41) drilled to various depths in the alluvial aquifers around the perimeter of the basin were being monitored on a monthly basis for the purpose of immediately detecting any sharp increases in concentration levels which might indicate that the liner had been breached. 33/ By 1969, chloride concentration levels in these perimeter wells were being recorded on a weekly basis and, in addition, a similar procedure was being followed monthly in seven wells downgradient from the basin. Between 1962 and 1976, chloride concentration levels in the Basin F perimeter wells were consistent with those levels found in wells drilled into the aquifer elsewhere on RMA and far below the chloride concentrations present in the effluent of Basin F. 34/ The additional absence in 1974 and 1975 in these perimeter wells of anomalously high levels of chemicals prevalent in the basin, e.g., copper and sodium hydroxide, tended to substantiate further the general perception of continuing membrane integrity. 35/

Similarly, periodic review over time of monthly basin evaporation data for indications of leakage, i.e., abnormally high rates of evaporative loss, revealed no inexplicable anomalies. 36/ At the same time, recorded evaporative loss data possessed only limited value for an evaluation over time of liner integrity. Figures on evaporation loss were calculations derived ultimately from measurements of precipitation and influent flows. 37/ As late as July 1976, evaporation pan measurements were not being used to verify calculated figures on evaporative loss. 38/

On at least two occasions, physical inspections of selected portions of the liner were used for the purpose of verifying membrane integrity. Although the inspection conducted in December 1969 revealed liner deterioration and dissolution at one location in Basin F and one location in F-1, subsequent ground water investigations performed in 1970 by the State of Colorado and U.S. Geological Survey could not establish leakage of basin effluents into the subsurface aquifer. 39/ In 1976 two cofferdams were built in Basin F immediately adjacent to the dike separating the basin from F-1. An

inspection of two 10-ft by 20-ft sections of the liner following drainage of the interior of the coffer dams and excavation of the protective soil covering revealed no indications of deterioration. 40/

2.1.7 Preliminary Closure

Following the termination on December 31, 1981 of all waste discharges to the chemical sewer, the Army implemented a series of measures designed to accelerate the evaporation of the remaining liquids in Basin F and to prevent sewer transported flows of infiltrating surface and ground water and surface run-off from augmenting any further the volumes already contained in the basin. Specifically, the Army: 1) removed the chemical sewer trunkline and lateral connections to Basin F from the South Plants; 2) plugged the sewer lateral from the GB Plant; 3) constructed a pipe trickler system in the basin to enhance natural solar evaporation; 4) installed a dike in the basin separating the "wet" from the "dry" areas; and 5) built a north-south surface run-off interceptor ditch along the eastern basin perimeter. In addition, special diking and a new 30-mil PVC liner were installed in a designated storage area in the southeast corner of the basin for the purpose of providing for environmentally safe disposal of the excavated sewer line and surrounding contaminated soil. Approximately, 9,700 linear ft of crushed vitrified clay pipeline and 3,200 bank cubic yards (bcy) of surrounding soil were placed in this area. As of July 14, 1982, the means for conveyance of further liquid discharges into Basin F had been removed. 41/ The signature of the Corps of Engineers Contracting Officer on Form DD1354 (Transfer and Acceptance of Military Real Property) on this date signified the completion of the project for the preliminary closure of the basin. 42/

2.1.8 Aerial Photograph Interpretation

As of 1982, the total volume of fluid in Basin F had decreased and was estimated at 30 million gal (Meyers and Thompson, 1982, RIC#82350R01). More recent investigations have estimated the fluid volume at 3 million gal (October 1986) and 5 million gal (January 1987) (Wilson, 1987). Historical photographs of Basin F and the surrounding area (Stout et al., 1982, RIC#83362R01; HLA, 1985, RIC#86314P01) are interpreted as follows:

Photograph Date	Description
June 12, 1948	Basin F has not been constructed as of this photograph. The area to be used for the basin is covered with vegetation. Near the southeast corner of the area to become Basin F, water from the Sand Creek Lateral appears to have been discharged to an existing topographic depression.
October 15, 1964	Basin F has been constructed and liquid covers the entire basin. Two skimmer ponds in the southeast corner (F-1) have been constructed and are full of liquid. A large dock on the northeast side of the basin trending southwest-northeast is visible (possibly the intake for the injection well) along with an array of floats sectioning off the north-central portion of the basin. The soil appears to be bleached adjacent to the eastern side of the basin, outside the perimeter fence.
April 25, 1970	Basin F is covered with liquid, but the level of liquid appears lower than in the previous photograph. The large southwest-northeast trending dock and the array of floats in the north-central section of the basin are not visible. The bleaching along the eastern margin is not as extensive as observed in the October 15, 1964 photograph. The easternmost portion of this area is now covered by vegetation. Abundant surface scarring which was not evident in the October 15, 1964 photograph, is west of Basin F in this photograph. The partition between the two skimmer ponds appears to be partially submerged.
1976 (Oblique aerial photographs and ground level photographs)	The only inference that can be made from these photographs is that Basin F is full of liquid.
October 27, 1978 (Ground level photographs)	The only inference that can be made from these photographs is that Basin F is close to being full, but the liquid level is not as high as in the 1976 photographs.
September 20, 1980	Approximately three-fourths of Basin F is covered by fluid. F-1 is only partially covered by liquid. The liquid has receded in the southwest corner of the basin and along the western margin. Various colors and patterns of stain are evident in the portion

	of the basin where liquid has receded. The scarred and devegetated areas west of the basin that were apparent in the April 25, 1970 photograph are now covered by vegetation. A northwest-southeast trending linear feature originating from the northeast corner of little Basin F is evident parallel to the eastern margin of the basin.
1981 (Ground level photographs)	The only inference that can be made from these photographs is that the basin contains approximately the same or a slightly smaller amount of liquid than in the September 20, 1980 photograph.
June 12, 1985	Major construction has taken place in Basin F since the last photograph. A new perimeter dike has been constructed which isolates the main liquid body of Basin F from the western and southern portions of the original basin and F-1. This excluded area encompasses approximately one-third of the original basin. The new bermed area has a road on top and a pipeline coincident with the northern side of the road (possibly the trickling evaporation system). The volume of liquid in Basin F proper is much less than in previous photographs. Two discrete liquid pools are west of the new berm and another small pool is south of the new berm. A large body of liquid is visible just northwest of F-1. F-1 contains more liquid than in the September 20, 1980 photograph.

2.2 CHARACTERIZATION OF BASIN F FLUID AND OVERBURDEN

2.2.1 Basin_F_Fluid

The composition of Basin F fluid has been investigated on numerous occasions (Millbury, 1966, RIC#81320R07; AEHA, 1965, RIC#84230R01; RMA, 1978a, RIC#81320R02). One of the most comprehensive studies was conducted by Buhts and Francingues in 1978 (RIC#81266R16). The Buhts and Francingues investigation took 40 fluid samples from discrete depth intervals at 17 locations, Figure 26-6-7. A summary of the analytical results is given in Table 26-6-1. Data from the individual sampling sites indicate that the distribution of soluble analytes, chloride, sulfate, copper, iron, inorganic nitrogen, and inorganic phosphate, is essentially homogeneous throughout the basin. Five samples, selected at random, were analyzed separately for arsenic, magnesium, cyanide, chemical oxygen demand (COD), and total organic

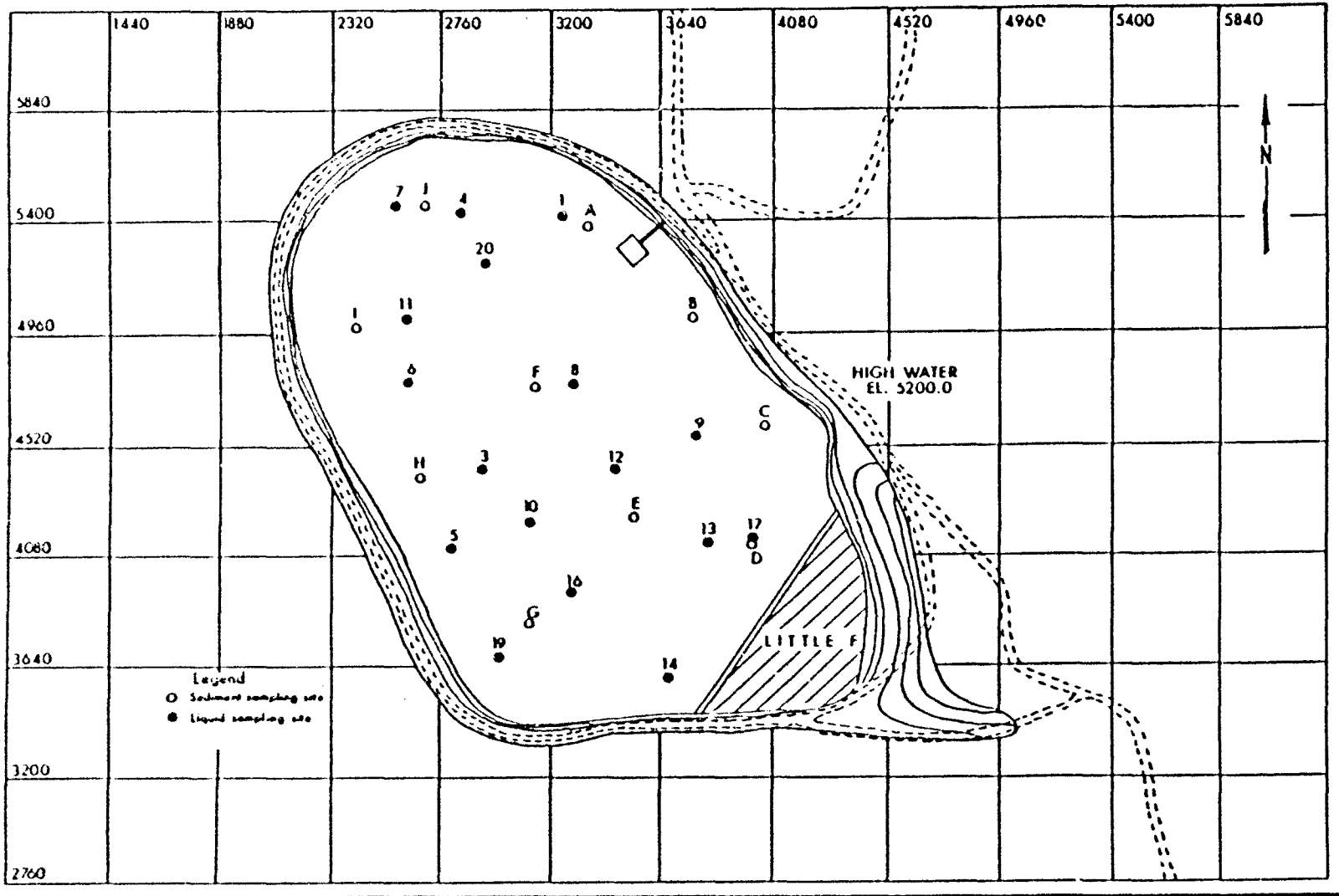

Figure 26-6-7
BASIN F SAMPLING LOCATIONS

SOURCE: BUNTS & FRANCINGUES, 1978, RIC#81266R16

Prepared for:
U.S. Army Program Manager's Office
For Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

Table 26-6-1. Analytical Results, Basin F Fluid Samples, Buhcs and Francingues (WES) 1978 Investigation (Page 1 of 2)

Sample Location	Depth to Bottom, m	pH	Parts Per Billion (ppb)					Parts Per Million (ppm)			
			Aldrin	Isodrin	Dieldrin	Endrin	Dithiane	DIMP	DMMP	Sulfoxide	Sulfone
7	3.20	7.0	212	5	59	28	26	19	1100	6	49
7a		7.1	240	7	44	27	41	18	1200	5	39
7b		7.0	101	2	28	18	26	11	620	4	48
4	3.30	7.1	31	1	6	3	50	11	560	4	25
4a		7.2	344	6	63	35	55	12	1400	6	48
4b		7.1	230	4	41	22	101	12	420	6	56
1	1.05	7.1	80	3	5	7	<20	19	1040	9	76
20	3.10	7.2	20	<1	42	13	35	20	1120	7	45
20a		7.0	375	6	72	31	76	10	700	4	40
20b		7.1	163	3	28	6	102	12	830	6	45
11	3.25	7.0	240	5	65	23	34	19	1100	6	51
11a		7.1	313	10	66	25	58	13	1900	7	58
11b		7.0	206	6	40	23	95	12	1200	6	50
11c		7.0	81	3	14	7	88	6	320	4	43
6	1.75	7.1	39	2	6	5	56	11	800	4	19
6a		7.0	300	7	6	37	29	22	1100	6	52
8	2.95	7.0	48	3	16	6	26	17	1150	5	32
8a		7.2	295	10	51	24	38	15	530	6	47
8b		7.0	154	3	42	16	81	13	1800	6	51
3	2.95	7.0	320	11	53	24	90	19	890	9	58
3a		7.1	230	7	45	26	34	20	1100	6	42
3b		7.0	266	8	49	27	86	13	1500	6	49
5	1.30	7.1	420	14	110	36	123	55	3750	10	60
5a		7.2	188	3	63	23	70	13	1400	6	52
10	1.70	7.1	240	5	68	23	82	19	1100	4	28
10a		7.0	130	3	38	24	<20	17	760	6	42
16	1.55	7.1	92	4	22	12	38	13	470	5	32
16a		7.0	20	<1	58	16	77	13	1800	6	50
19	0.95	7.3	120	<1	30	15	44	12	500	5	46
12	2.65	7.0	480	17	110	42	38	15	1130	6	42
12a		7.2	250	16	12	20	<20	12	1300	5	43
12b		7.0	139	3	27	11	82	12	1000	6	46
9	1.70	7.0	480	15	104	33	32	33	2380	4	43
9a		7.3	239	7	49	23	28	26	1700	6	47
13	1.55	7.1	90	2	16	10	90	13	470	4	29
13a		7.0	142	6	38	12	35	13	1800	*	56
17	1.50	7.0	270	<1	74	36	68	21	1300	6	44
17a		6.0	214	12	44	24	93	13	1500	*	39
14	1.65	7.0	150	4	30	18	46	18	930	6	37
14a		7.0	251	9	55	29	31	13	1400	*	45

Table 26-6-1. Analytical Results, Basin F Fluid Samples, Buhts and Francingues (WES) 1978 Investigation (Page 2 of 2)

Sample Location	Depth to Bottom, m	Parts Per Million (ppm) Chloride	Sulfate	Copper	Iron	Total Nitrogen	Ortho-Phosphate	Phosphorous	Hardness	Fluoride
7	3.20	48,000	22,500	713	6	136	115		2450	
7a		53,500	24,500	709	6	131	125		2400	
7b		48,500	22,500	718	6	115	120		2450	115
4	3.30	49,000	23,500	748	5	128	114		2450	
4a		55,000	25,000	760	7	140	126		2750	
4b		53,000	23,500	731	6	125	122	2130	2450	
1	1.05	47,500	20,500	733	6	130	99	2070	2400	
20	3.10	57,500	29,000	730	5	115	113		2600	
20a		51,000	24,500	742	10	140	128		2490	
20b		56,000	24,500	731	5	125	125		2450	
11	3.25	51,500	24,500	730	6	120	112		2090	117
11a		52,500	25,000	729	6	130	125		2550	
11b		56,000	23,500	727	6	125	122		[illegible]	
11c		54,000	31,000	745	6	125	131		2450	
6	1.75	50,000	22,500	733	6	134	112		2450	
6a		51,000	23,500	733	6	145	120		2390	
8	2.95	51,500	24,500	728	6	124	110		2600	
8a		50,000	23,500	721	5	135	128	2060	2330	
8b		51,400	23,500	732	5	120	123		2400	
3	2.95	57,500	27,000	756	13	128	122		2550	
3a		50,000	24,500	720	5	142	118		2500	110
3b		51,000	24,500	758	6	145	122		2090	
5	1.30	48,750	21,500	719	5	128	113		2400	
5a		50,300	25,000	757	6	147	129		2610	
10	1.70	51,400	24,500	730	5	120	112	2170	2450	
10a		51,250	22,500	727	5	145	125		2520	
16	1 55	50,000	21,500	723	6	136	115		2170	
16a		51,000	32,500	740	5	140	122		2590	
19	0.95	52,500	24,100	725	5	138	110		2850	
12	2.65	51,500	23,000	724	5	136	112		2450	
12a		52,500	24,500	753	5	145	123		2170	
12b		51,000	23,500	731	6	125	121		2690	
9	1.70	49,000	24,500	716	5	112	113		2520	
9a		51,500	24,500	721	6	145	127		2400	
13	1.55	50,000	23,000	732	6	144	110		2490	
13a		47,500	21,500	727	5	145	125	2120	2090	
17	1.50	53,500	24,500	724	5	136	115		2200	
17a		56,000	25,000	728	6	138	123		2650	
14	1.65	50,300	21,500	729	5	150	112		2490	
14a		50,000	22,500	720	5	145	122		2150	

* The sample location numbers indicate surface sample a, b, or c following the surface sample indicates depth of 1, 2, and 3 meters, respectively.

Source: Buhts and Francingues (WES), 1978, RIC#81264R16.

carbon (TOC). The results summarized in Table 26-6-2 indicate that little variation in the concentration of the analytes occurs either vertically or horizontally. The Buhts and Francingues (1978, RIC#81266R16) study concludes that natural mixing by wind and wave action effectively precludes any significant chemical stratification of the fluid.

All 40 liquid samples were analyzed for total solids, and stepwise weight changes were determined for six samples upon heating from 103 degrees Celsius (°C) through 600 °C. The results of these analyses, given in Tables 26-6-3 and 26-6-4, indicate that the Basin F fluid averages about 16 percent solids by weight (Buhts and Francingues, 1978, RIC#81266R16).

The COD, TOC, and stepwise weight change results indicate that the organic content of the liquid is about 2.5 percent by weight. The Buhts and Francingues (1978, RIC#81266R16) study concluded that the liquid is mostly composed of inorganic salts.

Analysis of liquid samples for selected organic compounds also supports the conclusion that the basin fluid is well-mixed and predominantly composed of inorganic salts. The target organic compounds are listed in Table 26-6-5 and average detected concentrations are given in Table 26-6-6. The target analytes oxathiane, dichlorodiphenyltrichloroethane (pp'-DDT), dichlorodiphenylethane (pp'-DDE), trimethylphosphate (TMP), and DCPD were not detected. The hydrophilic target analytes, diisopropylmethyl phosphonate (DIMP), p-chlorophenylmethyl sulfoxide (CPMSO), and $CPMSO_2$ were found to be uniformly distributed throughout the basin. The distribution of dimethylmethyl phosphonate (DMMP), a very soluble compound, was expected to be uniform, but problems with the analytical method produced erratic results (Buhts and Francingues, 1978, RIC#81266R16).

The Buhts and Francingues investigation was conducted more than 7 years before the Phase I Remedial Investigation (RI). In this time period evaporation has decreased the volume of fluid retained in the basin significantly (Meyers and Thompson, 1982, RIC#82350R01; Wilson, 1987), thereby further concentrating the analytes contained therein. In addition, the decreased liquid depth and the increased area of exposed overburden

Table 26-6-2. Analytical Results for Selected Basin F Fluid Samples, Buhts and Francingues (WES) 1978 Investigation.

Additional Chemical Analyses of Basin F Liquid

Sample		Concentration, ppm					
Location	Depth m	Arsenic	Magnesium	Mercury	Cyanide	COD	TOC
4b	2	1.30	36.6	0.029	1.44	24,400	20,200
1	0	1.00	37.7	0.027	1.49	25,300	22,400
8a	1	1.20	41.2	0.029	1.50	26,000	22,800
10	0	1.00	35.6	0.026	1.48	26,000	20,500
13a	1	1.10	40.0	0.027	1.53	25,400	21,700

Source: Buhts and Francingues, 1978, RIC#81266R16.

Table 26-6-3. Total Solids Basin F Liquid

Sample Location and Depth*	Residue at 103°C ppm
1	154,176
3	158,324
4	153,612
5	156,092
6	156,548
7	157,692
8	151,524
9	159,328
10	148,932
11	156,568
12	158,424
13	159,268
14	158,988
16	163,448
17	157,800
3a	166,580
4a	173,764
5a	152,600
6a	150,577
7a	164,988
8a	167,832
9a	154,756
10a	114,124
11a	155,808
12a	153,828
13a	155,980
14a	159,896
16a	153,996
17a	159,896
20a	154,112
3b	157,780
4b	161,728
7b	155,260
8b	156,136
11b	151,208
12b	140,548
20b	160,957
11c	148,948

* The sample location numbers indicate surface sample; a, b, or c following the surface sample indicates depths of 1, 2, and 3 m, respectively.

Source: Dubts et al., 1978 (RIC#81281R12)

Table 26-6-4. Weight Change of Residue (Total Solids) From Basin F Liquid Evaporation

Sample* Location	Test Temperature, °C--Percent Change						
	300	350	400	450	500	550	600
20b	1.60	1.69	1.71	1.80	1.82	1.83	1.84
4a	1.97	2.06	2.08	2.16	2.24	2.25	2.26
5a	1.51	1.62	1.64	1.77	1.76	1.77	1.78
6a	1.53	1.63	1.65	1.75	1.78	1.79	1.80
7a	1.48	1.56	1.58	1.67	1.70	1.71	1.72
8a	1.64	1.72	1.72	1.76	1.80	1.88	1.90

* Residue from sample evaporated at 103° C to determine total solids content.

Source: Buhts and Francinques, 1978 (RIC#81266R16)

Table 26-6-5. Organic Compounds Quantitatively Determined in Basin F Liquid*

Diisopropylmethylphosphonate (DIMP)	Dicyclopentadiene (DCPD)
Dimethylmethylphosphonate (DMMP)	Aldrin
Trimethylphosphonate (TMP)	Endrin
p-Chlorophenylmethylsulfoxide (CPMSO)	Dieldrin
p-Chlorophenylmethylsulfone ($CPMSO_2$)	Isodrin
Dichlorodiphenyltrichloroethane (pp'-DDT)	Dithiane
Dichlorodiphenylethane (pp'-DDE)	Oxathiane

* All but two of these compounds were selected because readily available analytical procedures existed for their quantification. Several of the compounds have also been found at the northern boundary of RMA. Routine analytical procedures did not exist for DMMP and TMP but they were thought to be present in Shell Chemical Company effluent.

Source: Buhts et al., 1978 (RIC#81281R12).

Table 26-6-6. Average Contaminant Concentrations, Basin F Fluid

	Concentration, ppm Basin F
Aldrin	0.205
Dieldrin	0.044
Endrin	0.021
Dithiane	0.054
Sulfone ($CPMSO_2$)	48
DIMP	18
DMMP	1,260
Chloride	51,000
Sulfate	24,000

Source: Buhts and Francinques, 1978 (RIC#81266R16)

should have induced limitations on mixing, while increasing the potential for sediment-liquid interaction and precipitation of solids.

The results of contemporary investigations of Basin F fluid and overburden composition, performed concurrently with the RI program, will be presented in the RI Final Reports.

2.2.2 Basin F Overburden

During the 1978 Buhts and Francingues investigation, basin overburden grab samples were collected at locations shown in Figure 26-6-7. Before analysis, each overburden sample was homogenized and then allowed to settle. The results for solids and supernatant liquid are given in Table 26-6-7 (Buhts and Francingues, 1978, RIC#81266R16).

The overburden samples contained extremely high concentrations of copper, iron, and chlorinated hydrocarbons, especially aldrin. Areal distribution of contaminants, however, was not homogeneous as in the fluid samples. Elevated chlorinated hydrocarbon concentrations, particularly aldrin, were detected at locations C and D (Figure 26-6-7) in the southeastern quarter of the basin. The higher concentrations of copper and iron were found in the deepest portions of the basin where the liquid level remained fairly consistent. Most copper and iron entered the basin as water-soluble salts and subsequently precipitated onto the overburden. The fluctuating liquid level in the basin was probably responsible for the areal distribution of copper and iron in the overburden (Buhts and Francingues, 1978, RIC#81266R16).

Comparison of analytical results from the overburden and supernatant liquid samples reveal some aspects of the chemical behavior of the target analytes. The concentration of chlorinated hydrocarbons was found to be much lower in the liquid, indicating that they tend to remain adsorbed to the overburden. Concentrations of copper and iron salts were higher in the overburden, probably as a result of decreases in temperature and fluctuations in the liquid level. $CPMSO_2$ was found to be nearly equally partitioned between the supernatant liquid and the overburden, while DIMP and DMMP were more prevalent in the liquid (Buhts and Francingues, 1978, RIC#81266R16).

Table 26 6-7. Basin F Bottom Sediment Analysis, URS (1978) Investigation

Sample Location	Concentration, µg/kg												
	Aldrin	Isodrin	Dieldrin	Endrin	DDT	DIMP	DMMP	Sulfone	Copper	Iron	T-PD$_E$	O-PD$_E$	Chloride
Water Above Sediment Supernatant													
A	11	4	4	6	<1	28	1,340	47	52	121	3,000	145	50,600
B	2	<1	<1	<1	<1	7	1,420	40	748	4	2,900	49	53,400
C	3	<1	<1	<1	<1	7	1,340	46	506	13	2,990	89	50,600
D	2	<1	8	2	<1	6	1,990	41	717	2	2,600	92	51,200
E	10	2	4	3	<1	9	2,270	53	762	48	3,020	98	47,200
F	5	1	3	2	<1	17	1,920	53	313	90	2,470	335	48,000
G	40	5	12	10	2	10	1,890	63	877	84	2,270	86	53,200
H	8	10	2	<1	<1	8	3,060	42	681	95	2,520	87	53,600
I	3	<1	2	1	<1	8	1,730	48	238	140	3,280	199	53,600
J	<1	<1	<1	<1	<1	8	2,370	46	595	4	3,420	121	51,800
Sediment Analysis													
A	1,400	509	305	544	198	10	1	105	9,200	9,300	11,800		
B	16	2	4	2	<2	2	77	20	1,800	2,800	1,160		
C	2,510	91	204	88	<2	1	<1	16	4,300	5,400	144		
D	10,700	706	3,600	1,100	8	28	6	290	13,000	2,800	1,690		
E	1,620	870	227	139	<2	3	82	38	13,000	9,500	13,700		
F	1,080	116	304	170	67	3	8	45	16,000	11,000	34,300		
G	1,120	117	302	210	63	3	8	71	14,000	11,000	11,700		
H	878	69	369	111	37	3	12	74	20,000	9,900	14,200		
I	925	189	96	242	119	4	3	108	21,000	6,400	14,300		
J	17	2	4	2	<2	1	<1	14	210	190	<1		

Source: Bolts and Francingues, 1978 (REG#81266816)

In 1982 WES investigated the distribution of contaminants in the soil beneath the basin liner and in several overburden samples. The results of this study are summarized in Section 3.1.

2.2.3 Ground Water Characterization

Several studies have included ground water quality investigations in the vicinity of Basin F (ESE, 1986, RIC#86317R01; Stollar and van der Leeden, 1981, RIC#81293R05; RMA, 1978b, RIC#81266R51; Buhts and Francingues, 1978, RIC#81266R16; WES, 1979, RIC#81266R15). These studies have indicated that ground water in the Basin F area contains contaminants at various concentrations.

The most recent investigation (ESE, 1986, RIC#86317R01) was conducted as part of the Task 4 RMA Water Quality/Quantity Survey. Twenty-four wells screened in the alluvium, Upper, Intermediate, and Lower Denver sands were sampled in the area surrounding Basin F during March 1986. Well locations are shown in Figure 26-6-4. Analytical data from these wells are given in Table 26-6-8.

As the data indicate, contamination is present in both the alluvium and the Denver Formation. The two wells northeast of Basin F, Well 26041 (Upper Denver) and Well 26133 (alluvium), have the greater frequency and concentrations of contaminants, notably DCPD, DIMP, dithiane, $CPMSO_2$, and volatile aromatic compounds. Alluvial wells to the north (26011, 26015, 26017) and west (26020) of the basin perimeter contain fewer contaminants at lower concentrations, most commonly DIMP, dieldrin, and $CPMSO_2$. Contaminant occurrences and concentrations upgradient of Basin F are variable. Alluvial and Denver wells directly to the south and within or adjacent to Basin C (26066, 26067, 26070 to 26072, 26085, 26086, 26127 to 26128) generally contain numerous target analytes: notably DIMP, dithiane, CPMS, CPMSO, CPMSO2, dieldrin, and aldrin. Upgradient Denver wells to the southeast (26074, 26075, 26140 to 26142) generally contained fewer contaminants at lower concentrations: notably organochlorine pesticides and chloroform. No contaminants were detected in the alluvial well to the west (26083) and the Lower Denver well (26147) to the northwest.

Table 26-6-8. Task 4 Initial Quarter Screening Results, Basin F Area Analyte Concentration (ppb) (Page 1 of 3)

Well Number	Formation	Aldrin	Isodrin	Dieldrin	Endrin	DCPD	MIBK	DBCP	DMMP	DIMP	DMDS	Oxathiane	Dithiane	CPMS
26011	Alluvium	BDL	BDL	0.4	BDL	BDL	BDL	BDL	BDL	33	BDL	BDL	3.6	BDL
26015	Alluvium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	870	BDL	BDL	16	BDL
26017	Alluvium	BDL	BDL	0.5	BDL	NA	NA	BDL	BDL	NA	BDL	BDL	BDL	BDL
26020	Alluvium	BDL	BDL	0.2	BDL	NA	NA	BDL	BDL	1,330	BDL	BDL	BDL	BDL
26041	Upper Denver	BDL	BDL	2	3	32.4	BDL	BDL	17,400	3,200	11	6.6	722	725
26083	Alluvium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26084	Intermediate Denver	BDL	BDL	0.08	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26133	Alluvium	0.4	>1	BDL	71	512	130	31	BDL	960	4.7	13	722	725
26140	Intermediate Denver	1	BDL	3	0.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26141	Intermediate Denver	2	0.07	6	0.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26142	Lower Denver	2	0.09	5	0.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26147	Lower Denver	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Table 26 6-8. Task 6 Initial Quarter Screening Results, Basin F Area Analyte Concentration (ppb) (Continued, Page 2 of 3)

Well Number	Formation	CPMSO	$CPMSO_2$	Benzene	Toluene	o,p-xylene	CH_2Cl_2	11DCLE	$CHCl_3$	TBCL	TCLEE	Chloride	Fluoride
26011	Alluvium	BDL	8.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1,180,000	3,100
26015	Alluvium	14	210	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1,560,000	4,460
26017	Alluvium	BDL	33	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	589,000	2,630
26020	Alluvium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	656,000	2,610
26041	Upper Denver	7110	7110	75.9	1,250	BDL	BDL	BDL	BDL	BDL	BDL	25,900,000	307,000
26083	Alluvium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	322,000	4,210
26084	Intermediate Denver	56	7.5	2.34	BDL	BDL	BDL	BDL	BDL	BDL	BDL	133,000	<1,200
26133	Alluvium	30	7,110	496	3412	54.1	560	17	60,800	33	350	378,000	3,600
26140	Intermediate Denver	BDL	BDL	BDL	BDL	BDL	BDL	BDL	29.9	BDL	BDL	691,000	1,410
26141	Intermediate Denver	BDL	BDL	2.71	BDL	BDL	BDL	BDL	BDL	BDL	BDL	22,200	<1,200
26142	Lower Denver	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	58,300	1,710
26147	Lower Denver	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	221,000	<1,200

Table 2b o 8. Task 6 Initial Quarter Screening Results, Upgradient of Basin F (Page 3 of 3)

Well Number	Formation	Analyte Concentration (ppb)																		
		Aldrin	Endrin	PHXE	Dieldrin	Endrin	DBCP	DIMP	Oxathiane	Dithiane	CMXS	CMXO	CMXSO2	CHCL3	CCL4	TRCLE	TCLEE	CLOSIS	Chloride	Fluoride
2[illegible]6	Denver	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	86	22	>22	31	N.D.	37	N.D.	N.D.	4.1	5.4	8.9	3,020,000	3,750
2[illegible]7	Denver	N.D.	N.D.	N.D.	0.07	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	157,000	<1,200
2[illegible]1	Denver	N.D.	0.2	0.07	0.1	N.D.	NA	>5,200	3.0	18	4.6	14	61	N.D.	N.D.	N.D.	4.0	2.6	616,000	2,220
2[illegible]2	Denver	N.D.	N.D.	N.D.	0.1	N.D.	NA	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	130,000	<1,200
2[illegible]3	Alluvial	N.D.	N.D.	N.D.	0.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	12.3	5.07	N.D.	N.D.	N.D.	158,000	1,820
2[illegible]4	Denver	N.D.	N.D.	N.D.	0.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	8.50	N.D.	N.D.	N.D.	N.D.	185,000	1,310
2[illegible]5	Denver	N.D.	N.D.	N.D.	0.08	N.D.	N.D.	N[illegible]	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	37,000	<1,200
2[illegible]0	Alluvial	N.D.	N.D.	N.D.	N.D.	0.07	0.18	99	[illegible]	N.D.	11	>110	56	28.1	N.D.	6.7	N.D.	N.D.	1,980,000	2,880
2[illegible]6	Denver	0.1	N.D.	N.D.	1	0.3	N.D.	180	N.D.	15	27	11	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	652,000	1,330
2[illegible]27	Alluvial	1	0.1	N.D.	3	0.5	N.D.	1,800	2.8	>22	>25	39	15	8.68	N.D.	N.D.	N.D.	2.0	964,000	1,560
2[illegible]8	Denver	1	4	N.D.	N.D.	N.D.	N.D.	1,800	N.D.	>22	11	17	46	N.D.	N.D.	N.D.	N.D.	2.8	868,000	1,370
2[illegible]9	Denver	0.5	N.D.	N.D.	N.D.	N.D.	N.D.	2,300	9.3	>22	14	10	9.9	N.D.	N.D.	N.D.	N.D.	N.D.	873,000	1,410
Detection Limit		0.07	0.08	0.05	0.08	0.05	0.13	10	2.0	1.1	1.3	4.2	4.7	1.40	2.40	1.1	1.3	0.58		

N.D. = Below detection limit.

Source: [illegible], 1990, MK-600.11/061.

Task 4 results correspond closely with data from previous investigations (RMA, 1978b, RIC#81266R51; Stollar and van der Leeden, 1981, RIC#81293R05). Stollar and van der Leeden postulated that elevated chloride [2,000 milligrams per liter (mg/l)] concentrations at the northeast and southeast corners of the basin, and elevated DBCP [10 parts per billion (ppb)] values on the east side could be due to leakage through the liner. The authors also proposed the chemical sewer as a possible contaminant source.

It should also be noted that the compounds detected in the wells surrounding Basin F are representative of the class of chemicals typically found upgradient in the ground water beneath the South Plants Manufacturing Complex and Basin A. Detection of these chemicals, therefore, in ground water downgradient of Basin F does not necessarily indicate that Basin F is the source.

3.0 SITE INVESTIGATION

3.1 PREVIOUS SOIL INVESTIGATIONS

The U.S. Department of Agriculture Soil Conservation Service (Sampson and Baber, 1974) identified four distinct soil series comprising the soil surrounding Basin F: (1) Truckton sandy loam, 3- to 9-percent slope, bordering the Basin on the southwest, south, and southeast; (2) Ascalon-Vona sandy loam, 1- to 5-percent slope, on the northwest; (3) Platner loam, 0- to 3-percent slope, to the north; and (4) Weld loam, 1- to 3-percent slope, to the northeast. Truckton sandy loam is well-drained, moderately sloping soil formed in wind-worked sandy soil. The representative profile consists of a noncalcareous grayish-brown loamy sand that becomes progressively sandier and coarser with depth. Infiltration in this soil is rapid and the potential for soil blowing is high. Ascalon-Vona sandy loam is a well-drained, level to moderately sloping soil formed in loamy material with variable amounts of sand and gravel. The soil profile is similar to the Truckton Series, but is highly calcareous and contains some clay in the subsoil. Platner loam is formed in old alluvium on gently sloping uplands and is typically well-drained and has a slow infiltration rate. The representative soil profile contains a surface layer of noncalcareous grayish-brown loam underlain by brown clay grading into a highly calcareous light-gray clay loam. The Weld series consists of well-drained, nearly level soil formed on uplands from wind-worked loamy soil. The typical soil section includes a surface layer of noncalcareous brown loam, followed by a subsoil of noncalcareous dark-brown clay underlain by a highly calcareous, very fine, sandy loam. The infiltration rate of Weld soil is moderate, permeability is low, and the potential for soil blowing is severe during dry periods.

A study performed in 1982 by the Army Corps of Engineers Waterways Experiment Station (WES) investigated contaminant distribution in Basin F overburden and soil underlying the liner (Meyers and Thompson, 1982, RIC#82350R01). The study included development of soil sampling protocols for Basin F, leach testing and analysis of selected overburden samples and soil cores from 16 locations within the basin (Figure 26-6-8), and bulk chemical analysis of several overburden and soil samples. Analytical results are partially summarized in Figure 26-6-8. The WES study analyzed

for a different suite of contaminants than that chosen as target compounds for the current RI. Therefore, Figure 26-6-8 includes only those analytes detected which are also targets of the RI analytical methods.

The liner condition and depth of overburden sediment were noted at each boring location (Table 26-6-9). Liner damage was observed at WES Borings 2, 13, and 15. The liner appeared to be intact at all the boring locations.

In this study bulk chemical analyses were performed on subliner soil samples from the 0- to 1-ft interval of 6 of the 15 borings, and overburden samples from 3 boring locations. These analyses were conducted using U.S. Army Toxic and Hazardous Materials Agency (USATHAMA)-certified GC/MS methods for organic compounds, inductively-coupled argon plasma (ICP) techniques for metals, and AA spectrophotometry for mercury and arsenic. All of the subliner soil cores and selected subliner samples from the 16 borings were first treated as requested by USATHAMA by the Solid Waste Leaching Procedure (SWLP). This procedure involved preparation of 100 gram representative subsamples from each sample which were then immersed in 1-gal containers of deionized/distilled water and placed for 24 hours in a rotating leaching device. The resulting extracts were then filtered and subjected to USATHAMA-approved chemical analyses for aldrin, dieldrin, endrin, isodrin, DIMP, DMMP, Dithiane, DBCP, CPMSO, CPMSO2, mercury, arsenic, and fluoride.

Contaminants found in the SWLP extracts at concentrations above Environmental Protection Agency (EPA)- or Army-designated action levels included aldrin, dieldrin, endrin, isodrin, organosulfurs, DBCP, arsenic, and mercury. Concentrations in overburden samples were much higher than in accompanying subliner samples, and concentrations in subliner samples generally decreased with depth. The greatest number and highest concentrations of contaminants were detected at Boring Locations 1 and 2 which were within F-1.

The bulk chemical analyses detected a somewhat different set of contaminants than the SWLP analyses. The most prevalent analytes in the subliner samples were xylene, toluene, mercury, DIMP, CPMSO2, and halocarbons. Organochlorine pesticides were detected by bulk analysis only in the

Table 26-6-9. Depth of Overburden Soil Above Basin F Liner at WES (1982) Borings

Boring No.	Overburden Thickness Above Liner (ft)
01	1.3
02	1.35
11	1.55
12	1.25
13	0.65
14	1.5
15	1.2
21	1.25
22	1.2
23	1.3
31	1.6
32	1.6
33	1.8
50	1.7
60	1.8
70	1.4

Source: Meyers and Thompson (WES), 1982 (RIC#82350R01)

overburden samples from Borings 12 and 31. As was the case with the SWLP analyses, the overburden samples contained more contaminants at much higher concentrations than the accompanying subliner samples. Contaminant concentrations in the sub-liner samples were generally consistent between borings. Concentrations in the overburden samples were variable. The highest concentrations detected were in the overburden sample from Location 31 in the northeast quarter of the basin, the lowest were in the sample from Location 12, in the southwest quarter of the basin.

The contaminant concentrations detected by bulk analysis ranged from 2 to 5 orders of magnitude greater than those detected in corresponding SWLP extracts. According to WES, this indicates the SWLP extracted only a small fraction of the total amount of contaminants present; and, therefore, if the SWLP is presumed to simulate natural leaching conditions, the subliner soil and overburden represented by the samples collected by this study may be potential contaminant sources for some time. It should be noted, however, that the analytical results from SWLP extracts do not indicate actual contaminant levels in the subliner soils. Furthermore, the analytical methods employed during bulk analysis do not correspond to methods used on the SWLP extracts; therefore direct comparison of results from both sample sets is not appropriate. These data also should not be compared against Phase I RI soil data as analytical methods differ. The results of the 1982 WES study are presented as background information only.

3.2 PHASE I SURVEY

3.2.1 Phase I Program

The initial Phase I program for Basin F included 14 soil borings ranging in depth from 3.5 to 40 ft below the Basin F liner, from which 40 soil samples were obtained. Three samples were also collected from one location within the drainage ditch adjacent to the east boundary. These samples were obtained from the western side of the ditch at 0.7, 1.7, and 2.4 ft below ground surface. After completion of the initial Phase I work, a Supplemental Phase I program was requested by RMA Project Managers Office (PMO) to correlate liner condition with underlying soil chemistry as an aid in determining volumes of contaminated subliner soil to be removed during interim action activities. The Supplemental Phase I program included

assessments of liner integrity at 42 observation sites and the collection of 13 samples at 7 locations. In summary, 56 soil samples were collected at 22 locations throughout the site.

On the basis of site history and use, gradiometer borehole clearance and exploration geophysics were considered unnecessary at this site. Boring and liner observation sites were selected on the basis of visual evidence, historical reports, aerial photographs, and to provide uniform coverage of the site. All borings and liner observation sites were outside the areas covered by liquid.

A photoionization detector (PID), calibrated to an isobutylene standard, was used to obtain readings from open boreholes during drilling and sampling, at liner observation points, and from soil samples during geologic logging. The PID measures the concentration of organic vapors in the air and is a method of ensuring personnel safety.

Most of the 56 samples were collected using the continuous soil sampling method detailed in the Task 6 Technical Plan (ESE, 1987b, RIC#87343R01); however, some of the sampling sites (4617, 4618, 4622) could not be reached by the drill rig. These borings and the 7 borings (13 samples) completed during the Supplemental Phase I work were advanced using a posthole digger. Samples from the 0- to 1-ft interval were obtained by excavating through the liner and overburden to the top of the sampling interval and pounding a 1-ft-polybutyrate tube into the soil with a hammer. Samples at greater depths were obtained by excavating to near the desired interval, pounding a 4-ft-long section of polybutyrate to the desired depth, and then removing the bottom 1-ft section to obtain the required sample volume. Samples at Location 4639 were collected from a 5-ft-wide drainage trench located just outside the Basin F fence along the southeast boundary. Samples at this location were obtained by pounding a 1-ft-polybutyrate tube horizontally into the wall of the trench. All other Phase I soil samples were collected at predetermined 5-ft-depth intervals, except where downhole conditions (i.e., water table, staining, etc.) required an adjustment in the intervals.

All boreholes were sealed with cement-bentonite grout in accordance with the Task 6 Technical Plan (ESE, 1987b, RIC#87343R01) immediately after the last sample was extracted.

All samples obtained during the initial Phase I investigation were scheduled to be analyzed for volatile and semivolatile organic compounds by gas chromatography/mass spectrometry (GC/MS). Cadmium, chromium, copper, lead, and zinc were to be analyzed using ICP.

All samples were analyzed for mercury and arsenic by atomic absorption (AA) and for DBCP, by specific GC method. Analyses for semivolatile organic compounds were not performed on Sample 4622 (0 to 1 ft), Samples 4625 (0.5 to 1.5, 4 to 5, and 9 to 10 ft), and Sample 4628 (4 to 5 ft); and a volatile organics analysis was not performed on Sample 4622 (0 to 1 ft). Holding times for these fractions were exceeded.

Analytical results from the initial Phase I investigation identified a suite of metals and semivolatile organic compounds as indicators of liner leakage. The 13 samples taken during the supplemental Phase I investigation were analyzed for these parameters by ICP and GC/MS methods. A review of site history indicated agent testing was not necessary during this investigation.

The RMA Phase I RI, including the assessment of this site, was originally designed after review of historical documents and aerial photographs provided by the RIC, and field reconnaissance. After completion of Phase I field activities, a more detailed historical summary, drawn from RMA operating records and other documents previously unavailable to the RI Team, was submitted and incorporated into the history section of a previous version of this report. This historical summary has been abridged for the final version. All information has been evaluated in detail to determine how it might impact the investigative approach at this site. Based upon this evaluation, it has been determined that the additional information collected since the Phase I program was designed does not substantially alter the view of potential contamination at this site. As a result, the Phase I program as conducted and Phase II program as designed are judged to provide a complete and accurate investigation of the possible contamination at this site.

3.2.2 Phase I Field Observations

Approximately 22 acres in the northern half of Basin F and two small areas in the southern half were covered by liquid and inaccessible during the Phase I investigation. Liner overburden soil covers most of the remainder of the basin to a maximum depth of 2 ft. The overburden soil is extremely soft and nearly saturated.

The site history and nature of the Basin F liquid required hydrogeologists and geotechnicians drilling the Phase I borings to wear at least Level C protection and upgrade to Level B protection when working in close proximity to the liner surface. The Supplemental Phase I work was performed manually under Level B protection.

Field observations made during the Phase I soil sampling activities are summarized in Table 26-6-10. Field observations made during Supplemental Phase I work are summarized in Table 26-6-11. Significant field observations made during work in Basin F are discussed below:

- Overburden soil was generally a dark-brown sandy silt that became more discolored and sludge-like as excavations approached the liner surface. Much of the exposed overburden was covered by dark-green crystals;
- The asphalt liner was exposed at several locations in the southern and eastern portions of the basin. The liner was usually cracked and weathered where exposed:
- Seepage of overburden fluid into the area where the liner was removed occurred at four boreholes during initial Phase I activities (4619 through 4621, 4625). Seepage occurred after the liner sample was obtained and prior to drilling. As a result, the first sample interval (0 to 1 ft) was modified to 0.5 to 1.5 ft:
- The 19- to 20-ft sample in Borehole 4620 was stained black. The boring was terminated at this depth to preclude the possibility of introducing contamination into ground water. Upon auger removal, the drill bit was partly covered with a black sludge material:
- Air monitoring during drilling for the initial Phase I borings recorded organic vapor concentrations above background at the breathing zone only at Boring 4620. The hole was completed in

Table 26-6-10. Liner Sampling Observations

Borehole	Approximate overburden Thickness (feet)	Liner Condition	Underburden Condition	Other Remarks
4617	1.5	One solid piece 1/4 inch thickness	No visible soil discoloration	Heavy seepage from surrounding overburden
4618	1.0	One solid piece 1/4 inch thickness	No visible soil discoloration	
4619	1.5	One solid piece	No visible soil discoloration	Cracked, exposed liner to east
4620	2	Broken, cracked, difficult to distinguish	Black discoloration	Minor seepage from overburden
4621	1.5	One solid piece 1/4 inch thickness	No visible soil discoloration	Minor seepage from overburden
4622	1.5	One solid piece 1/4 inch thickness	Black discoloration to a depth of 1 in	Thin layer of salt crystals at 0.2 ft
4623	1.3	One solid piece	Very light soil discoloration	
4624	1.2	One solid piece	Random black discolorations to a depth of 2.5 in	
4625	1.7	One solid piece	Black discoloration	Moderate seepage from overburden
4626	1.3	Liner discontinuous; only bits and pieces obtained	Black discoloration to a depth of 4 in	
4627	1.0	Liner is too soft and tacky to lift. Sample was bottled	Visible discoloration	
4628	1.5	One solid piece 1/4 inch thickness	No visible soil discoloration	
4629	1.5	One solid piece 1/4 inch thickness	Soil is dark brown	
4630	0.25	One solid piece 1/4 inch thickness	No visible soil discoloration	Cracked liner exposed 5 ft south

Source: ESE, 1987.

Table 26-6-11. Supplemental Phase I Liner Observations (Page 1 of 3)

Observation Site Number	Overburden Depth (ft)	Liner Condition	Maximum PID Readings	Sampling Interval/Subliner Soil Condition
OS-1	0.0	Broken, weathered, exposed	11	Not sampled
OS-2	1.1	Solid, intact	1	Not sampled
OS-3	0.0	Broken, weathered, exposed	No reading taken	Not sampled
OS-4	1.5	Solid, intact	80	Not sampled
OS-5/4640	1.4	Solid, intact	30	Samples collected from 0 to 1 ft and 3 to 3.6 ft; no soil staining evident
OS-6	1.3	Solid, intact	22	Not sampled
OS-7	0.0	Broken, weathered, exposed	52	Not sampled
OS-8	0.0	Broken, weathered, exposed	No reading taken	Not sampled
OS-9/4642	1.25	Soft, torn	60	Samples collected from 0 to 1 ft and 2 to 3 ft; no soil staining evident
OS-10	1.1	Soft, inconsistent	40	Not sampled
OS-11	1.5	Intact, soft top	30	Not sampled
OS-12/4641	1.6	Intact, soft top	113	Sample collected from 0 to 1 ft; no soil staining evident
OS-13	1.45	Solid, intact	19	Not sampled
OS-14	0.7	Solid, intact	35	Not sampled
OS-15	1.0	Solid, intact	124	
OS-16	1.4	Solid, intact	220	Not sampled

Table 26-6-11. Supplemental Phase I Liner Observations (Page 2 of 3)

Observation Site Number	Overburden Depth (ft)	Liner Condition	Maximum PID Readings	Sampling Interval/Subliner Soil Condition
OS-17	1.6	Intact, soft top	40	Not sampled
OS-18	1.5	Intact, soft top	No reading taken	Not sampled
OS-19	1.2	Decomposed and cracked	No reading taken	Not sampled
GS-20	1.2	Solid, intact	No reading taken	Not sampled
OS-21	1.5	No liner observed at bottom of hole	No reading taken	Not sampled
OS-22	1.1	No liner observed at bottom of hole	No reading taken	Not sampled
OS-23	2.5	No liner observed at bottom of hole	No reading taken	Not sampled
OS-24	2.1	Liner difficult to distinguish; appears solid. Intact	500	Not sampled
OS-25	2.0	Soft, noncohesive	420	Not sampled
OS-26/6645	1.7	Intact, soft top	128	Samples collected from 0 to 1 ft and 2 to 3 ft; soils stained in both intervals
OS-27	1.4	Solid, intact	17	Not sampled
OS 28	0.2	Solid intact May be salts layer	23	Not sampled
OS-29	2.0	Intact, solid	800	Not sampled
OS 30	1.2	Intact, solid	130	Not sampled
OS-31	2.2	Intact, solid	No reading taken	Not sampled
OS 32	Unknown	No liner observed	No reading taken	Not sampled
OS 33	0.0	Broken, weathered, exposed	No reading taken	Not sampled

Table 26-6-11. Supplemental Phase I Liner Observations (Page 3 of 3)

Observation Site Number	Overburden Depth (ft)	Liner Condition	Maximum PID Readings	Sampling Interval/Subliner Soil Condition
OS-34	1.1	Solid, intact	10.2	Not sampled
OS-35	0.9	Solid, intact	4.5	Not sampled
OS-36	1.7	Intact, soft top	320	Not sampled
OS-37	2.2	No liner in center of excavation, soft elsewhere	1000	Not sampled
OS-38	1.8	Solid, intact	300	Not sampled
OS-39	1.8	Intact, soft top	235	Not sampled
OS-40/4643	3.2	Solid	1000	Samples collected from 0 to 1 ft; soil stained
OS-41/4644	1.5	Soft Non-cohesive	500	Samples collected from 0 to 1 ft and 2 to 3 ft; stained in both intervals
OS-42/4646	1.5	Solid, intact	19	Samples collected from 0 to 1 ft and 2 to 3 ft; soil stained in both intervals

Source: ESE, 1987.

Level B protection. Readings taken down the borehole annulus ranged from background to 1,500 (Boring 4620, 5 to 9 ft);

- Air monitoring of both the overburden soil and soil beneath the liner was performed during Supplemental Phase I work. PID readings in the overburden soil ranged from background to 1,000. PID readings in subliner soil ranged from background to 500. PID readings ranging from 8 to 30 were obtained from subliner soil at sites where the liner was intact (4640, 4643, and 4645); and
- Field observations confirmed that the Basin F liner was intact over a large area in the central and western part of the basin and along the northern boundary. Damage to the liner was observed in the southern and eastern part of the basin.

3.2.3 Geophysical_Exploration

On the basis of the history and use of Basin F, a geophysical exploration program was not warranted.

3.2.4 Phase_I_Analyte_Levels_and_Distribution

Fifty-six soil samples were obtained from 22 locations during the Phase I soil investigation. A statistical summary of all Phase I analytical results is presented in Table 26-6-12. An analytical summary for each sample, including lithology and air monitoring results, is presented in Table 26-6-13. A listing of the target compounds and a tabulation of analytical data can be found in Appendices 26-6-A and 26-6-B, respectively. Liner observation sites, boring locations, and Phase I data are presented in Figure 26-6-9. It should be noted that toluene was detected at a high concentration in Sample 4626 (0 to 1 ft), and bicycloheptadiene (BCHPD) and tetrachloroethene were found at similar concentrations in Sample 4626 (4 to 5 ft). Matrix effects, however, prevented precise quantification of the amount present at concentrations greater than (>) 25 ppm. These samples are presented in Tables 26-6-12 and 26-6-13, but have not been included in the statistical summary.

To assess the significance of metal and organic analytical values, indicator ranges were established. For organic compounds, the indicator level is the method detection limit. For metals, a range of values was chosen to reflect

Table 26-6-12. Summary of Analytical Results for Site 26-6 Soil Samples

Constituent	Number of Detections*	Concentrations (µg/g) Range	Mean	Median	Standard Deviation	ESE Detection Limit	MRI Detection Limit	Indicator Range
Volatiles (N=42)†								
Chlorobenzene	2	0.8-5	--	--	--	0.3	0.3	DL
Chloroform	3	0.3-70	--	--	--	0.3	0.7	DL
1,2-Dichloroethene	1	1	--	--	--	0.3	0.4	DL
BCHPD	5	2-30	9	5	10	0.3	0.8	DL
BCHOD	1	>25	--	--	--	0.3	0.8	DL
Ethylbenzene	2	1-8	--	--	--	0.3	0.4	DL
Tetrachloroethene	7	1-40	10	10	10	0.3	0.5	DL
Tetrachloroethene	1	>25	--	--	--	0.3	0.5	DL
Toluene	7	1-1000	400	300	400	0.3	0.3	DL
Toluene	1	>25	--	--	--	0.3	0.3	DL
1,1,1-Trichloroethane	1	0.4	--	--	--	0.3	0.5	DL
m-Xylene	2	0.4-5	--	--	--	0.3	--	DL
MIBK	3	0.4-1	--	--	--	0.5	0.4	DL
DMDS	3	2-70	--	--	--	0.3	4.0	DL
Benzene	3	1-3	--	--	--	0.3	1.0	DL
o,p-Xylene	1	10	--	--	--	0.5	0.5	DL
Semivolatiles (N=51)†								
Aldrin	15	0.7-4000	800	100	1000	0.9	0.5	DL
Dieldrin	17	0.5-2000	200	90	400	0.3	0.6	DL
Endrin	12	2-900	300	150	300	0.7	4.0	DL
DINP	8	0.5-2.0	1	.8	0.6	0.5	3.0	DL
Isodrin	11	1.0-3000	800	300	1000	0.3	0.6	DL
DCPD	10	0.4-4000	800	200	1000	0.3	6.0	DL
CPMS	6	0.5-700	200	14	300	0.3	0.3	DL
CPMSO	12	0.5-70	8	1	20	0.4	1.0	DL
DMNP	9	0.5-70	10	6	20	2	3.0	DL
$CPMSO_2$	28	0.4-300	20	.5	60	0.3	0.4	DL
DBCP (N=43)†	7	0.04-8	2	0.9	3.0	0.005	0.005	DL
ICP Metals (N=56)†								
Cadmium	1	2.0	--	--	--	0.9	0.5	DL-2
Chromium	52	9.5-34	18	17	5.6	7.2	3.4	25-40
Copper	56	5.0-2300	100	20	310	4.9	4.9	20-35
Lead	5	18-35	23	20	6.8	17	16	25-40
Zinc	51	30-320	62	53	42	16	28	60-80
Arsenic (N=43)†	22	4.8-18	9.4	9.2	3.5	4.7	5.2	4.7-80
Mercury (N=43)†	2	0.08-0.09	--	--	--	0.05	0.07	0.05-0.1

* Number of samples in which constituent was detected above the detection limit.
† N = Number of samples analyzed.
DL Detection limit.
-- Not calculated for less than five detections.

Source: ESE, 1988.

Table 26-6-1). Concentrations of Target Analytes Above Detection Limits in Site 26-6 Soil Samples (Page 1 of 6)

Bore Number	4617	4617	4618	4618	4619	4619	4619	4620	4620	4620
Depth (ft)	0-1	4-5	0-1	3-3.5	0.5-1.5	4-5	9-10	0.5-1.5	4-5	9-10
Geologic Material	Sandy Clayey Silt	Sandy Clayey Silt	Sandy Silt	Sandy Silt	Sandy Silt	Sandy Silt	Gravel Sand	Slightly Sandy Silt	Clayey Silt	Clayey Silt
AIR MONITORING										
PID*	7.0	2.4	13.5	BKD	0.8*	300	1500	156	630	420
SOIL CHEMISTRY										
Volatiles (µg/g)										
BCMD	BDL	BDL	BDL	BDL	BDL	BDL	BDL	8	4	5
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Tetrachloroethene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5	10	40
Toluene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	800	300	1000
DMDS	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10	BDL	BDL
Benzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2	BDL	1
MIBK	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.4
Semivolatiles (µg/g)										
$CPHSO_2$	0.8	BDL	20	0.7	BDL	BDL	BDL	20	BDL	BDL
Aldrin	BDL	BDL	0.7	1	BDL	BDL	BDL	1000	800	2000
Dieldrin	BDL	BDL	BDL	BDL	BDL	BDL	BDL	400	200	400
Endrin	BDL	BDL	BDL	BDL	BDL	BDL	BDL	900	500	800
Isodrin	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3000	1000	3000
DCPD	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2000	1000	4000
DBCP	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.044	2.5
DMMP	BDL	BDL	BDL	BDL	3	BDL	BDL	20	BDL	BDL
DIMP	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.8	BDL	BDL
ICP Metals (µg/g)										
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium	16	18	16	18	28	20	15	28	19	18
Copper	22	25	140	28	12	11	11	16	23	26
Lead	BDL	BDL	20	BDL	22	BDL	BDL	BDL	BDL	BDL
Zinc	120	53	57	53	69	58	45	67	57	53
Arsenic (µg/g)	BDL	BDL	BDL	BDL	8.9	6.2	4.9	9.1	BDL	BDL
Mercury (µg/g)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Table 26-6-13. Concentrations of Target Analytes Above Detection Limits in Site 26-6 Soil Samples (Fall, 1985) (Page 2 of 6)

Bore Number	4620	4620	4621	4621	4622	4622	4623	4623	4624	4624
Depth (ft)	14-15	19-20	0.5-1.5	4-5	0-0.5	4-5	0-1	4-5	0-1	4-5
Geologic Material	Clayey Silt	Silty Sand	Clayey Silt	Clayey Silt	Clayey Silt	Sandy Silt	Silty Sand	Silty Sand	Clayey Sand	Silty Sand
AIR MONITORING										
PID*	530	400	122	27.2	NA	BKD	BKD	BKD	1.3	2.8
SOIL CHEMISTRY										
Volatiles (µg/g)										
BCHD	BDL	2	BDL	BDL	NA	BDL	BDL	BDL	BDL	BDL
PCE	6	20	BDL	BDL	NA	5DL	BDL	BDL	BDL	BDL
Toluene	100	300	BDL	BDL	NA	BDL	BDL	BDL	BDL	BDL
Semivolatiles (µg/g)										
$CPHSO_2$	BDL	BDL	BDL	BDL	NA	BDL	BDL	BDL	2	BDL
Aldrin	500	900	BDL	BDL	NA	BDL	BDL	BDL	BDL	BDL
Dieldrin	100	200	BDL	BDL	NA	BDL	BDL	BDL	BDL	BDL
Endrin	300	400	BDL	BDL	NA	BDL	BDL	BDL	BDL	BDL
Isodrin	700	1000	BDL	BDL	NA	BDL	BDL	BDL	BDL	BDL
DCPD	300	600	BDL	BDL	NA	BDL	BDL	BDL	BDL	BDL
DBCP	0.53	0.064	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ICP Metals (µg/g)										
Cadmium	BDL	BDL	BDL	2.0	BDL	BDL	BDL	BDL	BDL	BDL
Chromium	BDL	BDL	22	21	34	19	12	11	19	14
Copper	14	19	17	13	17	28	15	18	12	5.0
Lead	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	18	BDL
Zinc	BDL	BDL	61	53	96	53	33	BDL	52	38
Arsenic (µg/g)	BDL	BDL	9.6	14	10	BDL	BDL	BDL	6.6	5.2
Mercury (µg/g)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Table 26-6-13. Concentrations of Target Analytes Above Detection Limits in Site 26-6 Soil Samples (Fall 1985) (Page 3 of 6)

Bore Number	4625	4625	4625	4626	4626	4627	4627	4627	4628	4628
Depth (ft)	0.5-1.5	4-5	9-10	0-1	4-5	0-1	4-5	9-10	0-1	4-5
Geologic Material	Clayey Silt	Clayey Silt	Clayey Silt	Clayey Silt	Clayey Silt	Clayey Silt	Clayey Silt	Clayey Silt	Silty Clay	Clayey Silt
AIR MONITORING										
PID*	1.0	2.7	98	420	90	21.2	52.4	15.6	BKD	0.9
SOIL CHEMISTRY										
Volatiles (µg/g)										
Ethylbenzene	BDL	BDL	BDL	1	8	BDL	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	BDL	BDL	0.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BCMD	BDL	BDL	BDL	30	>25	BDL	BDL	BDL	BDL	BDL
m-Xylene	BDL	BDL	BDL	5	BDL	BDL	BDL	BDL	BDL	BDL
PCE	BDL	BDL	BDL	20	>25	1	BDL	BDL	LDL	BDL
Toluene	BDL	BDL	BDL	>25	600	1	BDL	BDL	BDL	BDL
DMDS	BDL	PDL	BDL	2	70	BDL	BDL	BDL	BDL	BDL
o-p-Xylene	BDL	BDL	BDL	BDL	10	BDL	BDL	BDL	BDL	BDL
Benzene	BDL	BDL	BDL	BDL	1	BDL	BDL	BDL	BDL	BDL
Chlorobenzene	BDL	BDL	BDL	0.8	5	BDL	BDL	BDL	LDL	BDL
Chloroform	BDL	BDL	BDL	4	70	0.3	BDL	BDL	BDL	BDL
Semivolatiles (µg/g)										
$CPMSO_2$	NA	NA	NA	300	90	30	10	8	0.9	NA
Aldrin	NA	NA	NA	3000	4000	BDL	BDL	BDL	BDL	NA
Dieldrin	NA	NA	NA	700	2000	BDL	BDL	BDL	BDL	NA
Endrin	NA	NA	NA	90	200	BDL	BDL	BDL	BDL	NA
Isodrin	NA	NA	NA	100	300	BDL	BDL	BDL	BDL	NA
DCPD	NA	NA	NA	30	100	BDL	BDL	BDL	BDL	NA
DBCP	BDL	BDL	BDL	4.8	8.1	0.86	BDL	BDL	BDL	BDL
DMMP	NA	NA	NA	9	70	BDL	BDL	BDL	BDL	NA
CPMS	NA	NA	NA	400	700	6	BDL	BDL	BDL	NA
CPMSO	NA	NA	NA	70	4	10	5	5	BDL	NA
ICP Metals (µg/g)										
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium	19	14	20	31	15	29	21	17	28	17
Copper	10	12	20	2300	290	24	17	14	14	12
Lead	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	35	BDL
Zinc	50	41	73	93	61	81	68	160	59	50
Arsenic (µg/g)	6.6	10	18	15	9.2	14	6.8	12	9.1	7.8
Mercury (µg/g)	BDL	BDL	BDL	0.08	BDL	BDL	BDL	BDL	BDL	BDL

Table 26-6-13. Concentrations of Target Analytes Above Detection Limits in Site 26-6 Soil Samples (Page 4 of 6)

Bore Number	4629	4629	4629	4629	4629	4629	4629	4630	4630	4630
Depth (ft)	0-1	4-5	9-10	14-15	19-20	29-29.75	39-39.25	0-1	4-5	9-10
Geologic Material	Sandy Clay	Sandy Silt	Clayey Sand	Silty Sand	Sand	Silty Clay	Saturated Gravel Sand Mix	Silty Sand	Silty Clay	Clayey Silty Sand
AIR MONITORING										
PID*	0.8	1.6	1.6	13	2	1.1	1.8	0.7	20	2.6
SOIL CHEMISTRY										
Volatiles (µg/g)										
CH_2Cl_2	NA	NA	NA	NA	NA	NA	NA	BDL	BDL	BDL
M-Xylene	BDL	BDL	BDL	BDL	0.4	BDL	BDL	BDL	BDL	BDL
MIBK	BDL	BDL	BDL	BDL	BDL	BDL	1	BDL	BDL	BDL
Semivolatiles (µg/g)										
DMMP	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4	6	BDL
$CPMSO_2$	1	BDL	BDL	BDL	BDL	BDL	BDL	0.7	0.5	BDL
DIMP	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.5	BDL
ICP Metals (µg/g)										
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium	23	BDL	14	19	11	14	BDL	17	18	14
Copper	24	11	16	29	29	26	14	8	16	7
Lead	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Zinc	77	BDL	45	59	16	65	BDL	15	50	46
Arsenic (µg/g)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	11	BDL
Mercury (µg/g)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Table 26-6-13. Concentrations of Target Analytes Above Detection Limits in Site 26-6 Soil Samples (Page 5 of 6)

Bore Number	4639	4639	4639	4640	4640	4641	4641	4642	4642	4643	4644
Depth (ft)	0.7	1.7	2.4	0-1	3-4	0-1	2-3	0-1	2-3	0-1	0-1
Geologic Material	Silty Clayey Sand	Silty Clayey Sand	Silty Clayey Sand	Silty Sand	Silty Sand	Silty Sand	Silty Sand	Silty Sand	Silty Sand	Silty Sand	Silty Sand
AIR MONITORING											
PID*	BKD	BKD	BKD	10.0	24.0	113.0	80.0	12.0	3.3	BKD	220
SOIL CHEMISTRY											
Volatiles (mg/g)	BDL	BDL	BDL	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatiles (µg/g)											
Aldrin	100	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	40	100
Dieldrin	90	BDL	BDL	BDL	BDL	[illegible]	0.9	BDL	BDL	30	80
Endrin	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100
Isodrin	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10	10
CPMS	0.5	BDL	BDL	3	BDL	BDL	BDL	BDL	BDL	BDL	100
CPMSO	1	2	0.6	BDL	0.8	BDL	BDL	BDL	BDL	BDL	1
$CPMSO_2$	0.4	BDL	1	5	5	6	2	3	BDL	70	10
DCPD	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	80	6
DIMP	BDL	BDL	2	BDL	BDL	0.5	BDL	BDL	BDL	BDL	BDL
DMMP	BDL	BDL	BDL	BDL	6	BDL	BDL	BDL	BDL	BDL	8
ICP Metals (µg/g)											
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium	9.5	17	28	9.7	12	22	16	10	16	19	18
Copper	370	12	11	12	180	120	360	60	25	120	230
Lead	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	19
Zinc	34	59	50	30	42	50	56	47	50	65	66
Arsenic (µg/g)	BDL	6.8	7.4	NA	NA	NA	NA	NA	NA	NA	NA
Mercury (µg/g)	0.090	BDL	BDL	NA	NA	NA	NA	NA	NA	NA	NA

Table 26-6-13. Concentrations of Target Analytes Above Detection Limits in Site 26-6 Soil Samples (Page 6 of 6)

Bore Number	4644	4645	4645	4646	4646
Depth (ft)	2-3	0-1	2-3	0-1	2-3
Geologic Material	Silty Sand	Silty Sand	Silty Sand	Silty Sand	Silty Sand
AIR MONITORING					
PID*	500	12	8.3	36	71
SOIL CHEMISTRY					
Volatiles (µg/g)	NA	NA	NA	NA	NA
Semivolatiles (µg/g)					
Aldrin	40	5	20	BDL	BDL
Dieldrin	20	6	10	0.9	0.5
Endrin	20	2	5	BDL	BDL
Isodrin	2	BDL	BDL	BDL	BDL
CPMS	20	BDL	5	BDL	BDL
CPMSO	0.6	BDL	1	BDL	BDL
$CMPSO_2$	4	6	5	4	1
DCPD	0.4	BDL	BDL	BDL	BDL
DIMP	2	0.6	0.7	BDL	1
DMMP	5	BDL	BDL	BDL	BDL
ICP Metals (µg/g)					
Cadmium	BDL	BDL	BDL	BDL	BDL
Chromium	14	13	14	16	11
Copper	240	240	340	63	69
Lead	BDL	BDL	BDL	BDL	BDL
Zinc	51	52	54	56	42
Arsenic (µg/g)	NA	NA	NA	NA	NA
Mercury (µg/g)	NA	NA	NA	NA	NA

* As calibrated to an isobutylene standard.
BDL Below detection limit.
BFD No readings above ambient background.
NA Not analyzed.

Source: ESE, 1988

the upper end of the natural range for each metal as normally found in RMA alluvial soil. The procedure for establishing indicator ranges is presented in the Introduction to the Contamination Assessment Reports (ESE, 1987a).

Only three borings (4621, 4622, and 4623) did not contain organic compounds. The sample from the 0.0- to 0.5-ft interval in Boring 4622 was not analyzed for volatile or semivolatile organic compounds; however, organic compounds were not detected in this boring from the 4- to 5-ft interval. Borings 4622 and 4623 were drilled in the central portion of the basin where the liner is intact over a large area. Results for Boring 4621 appear to be anomalous. Although the liner at Boring 4621, in the eastern part of the basin, is intact, it has cracked and is deteriorated in adjacent areas. Nearby Borings 4620, 4626, 4645, and 4646 contained numerous organic compounds.

Samples from remaining boreholes contained a variety of volatile organic compounds, organochlorine pesticides, and levels of metals within or above the indicator ranges. In general, borings drilled along the eastern boundary and in the southern part of the basin (4620, 4626, 4627, 4641, 4643 to 4646) yielded the greatest number of contaminant detections.

The greatest concentrations of contaminants were found in samples from Borings 4620 and 4626 in the eastern part of the basin. Concentrations of organic compounds in Boring 4620 were relatively uniform with depth. Semivolatile organic compounds were detected at levels up to 3,000 ppm; concentrations of volatile organic compounds up to 800 ppm were detected in the 0.5- to 1.5-ft interval. The greatest contaminant concentrations were detected in the 9- to 10-ft interval, where as much as 1,000 ppm for volatile organic compounds and 4,000 ppm for semivolatile compounds were detected. Concentrations were as much as 300 ppm for volatile organic compounds, and 1,000 ppm for semivolatile organic compounds in the deepest interval (19 to 20 ft).

Boring 4626 contained volatile organic compounds in concentrations up to 600 ppm and semivolatile organic compounds in concentrations up to 4,000 ppm. The highest concentration of copper (2,300 ppm) recorded during the Phase I investigation was detected at 0 to 1 ft in Boring 4626.

Borings 4643 to 4646 are also in the eastern part of the basin. Sampling in these borings was limited to the 0- to 1-ft and 2- to 3-ft intervals; concentrations of semivolatile organic compounds ranged up to 120 ppm. Elevated copper values (63.4 ppm to 343 ppm) were also detected in these borings.

Boring 4627 was drilled in the southeastern part of the basin in F-1. Organic compounds in concentrations up to 30 ppm were detected in the 0- to 1-ft interval at this location. Semivolatile compounds were detected at values up to 8 ppm in the deepest interval (9 to 10 ft).

Boring 4629, in the southwest quarter of the basin, was advanced to the water table. Organic compounds were not detected below the 0- to 1-ft interval except for m-xylene at 0.4 ppm in the 19- to 20-ft interval, and MIBK at 1 ppm in the 39- to 39.25-ft interval. The m-xylene concentration is near the detection limit.

Borings 4622, 4623, and 4625, in the west-central part of the basin, exhibited little or no organic or trace metal contamination within or above the indicator ranges. Volatile and semivolatile organics were not analyzed in the sample from the 0- to 0.5-ft interval in Boring 4622; semivolatile organics were not analyzed in samples from Boring 4625. No organic compounds were detected in the 4- to 5-ft interval from Boring 4622, suggesting that organic compounds are either absent or limited to low concentrations at shallow (<4 ft) depths in this area.

Relatively low levels of contamination were detected in Borings 4617 and 4618 along the northern perimeter of the basin. Boring 4617 contained organic contamination (0.8 ppm) only in the 0- to 1-ft interval. Metal concentrations in Boring 4617 were within or below the indicator ranges except for zinc (320 ppm, 0 to 1 ft). Boring 4618 contained low levels of organic compounds (1 ppm) in the 3.0- to 3.5-ft interval. Sampling was not conducted below this depth. Except for copper (140 ppm, 0- to 1-ft interval), metals values were within or below the indicator ranges in Boring 4618.

Several compounds were detected by GC/MS that were not included in the target compound list and that were not conclusively identified. These compounds are included in the data presented in Appendix 26-6-B. Table 26-6-14 lists the boring number, sample interval depth, relative retention time (shown as "unknown number" on the table), concentration, sample number, lot, best-fit identification, and comments for these nontarget compounds detected at Site 26-6. It should be noted that an individual compound may have more than one retention time, and also that a particular retention time may be assigned to more than one compound. Therefore, Table 26-6-14 provides only a general indication of additional compounds that may be present.

The results for nontarget compounds were generally consistent with the target analyte results. Samples containing a wide variety of volatile and semivolatile target compounds at elevated concentrations (e.g., Borings 4620 and 4643), also had numerous volatile and semivolatile nontarget compounds at comparable levels. The reverse is also true for samples in which target organic compounds were not found or were detected at low concentrations (e.g., Borings 4623, 4621, and 4624).

Most of the nontarget compounds could not be identified. Several nontarget semivolatiles were identified as target volatile compounds: e.g., toluene, xylene, DMDS, tetrachloroethane (TCLEE), or as compounds related to target compounds (DMMP isomer, Boring 4644, 2 to 3 ft). Some nontarget compounds were identified as organic alcohols, acids, or esters which occur naturally at the concentrations detected. Other nontarget detections were tentatively identified as probable constituents of the aqueous waste stream. The remaining nontarget detections were tentatively identified as relatively obscure compounds, the source of which cannot be determined.

3.2.5 Phase_I_Contamination_Assessment

Examination of the Phase I analytical data indicates that in the central and western part of Basin F, lower contaminant concentrations are found in the soil underlying the liner. In addition, data confirm the most elevated contaminant levels are generally found in areas where the liner is damaged. However, data also indicate that detectable levels of contaminants are

Table 26-6-14. Tentative Identification of Nontarget Compounds in Site 26-6 Soil Samples (Page 1 of 9)

Borehole Number	Interval Depth (ft)	Unknown Number	Concentration (ppm)	Best Fit	Comments
4617	0-1	544	9	Chlorinated unknown	a
		609	5	Unknown	a
		618	3	Unknown	a
		620	10	Unknown	a
		522	7	Unknown	a
		623	7	Unknown	a
	4-5	562	0.3	Unknown	a
		611	0.7	Benzenediol monobenzoate	f
		614	4	Dibutyl nonanedioate	d
		619	0.9	Unknown	a
		629	1	Dibutyl adipate	c, f, h
		633	0.4	Unknown hydrocarbon	a, f
4618	0-1	543	5	Unknown	a
		558	4	Unknown	a
		610	4	Unknown	a
		618	6	Unknown	a
		621	10	Unknown	a
		623	10	Unknown	a
	3-3.5	611	10	Benzenediol monobenzoate	d
		614	50	Dibutyl nonanedioate	d
		619	6	Dibutyl decanedioate	d
		624	9	Unknown	a
		629	20	Dioctyl adipate	c, h
4619	0.5-1.5	520	8	N-methyl acetamide	g
		532	2	Methyl pentanediol	g
		561	9	Cis (1,3-butadienyl) cyclobutane	g
	4-5				j
	9-10	614	20	Octadecenol	d
		633	1	Diheptyl phthalate	c, f, h
4620	0.5-1.5	519	1	N-methylacetamide	g
		525	2	Unknown	a
		581	8	Hexachlorobicycloheptadiene	i
		591	20	Heptachlorobicycloheptene	i
		596	10	Tetrachlorobenzene	g
	4-5	576	4.0	Chlorinated unknown	a
		582	100	Unknown	a
		591	400	Unknown	a
		596	400	Unknown	a
		618	200	Unknown	a
	9-10	576	100	Chlorinated unknown	a
		582	300	Chlorinated unknown	a
		591	700	Chlorinated unknown	a
		596	700	Chlorinated unknown	a
		618	400	Unknown	a

Table 26-6-14. Tentative Identification of Nontarget Compounds in Site 26-6 Soil Samples (Continued, Page 2 of 9)

Borehole Number	Interval Depth (ft)	Unknown Number	Concentration (ppm)*	Best Fit	Comments
4620	14-15	576	30	Chlorinated unknown	a
		582	60	Chlorinated unknown	a
		592	100	Chlorinated unknown	a
		595	10	Unknown	a
		596	100	Chlorinated unknown	a
		618	100	Chlorinated unknown	a
		633	10	Unknown	a
	19-20	582	200	Unknown	a
		591	400	Unknown	a
		596	400	Unknown	a
		618	200	Unknown	a
		633	70	Chlorinated unknown	a
4621	0.5-1.5	520	5	N-methyl acetamide	g
		534	9	2-methyl-2,4 pentanedial	g
		556	3	Unknown	a
		561	10	Cis (1,3-butadinyl) cyclobutane	g
	4-5	537	0.5	Oxybis ethanol	Antifreeze
		598	2	Tetradecanoic acid	d
		627	0.6	Octadecenoic acid	d
4622	0-0.5				j
	4-5	611	2	Benzenediol monobenzoate	d
		614	8	Dibutyl nonanedioate	d
		619	2	Dibutyl decanedioate	a
		624	2	Unknown	c, h
		629	4	Dioctyl adipate	
4623	0-1				j
	4-5				j
4624	0-1	520	6	N-methyl acetamide	g
		[illegible]	2	Ethyl heptane	l
		[illegible]	7	Cis (1,3-butedienyl) cyclobutane	g
		562	1	Unknown	a
	4-5	614	2	Octadecenol	d
4264	4-5	629	0.5	Octadecanoic acid, butyl ester	d
4625	0.5-1.5				j
	4-5				j
	9-10				i
4626	0-1	551	0.4	Unknown	a
		611	40	Aldrin	k
		628	1	Unknown	a
		630	0.6	Methyl (fluorophenyl) dihydrobenzothiazpine	g

Table 24-6-14. Tentative Identification of Nontarget Compounds in Site 24-6 Soil Samples (Continued, Page 3 of 9)

Borehole Number	Interval Depth (ft)	Unknown Number	Concentration (ppm)*	Best Fit	Comments†
4626	4-5	519	0.5	N-methyl acetamide	g
		539	0.7	Trimethylbenzene	k
		560	0.9	Bicycloheptadiene	h
		581	0.9	Hexachlorobicycloheptadiene	l
		628	2	Unknown	a
4627	0-1	513	1	N,N, Diethyl-1-propanamine	g
	4-5	578	3	Unknown	a
		585	3	1-Chloro-4-(methylsulfonyl) benzene	g
		604	5	Tetradecadiene	h
		605	7	Cyclohexadecane	h
	9-10	547	2	Unknown cyclic alkane	a
		557	30	Unknown	a
		561	2	Unknown cyclic alkane	a
		578	3	Unknown	a
4628	0-1	634	0.5	Ditriacontane	h
	4-5				j
4629	0-1	563	0.6	Unknown	a
		604	1	Dibutyl phthalate	c, f, h
		615	0.6	Sulfur-8	
		633	0.5	Unknown hydrocarbon	a, f
	4-5				j
	9-10	633	0.4	Unknown hydrocarbon	a, f
	14-15	614	0.4	Dibutyl nonanedioate	d
		633	0.5	Unknown hydrocarbon	a, f
	19-20	614	1	Dibutyl nonanedioate	d
		629	0.6	Dioctyl adipate	d
		633	0.4	Unknown hydrocarbon	a, f
	29-29.75	633	0.4	Unknown hydrocarbon	a, f
	39-39.25				j
4630	0-1	520	6	N-methyl acetamide	g
		561	4	Cis (1,3 butadienyl) Cyclobutane	g
		614	30	Octadecenol	d
	4-5	526	4	Phosphoric acid, methyl-, Dimethyl ester	g
		547	2	Unknown	a
		561	1	Cis (1,3 butadienyl) cyclobutane	g
		582	7	Methyl cyclohexanol	g
	9-10	608	2	Hexadecenoic acid	d
		625	0.8	Tetracosenoic acid, methylester	d
		654	1	Tetramethyl hexadecanol	d

Table 26-6-14. Tentative Identification of Nontarget Compounds in Site 26-6 Soil Samples (Continued, Page 4 of 9)

Borehole Number	Interval Depth (ft)	Unknown Number	Concentration (ppm)[a]	Best Fit	Comments[f]
4639	0.5	604	0.6	1,1-Dimethylethyl phenohyl-ethanol	f
		633	4	Unknown	a
		629	1	Unknown	a
		625	1	Unknown	a
		581	0.8	Hexachlorobicycloheptadiene	i
		628	30	Unknown	a
		630	20	Unknown	a
	2.0	629	1	Unknown	a
	2.5	146	1	Unknown	a
		011	5	Unknown	a
4640	0-1	524	4	Methylacetamide	
		549	0.5	Unknown	a
		551	0.7	Unknown	a
		553	1	Unknown	a
		557	0.8	Unknown	a
		559	0.4	Unknown	a
		562	5	Butadienylcyclobutane	
		563	1	Butadienylcyclobutane	
			0.7	Dibutyl esternonanedioic acid	d, f, h
		618	0.3	Unknown	a
	3-4	516	30	*Propylpropanamine*	
		524	2	Unknown	a
		546	0.3	Unknown	a
		550	0.5	Unknown	a
		551	0.4	Unknown	a
		553	3	Methylpropylbutanamine	
		555	9	Unknown	a
		557	1	Unknown	a
		558	6	Unknown	a
		567	0.4	Unknown	a
		570	3	Unknown	a
		579	0.5	Ethenyldihydro-dimethyltetrazaborole	f
		580	1	Unknown	a
		586	1	Chloromethylsulfonylbenzene	
		587	0.9	Unknown	a
		588	1	Unknown	a
		593	0.4	Unknown	a
		595	0.3	Unknown	a
		596	0.4	Unknown	a
		598	0.6	Dimethylaminobenzofurazan	g
		602	0.4	Unknown	a
		603	0.6	Unknown	a
		606	0.7	Unknown	a
		609	2	Methyl ester dihydroxybenzoic acid	g
		611	0.4	Unknown	a
		612	0.7	Unknown	a
		614	1	Molecular sulfur	
		615	0.5	Unknown	a

Table 26-6-14. Tentative Identification of Nontarget Compounds in Site 26-6 Soil Samples (Continued, Page 5 of 9)

Borehole Number	Interval Depth (ft)	Unknown Number	Concentration (ppm)*	Best Fit	Comments†
		618	0.7	Unknown	a
		619	4	Unknown	a
		621	3	Unknown	a
		622	4	Unknown	a
		625	0.7	Unknown	a
		628	0.8	Unknown	a
4641	0-1	523	0.9	Methylacetamide	f
		524	1	Unknown	a
		525	1	Methylacetamide	
		528	1	Dimethylacetamide	
		535	1	Methyl pentanediol	
		542	0.6	Unknown	a
		548	0.4	Unknown	a
		552	1	Unknown	a
		553	2	Unknown	a
		554	0.5	Unknown	a
		557	2	Unknown	a
		559	0.6	Unknown	a
		562	2	Hexahydropentalene	
		563	6	Propanalcyclopentene	
		570	1	Unknown	a
		598	0.5	Unknown	a
		603	0.4	Unknown	a
		609	1	Unknown	a
		610	0.4	Unknown	a
		618	4	Unknown	a
		620	2	Unknown	a
		622	0.5	Unknown	a
		635	5	Di-n-octylphthalate	c
	2-3	516	0.6	Propylpropanamine	f
		524	2	Methylacetamide	
		549	1	Unknown	a
		553	0.9	Unknown	a
		556	0.8	Unknown	a
		557	1	Unknown	a
		562	0.4	Butadienylcyclobutane	f
		563	3	Butadienylcyclobutane	
		564	2	Butadienylcyclobutane	
		570	1	Unknown	a
		582	0.6	Dichloroethylbenzene	f
		603	0.4	Unknown	a
		609	1	Unknown	a
		610	0.4	Unknown	a
		614	2	Dibutyl ester nonanedioic acid	d, h
		618	4	Unknown	a
		620	1	Unknown	a
		627	0.8	Unknown	a
		628	0.4	Unknown	a

Table 26-6-14. Tentative Identification of Nontarget Compounds in Site 26-6 Soil Samples (Continued, Page 6 of 9)

Borehole Number	Interval Depth (ft)	Unknown Number	Concentration (ppm)*	Best Fit	Comments
4642	0-1	523	0.5	Methylacetamide	f
		534	0.5	Methyl pentanediol	f
		552	0.6	Unknown	a
		553	0.7	Unknown	a
		562	2	Butadienylcyclobutane	
		563	0.9	Butadienylcyclobutane	
		614	1	Molecular sulfur	f
		618	0.7	Unknown	a
		619	0.4	Unknown	a
	2-3	559	0.6	Unknown	a
		562	0.6	Unknown	a
		614	2	Dibutyl ester nonanedioic acid	d, h
		618	0.3	Unknown	a
4643	0-1	514	40	Dimethyldisulfide	k
		516	800	Toluene	k
		520	30	Unknown	a
		521	30	Tetrachloroethane	k
		523	10	Methylacetamide	
		527	100	Ethyl benzene	k
		528	600	Xylene	k
		531	200	Xylene	k
		534	10	Methylethyl benzene	
		539	20	Unknown	a
		544	10	Octahydromethano-cyclobutapentalene	
		547	40	Bicyclodihydro-dipentadiene	
		549	30	Phenylethanone	
		552	50	Unknown	a
		553	10	Unknown	a
		561	20	Butadienyl-cyclobutane	
		562	10	Hexachlorobutadiene	
		579	50	Unknown	a
		581	20	Hexachlorobicyclo heptadiene	
		628	9	Hydrocarbon	a, h
		632	20	Hydrocarbon	a, h
		636	20	Hydrocarbon	a, h
		640	20	Hydrocarbon	a, h
		645	10	Hydrocarbon	a, h
4644	0-1	516	10	Propylpropanamine	
		524	5	Methylacetamide	
		528	1	Dimethylacetamide	
		547	9	Bicyclodihydropentadiene	
		551	2	Unknown	a
		552	6	Unknown	a
		553	2	Unknown	a
		558	10	Unknown	a
		562	20	Hexachlorobutadiene	
		563	2	Unknown	a

Table 26-6-14. Tentative Identification of Nontarget Compounds in Site 26-6 Soil Samples (Continued, Page 7 of 9)

Borehole Number	Interval Depth (ft)	Unknown Number	Concentration (ppm)[a]	Best Fit	Comments[b]
		587	10	Unknown	a
		596	5	Hexachlorobicycloheptene	
		603	20	Unknown	a
		632	8	Hydrocarbon	a, h
	2-3	524	3	Methylacetamide	
		528	3	Dimethylacetamide	
		531	2	Dimethyl methyl phosphonate isomer	Related to DMMP (target compound)
		534	1	Methyl pentanediol	
		554	0.9	Unknown	a
		558	9	Unknown	a
		562	3	Hexachlorobutadiene	
		563	4	Unknown	a
		579	2	Unknown	a
		582	20	Hexachlorobicycloheptadiene	i
		586	0.9	Unknown	a
		587	3	Unknown	a
		596	1	Unknown	a
		602	0.7	Unknown	a
		603	3	Unknown	a
		609	1	Di-n-butyl phthalate	c
		614	2	Molecular sulfur	
		618	2	Unknown	a
		620	1	Unknown	a
4645	0-1	516	9	Propylpropanamine	
		523	1	Methylacetamide	
		528	1	Dimethylacetamide	
		542	0.7	Unknown	a
		552	0.8	Unknown	a
		553	0.7	Unknown	a
		554	0.6	Unknown	a
		558	3	Unknown	a
		562	0.8	Methylethyl urea	f
		563	5	Unknown	a
		564	4	Unknown	a
		570	0.5	Ethylmethylpentanamine	f
		581	2	Pentachlorobenzamine	
		582	0.4	Unknown	a
		596	0.7	Tetrachlorobenzene	f
		598	0.7	Unknown	a
		603	1	Unknown	a
		609	2	Unknown	a
		615	0.5	Unknown	a
		618	1	Unknown	a
		628	0.7	Unknown	a
		616	0.4	Bis (2-ethylhexyl) phthalate	c, f

Table 26-6-14. Tentative Identification of Nontarget Compounds in Site 26-6 Soil Samples (Continued, Page 8 of 9)

Borehole Number	Interval Depth (ft)	Unknown Number	Concentration (ppm)*	Best Fit	Comments†
	2-3	516	2	Propylpropanamine	
		523	1	Methylacetamide	
		552	1	Unknown	a
		554	1	Unknown	a
		557	0.9	Unknown	a
		562	3	Hexachlorobutadiene	
		563	5	Butadienylcyclobutane	
		581	4	Pentachlorobenzenamine	
		582	0.8	Alkane	a, f, h
		595	0.6	Alkane	a, f, h
		596	1	Tetrachlorobenzene	
		603	4	Unknown	a
		609	1	Di-n-butyl phthalate	c
		614	1	Dibutylester-nonanedioic acid	d, h
		615	1	Alkane	a, h
		618	4	Tetra methylbutyl phenoxyl-ethoxy-ethanol	
		619	0.9	Unknown	a
		620	0.8	Alkane	a, f, h
		621	1	Alkane	a, h
		625	0.6	Unknown	a
		628	2	Unknown	a
4646	0-1	514	0.4	Unknown	a
		516	20	Propylpropanamine	
		524	1	Unknown	a
		528	6	Unknown	a
		534	1	Unknown	a
		539	4	Methyl pentanediol	
		547	2	Unknown	a
		550	2	Nitrosopropylpropanamine	
		553	4	Methylpropylbutanamine	
		555	4	Unknown	a
		559	10	Unknown	a
		570	10	Unknown	a
		579	0.6	Unknown	a
		580	0.7	Unknown	a
		581	0.4	Unknown	a
		586	1	Chlorophenyl methyl sulfide-isomer	Related to target compound
		596	0.4	Tetrachlorobenzene	f
		602	1	Unknown	a
		603	0.9	Molecular sulfur	f
		609	3	Unknown	a
		610	0.4	Unknown	a
		614	0.5	Molecular sulfur	f
		618	1	Unknown	a
		619	1	Unknown	a
		621	0.5	Unknown	a
		622	1	Unknown	a
		635	6	Bis (2-ethylhexyl) phthalate	c

Table 26-6-14. Tentative Identification of Nontarget Compounds in Site 26-6 Soil Samples (Continued, Page 9 of 9)

Borehole Number	Interval Depth (ft)	Unknown Number	Concentration (ppm)*	Best Fit	Comments†
	2-3	516	2	Propylpropanamine	
		523	2	Methylacetamide	
		553	0.4	Unknown	a
		557	1	Unknown	a
		562	10	Unknown	a
		563	2	Butadienylcyclobutane	
		564	2	Cyclopentenepropanol	
		570	0.4	Unknown	a
		609	0.6	Unknown	a
		610	0.4	Monobenzoate-benzene diol-dibutyl ester	f
		614	2	Nonanedioic acid	d, h
		618	2	Unknown	a
		620	0.8	Unknown	a
		622	0.4	Unknown	a
		628	0.4	Unknown	a

* Values reported are blank corrected.

† a. No positive identification.
b. Surfactant.
c. Plasticizer (note: All phthalates and adipates will have this comment).
d. Derived from natural products.
e. Suspected laboratory contaminant.
f. Low concentration.
g. Low frequency of occurrence.
h. Ubiquitous.
i. Possible column bleed.
j. None detected.
k. Tentatively identified as target compound
l. Identified in Section 2.1.5 as a probable waste stream constituent.

Source: ESE, 1988.

present at depths greater than 3 ft beneath areas having good liner integrity.

Many locations where the liner is intact and the underlying soil is contaminated are in close proximity to and, in many cases, downslope of areas where the liner is damaged. Both the liner and basin floor slope toward the northwest. Contaminated fluids at the interface between the liner and the subliner soil in areas where the liner is damaged could possibly have migrated to adjacent areas of relatively good liner integrity.

The seal used to prevent infiltration of liquid and rainwater beneath the liner during borehole drilling may have been only partially effective at several borehole locations (4619, 4620, 4621, and 4623). Although the shallow sampling interval was modified (0.5 to 1.5 ft) to account for this, the uppermost soil at two of these locations (4619 and 4621) where the liner was intact contained moderate to low levels of organic and inorganic contaminants. Significant contaminant concentrations were not present in these borings at a depth of 4 to 5 ft. Contamination in the shallow subsurface soil at these locations may have resulted from infiltration or leakage through the surface seal. These two locations were also in close proximity to areas where the liner is cracked or has deteriorated; therefore, contamination may also have been due to lateral migration from contaminated soil in nearby areas where the liner is damaged.

Samples collected where physical integrity of the liner was questionable (4620, 4626, 4627, 4630, and 4644) were generally found to contain elevated concentrations of a wide array of organic contaminants. In Boring 4620, where the liner was broken and cracked, elevated concentrations of organochlorine pesticides, DBCP, DCPD, chlorinated solvents, and volatile aromatic compounds were found at depths to 20 ft. The relatively uniform vertical distribution of most of these organic compounds suggests that downward fluid migration has occurred at this location over a long period of time and that maximum soil retention of these compounds has been attained in the soil column.

The liner integrity at Boring 4642 was poor; however, contamination was detected only in the 0- to 1-ft sample at a relatively low concentration ($CPMSO_2$, 2.7 ppm). This may indicate that liner damage at this location is recent and occurred after the basin fluid level receded.

Moderate to low levels of contaminants were detected in the underlying soil at most locations where the liner was intact, and concentrations decreased with depth. Two mechanisms which may account for the occurrence and distribution of contaminants in these areas have been suggested: (1) permeation of Basin F fluid through the intact liner at slow infiltration rates, or (2) lateral migration of fluid along the liner/soil interface from areas where the liner has cracked or deteriorated, accompanied by slow downward infiltration. Further investigation is necessary before the actual mechanism can be determined.

To summarize, where integrity of the liner material is poor or questionable, elevated concentrations of a wide variety of organic contaminants were found in the soil column as deep as 20 ft. Concentrations remained relatively uniform with depth, and extremely high concentrations of many contaminants occurred in the soil at or above the water table elevation.

Where the surface seal placed before borehole drilling may have leaked, and at locations in close proximity to areas having liner damage, moderate to low concentrations of several contaminants are in the near-surface soil. In the western part of the basin, the liner is intact over a large area and the underlying soil generally shows little or no contamination below a depth of 0 to 1 ft (4622 and 4623). Shallow soil beneath the liner in the northern perimeter of the basin where the liner is thought to be intact, contains relatively moderate contaminant concentrations above 4 ft (Borings 4617 and 4618).

3.3 PHASE II SURVEY

An interim response cleanup action will be conducted at Basin F in the spring of 1988. The scope of this effort is described in Section 3.4. A Phase II soil investigation which will include sample collection within and outside the basin is proposed to complement the interim response action.

The Phase II data will indicate the lateral and vertical extents of contamination remaining at the site. The final remediation plan for the Basin F area will be designed from Phase I and Phase II data and any subsequent Feasibility Study (FS) investigations.

The Phase II investigation will be conducted in two stages: (1) sample collection outside the basin area to be performed before or during interim action activities, and (2) soil borings within the basin area to be drilled in conjunction with the interim action. Sampling outside the basin will be performed to accomplish two primary objectives: (1) to assess both lateral and vertical extent of soil contamination outside the Basin F fence through a series of 16 soil borings ranging from 10 to 40 ft in depth, and (2) to determine if airborne particulates emanating from Basin F have affected Section 26 soil quality by collecting shallow (0 to 0.5 ft) soil samples at various distances from the basin along primary wind directions.

The Phase II soil samples from borings drilled within the basin interior will be collected by the contractor performing the interim action cleanup. Each subarea within the basin will be sampled after the overburden, liner, and some of the underlying soil have been excavated. The number of borings, locations, depths, and sampling intervals will be selected by the contractor based on Phase I results, liner condition, and the conditions encountered during excavation. For estimation purposes, the Interior Phase II program may be summarized as follows:

Borings	Sampling Intervals (ft)	No. of Samples Per Boring	Total
15	0-1, 4-5	2	30
8	0-1, 4-5, 9-10, 14-15, 19-20	5	40
5 (Water Table)	0-1, 4-5, 9-10, 14-15, 19-20, 29-30, 39-40	7	35
28			105

The Phase II investigation outside the basin will drill 16 soil borings at the proposed depths and locations given in Figure 26-6-10 to investigate the lateral and vertical extent of soil contamination outside Basin F

boundaries. Four borings will be drilled to the water table (approximately 40 ft) and sampled at intervals of 0 to 1, 4 to 5, 9 to 10, 19 to 20, 29 to 30, and 39 to 40 ft. Two boreholes will be drilled immediately south of Basin F at the toe of the levee to a total depth of 20 ft, and sampled at intervals of 0 to 1, 4 to 5, 9 to 10, 14 to 15, and 19 to 20 ft. The remaining 10 boreholes will each be drilled to a total depth of 10 ft and sampled at intervals of 0 to 1, 4 to 5, and 9 to 10 ft. All 10 ft and water table (40 ft) borings will be drilled 5 to 15 ft outside the Basin F fence as conditions allow. Actual distances will be determined by the Site Geologist.

In addition to samples generated by the soil borings, another 25 surficial (6 inch) soil samples will be collected along five radial vectors corresponding to the RMA primary wind rose (Figure 26-6-11). The five radial lines have been selected as probable vectors along which surficial soil may have received particulate blown from Basin F by high frequency winds or high velocity events. Soil samples will be collected at distances of 50, 100, 300, 600, and 1,000 ft from the Basin F fence line. Data used to construct the wind rose were gathered from nearby Stapleton International Airport as insufficient data were available from RMA itself.

The 25 surficial samples will be analyzed by Phase II methods for organochlorine pesticide compounds, organosulfur compounds, ICP metals, DIMP, DBCP, DCPD, arsenic, and mercury. The approximately 169 samples obtained from the soil borings inside and outside the basin will all be analyzed for the same compounds, except for arsenic and mercury which will be analyzed for only in the 0- to 1- and 4- to 5-ft intervals, and purgeable aromatics which will be run on sample intervals below 0 to 1 ft.

The detection of DIMP and DMMP in numerous borings at this site indicates that Army Agent Degradation Products (ADP) may be present. Two analytical methods for ADP have been approved for inclusion into the Phase II Remedial Investigation Program. One method utilizes high performance liquid chromatography to analyze for chloroacetic acid and thiodiglycol (TDGCL). The second method uses ion chromatography to detect fluoroacetic acid, isopropylmethylphosphonic acid (IMPA), and methylphosphonic acid (MPA). All

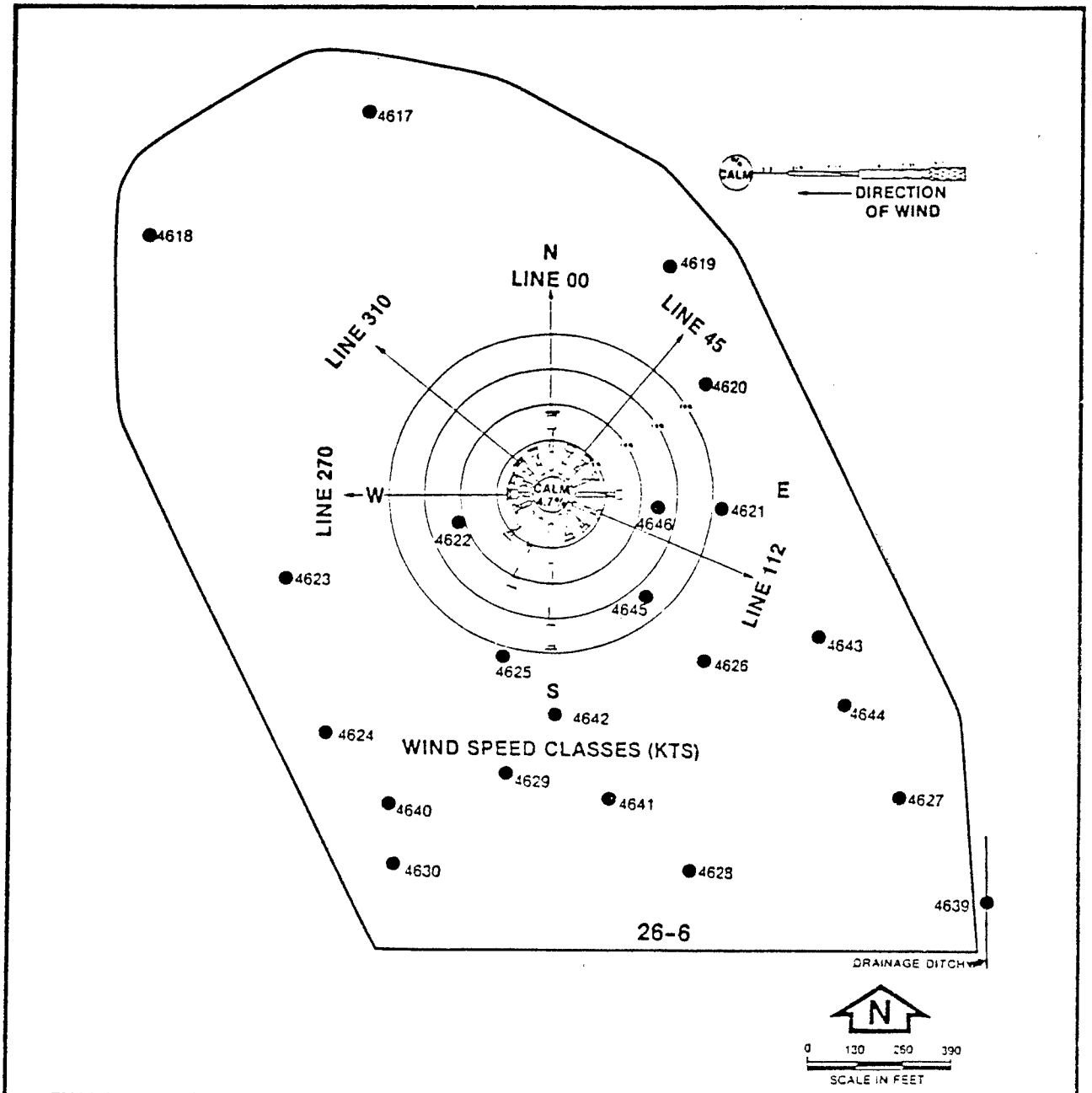

Figure 26-6-11
WIND ROSE FOR RMA VICINITY
(Stapleton International Airport,
1975 - 1979)
SOURCE: ESE, 1987

Prepared for:
U.S. Army Program Manager's Office
For Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

soil samples from all borings drilled to the water table will be analyzed for ADP using both of these methods.

The Phase II sampling program outside the basin is summarized below:

	Sample Locations	Total Sampling Depth	Number of Samples
	2	20 ft	10
	10	10 ft	30
	4	40 ft (water table)	24
	25	6 inch	25
Total	41		89

All samples collected under this Phase II plan will be analyzed by a comprehensive list of Army-certified quantitative methods. Selected Phase II samples will also be analyzed using Phase I GC/MS methods for volatile and semivolatile [extractable (EX)] organic compounds. This procedure is expec i to confirm the presence of target compounds of adequate concentration detected by Phase II methods and to identify any nontarget compounds present This procedure will also allow for further evaluation of the distribution of any nontarget compounds of concern detected during Phase I. Samples slated for confirmation analysis outside the basin are shown in Figure 26-6-10.

Those samples from the inside of the basin to be analyzed by GC/MS will be chosen by the Site Geologist during the interim action program. For estimation purposes, it is anticipated that the samples to be analyzed will be from the 9- to 10-ft, 19- to 20-ft, and 39- to 40-ft intervals of the five proposed water table borings.

The following list is a summary of the scheduled Phase II analyses for both inside and outside of the basin:

Analyte	No. of Samples
Organochlorine compounds	194
Organosulfur compounds	194
ICP metals	194
DIMP	194
DBCP	194
DCPD	194
Volatile aromatic organic compounds	125
Arsenic	113

Mercury	113
ADP	59
Volatile organic compounds (GC/MS)	33
Extractable organic compounds (GC/MS)	33

The final draft of this report and the proposed Phase II program were submitted for review to representatives of the EPA, Colorado Department of Health, and Shell on November 11, 1987, with a request for formal comments within 30 days. Shell comments were received December 18, 1987, Colorado Department of Health comments were received March 25, 1988, and EPA comments were received April 29, 1988. All comments were considered in the preparation of this final report and are presented with responses in Appendix 26-6-C. The original draft version of this report was presented at a meeting of all Parties and the State on June 3 and 4, 1986. Comments received during this presentation were incorporated in subsequent versions.

3.4 INTERIM RESPONSE ACTION SUMMARY: ESTIMATED VOLUMES OF POTENTIALLY CONTAMINATED MATERIAL TO BE REMOVED

An interim response action cleanup operation is scheduled to begin at Basin F in spring 1988. The scope of this effort has been designed from the Phase I data and previous investigations. A comprehensive description of this program is given in the "Request for Proposal, Interim Action of Basin F, Hazardous Waste Cleanup" (COE, May 1987, RIC#87176R01) and the "Proposal to Perform Interim Action of Basin F, Hazardous Waste Cleanup," EBASCO, August 1987. The program is summarized as follows: First all liquid remaining in the basin will be transferred to temporary storage tanks located in the northeast quarter of Section 26. The basin will then be subsectioned into discrete areas. Temporary dikes of uncontaminated material will be erected around each area to prevent runoff from coming into contact with contaminated soil or overburden. Any runoff that does enter an area will be directed to an evaporation pond to the north. The overburden, liner, and some of the soil underlying the liner in each area will be excavated and stabilized by solidification/absorption, and the resulting material will be piled into three lined subcells and immediately covered with a synthetic liner and clay cap. An adjacent double-lined surface impoundment will also be constructed to intercept any leachate emanating from the waste pile. After all activities have been completed in a particular area, the entire

area will be regraded, sealed with a low permeability compacted clay cap, covered with topsoil, and revegetated.

In 1984, the Rocky Mountain Arsenal Contamination Control Program Management Team (RMACCPMT, 1984, RIC#84034R01) estimated the total volume of contaminated soil at Basin F at 900,000 bcy. This figure was calculated by determining the basin area and multiplying by an excavation depth of 6 ft. This depth was considered conservative based on existing information.

During the planning stages of the Interim Response Action, volumes of contaminated overburden, liner, and underlying soil to be excavated and treated were estimated. Using Phase I analytical data and liner observations, two areas within the basin were designated to be excavated down to the maximum 6 ft depth (Figure 26-6-12). All remaining areas in the basin will be subject to excavation to a minimum of 6 inches below the liner. These areas are also subject to further excavation to a maximum of 6 ft at the discretion of the Contracting Officer. Actual excavation depths will be determined during the Interim Response Action field operations and will be based on soil discoloration. As noted in the "Request for Proposal, Interim Action for Basin F Hazardous Water Cleanup" (CCE, May 1987) it is estimated that approximately 405,000 bcy of bituminous liner, underlying soil overburden/sludge, and residual liquid will be excavated, solidified, and placed into a waste pile with a maximum capacity of 605,000 bcy. Other materials to be transferred to the waste pile include the rip-rap reinforcing the dikes and the crushed chemical sewer line and surrounding soil stored north of F-1. The estimated volumes of these materials are 25,000 bcy and 12,000 bcy, respectively.

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3/ The Ralph Parsons Co. in 1955 viewed sealed ponds at RMA as interim retention and evaporative disposal facilities. However, the Parsons Co. was a consulting engineering firm contracted to the Omaha District of the Corps of Engineers. In 1955, RMA was a unit of the Chemical Corps and the Chemical Corps was in no way bound by the recommendations of the Parsons Co. In its review of the Parsons Report and in its original project funding request for monies to cover the cost of sealing ponds for the evaporative disposal of contaminated liquid waste, the Chemical Corps was notably silent on alternatives to sealed ponds and on the development of ultimate disposal systems. In the summer of 1956, concurrent with the construction of Basin F, Chemical Corps Engineering Command initiated engineering feasibility studies on a project for the development of a pressure injection deep well for the disposal of contaminated liquid wastes. However, the primary purpose of a deep well at RMA originally envisaged by the Chemical Corps was

for the disposal of waste by-product hydrochloric acid from GB production. As late as May 1958 the Chemical Corps had no plans to proceed with the construction of a deep well. Initial funds for the design and construction of a deep well were not obligated until September 1959. In all probability, were it not for the impending litigation of suits against the Army for crop damage northwest of RMA allegedly caused by pollution of the alluvial aquifer and political pressure which in 1959 lead to an evaluation of the ground water problem by the U.S. Public Health Service and subsequent assignment of responsibility for this problem to the Army, the deep well, built in 1961, would never have been constructed. Engineering feasibility studies on other methods of final disposal for contaminated liquid wastes at RMA, e.g. multiple-effect evaporation and incineration, were not initiated by the Army until the Spring of 1966.

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6/ The underlying suppositions concerning the capacity of Basin F as finally built to contain current and projected volumes of contaminated liquid waste from Army and Shell operations of RMA has been the subject of considerable controversy. The final design project for the construction of Basin F was the fifth modification of the approved project for the sealing of contaminated liquid waste basins at RMA. Although the Parsons Co. recommended the sealing of 142 acres--a recommendation concurred in by the Corps of Engineers--the Chemical Corps stood by its original projection, developed during the summer of 1955, for a need to seal only a hundred acres initially. The initial approved project called for the sealing of Basin C and 32 acres in Basin F, a total of 102 acres. In June 1956, a final decision was made to seal a total of 92.7 acres in Basin F only, because of high costs associated with wet and unstable conditions in Basin C. However, additional berms and dikes gave Basin F a holding capacity approximately equal to that which would have obtained had the sealing of Basin C and Basin F proceeded as planned. Interestingly, both the Parsons recommendation and the Chemical Corps proposal presupposed a reduction in contaminated liquid waste discharges from Army and Shell Operations to a combined total of under 200 gpm. Planning for the implementation of the necessary reductions in discharges by the Army and Shell was completed in the summer of 1955. In 1955, the Parsons and the Chemical Corps estimated the average annual evaporation rate at 2 gpm/acre. However, the Parsons Co. based its calculation of the required amount of sealed acreage in part on a 1 gpm/acre evaporative rate to provide a safety factor. Both the Parsons Co. and the Chemical Corps in their respective calculations of necessary sealed basin holding capacity took into account "round-out" projections on the production of C.B. However, by the fall of 1957 "round-out" was dead and the manufacture of GB at RMA had ceased, never to resume. See Ralph M. Parson Co., Final Report Disposal of Chemical Wastes, Rocky Mountain Arsenal, September 29, 1955, RNA 002 0928-1007; Ken R. White, Architect-Engineer, "Drains and Impervious Blanket," 16-01-03 (Sheet 1), June 14, 1956 (Revised to Show As Built Conditions 2/1/57); Robert R. Kitchen, Action Chief, Plants Division, Chemical Corps Engineering agency, Memorandum re: Report of

Conference on Site B Waste Disposal on 8 July 1955, July 11, 1955, RMA 069 0902-0905; John L. Traub, Chemical Corps Materiel Command and Louis E. Garono, Chemical Corps Research and Engineering Command, Memorandum re: Staff Study--Waste Disposal, RMA, July 12, 1955 RMA 061, 1985-1988; F.G. De Angelis, Chief, Installations Branch, Chemical Corps Materiel Command, Memorandum re: Report of Conference, Rocky Mountain Arsenal Ground Contamination, July 15, 1955, RMA 061 1973-1976; COL D.G. Grothaus, Commanding Officer, RMA, Letter to Shell Chemical Corporation, July 25, 1955, 526001139793, RSH 884 1238; COL Carl E. Grant, Assistant for Manufacturing, RMA, Letter to Commanding General, Chemical Corps Materiel Command, August 9, 1955, RMA 061 2346-2347; RMA [unsigned], "Status Waste Disposal and Water Conservation at Rocky Mountain Arsenal," August 18, 1955, RMA 061 2342-2345; George F. Donnelly, Chief, Engineering Office, RMA, Disposition Form re: Sealing of Ponds at Rocky Mountain Arsenal to Commanding Officer, RMA, October 7, 1955; D.Q. Falck and Neal P. Cochran, RMA, "Review of Final Report Disposal of Chemical Wastes Rocky Mountain Arsenal, Ralph M. Parson Co., October 12, 1955, RMA 043 0102-0107; MAJ GEN William M. Creasy, Chief Chemical Officer, "Project Request for Provision of Production Facilities Funds," October 26, 1955; E.A. Conklin, Assistant Chief, Army Projects Division Military Construction, Memorandum re: Authorization--Construction--Sealing Two Retaining Ponds and Two Canals at Rocky Mountain Arsenal, February 7, 1956, RNA 005 1333-1334; COL W.A. Johnson, Commanding Officer, RMA, Memorandum re: Drains and Impervious Blanket, Rocky Mountain Arsenal to District Engineer, Corps of Engineers, June 4, 1956, RLA 009 1234; L.S. Bray, Omaha District, Corps of Engineers, Memorandum re: Drains and Impervious Blanket--Rocky Mountain Arsenal to Chief, Engineering Division, Omaha District, Corps of Engineers, June 14, 1956, RNA 006 0322; History_of_Rocky_Mountain_Arsenal, 1 April 1956 through 30 June 1956, RSA 012 1963; Irving B. Morgan, Office of the Chief Chemical Officer, Memorandum re: Deep Well Waste Disposal at RMA, October 19, 1957, RMA 043 0351-0352; LT COL Fred Martin, Director for Facilities, U.S. Army Chemical Center and Chemical Corps Materiel Command, 1st Indorsement to Letter (July 29, 1960) re: Request for Authority to Construct a Pressure Injection Waste Disposal Well at Rocky Mountain Arsenal to Chief Chemical officer, August 5, 1960, RAA 014 2027-2028.

7/ On the cost for the construction of Basin F, see History of Rocky Mountain Arsenal, 1 April 1956 through June 30, 1956, RSA 012 1963, L.S. Bray, Omaha District, Corps of Engineers, Memorandum re: Drains and Impervious Blanket to Chief, Engineering Divisions, Omaha District, Corps of Engineers, June 14, 1956, RNA 006 0322.

Whether or not Basin F before it was lined in 1956 actually was used for the disposal of contaminated liquid waste has been a controversial issue. In early 1953, the Army faced a liquid waste disposal capacity problem of considerable proportions. GB manufacture was in the process of being initiated and as of the end of January 1953, unlined basins "A" and "B" were full and overflowing and reserve basin "D" was nearly full. However, at this point in time reserve basin "E" was empty. Between March and June 1953, the Army built two dikes in the northern portion of Section 26 and, possibly, also the pipe and ditch connections from Basin F to the Sand Creek Lateral downstream from Headgate 41. Between July and October 1953, the Army built Basin C, enlarged Basin E, installed concrete overflow structures and riprapped connecting ditches between basins "C", "D" and "E" and modified the liquid waste ditch transport system from Basin B. Addendum No. 1 to the Contract Specifications and the Drawings of Record for this project prescribed the installation of a dike for the purpose of blocking the Sand Creek Lateral at a point immediately downstream from Headgate No. 41 (the location at which the Army in 1953 built the canal connecting Basin C with the Sand Creek Lateral). As of the completion of this project, all liquid wastes flowing up the Sand Creek Lateral were diverted to Basin C at Headgate No. 41. The "blocking" of the Sand Creek Lateral downstream from Headgate No. 41 prevented any liquid wastes from entering Basin F between the fall of 1953 and the fall of 1956. Whether or not in the course of the spring and summer of 1953 Basin E filled to capacity, thereby forcing the use of Basin F for the disposal of liquid wastes in the spring and summer of 1953 is unknown. No extant records either confirm or deny this proposition. On this issue see LT COL Donald P. Smit Executive Officer, RMA, Letter to District Engineer, Omaha District, Corps of Engineers, January 23, 1953, RMA 060 1779-1780; History of Rocky Mountain Arsenal 1 April 1953 through 30 June 1953, RSA 012 2678; History of Rocky Mountain Arsenal 1 July 1953 through 30 September 1953, RMA 193 0012; History of Rocky Mountain Arsenal

1 January 1953 through 31 March 1953, RSA 012 2548; U.S. Army Chemical Corps, "Contaminated Reservoir Plan," E-2-1-6, May 6, 1953; Omaha District, Corps of Engineers, "Additional Reservoir Capacity Contaminated," 71-07-01 (Sheets 1,2), March 13, 1953 (Revised 11/12/53 to show as Built Conditions); Omaha District, Corps of Engineers, Addendum No. 1 to Specifications and Drawings for the Construction of Additional Contaminated Reservoir Capacity, Rocky Mountain Arsenal, Denver, Colorado, Serial No. ENG-25-066-53-164, April 1, 1953, RMA 057 1186-1188.

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9/ Ken R. White, Architect--Engineer, "Drains & Impervious Blanket Plan--Profile (Lines 1 through 5)," 71-17-01 (Shs 1 through 9), June 14, 1956 (Revised to Show "As-Built" Conditions 2/1/57); Ken R. White, Architect--Engineer, "Drains & Impervious Blanket Misc. Sections & Details Membrane Blanket," 16-01-03 (Sh 3). June 14, 1956 (Revised to Show 'As-Built' Conditions 2/1/57). CAPT Ernest J. Tinsley, Adjutant, RMA, Memorandum re: Staff Conference No. 31, October 26, 1956, RLA 009 0378-0384; CAPT Ernest J. Tinsley, Adjutant, RMA Memorandum re: Staff Conference No. 33, November 2, 1956, RLA 009 0364-0370; CAPT Ernest J. Tinsley, Adjutant, RMA, Memorandum re: Staff Conference No. 36, December 7, 1956, RLA 009 0346-0353; N. S. MacDonald, Recorder, RMA Memorandum re: Program Review and Analysis Conference, October 26, 1956, RLA 009 0685-0697.

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December 1966, pp. 39-40, RSA 015 2173-2174; Ibid; 1 January 1967 through 30 June 1967, RSA 016 0321 ; "Summary History of Rocky Mountain Arsenal 1942 - 1967," RIA 026 0320-0375; "History of Rocky Mountain Arsenal for the Period 1 January through 30 June 1969," p. 3, RSA 016 0233; Standing Operating Procedure for Demilitarization of M-79 Cyanogen Chloride (CK) Filled Bombs," 19 January 1966, p. 3, RMA 150 1123-1128; "History of Rocky Mountain Arsenal," May 1986, p. 14, RMA 052 0018; Standing Operating Procedure For: Hydrazine, UDMH, Aerozine Storage and Blending Facility, March 24, 1972, p. 13, RMA 229 1167; Standing Operating Procedure for hydrazine, UDMH and Aerozine, October 23, 1975, p. 12, RMA 228 0399; Standing Operating Procedure for Hydrazine, UDMH and Aerozine Operations, November 1, 1978, pp. 55-56, RIA 025 1320-1321; "Wastewater Treatment System For Hydrazine Fuel Mixing Facility at Rocky Mountain Arsenal," October 30, 1978, p. 1, RMA 064 1427; J. Melito, Memorandum for Record, "Procedures for Treating the Hydrazine Waste Pit," May 9, 1978, p. 2, RMA 081 0331; "Procedure for Cleaning Ton Containers with Inhibited HCL," RMA 067 1270; "Standard Operating Procedure for Ton-Container Cleaning Prior to Refilling with Redistilled GB, May 2, 1967, RMA 103 1586-88; "Operating Manual: GB Manufacturing," October 12, 1956, Section III, "Building 1501 Operating Procedures," pp. 1-2, & 15, RMA 199 0889-0890, 0904; David L. Way, Deposition Exhibit No. 19, flowchart, "GB Nerve Agent Production"; Trautmann Report, "History of Pollution Sources and Hazards at Rocky Mountain Arsenal," by Casimir Kuznear, William L. Trautmann, September 1980, RMA 111 0376-0463, pp. 0392-0394, 0432; Final Report, Mustard Demilitarization, RMA 100 0649; R.E. Boyle, Memorandum regarding Trip Report, December 15, 1975, RMA 023 0346-0349; "Summary History of the Rocky Mountain Arsenal,1942 through 1967," RMA 195 1145; Deposition transcript of D. Way, V. II, p. 412; Parsons Report, dated September 29, 1955, Table II, RNA 002 0928-2007, p. 0942; "Rocky Mountain Arsenal Quarterly Historical Report," 1 January 1959 through 31 March 1959, p. 35, RSA 014 0793; ibid; 1 April 1959 through 30 June 1959, pp. 25026, RSA 014 0925-0926; Ibid; 1 October 1959 through 31 December 1959, p. 33, RSA 014 1084; "H Demil Report," 22 June 1959, RMA 150 0887-0888; Deposition transcript of D.L. Way, Vol. I, p. 102; Deposition transcript of J.A. Ursillo, Vol. I, pp. 73-74; Trautmann Report, "History of Pollution Sources and Hazards at Rocky Mountain Arsenal," by Casimir Kuznear, William L. Trautmann, September 1980, RMA 111 0376-0463, p. 0436.

25/ Shell's Responses to U.S. Interrogatory No. 15, Exhibit A, Appendices A and F; Deposition of J.A. Streich, Vols. I-III.

26/ Stanley A. Miller, Assistant Area Engineer, Omaha District, Corps of Engineers. Memorandum to District Engineer Omaha District, January 17, 1957. RNA 006 0318; Ken R. White, Architect/Engineer, "Drains and Impervious Blanket Grading Plan Reservoir F," 16-01-03 (Sh 1), June 14, 1956, (Revised to show 'As Built' Conditions, 2/1/57).

27/ The tear in the liner occurred on the northwest perimeter between coordinates N 30,400 E 13,100 and N 31,500 E 13,500 along a line parallel to and four to five feet below the top of the dike (interview with George Donnelly, April 19, 1988). On this event, also see references to Note 10 and George Donnelly, Chief, Facility Engineering Division, Disposition form re: Monthly Waste Disposal Report to Chief, Industrial Engineering Division, May 17, 1957, RMA 065 1279; J. O. Ackerman, Chief, Engineering Division, Omaha District, Corps of Engineers, Letter to George Donnelly, Chief, Engineering and Service Division, May 10, 1957, RNA 006 0305-0307; L. S. Sray, Omaha District, Corps of Engineers, Field Notes, (undated), RMA 064 0105-0108; George Donnelly, Chief Facility Engineering Division, Disposition Form re: Installation of Rip-Rap for Protection of Slope at Reservoir F to Assistant for Manufacturing, June 20, 1957, RMA 064 0090; J. D. Hartose, Installations Branch, Chemical Corps Materiel Command, Memorandum for Record re: FY 1958 Project Request--P&P 4211--Rip Rap of Sealed Lake Chemical Project 243, September 30, 1957, RMA 043 0787-0788.

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Waste Survey Project No. 347E19-59/66 Rocky Mountain Arsenal, Denver, Colorado 9-21 February 1965, September 29, 1965, RSH 978 1473-1522.

29/ See Reuter and Milbury, Note 28, above.

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31/ LT COL. Gerald G. Watson, Commanding Officer, RMA, Letter to Colorado Department of Health, May 27, 1975, RMA 012 1452-1452.

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Research Branch, U.S. Public Health Service, "Public Health Aspects of Contamination of Ground Water in South Platte River Basin in Vicinity of Henderson, Colorado, August 1959," November 2, 1959, RMA 062 0255-0282.

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35/ See William McNeill, Note 34 above, also AEHA, "Water Quality Geohydrological Consultation No. 24-012-74, RMA, 30 July--3 August 1973," July 10, 1974, RAA 023 0734-0821.

36/ See references to Note 34 above.

37/ See references to Notes 18, 19, 20, 21 above.

38/ See references to Note 21 above.

39/ R. U. Grozier, Geologic Survey, U.S. Department of the Interior, Letter to George Donnelly, September 21, 1970, RMA 063 1659-1660; William S. Dunn, Colorado Department of Health, Memorandum to Frank J. Rozich, Division of Water Pollution Control, June 5, 1970, RMA 065 1448-1458; U.S. Army Munitions Command, "Continuing Report on Rocky Mountain Industrial Waste Retention Capability (U)," [February 25, 1970], RIA 018 0284-0293.

40/ See references to Note 32 above; also Deposition of William McNeill, pp. 760-762.

41/ Grace Crooker, EPA, Chris Sutton, Colorado Department of Health, "U.S. Environmental Protection Agency, Region VIII Waste Management Branch RCRA Inspection Report," August 30, 1982; Rich McRea, Project Engineer, Omaha District, Corps of Engineers, Memorandum for Record re: Contract DACA 45-82-C-0027, Liquid Waste Disposal Facility, Basin F, June 22, 1982, REX 003 0468; Cornerstone Builders, Inc., "Two Week Construction Progress Schedule--Week of 2-1-82 and week of 2-8-82," January 28, 1982, RMA 131 1630; Cornerstone Builders, Inc., "Two Week Construction Progress Schedule--Week of 2-15-82 and Week of 2-22-82," February 11, 1982, REX 003 0472; Cornerstone Builders, Inc., "Two Week Construction Progress Schedule, Week of 3-1-82 and week of 3-8-82," February 25, 1982, RMA 131 1627; COL John D. Spence, Commanding Officer, USATHAMA, "Environmental Assessment: the Elimination of the Liquid Content from Basin F at Rocky Mountain Arsenal," May 1981, RMA 012 0136-0154, pp. 0138, 0143-0144, 0150; Douglas W. Thompson and Edwin W. Berry, RMA, "Resource Conservation and Recovery Act Basin F Closure Plan," June 1981, RMA 012 0257-0270, pp. 0261-0264; Omaha District, Corps of Engineers, "Specifications for Construction of Liquid Waste Disposal Facility Basin F, Phase I, Rocky Mountain Arsenal, Colorado (Serial No. DACA 45-81-B-0233); August 17, 1981, RMA 012 0434-0475, pp. 0441, 0444-0445, 0455-0459, 0460-0463, 0464-0468, 0471, 0474-0475; Cornerstone Builders, Inc., "Environmental Protection Program U.S. Army Corps of Engineers Contract No. DACA 45-82-C-0027 Liquid Waste Disposal Facility Basin F--Phase I, Rocky Mountain Arsenal, Commerce City, Colorado, December 1981, RNA 025 1759-1762.

42/ Declaration of David Strang before the United States Environmental Protection Agency, January 7, 1987; David Heim, Director of Installation Services, RMA, Letter to David L. Anderson, Environmental Enforcement Section, Land and Natural Resources Division, U.S. Department of Justice, January 12, 1987; COL Philip D. Weinert, Area Engineer, Corps of Engineers, DD Form 1354 (Transfer and Acceptance of Military and Real Property) re: Contract No. DACA 45-82-C-0027, to Commander, RMA, July 14, 1982, RNA 025 1785-1789.

APPENDIX 26-6-A
CHEMICAL NAMES, METHODS, AND ABBREVIATIONS

APPENDIX 26-6-A
CHEMICAL NAMES, METHODS, AND ABBREVIATIONS

PHASE I ANALYTES AND CERTIFIED METHODS

Analytes/Methods	Synonymous Names and Abbreviations	Standard Abbreviations
VOLATILE ORGANIC COMPOUNDS/GCMS	VOL	VO
1,1-Dichloroethane	1,1-Dichloroethane	11DCLE
1,2-Dichloroethane	1,2-Dichloroethane	12DCLE
1,1,1-Trichloroethane (TCA)	1,1,1-Trichloroethane	111TCE
1,1,2-Trichloroethane	1,1,2-Trichloroethane	112TCE
Benzene	Benzene	C_6H_6
Bicycloheptadiene	Bicycloheptadiene (BCHD)	BCHPD
Carbon tetrachlocide	Carbon tetrachloride	CCL_4
Chlorobenzene	Chlorobenzene	CLC_6H_5
Chloroform	Chloroform	$CHCL_3$
Dibromochloropropane	Dibromochloropropane	DBCP
Dicyclopentadiene	Dicyclopentadiene	DCPD
Dimethyldisulfide	Dimethyldisulfide	DMDS
Ethylbenzene	Ethylbenzene	ETC_6H_5
m-Xylene	meta-Xylene	13DMB
Methylene chloride	Methylene chloride	CH_2CL_2
Methylisobutyl ketone	Methylisobutyl ketone	MIBK
o,p-Xylene	ortho- and/or para-Xylene	XYLEN
Tetrachloroethene (PCE)	Tetrachloroethylene	TCLEE
Toluene	Toluene	MEC_6H_5
Trans 1,2-dichloroethene	Trans 1,2-dichloroethylene	12DCE
Trichloroethene (TCE)	Trichloroethylene	TRCLE
SEMIVOLATILE ORGANIC COMPOUNDS/GCMS	EXTRACTABLE ORGANIC COMPOUNDS (EX)	SVO
1,4-Oxathiane	1,4-Oxathiane	OXAT
2,2-Bis (para-chlorophenyl)-1,1-dichloroethane	Dichlorodiphenylethane	PPDDE
2,2-Bis (para-chlorophenyl) 1,1,1-trichloroethane	Dichlorodiphenyltrichloroethane	PPDDT
Aldrin	Aldrin	ALDRN
Atrazine	Atrazine	ATZ
Chlordane	Chlordane	CLDAN
Chlorophenylmethyl sulfide	p-Chlorophenylmethyl sulfide	CPMS
Chlorophenylmethyl sulfoxide	p-Chlorophenylmethyl sulfoxide	CPMSO
Chlorophenylmethyl sulfone	p-Chlorophenylmethyl sulfone	$CPMSO_2$
Dibromochloropropane	Dibromochloropropane	DBCP
Dicyclopentadiene	Dicyclopentadiene	DCPD
Dieldrin	Dieldrin	DLDRN
Diisopropylmethyl phosphonate	Diisopropylmethyl phosphonate	DIMP

APPENDIX 26-6-A
CHEMICAL NAMES, METHODS, AND ABBREVIATIONS

Analytes/Methods	Synonymous Names and Abbreviations	Standard Abbreviations
SEMIVOLATILE ORGANIC COMPOUNDS (CONT)		
Dimethylmethyl phosphonate	Dimethylmethyl phosphonate	DMMP
Dithiane	Dithiane	DITH
Endrin	Endrin	ENDRN
Hexachlorocyclopentadiene	Hexachlorocyclopentadiene (HCCPD)	CL_6CP
Isodrin	Isodrin	ISODR
Malathion	Malathion	MLTHN
Parathion	Parathion	PRTHN
Supona	2-Chloro-1(2,4-dichlorophenyl) vinyldiethyl phosphate	SUPONA
Vapona	Vapona	DDVP
METALS/ICP	ICAP	ICP
Cadmium	Cadmium	CD
Chromium	Chromium	CR
Copper	Copper	CU
Lead	Lead	PB
Zinc	Zinc	ZN
SEPARATE ANALYSES		
Arsenic/AA	Arsenic	AS
Mercury/AA	Mercury	HG
Dibromochloropropane/GC	Dibromochloropropane	DBCP

APPENDIX 26-6-A
CHEMICAL NAMES, METHODS, AND ABBREVIATIONS

PHASE II ANALYTES AND CERTIFIED METHODS

Analytes/Methods	Synonymous Names and Abbreviations	Standard Abbreviations
VOLATILE ORGANIC COMPOUNDS/GCMS (Same as Phase I)	VOL	VO
SEMIVOLATILE ORGANIC COMPOUNDS/GCMS (Same as Phase I)	EXTRACTABLE ORGANIC COMPOUNDS (EX)	SVO
VOLATILE HALOCARBON COMPOUNDS/GCCON	PURGEABLE HALOCARBONS (PHC)	VHO
1,1-Dichloroethane	1,1-Dichloroethane	11DCLE
1,2-Dichloroethane	1,2-Dichloroethane	12DCLE
1,1-Dichloroethene	1,1-Dichloroethene	11DCE
1,1,1-Trichloroethane (TCA)	1,1,1-Trichloroethane	111TCE
1,1,2-Trichloroethane	1,1,2-Trichloroethane	112TCE
Carbon tetrachloride	Carbon tetrachloride	CCL_4
Chlorobenzene	Chlorobenzene	CLC_6H_5
Chloroform	Chloroform	$CHCL_3$
Methylene chloride	Methylene chloride	CH_2CL_2
Trans 1,2-dichloroethylene	Trans 1,2-dichloroethene	12DCE
Tetrachloroethene (PCE)	Tetrachloroethylene	TCLEE
Trichloroethene (TCE)	Trichloroethylene	TRCLE
VOLATILE HYDROCARBON COMPOUNDS/GCFID	DCPD	HYDCBN
Bicycloheptadiene	Bicycloheptadiene (BCHD)	BCHPD
Dicyclopentadiene	Dicyclopentadiene	DCPD
Methylisobutyl ketone	Methylisobutyl ketone	MIBK
VOLATILE AROMATIC COMPOUNDS/GCPID	PURGEABLE AROMATICS (PAM)	VAO
Benzene	Benzene	C_6H_6
Ethylbenzene	Ethylbenzene	ETC_6H_5
m-Xylene	meta-Xylene	13DMB
o,p-Xylene	ortho- and/or para-Xylene	XYLEN
Toluene	Toluene	MEC_6H_5
ORGANOCHLORINE PESTICIDES/GCEC		OCP
2,2-Bis (para-chlorophenyl)-1,1-dichloroethane	Dichlorodiphenylethane	PPDDE
2,2-Bis (para-chlorophenyl)-1,1,1-trichloroethane	Dichlorodiphenyltrichloroethane	PPDDT
Aldrin	Aldrin	ALDRN
Chlordane	Chlordane	CLDAN
Dieldrin	Dieldrin	DLDRN
Endrin	Endrin	ENDRN
Hexachlorocyclopentadiene	Hexachlorocyclopentadiene (HCCPD)	CL_6CP
Isodrin	Isodrin	ISODR

APPENDIX 26-6-A
CHEMICAL NAMES, METHODS, AND ABBREVIATIONS

Analytes/Methods	Synonymous Names and Abbreviations	Standard Abbreviations
ORGANOPHOSPHOROUS PESTICIDES/GCNPD	ORGANOPHOSPHOROUS COMPOUNDS (OPC)	OPP
Atrazine	Atrazine	ATZ
Malathion	Malathion	MLTHN
Parathion	Parathion	PRTHN
Supona	2-Chloro-1(2,4-dichlorophenyl) vinyldiethyl phosphate	SUPONA
Vapona	Vapona	DDVP
ORGANOPHOSPHOROUS COMPOUNDS/GCFPD	DIMP	OPC
Diisopropylmethyl phosphonate	Diisopropylmethyl phosphonate	DIMP
Dimethylmethyl phosphonate	Dimethylmethyl phosphonate	DMMP
ORGANOSULPHUR COMPOUNDS/GCFPD		OSC
1,4-Oxathiane	1,4-Oxathiane	OXAT
Benzothiazole	Benzothiazole	BTZ
Chlorophenylmethyl sulfide	p-Chlorophenylmethyl sulfide	CPMS
Chlorophenylmethyl sulfone	p-Chlorophenylmethyl sulfone	$CPMSO_2$
Chlorophenylmethyl sulfoxide	p-Chlorophenylmethyl sulfoxide	CPMSO
Dimethyldisulfide	Dimethyldisulfide	DMDS
Dithiane	Dithiane	DITH
METALS/ICP	ICAP	ICP
Cadmium	Cadmium	CD
Chromium	Chromium	CR
Copper	Copper	CU
Lead	Lead	PB
Zinc	Zinc	ZN
SEPARATE ANALYSES		
Arsenic/AA	Arsenic	AS
Mercury/AA	Mercury	HG
Dibromochloropropane/GC	Dibromochloropropane	DBCP

APPENDIX 26-6-A
CHEMICAL NAMES, METHODS, AND ABBREVIATIONS

Analytes/Methods	Synonymous Names and Abbreviations	Standard Abbreviations
ARMY AGENT DEGRADATION PRODUCTS:		ADP
AGENT PRODUCTS/HPLC	TDGCL	
Chloroacetic Acid	Chloroacetic acid	CLC2A
Thiodiglycol	Thiodiglycol (TDG)	TDGCL
AGENT PRODUCTS/IONCHROM	IMPA	GBDP
Fluoroacetic acid	Fluoroacetic acid	FC2A
Isopropylmethylphosphonic acid	Isopropylmethylphosphonate	IMPA
Methylphosphonic acid	Methylphosphonate	MPA

Methods	Abbreviations
Atomic Absorption Spectroscopy	AA
Gas Chromatography/Conductivity Detector	GCCON
Gas Chromatography/Electron Capture	GCEC
Gas Chromatography/Flame Ionization Detector	GCFID
Gas Chromatography/Flame Photometric	GCFPD
Gas Chromatography/Mass Spectrometry	GCMS
Gas Chromatography/Nitrogen Phosphorous Detector	GCNPD
Gas Chromatography/Photoionizaton Detector	GCPID
High Performance Liquid Chromatography	HPLC
Inductively Coupled Argon Plasma	ICP, ICAP
Ion Chromatography	IONCHROM

APPENDIX 26-6-B
PHASE I CHEMICAL DATA

ENVIRONMENTAL SCIENCE & ENGINEERING 01/29/87 STATUS: ACTIVE PAGE# 1

PROJECT NUMBER 85931 C420 PROJECT NAME RMA ONPOST
FIELD GROUP 266YA PROJECT MANAGER MICHAEL WITT
266YAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET #	METHOD	SAMPLE ID/# 4617A 266YA 0	4617B 266YA 1	4618A 266YA 10	4618B 266YA 11	4619A 266YA 20	4619B 266YA 21	4619C 266YA 22	4620A 266YA 30	4620B 266YA 31	4620C 266YA 32	4620D 266YA 33	4620E 266YA 34	4621A 266YA 40	4621B 266YA 41
DATE				10/09/85	10/09/85	10/09/85	10/09/85	10/01/85	10/01/85	10/01/85	10/03/85	10/04/85	10/04/85	10/04/85	10/04/85	10/02/85	10/02/85
TIME				10.46	11:08	10.15	10:31	11:44	11:56	12:26	09:22	09:19	09:47	10:38	11:15	10:45	10:52
SAMPLE TYPE		77999	0	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
SAMPLE DEPTH	FT	99758A	0	0.0	3.00	0.0	3.00	0.50	4.00	9.00	0.50	4.00	9.00	14.0	19.0	0.50	4.00
SITE TYPE 1		99759	0	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
INSTALLATION CODE	SAMPLE	99720	0	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK
SAMPLING TECHNIQUE		72005	0	S	S	S	S	S	S	S	S	S	S	S	S	S	S
COORDINATE N/S	STP	99392	0	190476	190476	190123	190123	190077	190077	190077	189757	189757	189757	189757	189757	189423	189423
COORDINATE E/W	STP	99393	0	2180053	2180053	2179470	2179170	2180866	2180866	2180886	2180983	2180983	2130983	2180983	2180983	2181050	2181050
MOISTURE	WHET WT	70320	0	9.6	9.1	7.8	10.8	11.6	7.2	8.5	13.4	15.6	15.1	4.8	3.8	13.1	11.4
CADMIUM	UG/G DRY	1027	0	<0.500	<0.500	<0.500	<0.500	<0.900	<0.900	<0.900	<0.900	<0.500	<0.500	<0.500	<0.500	<0.900	2.00
CHROMIUM	UG/G DRY	99564	0	16.0	18.0	16.0	18.0	28.0	20.0	15.0	28.0	19.0	18.0	<7.00	<7.00	22.0	21.0
COPPER	UG/G DRY	1043	0	22.0	25.0	142	28.0	12.0	11.0	11.0	15.0	23.0	26.0	14.0	19.0	17.0	13.0
LEAD	UG/G DRY	1052	0	<16.0	<16.0	20.0	<16.0	22.0	<17.0	<17.0	<17.0	<16.0	<16.0	<16.0	<16.0	<17.0	<17.0
ZINC	UG/G DRY	1093	0	320	53.0	57.0	53.0	69.0	58.0	45.0	67.0	57.0	53.0	<28.0	<28.0	61.0	53.0
ARSENIC	UG/G DRY	1003	0	<5.20	<5.20	<5.20	<5.20	8.90	6.20	4.90	9.30	<5.20	<5.20	<5.20	<5.20	9.60	14.0
MERCURY	UG/G DRY	71921	0	<0.070	<0.070	<0.070	<0.070	<0.050	<0.050	<0.050	<0.050	<0.070	<0.070	<0.070	<0.070	<0.050	<0.050
ALDRIN	UG/G DRY	99356	0	<0.500	<0.500	0.745	1.28	<0.900	<0.900	<0.900	1380	800	2020	541	928	<0.900	<0.900
DIELDRIN	UG/G DRY	98365	0	<0.600	<0.600	<0.600	<0.600	<0.300	<0.300	<0.300	438	195	389	95.3	197	<0.300	<0.300
DDT PP'	UG/G DRY	98364	0	<2.00	<2.00	<2.00	<2.00	<0.400	<0.400	<0.400	<0.400	<400	<400	<40.0	<200	<0.400	<0.400
ENDRIN	UG/G DRY	98369	0	<4.00	<4.00	<4.00	<4.00	<0.700	<0.700	<0.700	858	510	812	255	448	<0.700	<0.700
CHLORDANE	UG/G DRY	98361	0	<6.00	<6.00	<6.00	<6.00	<1.00	<1.00	<1.00	<1.00	<1200	<1200	<120	<600	<1.00	<1.00

ENVIRONMENTAL SCIENCE & ENGINEERING 01/29/87 STATUS: ACTIVE PAGE# 2

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266YA PROJECT MANAGER MICHAEL WITT
266YAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET #	METHOD	SAMPLE ID/# 4617A 266YA 0	4617B 266YA 1	4618A 266YA 10	4618B 266YA 11	4619A 266YA 20	4619B 266YA 21	4619C 266YA 22	4620A 266YA 30	4620B 266YA 31	4620C 266YA 32	4620D 266YA 33	4620E 266YA 34	4621A 266YA 40	4621B 266YA 41
DATE				10/09/85	10/09/85	10/09/85	10/09/85	10/01/85	10/01/85	10/01/85	10/03/85	10/04/85	10/04/85	10/04/85	10/04/85	10/02/85	10/02/85
TIME				10:46	11:08	10:15	10:31	11:44	11:56	12:26	09:22	09:19	09:47	10:38	11:15	10:45	10:52
DDE,PP'	UG/G-DRY	98363	0	<0.500	<0.500	<0.500	<0.500	<0.300	<0.300	<0.300	<0.300	<100	<100	<10.0	<50.0	<0.300	<0.300
1,4 DICHLORANE	UG/G-DRY	98644	0	<0.500	<0.500	<0.500	<0.500	<0.300	<0.300	<0.300	<0.300	<100	<100	<10.0	<50.0	<0.300	<0.300
DIMP	UG/G-DRY	98645	0	<3.00	<3.00	<3.00	<3.00	<0.500	<0.500	<0.500	0.817	<600	<600	<60.0	<300	<0.500	<0.500
DAPONA	UG/G-DRY	98646	0	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<60.0	<60.0	<6.00	<30.0	<0.300	<0.300
HEXACHLOROCYCLOPENTADIENE	UG/G-DRY	98647	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<200	<200	<20.0	<100	<1.00	<1.00
MALATHION	UG/G-DRY	98648	0	<2.00	<2.00	<2.00	<2.00	<0.600	<0.600	<0.600	<0.600	<400	<400	<40.0	<200	<0.600	<0.600
ISODRIN	UG/G-DRY	98649	0	<0.600	<0.600	<0.600	<0.600	<0.300	<0.300	<0.300	3220	1410	3150	676	1340	<0.300	<0.300
1,4 DITHIANE	UG/G-DRY	98650	0	<2.00	<2.00	<2.00	<2.00	<0.300	<0.300	<0.300	<0.300	<400	<400	<40.0	<200	<0.300	<0.300
DICYCLOPENTADIENE	UG/G-DRY	98651	0	<6.00	<6.00	<6.00	<6.00	<0.300	<0.300	<0.300	1510	1020	4040	293	620	<0.300	<0.300
DECAMETHRIN	UG/G-DRY	98652	0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.044	2.46	0.531	0.064	<0.005	<0.005
P-CHLORPHENYLMETHYL-SULFIDE	UG/G-DRY	98653	0	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<60.0	<60.0	<6.00	<30.0	<0.300	<0.300
P-CHLORPHENYLMETHYL-SULFOXIDE	UG/G-DRY	98654	0	<1.00	<1.00	<1.00	<1.00	<0.400	<0.400	<0.400	<0.400	<200	<200	<20.0	<100	<0.400	<0.400
ATRAZINE	UG/G-DRY	98655	0	<0.500	<0.500	<0.500	<0.500	<0.700	<0.700	<0.700	<0.700	<100	<100	<10.0	<50.0	<0.700	<0.700
SIPONA	UG/G-DRY	98656	0	<0.900	<0.900	<0.900	<0.900	<0.500	<0.500	<0.500	<0.500	<180	<180	<18.0	<90.0	<0.500	<0.500
DDEP	UG/G-DRY	98657	0	<3.00	<3.00	<3.00	<3.00	2.75	<2.00	<2.00	24.2	<600	<600	<60.0	<300	<2.00	<2.00
PARATHION	UG/G-DRY	98658	0	<2.00	<2.00	<2.00	<2.00	<0.700	<0.700	<0.700	<0.700	<400	<400	<40.0	<200	<0.700	<0.700
P-CHLORPHENYLMETHYL-SULFONE	UG/G-DRY	98703	0	0.810	<0.400	15.9	0.704	<0.300	<0.300	<0.300	16.1	<80.0	<80.0	<8.00	<40.0	<0.300	<0.300
TRANS-1,2-DICHLOROETHENE	UG/G-DRY	98687	0	<0.800	<0.800	<0.800	<0.800	<0.300	<0.300	<0.300	<1.20	<0.800	<0.800	<0.800	<0.600	<0.300	<0.300
ETHYLBENZENE	UG/G-DRY	98688	0	<0.400	<0.400	<0.400	<0.400	<0.300	<0.300	<0.300	<1.20	<0.400	<0.400	<0.400	<0.400	<0.300	<0.300
METHYLENE CHLORIDE	UG/G-DRY	98689	0	NA	NA	NA	NA	<0.300	<0.300	<0.300	<1.20	NA	NA	NA	NA	<0.300	<0.300

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266YA PROJECT MANAGER MICHAEL WITT
266YAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	STORET #	SAMPLE ID/# 4617A	4617B	4618A	4618B	4619A	4619B	4619C	4620A	4620B	4620C	4620D	4620E	4621A	4621B
UNITS	METHOD	266YA 0	266YA 1	266YA 10	266YA 11	266YA 20	266YA 21	266YA 22	266YA 30	266YA 31	266YA 32	266YA 33	266YA 34	266YA 40	266YA 41
DATE		10/09/85	10/09/85	10/09/85	10/09/85	10/01/85	10/01/85	10/01/85	10/03/85	10/04/85	10/04/85	10/04/85	10/04/85	10/02/85	10/02/85
TIME		10:46	11:08	10:15	10:31	11:44	11:56	12:26	09:22	09:19	09:47	10:38	11:15	10:45	10:52
TETRACHLOROETHENE	34475	<0.500	<0.500	<0.500	<0.500	<0.300	<0.300	<0.300	4.84	10.4	39.0	6.13	15.2	<0.300	<0.300
UG/G-DRY	0														
TOLUENE	34010	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	850	274	971	106	342	<0.300	<0.300
UG/G-DRY	0														
1,1,1-TRICHLORO-ETHANE	34506	<0.500	<0.500	<0.500	<0.500	<0.300	<0.300	<0.300	<1.20	<0.500	<0.500	<0.500	<0.500	<0.300	<0.300
UG/G-DRY	0														
1,1,2-TRICHLORO-ETHANE	34511	<0.600	<0.600	<0.600	<0.600	<0.300	<0.300	<0.300	<1.20	<0.600	<0.600	<0.600	<0.600	<0.300	<0.300
UG/G-DRY	0														
TRICHLOROETHENE	39180	<0.600	<0.600	<0.600	<0.600	<0.300	<0.300	<0.300	<1.20	<0.600	<0.600	<0.600	<0.600	<0.300	<0.300
UG/G-DRY	0														
M-XYLENE	34693	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<1.20	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
PYRENE	34469	<0.400	<0.400	<0.400	<0.400	<0.500	<0.500	<0.500	<2.00	<0.400	0.436	<0.400	<0.400	<0.500	<0.500
UG/G-DRY	0														
CRESOL	34477	<4.00	<4.00	<4.00	<4.00	<0.300	<0.300	<0.300	14.7	<4.00	<4.00	<4.00	<4.00	<0.300	<0.300
UG/G-DRY	0														
BENZENE	34030	<1.00	<1.00	<1.00	<1.00	<0.300	<0.300	<0.300	1.57	<1.00	3.36	<1.00	<1.00	<0.300	<0.300
UG/G-DRY	0														
2-METHYLNAPHTHALENE	34696	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<2.00	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
UG/G-DRY	0														
CARBON TETRACHLORIDE	34520	<0.400	<0.400	<0.400	<0.400	<0.300	<0.300	<0.300	<1.20	<0.400	<0.400	<0.400	<0.400	<0.300	<0.300
UG/G-DRY	0														
CHLOROBENZENE	34301	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<1.20	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
CHLOROFORM	34311	<0.700	<0.700	<0.700	<0.700	<0.300	<0.300	<0.300	<1.20	<0.700	<0.700	<0.700	<0.700	<0.300	<0.300
UG/G-DRY	0														
1,1-DICHLOROETHANE	34496	<0.500	<0.500	<0.500	<0.500	<0.300	<0.300	<0.300	<1.20	<0.500	<0.500	<0.500	<0.500	<0.300	<0.300
UG/G-DRY	0														
1,2-DICHLOROETHANE	34531	<0.400	<0.400	<0.400	<0.400	<0.300	<0.300	<0.300	<1.20	<0.400	1.36	<0.400	<0.400	<0.300	<0.300
UG/G-DRY	0														
DICHLOROMETHANE	34423	<0.800	<0.800	<0.800	<0.800	<0.300	<0.300	<0.300	8.06	4.15	5.41	<0.800	1.88	<0.300	<0.300
UG/G-DRY	0														
DISULFIDE,DIMETHYL	34052	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.04	2.5	0.53	0.06	<0.005	<0.005
UG/G-DRY	09														
DDEP	34652	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.044	2.46	0.531	0.064	<0.005	<0.005
UG/G-DRY	N9														
	90006														
	0														
UNITS	00145														
UG/G	0														

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PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266YA PROJECT MANAGER MICHAEL WITT
266YAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # / METHOD	SAMPLE ID/# 4617A 266YA 0	4617B 266YA 1	4618A 266YA 14	4618B 266YA 11	4619A 266YA 20	4619B 266YA 21	4619C 266YA 22	4620A 266YA 30	4620B 266YA 31	4620C 266YA 32	4620D 266YA 33	4620E 266YA 34	4621A 266YA 40	4621B 266YA 41
DATE			10/09/85	10/09/85	10/09/85	10/09/85	10/01/85	10/01/85	10/01/85	10/03/85	10/04/85	10/04/85	10/04/85	10/04/85	10/02/85	10/02/85
TIME			10:46	11:08	10:15	10:31	11:44	11:56	12:26	09:22	09:19	09:47	10:38	11:15	10:45	10:52
UNK053		90141									47.4	153	31.5	72.8		
	UG/G	0														
UNK145		90146									35.5	82.4	31.5	41.6		
	UG/G	0														
UNK059		90165				6.73										
	UG/G	0														
UNK024		90118														
	UG/G	0														
UNK011		90087		0.770												
	UG/G	0														
UNK062		90093		0.330												
	UG/G	0														
UNK023		90073	7.74													
	UG/G	0														
UNK059		90088	5.53													
	UG/G	0														
UNK058		90078			4.34											
	UG/G	0														
UNK062		90615										400	63.0			
	UG/G	0														
UNK033		90085							1.39					72.8		
	UG/G	0														
UNK526		90610									47.4	141				
	UG/G	0														
UNK524		90051								18.9		872				
	UG/G	0														
UNK526		90055								12.8		789				
	UG/G	0														
UNK038		90073										459				
	UG/G	0														
UNK598		90056						1.73								1.78
	UG/G	0														
UNK034		90081						1.01								
	UG/G	0														
UNK040		90074						2.46								
	UG/G	0														
UNK537		90622														0.544
	UG/G	0														
UNK027		90060														0.691
	UG/G	0														

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266YA PROJECT MANAGER MICHAEL WITT
266YAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 4617A 266YA 0	4617B 266YA 1	4618A 266YA 10	4618B 266YA 11	4619A 266YA 20	4619B 266YA 21	4619C 266YA 22	4620A 266YA 30	4620B 266YA 31	4620C 266YA 32	4620D 266YA 33	4620E 266YA 34	4621A 266YA 40	4621B 266YA 41
DATE			10/08/85	10/09/85	10/09/85	10/09/85	10/01/85	10/01/85	10/01/85	10/03/85	10/04/85	10/04/85	10/04/85	10/04/85	10/02/85	10/02/85
TIME			10:46	11:08	10:15	10:31	11:44	11:56	12:26	09:22	09:19	09:47	10:38	11:15	10:45	10:52
UNK520		90155					9.42								5.72	
	UG/G	0														
UNK532		90020					1.87									
	UG/G	0														
UNK561		90032					10.3								12.5	
	UG/G	0														
UNK614		90070							19.4							
	UG/G	0														
UNK516		90114													10.6	
	UG/G	0														
UNK555		90152													3.14	
	UG/G	0														
UNK519		90091								1.50						
	UG/G	0														
UNK535		90121								2.70						
	UG/G	0														
UNK581		90101								9.28						
	UG/G	0														
UNK161		90166														
	UG/G	0														
UNK076		90162														
	UG/G	0														
UNK054		90161														
	UG/G	0														
UNK167		90164														
	UG/G	0														
UNK178		90170														
	UG/G	0														

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266YA PROJECT MANAGER MICHAEL WITT
266YAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	STORET #	4622A	4622B	4623A	4623B	BLK	BLK	BLK	BLK	BLK
		SAMPLE ID/#								
UNITS	METHOD	266YA	266YA	266YA	266YA	266YA	266YA	266YA	266YA	266YA
		50	51	60	61	80	81	90	91	92
DATE		10/08/85	10/09/85	09/27/85	09/27/85	10/01/85	10/02/85	10/01/85	10/09/85	10/09/85
TIME		14:45	09:40	10:20	10:31	00:00	00:00	00:00	00:00	00:00
SAMPLE TYPE	71999	SO	SO	SO	SO	SO	SO	SO	SO	SO
	0									
SAMPLE DEPTH	99752A	0.50	3.00	0.0	4.00	0.0	0.0	0.0	0.0	0.0
FT	0									
SITE TYPE 1	99759	BORE	BORE	BORE	BORE	QCMB	QCMB	QCMB	QCMB	QCMB
	0									
INSTALLATION CODE	99720	RK	RK	RK	RK	RK	RK	RK	RK	RK
SAMPLE	0									
SAMPLING TECHNIQUE	72005	S	S	S	S	G	G	G	G	G
	0									
COORDINATE N/S	90392	189374	189374	189213	189213					
SIP	0									
COORDINATE E/W	90393	2180339	2180339	2179875	2179875					
SIP	0									
MOISTURE	70320	15.9	12.6	3.9	5.3	1.3	1.3			
%WET WT	0									
CADMIUM	1028	<0.900	<0.500	<0.500	<0.500	NA	<0.900	<0.500	NA	NA
UG/G- DRY	0									
CHROMIUM	99564	34.0	19.0	12.0	11.0	NA	16.0	15.0	NA	NA
UG/G-DRY	0									
COPPER	1043	17.0	28.0	15.0	18.0	NA	10.0	20.0	NA	NA
UG/G- DRY	0									
LE-D	1052	<17.0	<16.0	<16.0	<16.0	NA	<17.0	<16.0	NA	NA
UG/G-DRY	0									
ZINC	1033	96.0	53.0	33.0	<28.0	NA	48.0	43.0	NA	NA
UG/G-DRY	0									
ARSENIC	1003	10.0	<5.20	<5.20	<5.20	NA	6.80	NA	NA	<5.20
UG/G- DRY	0									
MERCURY	71921	<0.050	<0.070	<0.070	<0.070	NA	NA	<0.070	NA	NA
UG/G-DRY	0									
ALDRIN	98356	NA	<0.500	<0.500	<0.500	<0.900	NA	<0.500		
UG/G- DRY	0									
DIELDRIN	98365	NA	<0.600	<0.600	<0.600	<0.300	NA	<0.600		
UG/G-DRY	0									
DDT,PP'	98364	NA	<2.00	<2.00	<2.00	<0.400	NA	<2.00		
UG/G-DRY	0									
ENDRIN	98369	NA	<4.00	<4.00	<4.00	<0.700	NA	<4.00		
UG/G-DRY.	0									
CHLORDANE	98361	NA	<6.00	<6.00	<6.00	<1.00	NA	<6.00		
UG/G- DRY	0									

PROJECT NUMBER 85931 0420 PROJECT NAME RMA OMPOST
FIELD GROUP 266YA PROJECT MANAGER MICHAEL WITT
266YAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET #	METHOD	4622A 266YA 50	4622B 266YA 51	4623A 266YA 60	4623B 266YA 61	BLK 266YA 80	SAMPLE ID/# BLK 266YA 81	BLK 266YA 90	BLK 266YA 91	BLK 266YA 92
DATE				10/08/85	10/09/85	09/27/85	09/27/85	10/01/85	10/02/85	10/01/85	10/09/85	10/09/85
TIME				14:45	09:40	10:20	10:31	00:00	00:00	00:00	00:00	00:00
DDE,PP'	UG/G-DRY	98363	0	NA	<0.500	<0.500	<0.500	<0.300	NA	<0.500		
1,4 DIBROMOBENZENE	UG/G-DRY	98644	0	NA	<0.500	<0.500	<0.500	<0.300	NA	<0.500		
DIMP	UG/G-DRY	98645	0	NA	<3.00	<3.00	<3.00	<0.500	NA	<3.00		
VAPONA	UG/ -DRY	98646	0	NA	<0.300	<0.300	<0.300	<0.300	NA	<0.300		
HEXACHLOROCYCLOPENTADIENE	UG/G-DRY	98647	0	NA	<1.00	<1.00	<1.00	<1.00	NA	<1.00		
MALATHION	UG/G-DRY	98648	0	NA	<2.00	<2.00	<2.00	<0.600	NA	<2.00		
TOCRIN	UG/G-DRY	98649	0	NA	<0.600	<0.600	<0.600	<0.300	NA	<0.600		
1,4 DITHIANE	UG/G- DRY	98650	0	NA	<2.00	<2.00	<2.00	<0.300	NA	<2.00		
DICYCLOPENTADIENE	UG/G-DRY	98651	0	NA	<6.00	<6.00	<6.00	<0.300	NA	<6.00		
DBCP(NEMAGON)	UG/G-DRY	98652	0	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005	
P-CLPHENYLMETHYL-SULFIDE	UG/G-DRY	98653	0	NA	<0.300	<0.300	<0.300	<0.300	NA	<0.300		
P-CLPHENYLMETHYL-SULFOXIDE	UG/G-DRY	98654	0	NA	<1.00	<1.00	<1.00	<0.400	NA	<1.00		
ATRAZINE	UG/G-DRY	98655	0	NA	<0.500	<0.500	<0.500	<0.700	NA	<0.500		
SUPONA	UG/G-DRY.	98656	0	NA	<0.900	<0.900	<0.900	<0.500	NA	<0.900		
DMMP	UG/G-DRY	98657	0	NA	<3.00	<3.00	<3.00	<2.00	NA	<3.00		
PARATHION	UG/G-DRY	98658	0	NA	<2.00	<2.00	<2.00	<0.700	NA	<2.00		
P-CLPHENYLMETHYL-SULFONE	UG/G-DRY	98703	0		<0.400	<0.400	<0.400	<0.300		<0.400		
TRANS-1,2-DICHLORO-ETHENE	UG/G-DRY	98687	0	NA	<0.800	<0.800	<0.800	<0.300	<0.300	<0.800	<0.800	<0.800
ETHYLBENZENE	UG/G-DRY	98688	0	NA	<0.400	<0.400	<0.400	<0.300	<0.300	<0.400	<0.400	<0.400
METHYLENE CHLORIDE	UG/G-DRY	98689	0	NA	NA	NA	NA	0.950	0.602	NA	NA	NA

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266YA PROJECT MANAGER MICHAEL WITT
266YAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	STORET #	4622A 266YA	4622B 266YA	4623A 266YA	4623B 266YA	BLK 266YA	BLK 266YA	BLK 266YA	BLK 266YA	BLK 266YA
UNITS	METHOD	50	51	60	61	80	81	90	91	92
DATE		10/08/85	10/09/85	09/27/85	09/27/85	10/01/85	10/02/85	10/01/85	10/09/85	10/09/85
TIME		14:45	09:40	10:20	10:31	00:00	00:00	00:00	00:00	00:00
TETRACHLOROETHENE	98690	NA	<0.500	<0.500	<0.500	<0.300	<0.300	<0.500	<0.500	<0.500
UG/G-DRY	0									
TOLUENE	98691	NA	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0									
1,1,1-TRICHLORO-ETHANE	98692	NA	<0.500	<0.500	<0.500	<0.300	<0.300	<0.500	<0.500	<0.500
UG/G-DRY	0									
1,1,2-TRICHLORO-ETHANE	98693	NA	<0.600	<0.600	<0.600	<0.300	<0.300	<0.600	<0.600	<0.600
UG/G-DRY	0									
TRICHLOROETHENE	98694	NA	<0.600	<0.600	<0.600	<0.300	<0.300	<0.600	<0.600	<0.600
UG/G-DRY	0									
M-XYLENE	98695	NA	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G DRY	0									
MIBK	98696	NA	<0.400	<0.400	<0.400	<0.500	<0.500	<0.400	<0.400	<0.400
UG/G-DRY	0									
DMDS	98697	NA	<4.00	<4.00	<4.00	<0.300	<0.300	<4.00	<4.00	<4.00
UG/G DRY	0									
BENZENE	98699	NA	<1.00	<1.00	<1.00	<0.300	<0.300	<1.00	<1.00	<1.00
UG/G-DRY	0									
O-AND/OR P-XYLENE	98700	NA	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
UG/G-DRY	0									
CARBON TETRACHLORIDE	98650	NA	<0.400	<0.400	<0.400	<0.300	<0.300	<0.400	<0.400	<0.400
UG/G-DRY	0									
CHLOROBENZENE	98681	NA	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0									
CHLOROFORM	98682	NA	<0.700	<0.700	<0.700	<0.300	<0.300	<0.700	<0.700	<0.700
UG/G-DRY	0									
1,1-DICHLOROETHANE	98683	NA	<0.500	<0.500	<0.500	<0.300	<0.300	<0.500	<0.500	<0.500
UG/G-DRY	0									
1,2-DICHLOROETHANE	98684	NA	<0.400	<0.400	<0.400	<0.300	<0.300	<0.400	<0.400	<0.400
UG/G-DRY	0									
BICYCLOHEPTADIENE	98686	NA	<0.800	<0.800	<0.800	<0.300	<0.300	<0.800	<0.800	<0.800
UG/G-DRY	0									
DBCP(NEMAGON)	98652	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005	
UG/G-DRY	09									
DBCP	98652	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005	
UG/G-DRY	H9									
	90006									
	0									
UNA125	90145								0.816	
UG/G	0									

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266YA PROJECT MANAGER MICHAEL WITT
266YAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 4622A 266YA 50	4622B 266YA 51	4623A 266YA 60	4623B 266YA 61	BLK 266YA 80	BLK 266YA 81	BLK 266YA 90	BLK 266YA 91	BLK 266YA 92
DATE			10/08/85	10/09/85	09/27/85	09/27/85	10/01/85	10/02/85	10/01/85	10/09/85	10/09/85
TIME			14:45	09:40	10:20	10:31	00:00	00:00	00:00	00:00	00:00
UNK059		90141									
	UG/G	0									
UNK145		90146									
	UG/G	0									
UNK619		90105		2.29							
	UG/G	0									
UNK624		90118		2.29							
	UG/G	0									
UNK611		90067									
	UG/G	0									
UNK562		90033									
	UG/G	0									
UNK623		90077									
	UG/G	0									
UNK609		90066									
	UG/G	0									
UNK558		90058									
	UG/G	0									
UNK562		90045									
	UG/G	0									
UNK633		90085									
	UG/G	0									
UNK576		90040									
	UG/G	0									
UNK591		90051									
	UG/G	0									
UNK596		90055									
	UG/G	0									
UNK618		90073									
	UG/G	0									
UNK558		90056									
	UG/G	0									
UNK604		90061									
	UG/G	0									
UNK620		90074									
	UG/G	0									
UNK537		90022									
	UG/G	0									
UNK627		90080									
	UG/G	0									

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266YA PROJECT MANAGER MICHAEL WITT
266YAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 4622A 266YA 50	4622B 266YA 51	4623A 266YA 60	4623B 266YA 61	BLK 266YA 80	BLK 266YA 81	BLK 266YA 90	BLK 266YA 91	BLK 266YA 92
DATE			10/08/85	10/09/85	09/27/85	09/27/85	10/01/85	10/02/85	10/01/85	10/09/85	10/09/85
TIME			14:45	09:40	10:20	10:31	00:00	00:00	00:00	00:00	00:00
UNK 520		90155									
	UG/G	0									
UNK 532		90020									
	UG/G	0									
UNK 561		90032									
	UG/G	0									
UNK 614		90070									
	UG/G	0									
UNK 534		90114									
	UG/G	0									
UNK 556		90152									
	UG/G	0									
UNK 519		90091									
	UG/G	0									
UNK 575		90121									
	UG/G	0									
UNK 561		90101									
	UG/G	0									
UNK 163		90166									
	UG/G	0									
UNK 076		90162									
	UG/G	0									
UNK 054		90161									
	UG/G	0									
UNK 147		90164									
	UG/G	0									
UNK 178		90176									
	UG/G	0									

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PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266ZA PROJECT MANAGER MICHAEL WITT
266ZAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	STORET #	SAMPLE ID/# 4624A	4624B	4625A	4625B	4625C	4626A	4626B	4627A	4627B	4627C	4628A	4628B	4629A	4629B
UNITS	METHOD	266ZA 0	266ZA 1	266ZA 10	266ZA 11	266ZA 12	266ZA 20	266ZA 21	266ZA 30	256ZA 31	266ZA 32	266ZA 40	266ZA 41	266ZA 50	266ZA 51
DATE		09/26/85	09/26/85	10/08/85	10/08/85	10/08/85	10/02/85	10/02/85	10/02/85	10/02/85	10/02/85	09/26/85	09/26/85	09/24/85	09/24/85
TIME		11:21	11:28	09:18	09:28	09:54	12:11	12:19	08:53	09:02	09:21	08:27	08:35	08:36	08:47
SAMPLE TYPE	71999 0	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
SAMPLE DEPTH FT	99758A 0	0.0	4.00	0.50	4.00	9.00	0.0	4.00	0.0	4.00	9.00	0.0	4.00	0.0	4.00
SITE TYPE 1	99759 0	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
INSTALLATION CODE SAMPLE	99720 0	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK
SAMPLING TECHNIQUE	72005 0	S	S	S	S	S	S	S	S	S	S	S	S	S	S
COORDINATE N/S SIP	98392 0	188793	188793	189004	189004	189004	189002	189002	188640	188640	188640	188436	188436	188678	188678
COORDINATE E/W SIP	98393 0	2179989	2179989	2180465	2180465	2180465	2181018	2181018	2181572	2181572	2181572	2180993	2180993	2180496	2180496
MOISTURE %WET WT	70320 0	9.3	5.0	10.1	14.0	15.7	18.1	14.6	17.2	13.6	15.8	12.2	11.3	15.7	18.5
CADMIUM UG/G- DRY	1028 0	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.500	<0.500
CHROMIUM UG/G-DRY	99584 0	19.0	14.0	19.0	14.0	20.0	31.0	15.0	29.0	21.0	17.0	28.0	17.0	24.0	<7.00
COPPER UG/G- DRY	1043 0	12.0	5.00	10.0	12.0	20.0	2340	292	24.0	17.0	16.0	14.0	12.0	24.0	11.0
LEAD UG/G-DRY	1052 0	18.0	<17.0	<17.0	<17.0	<17.0	<17.0	<17.0	<17.0	<17.0	<17.0	35.0	<17.0	<16.0	<16.0
ZINC UG/G-DRY	1093 0	52.0	38.0	50.0	41.0	73.0	93.0	61.0	81.0	68.0	156	59.0	50.0	77.0	<28.0
ARSENIC UG/G- DRY	1003 0	6.60	5.20	6.60	10.0	18.0	15.0	9.20	14.0	4.80	12.0	9.10	7.80	<5.20	<5.20
MERCURY UG/G-DRY	71921 0	<0.050	<0.050	<0.050	<0.050	<0.050	.080	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.070	<0.070
ALDRIN UG/G- DRY	98356 0	<0.900	<0.900	NA	NA	NA	3200	3600	<0.900	<0.900	<0.900	<0.900	NA	<0.500	<0.500
DIELDRIN UG/G-DRY	98365 0	<0.300	<0.300	NA	NA	NA	732	1670	<0.300	<0.300	<0.300	<0.300	NA	<0.600	<0.600
DDT,PP' UG/G-DRY	98364 0	<0.400	<0.400	NA	NA	NA	<0.400	<0.400	<0.400	<0.400	<0.400	<0.400	NA	<2.00	<2.00
ENDRIN UG/G-DRY.	98369 0	<0.700	<0.700	NA	NA	NA	94.9	233	<0.700	<0.700	<0.700	<0.700	NA	<4.00	<4.00
CHLORDANE UG/G- DRY	98361 0	<1.00	<1.00	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NA	<6.00	<6.00

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266ZA PROJECT MANAGER MICHAEL WITT
266ZAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	STORET #	4624A	4624B	4625A	4625B	4625C	4626A	4626B	4627A	4627B	4627C	4628A	4628B	4629A	4629B
UNITS	METHOD	266ZA 0	266ZA 1	266ZA 10	266ZA 11	266ZA 12	266ZA 20	266ZA 21	266ZA 30	266ZA 31	266ZA 32	266ZA 40	266ZA 41	266ZA 50	266ZA 51
DATE		09/26/85	09/26/85	10/08/85	10/08/85	10/08/85	10/02/85	10/02/85	10/02/85	10/02/85	10/02/85	09/26/85	09/26/85	09/24/85	09/24/85
TIME		11:21	11:28	09:18	09:28	09:54	12:11	12:19	08:53	09:02	09:21	08:27	08:35	08:36	08:47
DDE,PP'	98363	<0.300	<0.300	NA	NA	NA	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	NA	<0.500	<0.500
UG/G-DRY	0														
1,4 OXATHIANE	98644	<0.300	<0.300	NA	NA	NA	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	NA	<0.500	<0.500
UG/G-DRY	0														
DIMP	98645	<0.500	<0.500	NA	NA	NA	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	NA	<3.00	<3.00
UG/G-DRY	0														
VAPONA	98646	<0.300	<0.300	NA	NA	NA	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	NA	<0.300	<0.300
UG/G -DRY	0														
HEXACHLOROCYCLOPENT-ADIENE	98647	<1.00	<1.00	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NA	<1.00	<1.00
UG/G-DRY	0														
MALATHION	98648	<0.600	<0.600	NA	NA	NA	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	NA	<2.00	<2.00
UG/G-DRY	0														
ISODRIN	98649	<0.300	<0.300	NA	NA	NA	146	274	<0.300	<0.300	<0.300	<0.300	NA	<0.600	<0.600
UG/G DRY	0														
1,4 DITHIANE	98650	<0.300	<0.300	NA	NA	NA	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	NA	<2.00	<2.00
UG/G- DRY	0														
DICYCLOPENTADIENE	98651	<0.300	<0.300	NA	NA	NA	32.0	95.7	<0.300	<0.300	<0.300	<0.300	NA	<6.00	<6.00
UG/G-DRY	0														
DBCP(NEMAGON)	98652	<0.005	<0.005	<0.005	<0.005	<0.005	4.84	8.09	0.862	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
UG/G-DRY	0														
P-CLPHENYLMETHYL-SULFIDE	98653	<0.300	<0.300	NA	NA	NA	353	734	5.82	<0.300	<0.300	<0.300	NA	<0.300	<0.300
UG/G-DRY	0														
P-CLPHENYLMETHYL-SULFOXIDE	98654	<0.400	<0.400	NA	NA	NA	70.3	3.86	14.9	4.76	5.38	<0.400	NA	<1.00	<1.00
UG/G-DRY	0														
ATRAZINE	98655	<0.700	<0.700	NA	NA	NA	<0.700	<0.700	<0.700	<0.700	<0.700	<0.700	NA	<0.500	<0.500
UG/G-DRY	0														
SUPONA	98656	<0.500	<0.500	NA	NA	NA	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	NA	<0.900	<0.900
UG/G-DRY,	0														
DMP	98657	<2.00	<2.00	NA	NA	NA	8.55	70.0	<2.00	<2.00	<2.00	<2.00	NA	<3.00	<3.00
UG/G-DRY	0														
PARATHION	98658	<0.700	<0.700	NA	NA	NA	<0.700	<0.700	<0.700	<0.700	<0.700	<0.700	NA	<2.00	<2.00
UG/G-DRY	0														
P-CLPHENYLMETHYL-SULFONE	98703	2.21	<0.300				258	86.1	25.6	12.1	7.81	0.889		1.49	<0.400
UG/G-DRY	0														
TRANS-1,2-DICHLORO-ETHENE	98687	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<1.20	<0.300	<0.300	<0.300	<0.300	<0.300	<0.800	<0.800
UG/G-DRY	0														
ETHYLBENZENE	98688	<0.300	<0.300	<0.300	<0.300	<0.300	1.44	8.32	<0.300	<0.300	<0.300	<0.300	<0.300	<0.400	<0.400
UG/G-DRY	0														
METHYLENE CHLORIDE	98689	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<1.20	<0.300	<0.300	<0.300	<0.300	<0.300	NA	NA
UG/G-DRY	0														

PROJECT NUMBER 85931 0420 PROJECT NAME RMA OnPOST
FIELD GROUP 266ZA PROJECT MANAGER MICHAEL WITT
266ZAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	STORET #	4624A	4624B	4625A	4625B	4625C	4626A	4626B	4627A	4627B	4627C	4628A	4628B	4629A	4629B
		SAMPLE ID/#													
UNITS	METHOD	266ZA 0	266ZA 1	266ZA 10	266ZA 11	266ZA 12	266ZA 20	266ZA 21	266ZA 30	266ZA 31	266ZA 32	266ZA 40	266ZA 41	266ZA 50	266ZA 51
DATE		09/26/85	09/26/85	10/08/85	10/08/85	10/08/85	10/02/85	10/02/85	10/02/85	10/02/85	10/02/85	09/26/85	09/26/85	09/24/85	09/24/85
TIME		11:21	11:28	09:18	09:28	09:54	12:11	12:19	08:53	09:02	09:21	08:27	08:35	08:36	08:47
TETRACHLOROETHENE	34690	<0.300	<0.300	<0.300	<0.300	<0.300	22.6	>25.0	1.14	<0.300	<0.300	<0.300	<0.300	<0.500	<0.500
UG/G-DRY	0														
TOLUENE	34691	<0.300	<0.300	<0.300	<0.300	<0.300	>25.0	627	1.07	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
1,1,1-TRICHLORO-ETHANE	34692	<0.300	<0.300	<0.300	<0.300	0.433	<0.300	<1.20	<0.300	<0.300	<0.300	<0.300	<0.300	<0.500	<0.500
UG/G-DRY	0														
1,1,2-TRICHLORO-ETHANE	34693	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<1.20	<0.300	<0.300	<0.300	<0.300	<0.300	<0.600	<0.600
UG/G-DRY	0														
TRICHLOROETHENE	34694	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<1.20	<0.300	<0.300	<0.300	<0.300	<0.300	<0.600	<0.600
UG/G-DRY	0														
M-XYLENE	34695	<0.300	<0.300	<0.300	<0.300	<0.300	4.69	<1.20	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
MIBK	34696	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<2.00	<0.500	<0.500	<0.500	<0.500	<0.500	<0.400	<0.400
UG/G-DRY	0														
DMDS	34697	<0.300	<0.300	<0.300	<0.300	<0.300	1.53	65.4	<0.300	<0.300	<0.300	<0.300	<0.300	<4.00	<4.00
UG/G-DRY	0														
BENZENE	34699	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	1.37	<0.300	<0.300	<0.300	<0.300	<0.300	<1.00	<1.00
UG/G-DRY	0														
O-AND/OR P-XYLENE	96700	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	13.5	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
UG/G-DRY	0														
CARBON TETRACHLORIDE	34680	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<1.20	<0.300	<0.300	<0.300	<0.300	<0.300	<0.400	<0.400
UG/G-DRY	0														
CHLOROBENZENE	34681	<0.300	<0.300	<0.300	<0.300	<0.300	0.838	5.14	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
CHLOROFORM	34682	<0.300	<0.300	<0.300	<0.300	<0.300	4.38	73.9	0.343	<0.300	<0.300	<0.300	<0.300	<0.700	<0.700
UG/G-DRY	0														
1,1-DICHLOROETHANE	34683	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<1.20	<0.300	<0.300	<0.300	<0.300	<0.300	<0.500	<0.500
UG/G-DRY	0														
1,2-DICHLOROETHANE	34684	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<1.20	<0.300	<0.300	<0.300	<0.300	<0.300	<0.400	<0.400
UG/G-DRY	0														
BICYCLOHEPTADIENE	34686	<0.300	<0.300	<0.300	<0.300	<0.300	25.5	>25.0	<0.300	<0.300	<0.300	<0.300	<0.300	<0.800	<0.800
UG/G-DRY	0														
DECAFLUOROBIPHENYL (SURR)	34652	<0.005	<0.005	<0.005	<0.005	<0.005	4.8	8.1	0.86	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
UG/G-DRY	09														
DBCP	34652	<0.005	<0.005	<0.005	<0.005	<0.005	4.84	8.09	0.862	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
UG/G-DRY	H9														
UNAG25	90140														
UG/G	0														
UNAG85	90142														
UG/G	0														

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 2662A PROJECT MANAGER MICHAEL WITT
2662AX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 4624A 2662A 0	4624B 2662A 1	4625A 2662A 10	4625B 2662A 11	4625C 2662A 12	4626A 2662A 20	4626B 2662A 21	4627A 2662A 30	4627B 2662A 31	4627C 2662A 32	4628A 2662A 40	4628B 2662A 41	4629A 2662A 50	4629B 2662A 51
DATE			09/26/85	09/26/85	10/08/85	10/08/85	10/08/85	10/02/85	10/02/85	10/02/85	10/02/85	10/02/85	09/26/85	09/26/85	09/24/85	09/24/85
TIME			11:21	11:28	09:18	09:28	09:54	12:11	12:19	08:53	09:02	09:21	08:27	08:35	08:36	08:47
UNK094		90067														
	UG/G	0														
UNK109		90143														
	UG/G	0														
UNK124		90144														
	UG/G	0														
UNK563		90034													0.474	
	UG/G	0														
UNK604		90068									6.20				1.19	
	UG/G	0														
UNK615		90071													0.474	
	UG/G	0														
UNK633		90085													0.593	
	UG/G	0														
UNK634		90070		1.52												
	UG/G	0														
UNK639		90082		0.512												
	UG/G	0														
UNK520		90155	6.62													
	UG/G	0														
UNK551		90095	1.86													
	UG/G	0														
UNK561		90032	7.35									1.73				
	UG/G	0														
UNK562		90033	1.17													
	UG/G	0														
UNK634		90086											0.578			
	UG/G	0														
UNK526		90156														
	UG/G	0														
UNK547		90094										2.28				
	UG/G	0														
UNK582		90045														
	UG/G	0														
UNK608		90065														
	UG/G	0														
UNK625		90076														
	UG/G	0														
UNK654		90113														
	UG/G	0														

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266ZA PROJECT MANAGER MICHAEL WITT
266ZAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 4624A 266ZA 0	4624B 266ZA 1	4625A 266ZA 10	4625B 266ZA 11	4625C 266ZA 12	4626A 266ZA 20	4626B 266ZA 21	4627A 266ZA 30	4627B 266ZA 31	4627C 266ZA 32	4628A 266ZA 40	4628B 266ZA 41	4629A 266ZA 50	4629B 266ZA 51
DATE			09/26/85	09/26/85	10/08/85	10/08/85	10/08/85	10/02/85	10/02/85	10/02/85	10/02/85	10/02/85	09/26/85	09/26/85	09/24/85	09/24/85
TIME			11:21	11:28	09:18	09:28	09:54	12:11	12:19	08:53	09:02	09:21	08:27	08:35	08:36	08:47
UNK 581		90101							1.10							
	UG/G	0														
UNK 513		90116								1.18						
	UG/G	0														
UNK 579		90043								2.22						
	UG/G	0														
UNK 578		90042									3.84	3.43				
	UG/G	0														
UNK 585		90102									3.12					
	UG/G	0														
UNK 605		90062									7.87					
	UG/G	0														
UNK 557		90031										34.2				
	UG/G	0														
UNK 553		90033						0.541								
	UG/G	0														
UNK 611		90067						45.5								
	UG/G	0														
UNK 628		90081						1.40	2.71							
	UG/G	0														
UNK 630		90106						0.739								
	UG/G	0														
UNK 519		90091							0.635							
	UG/G	0														
UNK 519		90129							0.801							
	UG/G	0														
UNK 560		90126							1.07							
	UG/G	0														
UNK 144		90009														
	UG/G	0														
UNK 186		90185														
	UG/G	0														
UNK 183		90187														
	UG/G	0														
UNK 174		90168														
	UG/G	0														
UNK 178		90170														
	UG/G	0														
UNK 153		90173														
	UG/G	0														

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 2662A PROJECT MANAGER MICHAEL WITT
2662AX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 4624A 2662A 0	4624B 2662A 1	4625A 2662A 10	4625B 2662A 11	4625C 2662A 12	4626A 2662A 20	4626B 2662A 21	4627A 2662A 30	4627B 2662A 31	4627C 2662A 32	4628A 2662A 40	4628B 2662A 41	4629A 2662A 50	4629B 2662A 51
DATE			09/26/85	09/26/85	10/08/85	10/08/85	10/03/85	10/02/85	10/02/85	10/02/85	10/02/85	10/02/85	09/26/85	09/26/85	09/24/85	09/24/85
TIME			11:21	11:28	09:18	09:28	09:54	12:11	12:19	08:53	09:02	09:21	08:27	08:35	08:36	08:47
UNK 047		90160														
	UG/G	0														
UNK 182		90171														
	UG/G	0														
UNK 186		90172														
	UG/G	0														
UNK 199		90174														
	UG/G	0														
UNK 011		90175														
	UG/G	0														
UNK 133		90176														
	UG/G	0														
UNK 199		90177														
	UG/G	0														
UNK 145		90146														
	UG/G	0														
UNK 177		90169														
	UG/G	0														

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 2662A PROJECT MANAGER MICHAEL WITT
2662AX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	STORET #	SAMPLE ID/# 4629C	4629D	4629E	4629F	4629G	4630A	4630B	4630C	4639A	4639B	4639C	BLK	BLK	BLK
UNITS	METHOD	2662A 52	2662A 53	2662A 54	2662A 55	2662A 56	2662A 60	2662A 61	2662A 62	2662A 63	2662A 64	2662A 65	2662A 80	2662A 81	2662A 82
DATE		09/24/85	09/24/85	09/24/85	09/24/85	09/24/85	09/26/85	09/26/85	09/26/85	07/24/86	07/24/86	07/24/86	09/26/85	10/02/85	10/08/85
TIME		09:13	10:07	10:32	11:39	12:29	09:45	09:56	10:09	11:15	11:20	11:25	00:00	00:00	00:00
SAMPLE TYPE	71999 0	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
SAMPLE DEPTH FT	99758A 0	9.00	14.0	19.0	29.0	39.0	0.0	4.00	9.00	0.50	2.00	2.50	0.0	0.0	0.0
SITE TYPE 1	99759 0	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	QCMB	QCMB	QCMB
INSTALLATION CODE SAMPLE	99720 0	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK
SAMPLING TECHNIQUE	72005 0	S	S	S	S	S	S	S	S	S	S	S	G	G	G
COORDINATE N S STP	98392 0	188678	188678	188678	188678	188678	188426	188426	188426	188464	188464	188464			
COORDINATE E W STP	98393 0	2180496	2180496	2180496	2180496	2180496	2180188	2180188	2180188	2181765	2181765	2181765			
MOISTURE %WET WT	70320 0	10.4	11.0	6.4	18.1	12.5	7.1	16.6	8.9	6.0	16.8	11.8	1.3	1.3	
CADMIUM UG/G- DRY	1028 0	<0.500	<0.500	<0.500	<0.500	<0.500	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	NA	<0.900	NA
CHROMIUM UG/G-DRY	99584 0	14.0	19.0	11.0	14.0	<7.00	17.0	18.0	14.0	9.45	17.4	27.8	NA	16.0	NA
COPPER UG/G- DRY	1043 0	16.0	29.0	29.0	26.0	14.0	8.00	16.0	7.00	369	11.7	11.3	NA	10.0	NA
LEAD UG/G-DRY	1052 0	<16.0	<16.0	<16.0	<16.0	<16.0	<17.0	<17.0	<17.0	<17.0	<17.0	<17.0	NA	<17.0	NA
ZINC UG/G-DRY	1093 0	45.0	59.0	36.0	65.0	<28.0	35.0	50.0	46.0	33.8	58.8	49.8	NA	46.0	NA
ARSENIC UG/G- DRY	1003 0	<5.20	<5.20	<5.20	<5.20	<5.20	<4.70	11.0	<4.70	<4.70	6.85	7.44	NA	5.00	NA
MERCURY UG/G-DRY	71921 0	<0.070	<0.070	<0.070	<0.070	<0.070	<0.050	<0.050	<0.050	0.090	<0.050	<0.050	<0.050	<0.050	NA
ALDRIN UG/G- DRY	98356 0	<0.500	<0.500	<0.500	<0.500	<0.500	<0.900	<0.900	<0.900	113	<0.900	<0.900	<0.900		
DIELDRIN UG/G-DRY	98365 0	<0.600	<0.600	<0.600	<0.600	<0.600	<0.300	<0.300	<0.300	90.3	<0.300	<0.300	<0.300		
DDT PP' UG/G-DRY	98364 0	<2.00	<2.00	<2.00	<2.00	<2.00	<0.400	<0.400	<0.400	<0.400	<0.400	<0.400	<0.400		
ENDRIN UG/G-DRY	98369 0	<4.00	<4.00	<4.00	<4.00	<4.00	<0.700	<0.700	<0.700	9.89	<0.700	<0.700	<0.700		
CHLORDANE UG/G- DRY	98361 0	<6.00	<6.00	<6.00	<6.00	<6.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00		

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266ZA PROJECT MANAGER MICHAEL WITT
266ZAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	STORET #	SAMPLE ID/# 4629C 266ZA	4629D 266ZA	4629E 266ZA	4629F 266ZA	4629G 266ZA	4630A 266ZA	4630B 266ZA	4630C 266ZA	4639A 266ZA	4639B 266ZA	4639C 266ZA	BLK 266ZA	BLK 266ZA	BLK 266ZA
UNITS	METHOD	52	53	54	55	56	60	61	62	63	64	65	80	81	82
DATE		09/24/85	09/24/85	09/24/85	09/24/85	09/24/85	09/26/85	09/26/85	09/26/85	07/24/86	07/24/86	07/24/86	09/26/85	10/02/85	10/08/85
TIME		09:13	10:07	10:32	11:39	12:29	09:45	09:56	10:09	11:15	11:20	11:25	00:00	00:00	00:00
DDE,PP'	98363	<0.500	<0.500	<0.500	<0.500	<0.500	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300		
UG/G-DRY	0														
1,4 OXATHIANE	98644	<0.500	<0.500	<0.500	<0.500	<0.500	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300		
UG/G-DRY	0														
DIMP	98645	<3.00	<3.00	<3.00	<3.00	<3.00	<0.500	0.530	<0.500	<0.500	<0.500	1.71	<0.500		
UG/G-DRY	0														
VAPONA	98646	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300		
UG/G -DRY	0														
HEXACHLOROCYCLOPENT- ADIENE UG/G-DRY	98647 0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00		
MALATHION	98648	<2.00	<2.00	<2.00	<2.00	<2.00	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600		
UG/G-DRY	0														
ISODRIN	98649	<0.600	<0.600	<0.600	<0.600	<0.600	<0.300	<0.300	<0.300	1.47	<0.300	<0.300	<0.300		
UG/G-DRY	0														
1,4 DITHIANE	98650	<2.00	<2.00	<2.00	<2.00	<2.00	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300		
UG/G- DRY	0														
DICYCLOPENTADIENE	98651	<6.00	<6.00	<6.00	<6.00	<6.00	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300		
UG/G-DRY	0														
DBCP(NEMAGON)	98652	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.300	<0.300	<0.300	<0.005	<0.005	
UG/G-DRY	0														
P-CLPHENTLMETHYL- SULFIDE UG/G-DRY	98653 0	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	0.512	<0.300	<0.300	<0.300		
P-CLPHENTLMETHYL- SULFOXIDE UG/G-DRY	98654 0	<1.00	<1.00	<1.00	<1.00	<1.00	<0.400	<0.400	<0.400	0.985	1.98	0.583	<0.400		
ATRAZINE	98655	<0.500	<0.500	<0.500	<0.500	<0.500	<0.700	<0.700	<0.700	<0.700	<0.700	<0.700	<0.700		
UG/G-DRY	0														
SUPONA	98656	<0.900	<0.900	<0.900	<0.900	<0.900	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500		
UG/G-DRY	0														
DMMP	98657	<3.00	<3.00	<3.00	<3.00	<3.00	4.02	5.94	<2.00	<2.00	<2.00	<2.00	<2.00		
UG/G-DRY	0														
PARATHION	98658	<2.00	<2.00	<2.00	<2.00	<2.00	<0.700	<0.700	<0.700	<0.700	<0.700	<0.700	<0.700		
UG/G-DRY	0														
P-CLPHENTLMETHYL- SULFONE UG/G-DRY	98703 0	<0.400	<0.400	<0.400	<0.400	<0.400	0.720	0.534	<0.300	0.355	<0.300	1.26	<0.300		
TRANS-1,2-DICHLORO- ETHENE UG/G-DRY	98687 0	<0.800	<0.800	<0.800	<0.800	<0.800	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
ETHYLBENZENE	98688	<0.400	<0.400	<0.400	<0.400	<0.400	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
METHYLENE CHLORIDE	98689	NA	NA	NA	NA	NA	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	0.658
UG/G-DRY	0														

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266ZA PROJECT MANAGER MICHAEL WITT
266ZAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	STORET #	SAMPLE ID/# 4629C	4629D	4629E	4629F	4629G	4630A	4630B	4630C	4639A	4639B	4639C	BLK	BLK	BLK
UNITS	METHOD	266ZA	266ZA	266ZA	266ZA	266ZA	266ZA	266ZA	266ZA	266ZA	266ZA	266ZA	266ZA	266ZA	266ZA
		52	53	54	55	56	60	61	62	63	64	65	80	81	82
DATE		09/24/85	09/24/85	09/24/85	09/24/85	09/24/85	09/26/85	09/26/85	09/26/85	07/24/86	07/24/86	07/24/86	09/26/85	10/02/85	10/08/85
TIME		09:13	10:07	10:32	11:39	12:29	09:45	09:56	10:09	11:15	11:20	11:25	00:00	00:00	00:00
TETRACHLOROETHENE	98690	<0.500	<0.500	<0.500	<0.500	<0.500	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
TOLUENE	98691	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
1,1,1-TRICHLORO-ETHANE	98692	<0.500	<0.500	<0.500	<0.500	<0.500	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
1,1,2-TRICHLORO-ETHANE	98693	<0.600	<0.600	<0.600	<0.600	<0.600	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
TRICHLOROETHENE	98694	<0.600	<0.600	<0.600	<0.600	<0.600	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
M-XYLENE	98695	<0.300	<0.300	0.388	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
MIBK	98696	<0.400	<0.400	<0.400	<0.400	1.06	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	0.556	<0.500
UG/G-DRY	0														
DMDS	98697	<4.00	<4.00	<4.00	<4.00	<4.00	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
BENZENE	98699	<1.00	<1.00	<1.00	<1.00	<1.00	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
O-AND/OR P-XYLENE	98700	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
UG/G-DRY	0														
CARBON TETRACHLORIDE	98680	<0.400	<0.400	<0.400	<0.400	<0.400	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
CHLOROBENZENE	98681	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
CHLOROFORM	98682	<0.700	<0.700	<0.700	<0.700	<0.700	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
1,1-DICHLOROETHANE	98683	<0.500	<0.500	<0.500	<0.500	<0.500	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
1,2-DICHLOROETHANE	98684	<0.400	<0.400	<0.400	<0.400	<0.400	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
BICYCLOHEPTADIENE	98686	<0.800	<0.800	<0.800	<0.800	<0.800	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300
UG/G-DRY	0														
DBCP(NEMAGON)	98652	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.30	<0.30	<0.30	<0.005	<0.005	
UG/G-DRY	09														
DBCP	98652	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.300	<0.300	<0.300	<0.005	<0.005	
UG/G-DRY	H9														
UNK025	90140		1.12												
UG/G	0														
UNK085	90142														
UG/G	0														

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266ZA PROJECT MANAGER MICHAEL WITT
266ZAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 4629C 266ZA 52	4629D 266ZA 53	4629E 266ZA 54	4629F 266ZA 55	4629G 266ZA 56	4630A 266ZA 60	4630B 266ZA 61	4630C 266ZA 62	4639A 266ZA 63	4639B 266ZA 64	4639C 266ZA 65	BLK 266ZA 80	BLK 266ZA 81	BLK 266ZA 82
DATE			09/24/85	09/24/85	09/24/85	09/24/85	09/24/85	09/26/85	09/26/85	09/26/85	07/24/86	07/24/86	07/24/86	09/26/85	10/02/85	10/08/85
TIME			09:13	10:07	10:32	11:39	12:29	09:45	09:56	10:09	11:15	11:20	11:25	00:00	00:00	00:00
UNK.094		90007														
	UG/G	0														
UNK.109		90143														
	UG/G	0														
UNK.124		90144														
	UG/G	0														
UNK.563		90034														
	UG/G	0														
UNK.604		90061									0.640					
	UG/G	0														
UNK.615		90071														
	UG/G	0														
UNK.633		90085	0.446	0.562	0.427	0.488					3.97					
	UG/G	0														
UNK.634		90070		0.449	1.07			29.6								
	UG/G	0														
UNK.629		90062			0.641						1.23	1.11				
	UG/G	0														
UNK.520		90155						6.40								
	UG/G	0														
UNK.551		90095														
	UG/G	0														
UNK.561		90032						3.73	1.51							
	UG/G	0														
UNK.562		90033														
	UG/G	0														
UNK.634		90086														
	UG/G	0														
UNK.526		90156							4.21							
	UG/G	0														
UNK.547		90094							2.90							
	UG/G	0														
UNK.562		90045							2.46							
	UG/G	0														
UNK.608		90065								1.82						
	UG/G	0														
UNK.625		90078								0.889	1.46					
	UG/G	0														
UNK.654		90113								1.34						
	UG/G	0														

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266ZA PROJECT MANAGER MICHAEL WITT
266ZAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 4629C 266ZA 52	4629D 266ZA 53	4629E 266ZA 54	4629F 266ZA 55	4629G 266ZA 56	4630A 266ZA 60	4630B 266ZA 61	4630C 266ZA 62	4639A 266ZA 63	4639B 266ZA 64	4639C 266ZA 65	BLK 266ZA 80	BLK 266ZA 81	BLK 266ZA 82
DATE			09/24/85	09/24/85	09/24/85	09/24/85	09/24/85	09/26/85	09/26/85	09/26/85	07/24/86	07/24/86	07/24/86	09/26/85	10/02/85	10/08/85
TIME			09:13	10:07	10:32	11:39	12:29	09:45	09:56	10:09	11:15	11:20	11:25	00:00	00:00	00:00
UNK 581		90101									0.771					
	UG/G	0														
UNK 513		90116														
	UG/G	0														
UNK 579		90043														
	UG/G	0														
UNK 578		90042														
	UG/G	0														
UNK 585		90102														
	UG/G	0														
UNK 635		90062														
	UG/G	0														
UNK 557		90031														
	UG/G	0														
UNK 553		90030														
	UG/G	0														
UNK 611		90067														
	UG/G	0														
UNK 628		90081									28.9					
	UG/G	0														
UNK 630		90106									21.7					
	UG/G	0														
UNK 519		90091														
	UG/G	0														
UNK 539		90129														
	UG/G	0														
UNK 560		90126														
	UG/G	0														
UNK 144		90069											1.13			
	UG/G	0														
UNK 148		90165														
	UG/G	0														
UNK 163		90167														
	UG/G	0														
UNK 174		90168														
	UG/G	0														
UNK 178		90170														
	UG/G	0														
UNK 193		90173														
	UG/G	0														

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266ZA PROJECT MANAGER MICHAEL WITT
266ZAX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 4629C 266ZA 52	4629D 266ZA 53	4629E 266ZA 54	4629F 266ZA 55	4629G 266ZA 56	4630A 266ZA 60	4630B 266ZA 61	4630C 266ZA 62	4639A 266ZA 63	4639B 266ZA 64	4639C 266ZA 65	BLK 266ZA 80	BLK 266ZA 81	BLK 266ZA 82
DATE			09/24/85	09/24/85	09/24/85	09/24/85	09/24/85	09/26/85	09/26/85	09/26/85	07/24/86	07/24/86	07/24/86	09/26/85	10/02/85	10/08/85
TIME			09:13	10:07	10:32	11:39	12:29	09:45	09:56	10:09	11:15	11:20	11:25	00:00	00:00	00:00
UNK 047		90160														
	UG/G	0														
UNK 182		90171														
	UG/G	0														
UNK 186		90172														
	UG/G	0														
UNK 199		90174														
	UG/G	0											5.22			
UNK 011		90175														
	UG/G	0														
UNK 133		90176														
	UG/G	0														
UNK 199		90177														
	UG/G	0														
UNK 145		90146														
	UG/G	0														
UNK 177		90169														
	UG/G	0														

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 2662A PROJECT MANAGER MICHAEL WITT
2662AX LAB COORDINATOR PAUL GEISZLER

SAMPLE ID/#

PARAMETERS	STORET #	BLK 2662A	BLK 2662A	BLK 2662A
UNITS	METHOD	83	90	91
DATE		10/08/85	09/24/85	10/02/85
TIME		00:00	00:00	00:00
SAMPLE TYPE	71999	SO	SO	SO
	0			
SAMPLE DEPTH	99758A	0.0	0.0	0.0
FT	0			
SITE TYPE 1	99759	QCMB	QCMB	QCMB
	0			
INSTALLATION CODE	99720	RK	RK	RK
SAMPLE	0			
SAMPLING TECHNIQUE	72065	G	G	G
	0			
COORDINATE N/S	98392			
STP	0			
COORDINATE E/W	98393			
STP	0			
MOISTURE	70320			
%WET WT	0			
CADMIUM	1028	NA	NA	NA
UG/G- DRY	0			
CHROMIUM	99534	NA	NA	NA
UG/G-DRY	0			
COPPER	1043	NA	NA	NA
UG/G- DRY	0			
LEAD	1052	NA	NA	NA
UG/G-DRY	0			
ZINC	1093	NA	NA	NA
UG/G-DRY	0			
ARSENIC	1003	NA	NA	NA
UG/G- DRY	0			
MERCURY	71921	NA	NA	NA
UG/G-DRY	0			
ALDRIN	98356		<0.500	
UG/G- DRY	0			
DIELDRIN	98365		<0.600	
UG/G-DRY	0			
DDT,PP'	98364		<2.00	
UG/G-DRY	0			
ENDRIN	98369		<4.00	
UG/G-DRY.	0			
CHLORDANE	98361		<6.00	
UG/G- DRY	0			

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 2662A PROJECT MANAGER MICHAEL WITT
2662AX LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET #	METHOD	SAMPLE ID/# BLK 2662A 93	BLK 2662A 90	BLK 2662A 91
DATE				10/08/85	09/24/85	10/02/85
TIME				00:00	00:00	00:00
DDE,PP'		98363			<0.500	
	UG/G-DRY	0				
1,4 OXATHIANE		98644			<0.500	
	UG/G-DRY	0				
DIMP		98645			<3.00	
	UG/G-DRY	0				
VAPONA		98646			<0.300	
	UG/G -DRY	0				
HEXACHLOROCYCLOPENT-ADIENE	UG/G-DRY	98647 0			<1.00	
MALATHION		98648			<2.00	
	UG/G-DRY	0				
ISOBAN		98649			<0.600	
	UG/G-DRY	0				
1,4 DITHIANE		98650			<2.00	
	UG/G- DRY	0				
DICYCLOPENTADIENE		98651			<6.00	
	UG/G-DRY	0				
DBCP(NEMAGON)		98652			<0.005	
	UG/G-DRY	0				
P-CLPHENYLMETHYL-SULFIDE	UG/G-DRY	98653 0			<0.300	
P-CLPHENYLMETHYL-SULFOXID	UG/G-DRY	98654 0			<1.00	
ATRAZINE		98655			<0.500	
	UG/G-DRY	0				
SUPONA		98656			<0.900	
	UG/G-DRY	0				
DMMP		98657			<3.00	
	UG/G-DRY	0				
PARATHION		98658			<2.00	
	UG/G-DRY	0				
P-CLPHENYLMETHYL-SULFONE	UG/G-DRY	98703 0			<0.400	
TRANS-1,2-DICHLORO-ETHENE	UG/G-DRY	98687 0		<0.300	<0.800	<0.800
ETHYLBENZENE		98688		<0.300	<0.400	<0.400
	UG/G-DRY	0				
METHYLENE CHLORIDE		98689		0.868	NA	NA
	UG/G-DRY	0				

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 2662A PROJECT MANAGER MICHAEL WITT
2662AX LAB COORDINATOR PAUL GEISZLER

SAMPLE ID/#

PARAMETERS	UNITS	STORET # / METHOD	BLK 2662A 83	BLK 2662A 90	BLK 2662A 91
DATE			10/08/85	09/24/85	10/02/85
TIME			00:00	00:00	00:00
TETRACHLOROETHENE	UG/G-DRY	98690 0	<0.300	<0.500	<0.500
TOLUENE	UG/G-DRY	98691 0	<0.300	<0.300	<0.300
1,1,1-TRICHLORO-ETHANE	UG/G-DRY	98692 0	<0.300	<0.500	<0.500
1,1,2-TRICHLORO-ETHANE	UG/G-DRY	98693 0	<0.300	<0.600	<0.600
TRICHLOROETHENE	UG/G-DRY	98694 0	<0.300	<0.600	<0.600
M-XYLENE	UG/G-DRY	98695 0	<0.300	<0.300	<0.300
MIBK	UG/G-DRY	98696 0	<0.500	<0.400	<0.400
DMDS	UG/G-DRY	98697 0	<0.300	<4.00	<4.00
BENZENE	UG/G-DRY	98699 0	<0.300	<1.00	<1.00
O-AND/OR P-XYLENE	UG/G-DRY	98700 0	<0.500	<0.500	<0.500
CARBON TETRACHLORIDE	UG/G-DRY	98680 0	<0.300	<0.400	<0.400
CHLOROBENZENE	UG/G-DRY	98681 0	<0.300	<0.300	<0.300
CHLOROFORM	UG/G-DRY	98682 0	<0.300	<0.700	<0.700
1,1-DICHLOROETHANE	UG/G-DRY	98683 0	<0.300	<0.500	<0.500
1,2-DICHLOROETHANE	UG/G-DRY	98684 0	<0.300	<0.400	<0.400
BICYCLOHEPTADIENE	UG/G-DRY	98686 0	<0.300	<0.800	<0.800
DBCP(NEMAGON)	UG/G-DRY	98652 09		<0.005	
DBCP	UG/G-DRY	98652 H9		<0.005	
UNK.025	UG/G	90140 0			
UNK.085	UG/G	90142 0			

PROJECT NUMBER 05931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 2662A PROJECT MANAGER MICHAEL WITT
2662AX LAB COORDINATOR PAUL GEISZLER

SAMPLE ID/#

PARAMETERS	UNITS	STORET # METHOD	BLK 2662A 83	BLK 2662A 90	BLK 2662A 91
DATE			10/08/85	09/24/85	10/02/85
TIME			00:00	00:00	00:00
UNK094		90007			
	UG/G	0			
UNK109		90143			
	UG/G	0			
UNK124		90144			
	UG/G	0			
UNK563		90034			
	UG/G	0			
UNK604		90061			
	UG/G	0			
UNK615		90071			
	UG/G	0			
UNK633		90085			
	UG/G	0			
UNK614		90070			
	UG/G	0			
UNK629		90082			
	UG/G	0			
UNK520		90155			
	UG/G	0			
UNK551		90095			
	UG/G	0			
UNK561		90032			
	UG/G	0			
UNK562		90033			
	UG/G	0			
UNK634		90086			
	UG/G	0			
UNK526		90156			
	UG/G	0			
UNK547		90094			
	UG/G	0			
UNK582		90045			
	UG/G	0			
UNK606		90065			
	UG/G	0			
UNK625		90078			
	UG/G	0			
UNK654		90113			
	UG/G	0			

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266ZA PROJECT MANAGER MICHAEL WITT
266ZAX LAB COORDINATOR PAUL GEISZLER

SAMPLE ID/#

PARAMETERS	UNITS	STORET # METHOD	BLK 266ZA 83	BLK 266ZA 90	BLK 266ZA 91
DATE			10/08/85	09/24/85	10/02/85
TIME			00:00	00:00	00:00
UNK.581		90101			
	UG/G	0			
UNK.513		90116			
	UG/G	0			
UNK.579		90043			
	UG/G	0			
UNK.578		90042			
	UG/G	0			
UNK.585		90102			
	UG/G	0			
UNK.605		90062			
	UG/G	0			
UNK.557		90031			
	UG/G	0			
UNK.553		90030			
	UG/G	0			
UNK.611		90067			
	UG/G	0			
UNK.628		90081			
	UG/G	0			
UNK.630		90106			
	UG/G	0			
UNK.519		90091			
	UG/G	0			
UNK.539		90129			
	UG/G	0			
UNK.560		90126			
	UG/G	0			
UNK.144		90009			
	UG/G	0			
UNK.148		90165			
	UG/G	0			
UNK.163		90167			
	UG/G	0			
UNK.174		90168			
	UG/G	0			
UNK.178		90170			
	UG/G	0			
UNK.193		90173			
	UG/G	0			

PROJECT NUMBER 85931 0420 PROJECT NAME RMA ONPOST
FIELD GROUP 266ZA PROJECT MANAGER MICHAEL WITT
266ZAX LAB COORDINATOR PAUL GEISZLER

SAMPLE ID/#

PARAMETERS	UNITS	STORET # METHOD	BLK 266ZA 83	BLK 266ZA 90	BLK 266ZA 91
DATE			10/08/85	09/24/85	10/02/85
TIME			00:00	00:00	00:00
UNK 047		90160			
	UG/G	0			
UNK 182		90171			
	UG/G	0			
UNK 186		90172			
	UG/G	0			
UNK 199		90174			
	UG/G	0			
UNK 011		90175			
	UG/G	0			
UNK 133		90176			
	UG/G	0			
UNK 159		90177			
	UG/G	0			
UNK 145		90146			
	UG/G	0			
UNK 177		90169			
	UG/G	0			

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PROJECT NUMBER 86933 0420 PROJECT NAME RMA TASK14 BF
FIELD GROUP 26-60F PROJECT MANAGER M. WITT
26-6UNK LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET #	METHOD	SAMPLE ID/# 4640A 26-68F 1	4640B 26-68F 2	4641A 26-68F 3	4641B 26-68F 4	4642A 26-68F 5	4642B 26-68F 6	4643A 26-68F 7	4644A 26-68F 9	4644B 26-68F 10	4645A 26-68F 11	4645B 26-68F 12	4646A 26-68F 13	4646B 26-68F 14	BLK 26-68F 80
DATE				10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/24/86	10/24/86	10/24/86	10/24/86	10/24/86	10/24/86	10/22/86
TIME				08:58	09:13	10:32	10:47	12:01	12:09	13:09	10:58	11:05	08:41	08:52	09:45	09:55	00:00
SAMPLE TYPE		71999 0		SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
SAMPLE DEPTH	FT	99758A 0		0.0	2.98	0.0	2.00	2.00	2.00	0.0	0.0	2.00	0.0	2.00	0.0	2.00	0.0
SITE TYPE 1		99759 0		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	QCMB
INSTALLATION CODE	SAMPLE	99720 0		RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK
SAMPLING TECHNIQUE		72005 0		U	U	U	U	U	U	U	U	U	U	U	U	U	G
MOISTURE	%WET WT	70320 1		5.5	6.1	13.9	12.0	12.4	9.3	15.0	15.9	16.8	10.9	12.1	11.6	13.8	2.4
ALDRIN	UG/G-DRY	98356 Q9		<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	36	120	42	5.1	23	<0.90	<0.90	<0.90
ATRAZINE	UG/G-DRY	98655 Q9		<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<18	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70
CHLORDANE	UG/G-DRY	98361 Q9		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
P-CLPHENYLMETHYL-SULFIDE	UG/G-DRY	98653 Q9		2.7	<0.30	<0.30	<0.30	<0.30	<0.30	<7.5	100	22	<0.30	4.8	<0.30	<0.30	<0.30
P-CLPHENYLMETHYL-SULFOXIDE	UG/G-DRY	98654 Q9		<0.40	0.77	<0.40	<0.40	<0.40	<0.40	<10	1.2	0.62	<0.40	1.2	<0.40	<0.40	<0.40
P-CLPHENYLMETHYL-SULFONE	UG/G-DRY	98703 Q9		4.7	4.9	5.7	2.5	2.7	<0.30	72	13	4.3	5.5	5.4	4.2	1.0	<0.30
DBCP(NEMAGON)	UG/G-DRY	98652 Q9		<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<7.5	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
DICYCLOPENTADIENE	UG/G-DRY	98651 Q9		<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	83	5.5	0.35	<0.30	<0.30	<0.30	<0.30	<0.30
DDE,PP'	UG/G-DRY	98363 Q9		<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<7.5	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
DDT,PP'	UG/G-DRY	98364 Q9		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<10	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
DIELDRIN	UG/G-DRY	98365 Q9		<0.30	<0.30	1.2	0.92	<0.30	<0.30	29	85	23	6.2	13	0.92	0.47	<0.30
DIMP	UG/G-DRY	98645 Q9		<0.50	<0.50	0.51	<0.50	<0.50	<0.50	<13	<0.50	2.1	0.60	0.70	<0.50	1.0	<0.50
1,4 DITHIANE	UG/G-DRY	98650 Q9		<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<7.5	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
DMMP	UG/G-DRY	98657 Q9		<2.0	6.0	<2.0	<2.0	<2.0	<2.0	<50	7.8	4.5	<2.0	<2.0	<2.0	<2.0	<2.0

PROJECT NUMBER 86933 0420 PROJECT NAME RMA TASK14 BF
FIELD GROUP 26-6BF PROJECT MANAGER M. WITT
26-6UNK LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET #	METHOD	SAMPLE ID/# 4640A 26-6BF 1	4640B 26-6BF 2	4641A 26-6BF 3	4641B 26-6BF 4	4642A 26-6BF 5	4642B 26-6BF 6	4643A 26-6BF 7	4644A 26-6BF 9	4644B 26-6BF 10	4645A 26-6BF 11	4645B 26-6BF 12	4646A 26-6BF 13	4646B 26-6BF 14	BLK 26-6BF 80
DATE				10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/24/86	10/24/86	10/24/86	10/24/86	10/24/86	10/24/86	10/22/86
TIME				08:58	09:13	10:32	10:47	12:01	12:09	13:09	10:58	11:05	08:41	08:52	09:45	09:55	00:00
ENDRIN		98369		<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<18	100	16	2.2	5.2	<0.70	<0.70	<0.70
	UG/G-DRY.		Q9														
HEXACHLOROCYCLOPENT-ADIENE	UG/G-DRY	98647	Q9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
ISODRIN		98649		<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	12	14	2.3	<0.30	<0.30	<0 30	<0.30	<0.30
	UG/G-DRY		Q9														
MALATHION		98648		<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<15	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60
	UG/G-DRY		Q9														
1,4 OXATHIANE		98644		<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<7.5	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	UG/G-DRY		Q9														
ETHYPARATHION		98658		<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<18	<0.70	<0.70	<0.70	<0.70	<0,70	<0.70	<0.70
	UG/G-DRY		Q9														
SUPONA		98656		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<13	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	UG/G-DRY		Q9														
VAPONA		98646		<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<7.5	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	UG/G-DRY		Q9														
CADMIUM,SED		1028		<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	
	UG/G- DRY		R9														
CHROMIUM,SOIL		99564		9.67	12.4	21.6	15.7	10.4	15.7	18.7	17.5	13.9	13.3	14.2	15.9	11.7	
	UG/G-DRY		R9														
COPPER,SED		1043		11.8	182	119	361	60.2	24.8	121	234	241	238	343	63.4	68.6	
	UG/G- DRY		R9														
LEAD,SED		1052		<17.0	<17.0	<17.0	<17.0	<17.0	<17.0	<17.0	19.3	<17.0	<17.0	<17.0	<17.0	<17.0	
	UG/G-DRY		R9														
ZINC,SED		1093		30	42	50	56	47	50	65	66	51	52	54	56	42	
	UG/G-DRY		R9														
UNK514		90128								40.9					0.424		
	UG/G		36														
UNK516		90011			29.7		0.593			788	9.82		9.42	1.84	17.4	2.02	
	UG/G		36														
UNK520		90155								28.8							
	UG/G		36														
UNK521		90521								33.9							
	UG/G		36														
UNK523		90092				0.855		0.486		13.8			1.29	1.49		1.73	
	UG/G		36														
UNK524		90015		4.49	1.78	1.18	2.38				4.91	2.78			1.36		
	UG/G		36														
UNK525		90016				1.02											
	UG/G		36														

PROJECT NUMBER 86933 0420 PROJECT NAME RMA TASK14 BF
FIELD GROUP 26-6BF PROJECT MANAGER M. WITT
26-6UNK LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 4640A 26-6BF 1	4640B 26-6BF 2	4641A 26-6BF 3	4641B 26-6BF 4	4642A 26-6BF 5	4642B 26-6BF 6	4643A 26-6BF 7	4644A 26-6BF 9	4644B 26-6BF 10	4645A 26-6BF 11	4645B 26-6BF 12	4646A 26-6BF 13	4646B 26-6BF 14	BLK 26-6BF 80
DATE			10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/24/86	10/24/86	10/24/86	10/24/86	10/24/86	10/24/86	10/22/86
TIME			08:58	09:13	10:32	10:47	12:01	12:09	13:09	10:58	11:05	08:41	08:52	09:45	09:55	00:00
UNK527		90017														
	UG/G	36							103							
UNK528		90132			0.985				604	3.20	2.90	1.39		5.52		
	UG/G	36														
UNK531		90531							247		2.09					
	UG/G	36														
UNK534		90114					0.486		11.6		1.23			1.01		
	UG/G	36														
UNK535		90093			1.00											
	UG/G	36														
UNK539		90129							16.2					4.12		
	UG/G	36														
UNK542		90024			0.567							0.664				
	UG/G	36														
UNK544		90026							10.4							
	UG/G	36														
UNK546		90028		0.331												
	UG/G	36														
UNK547		90094							40.9	8.85				2.32		
	UG/G	36														
UNK548		90029			0.375											
	UG/G	36														
UNK549		90125	0.482			1.19			30.6							
	UG/G	36														
UNK550		90550		0.512										2.48		
	UG/G	36														
UNK551		90095	0.698	0.426						1.89						
	UG/G	36														
UNK552		90157			1.00		0.441		48.6	5.89		0.842	1.09			
	UG/G	36														
UNK553		90030	1.04	3.23	1.63	0.894	0.740		14.1	1.96		0.742		4.19	0.437	
	UG/G	36														
UNK554		90096			0.451	0.799					0.933	0.578	1.07			
	UG/G	36														
UNK555		90097		8.73										4.31		
	UG/G	36														
UNK557		90031	0.822	1.45	1.77	1.30							0.884		1.48	
	UG/G	36														
UNK558		90098		5.55						11.8	9.38	3.19				
	UG/G	36														

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PROJECT NUMBER 86933 0420 PROJECT NAME RMA TASK14 BF
FIELD GROUP 26-6BF PROJECT MANAGER M. WITT
26-6UNK LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 4640A 26-6BF 1	4640B 26-6BF 2	4641A 26-6BF 3	4641B 26-6BF 4	4642A 26-6BF 5	4642B 26-6BF 6	4643A 26-6BF 7	4644A 26-6BF 9	4644B 26-6BF 10	4645A 26-6BF 11	4645B 26-6BF 12	4646A 26-6BF 13	4646B 26-6BF 14	BLK 26-6BF 80
DATE			10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/24/86	10/24/86	10/24/86	10/24/86	10/24/86	10/24/86	10/22/86
TIME			08:58	09:13	10:32	10:47	12:01	12:09	13:09	10:58	11:05	08:41	08:52	09:45	09:55	00:00
UNK559		90099	0.360		0.623			0.562						12.1		
	UG/G	36														
UNK561		90032							16.7							
	UG/G	36														
UNK562		90033	4.72		1.65	0.407	2.18	0.625	12.2	15.2	2.88	0.752	3.04		11.8	
	UG/G	36														
UNK563		90034	1.42		5.70	3.27	0.904			2.35	4.35	5.07	4.61		2.33	
	UG/G	36														
UNK564		90035				1.84						3.95			1.95	
	UG/G	36														
UNK567		90036		0.389												
	UG/G	36														
UNK570		90570		2.96	1.14	1.07						0.451		9.89	0.422	
	UG/G	36														
UNK013		90135														
	UG/G	36														
UNK579		90043		0.487					48.1	23.1	2.13			0.621		
	UG/G	36														
UNK580		90044		1.14										0.658		
	UG/G	36														
UNK581		90101							22.6			1.55	4.19	0.363		
	UG/G	36														
UNK582		90045				0.589				82.8	16.6	0.372	0.840			
	UG/G	36														
UNK586		90047		1.42							0.898			1.22		
	UG/G	36														
UNK587		90048		0.924						12.7	3.27					
	UG/G	36														
UNK588		90049		1.34												
	UG/G	36														
UNK593		90052		0.351												
	UG/G	36														
UNK595		90054		0.338									0.627			
	UG/G	36														
UNK596		90055		0.369						4.91	1.13	0.677	1.27	0.364		
	UG/G	36														
UNK598		90056		0.625	0.462							0.723				
	UG/G	36														
UNK602		90059		0.430							0.696			1.22		
	UG/G	36														

PROJECT NUMBER 86933 0420 PROJECT NAME RMA TASK14 BF
FIELD GROUP 26-6BF PROJECT MANAGER M. WITT
26-6UNK LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 4640A 26-6BF 1	4640B 26-6BF 2	4641A 26-6BF 3	4641B 26-6BF 4	4642A 26-6BF 5	4642B 26-6BF 6	4643A 26-6BF 7	4644A 26-6BF 9	4644B 26-6BF 10	4645A 26-6BF 11	4645B 26-6BF 12	4646A 26-6BF 13	4646B 26-6BF 14	BLK 26-6BF 80
DATE			10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/22/86	10/24/86	10/24/86	10/24/86	10/24/86	10/24/86	10/24/86	10/22/86
TIME			08:58	09:13	10:32	10:47	12:01	12:09	13:09	10:58	11:05	08:41	08:52	09:45	09:55	00:00
UNK.603	UG/G	90060 36		0.597	0.394	0.383				19.4	3.32	1.48	3.64	0.851		
UNK.606	UG/G	90063 36		0.677												
UNK.609	UG/G	90066 36		2.27	1.11	0.994					0.962	1.58	1.46	2.95	0.613	
UNK.610	UG/G	90124 36			0.394	0.382								0.428	0.403	
UNK.611	UG/G	90067 36		0.408												
UNK.612	UG/G	90068 36		0.746												
UNK.614	UG/G	90070 36	0.748	0.983		2.33	0.975	1.97			2.36		1.22	0.474	2.45	
UNK.615	UG/G	90071 36		0.454								0.539	1.01			
UNK.618	UG/G	90073 36	0.345	0.704	4.05	3.58	0.688	0.337			1.71	1.31	4.06	1.41	2.34	
UNK.619	UG/G	90105 36		4.39			0.396						0.864	1.18		
UNK.620	UG/G	90074 36			1.90	1.19					1.07		0.783		0.816	
UNK.621	UG/G	90075 36		2.86									0.992	0.531		
UNK.622	UG/G	90076 36		3.62	0.549	0.815								1.29	0.355	
UNK.625	UG/G	90078 36		0.700									0.645			
UNK.628	UG/G	90081 36		0.773		0.446			9.47			0.745	1.98		0.439	
UNK.632	UG/G	90084 36							16.0	8.16						
UNK.635	UG/G	90087 36			5.06	0.617								6.19		
UNK.636	UG/G	90088 36							16.5			0.414				
UNK.640	UG/G	90199 36							18.6							
UNK.645	UG/G	90645 36							14.4							

ENVIRONMENTAL SCIENCE & ENGINEERING 03/18/87 STATUS:

PROJECT NUMBER 86933 0420
FIELD GROUP 26-6BF
26-6UNK

PROJECT NAME RMA TASK14 BF
PROJECT MANAGER M. WITT
LAB COORDINATOR PAUL GEISZLER

SAMPLE ID/#

PARAMETERS	UNITS	STORET # METHOD	BLK 26-6BF 81
DATE			10/24/86
TIME			00:00
SAMPLE TYPE		71999 0	SO
SAMPLE DEPTH	FT	99758A 0	0.0
SITE TYPE 1		99759 0	QCMB
INSTALLATION CODE		99720 0	RK
SAMPLING TECHNIQUE	SAMPLE	72005 0	G
MOISTURE	%WET WT	70320 1	2.4
ALDRIN	UG/G-DRY	98356 Q9	<0.90
ATRAZINE	UG/G-DRY	98655 Q9	<0.70
CHLORDANE	UG/G-DRY	98361 Q9	<1.0
P-CLPHENYLMETHY-SULFIDE	UG/G-DRY	98653 Q9	<0.30
P-CLPHENYLMETHY-SULFOXIDE	UG/G-DRY	98654 Q9	<0.40
P-CLPHENYLMETHY-SULFONE	UG/G-DRY	98703 Q9	<0.30
DBCP(NEMAGON)	UG/G-DRY	98652 Q9	<0.30
DICYCLOPENTADIENE	UG/G-DRY	98651 Q9	<0.30
DDE,PP'	UG/G-DRY	98363 Q9	<0.30
DDT,PP'	UG/G-DRY	98364 Q9	<0.40
DIELDRIN	UG/G-DRY	98365 Q9	<0.30
DIMP	UG/G-DRY	98645 Q9	<0.50
1,4 DITHIANE	UG/G-DRY	98650 Q9	<0.30
DMMP	UG/G-DRY	98657 Q9	<2.0

PROJECT NUMBER 86933 0420 PROJECT NAME RMA TASK14 BF
FIELD GROUP 26-68F PROJECT MANAGER M. WITT
26-6UNK LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# BLK 26-68F 81
DATE			10/24/86
TIME			00:00
ENDRIN		98369	<0.70
	UG/G-DRY.	Q9	
HEXACHLOROCYCLOPENT-ADIENE	UG/G-DRY	98647 Q9	<1.0
ISODRIN		98649	<0.30
	UG/G-DRY	Q9	
MALATHION		98648	<0.60
	UG/G-DRY	Q9	
1,4 OXATHIANE		98644	<0.30
	UG/G-DRY	Q9	
ETHYPARATHION		98658	<0.70
	UG/G-DRY	Q9	
SUPONA		98656	<0.50
	UG/G-DRY	Q9	
VAPONA		98646	<0.30
	UG/G-DRY	Q9	
CADMIUM,SED		1028	
	UG/G- DRY	R9	
CHROMIUM,SOIL		99584	
	UG/G-DRY	R9	
COPPER,SED		1043	
	UG/G- DRY	R9	
LEAD,SED		1052	
	UG/G-DRY	R9	
ZINC,SED		1093	
	UG/G-DRY	R9	
UNK514		90128	
	UG/G	36	
UNK516		90011	
	UG/G	36	
UNK520		90155	
	UG/G	36	
UNK521		90521	
	UG/G	36	
UNK523		90092	
	UG/G	36	
UNK524		90015	
	UG/G	36	
UNK525		90016	
	UG/G	36	

PROJECT NUMBER 86933 0420 PROJECT NAME RMA TASK14 BF
FIELD GROUP 26-68F PROJECT MANAGER M. WITT
26-6UNK LAB COORDINATOR PAUL GEISZLER

SAMPLE ID/#

PARAMETERS	UNITS	STORET # METHOD	BLK 26-68F 81
DATE			10/24/86
TIME			00:00
UNK.527		90017	
	UG/G	36	
UNK.528		90132	
	UG/G	36	
UNK.531		90531	
	UG/G	36	
UNK.534		90114	
	UG/G	36	
UNK.535		90093	
	UG/G	36	
UNK.539		90129	
	UG/G	36	
UNK.542		90024	
	UG/G	36	
UNK.544		90026	
	UG/G	36	
UNK.546		90028	
	UG/G	36	
UNK.547		90094	
	UG/G	36	
UNK.548		90029	
	UG/G	36	
UNK.549		90125	
	UG/G	36	
UNK.550		90550	
	UG/G	36	
UNK.551		90095	
	UG/G	36	
UNK.552		90157	
	UG/G	36	
UNK.553		90030	
	UG/G	36	
UNK.554		90096	
	UG/G	36	
UNK.555		90097	
	UG/G	36	
UNK.557		90031	
	UG/G	36	
UNK.558		90098	
	UG/G	36	

PROJECT NUMBER 86933 0420 PROJECT NAME RMA TASK14 BF
FIELD GROUP 26-68F PROJECT MANAGER M. WITT
26-6UNK LAB COORDINATOR PAUL GEISZLER

SAMPLE ID/#

PARAMETERS	UNITS	STORET # METHOD	BLK 26-68F 01
DATE			10/24/86
TIME			00:00
UNK559		90099	
	UG/G	36	
UNK561		90032	
	UG/G	36	
UNK562		90033	
	UG/G	36	
UNK563		90034	
	UG/G	36	
UNK564		90035	
	UG/G	36	
UNK567		90036	
	UG/G	36	
UNK570		90570	
	UG/G	36	
UNK013		90135	
	UG/G	36	
UNK579		90043	
	UG/G	36	
UNK580		90044	
	UG/G	36	
UNK581		90101	
	UG/G	36	
UNK582		90045	
	UG/G	36	
UNK586		90047	
	UG/G	36	
UNK587		90048	
	UG/G	36	
UNK588		90049	
	UG/G	36	
UNK593		90052	
	UG/G	36	
UNK595		90054	
	UG/G	36	
UNK596		90055	
	UG/G	36	
UNK598		90056	
	UG/G	36	
UNK602		90059	
	UG/G	36	

PROJECT NUMBER 86933 0420 PROJECT NAME RMA TASK14 BF
FIELD GROUP 26-6BF PROJECT MANAGER M. WITT
26-6UNK LAB COORDINATOR PAUL GEISZLER

SAMPLE ID/#

PARAMETERS	UNITS	STORET # METHOD	BLK 26-6BF 81
DATE			10/24/86
TIME			00:00
UNK603		90060	
	UG/G	36	
UNK606		90063	
	UG/G	36	
UNK609		90066	
	UG/G	36	
UNK610		90124	
	UG/G	36	
UNK611		90067	
	UG/G	36	
UNK612		90068	
	UG/G	36	
UNK614		90070	
	UG/G	36	
UNK615		90071	
	UG/G	36	
UNK618		90073	
	UG/G	36	
UNK619		90105	
	UG/G	36	
UNK620		90074	
	UG/G	36	
UNK621		90075	
	UG/G	36	
UNK622		90076	
	UG/G	36	
UNK625		90078	
	UG/G	36	
UNK628		90081	
	UG/G	36	
UNK632		90084	
	UG/G	36	
UNK635		90087	
	UG/G	36	
UNK636		90088	
	UG/G	36	
UNK640		90199	
	UG/G	36	
UNK645		90645	
	UG/G	36	

APPENDIX 26-6-C
COMMENTS AND RESPONSES

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2405

MAY 02 1989

Ref: 8HWM-SR

Colonel W. N. Quintrell
Program Manager
AMXRM-EE Department of the Army
U.S. Army Toxic and Hazardous Materials Agency
Building 4460
Aberdeen Proving Ground, Maryland 21010-5401

Re: Rocky Mountain Arsenal, (RMA),
Task 6, Site 26-6, Draft Final
Phase I Contamination Assessment
Report, Basin F, November, 1987.

Dear Colonel Quintrell:

We have reviewed the above referenced report and have found it to be satisfactory, pending the Environmental Protection Agency's review of proposed Phase II boring locations after liquid removal is complete. This finding is based on our overall understanding of the subject document, plans for Phase II of the Remedial Investigation, and the Interim Response Action for Basin F. We expect the combinations of these actions will soon lead to a major benefit for the environment, while sufficient evaluation of the extent of the remaining contamination and of final remedial alternatives is proceeding. Our contact on this matter is Mr. Connally Mears at (303) 293-1528.

Sincerely yours,

Robert L. Duprey, Director
Hazardous Waste Management Division

cc: Thomas P. Looby, CDH
David Shelton, CDH
Lt. Col. Scott P. Isaacson
Chris Hahn, Shell Oil Company
R. D. Lundahl, Shell Oil Company
Thomas Bick, Department of Justice
David Anderson, Department of Justice
Mike Witt, ESE

880990

Shell Oil Company

c/o Holme Roberts & Owen
Suite 1800
1700 Broadway
Denver, CO 80290

December 14, 1987

FEDERAL EXPRESS

Mr. Don Campbell
Department of the Army
Program Managers Office for Rocky Mountain Arsenal
Building E4585
Dbl. Trailer
Aberdeen Proving Grounds, Maryland 21010-5401

Re: United States v. Shell Oil

Dear Mr. Campbell:

Enclosed are Shell's technical comments on Site 26-6, Basin F, Task 6.

Sincerely yours,

C. K. Hahn
Manager, Denver Site Project

CKH/jy/14332

Enc.

87147 8-½

cc: (w/enclosure)
USATHAMA
Office of the Program Manager
Rocky Mountain Arsenal Contamination Cleanup
ATTN: AMXRM-EE: Mr. Charles Scharmann
Bldg. E4460, Trailer
Aberdeen Proving Ground, MD 21010-5401

Mr. Thomas Bick
Environmental Enforcement Section
Land & Natural Resources Division
U.S. Department of Justice
P.O. Box 23896
Benjamin Franklin Station
Washington, DC 20026

Lt. Col. Scott P. Isaacson
Headquarters - Department of the Army
ATTN: DAJA-LTE
Washington, DC 20310-2210

Ms. Patricia Bohm
Office of Attorney General
CERCLA Litigation Section
1560 Broadway, Suite 250
Denver, CO 80202

Mr. Dave Shelton
Colorado Department of Health
4210 East 11th Avenue
Denver, CO 80220

Mr. Jeff Edson
Colorado Department of Health
4210 East 11th Avenue
Denver, CO 80220

Mr. Robert L. Duprey
Director, Air & Waste Management Division
U.S. Environmental Protection Agency, Region VIII
One Denver Place
999 18th Street, Suite 1300
Denver, CO 80202-2413

Mr. Connally Mears
U.S. Environmental Protection Agency, Region VIII
One Denver Place
999 18th Street, Suite 1300
Denver, CO 80202-2413

RESPONSE TO SPECIFIC COMMENTS OF SHELL OIL COMPANY ON THE PHASE I DRAFT FINAL TASK 6 REPORT SITE 26-6: BASIN F

Comment 1:
1a. Page iv. Executive Summary

The text should state that this site investigation sampled and analyzed only subsoil beneath Basin F liner.

In the last paragraph, the statement on the condition of the liner in the western part of the basin and along the northern part should be in the context of observations, e.g., liner damage was observed in (few, some, no, etc.) locations..... (Note that the 1982 WES investigation, RIC#82350, reported liner damage at two locations on the western perimeter of the basin.)

Response:

All editorial comments noted. These sections have been revised to be more consistent with the Scope of the Interim Response Action.

1b. Page v, second paragraph.

The text should state what will be done with overburden soil liner and grossly contaminated soil excavated during the interim response action.

Change "impermeable clay cap" to "low permeability clay cap."

Response:

All editorial comments noted. These sections have been revised to be more consistent with the Scope of the Interim Response Action.

1c. Page v: third paragraph

The estimated volume of 498,250 to 566,100 bank cubic yards, consists of both Basin F subsoil and overburden.

The statement in the last sentence that a detailed soil investigation will be conducted after completion of initial closure activities conflicts with the text at 3.0 Phase II Survey (page 73) which states that the Phase II remedial investigation will be done concurrently with interim response action activities.

Response:

All editorial comments noted. These sections have been revised to be more consistent with the scope of the Interim Action Response.

Comment 2:
Pg. 1, 3rd paragraph

The sand unit discussed in the last two sentences is the Slocum Alluvium.

Response:

Editorial change noted.

Comment_3:
p. 1,
4th paragraph

The alluvial/Denver contact is not always "marked by the appearance of weathered claystone or shale" especially in the vicinity of Basin F.

The strike and dip of the Denver may be altered locally by anomaly southeast of the basin.

The two "sand trends" reach a thickness of as much as 40 feet and do "intersect the alluvium" under much of Basin F.

Response:

Editorial changes noted.

Comment_4:
p. 3,
1.3 Hydrology

This section relies primarily on studies done by the Army in 1977 and 1979 (RIC#81266R51 and #81266R15) to describe the hydrology underlying Basin F. More recent, improved understanding of this hydrology should be included in the discussion, if it exists.

In the first paragraph, regional surface water flow in Section 26 is primarily to the northwest, not toward Basins C, D, and E.

Response:

The hydrologic information presented in this section is a compilation of the most comprehensive data available during the early stages of the RI program. Data from subsequent investigations, including those undertaken during the RI will be incorporated into the Study Area Reports (SAR's).

Editorial change noted.

Comment_5:
p. 24, 2.2.1
Basin F Fluid

"Composition" should be substituted for "chemistry" in the first line.

A more recent investigation of Basin F liquid parameters than those listed in the first paragraph was performed by Shell in 1986. Results of Shell's analysis were transmitted to USATHAMA, Attn: Mr. D. Campbell by letter of November 21, 1986.

The discussion in this section, based largely on the 1978 Buhts and Francinques investigation of Basin F liquid and sediments uses the parameters measured in 1978 to characterize the present liquid pool in Basin F. Shell's analyses of samples taken from the Basin F liquid pool in 1986 show significant changes in most all the parameters discussed in Section 2.2.1. Primarily, concentration parameters were markedly high in 1986 compared to 1978, undoubtedly due to the large reduction in Basin F liquid volume which has occurred over this time period due to evaporation. For example, the 1986/1978 concentration enhancement factors on some selected parameters are:

Total dissolved solids (3.5X), TOC (2.8), COD (5.0X), organic content (2.5X). Concentration enhancement of

specific contaminants varied, probably due to phase changes, chemical and biological reactions, weathering, etc. Some examples: Aldrin (1.66X), dieldrin (5.45X), DMMP (0.48X), chloride (2.5X), Phosphorous (5.8X), Copper (5.8X pH of 1986 samples were 5.9-6.0 compared to 7.0-7.3 in most 1978 samples.

The shallower depths of Basin F liquid, and the large areas of exposed overburden would contribute to less homogeneity in the liquid presently within the basin. Contributing factors would include: less mixing, increased sediment/liquid interchange, greater impact of precipitation events, etc. The limited 1986 sampling suggests that this is the case.

The above information strongly indicates that remedial actions should be based on contemporary characterizations of Basin F media.

Response: Editorial change noted.

The data referred to will be included in the North Central Study Area Report. The following passage has been added to the end of Section 2.2.1: "The Buhts and Francinques investigation was conducted more than 7 years before the Phase I Remedial Investigation (RI). In this time period evaporation has decreased the volume of fluid retained in the basin significantly (Meyers and Thompson, 1982, RIC#82350R01, Wilson, 1987), thereby further concentrating the analytes contained therein. In addition, the decreased liquid depth and the increased area of exposed overburden should have induced limitations on mixing, while increasing the potential for sediment/liquid interaction and precipitation of solids.

The results of contemporary investigations of Basin F fluid and overburden composition, performed concurrently with the RI program, will be presented in the RI Final Reports."

Comment_6: p. 35, 2.2.3 Groundwater Characterization

Data on upgradient Wells 26066, 067, 070, 071, 072, 074, 075, 085, 086, 127, 128, and 129 should be included in Table 26-6-8.

In the penultimate sentence of the last paragraph, note that chloroform (29.9 ppb) was detected in Well 26140.

Response: Editorial changes noted. Data from the wells listed have been included in Table 26-6-8 and cited in Section 2.2.3.

Comment_7: p. 38, last sentence

Change to: .....does not imply that Basin F is a source or the sole source.

Response: Editorial change noted.

Comment_8:
p. 39, 3.1
Previous Soil
Investigations

Is it known which of the four soil types described underlie Basin F Proper?

In the second paragraph, the 1982 WES study does not include Basin F liquid analyses.

Response:

The SCS survey does not classify the soil underlying Basin F. To date no documents classifying the soil type(s) beneath Basin F have been discovered by the RI team.

Correction noted.

Comment_9:
p. 40,
Figure 26-6-8

The bulk analyses shown for the 0-1 foot interval of boring 11 is actually the analyses of overburden.

The CPMSO2 concentration in the 0-1 foot interval bulk analysis of Boring 31 is shown in the WES report as 0.6 ppm, not 0.016.

The 3-4 foot interval SWLP analyses for boring 2 is not shown.

The bulk analyses shown on Figure 26-6-8 is not a complete listing of compounds and metals described and reported by the WES study. The text should explain the basis for selecting the contaminants shown.

Responses:

All corrections noted.

A passage has been inserted into the text explaining why the WES results as reported have been limited to the analytes shown in Figure 26-6-8.

Comment_10:
p. 41, First
full paragraph

Bulk_analysis and SWLP_extract_analysis should be defined.

In the first sentence, bulk analyses were conducted on six, not seven, subsoil borings. (The bulk analyses shown on Figure 26-6-8 for boring 11 is the analyses of boring 11 overburden, not subsoil.)

Contrary to what is stated in the third sentence, aldrin, and isodrin were not detected by bulk analyses of any of the subsoil samples.

In the fourth sentence:

3100 ppm aldrin is from analyses of Boring 31 overburden, not subsoil.
530 ppm dieldrin is from analyses of boring 11 overburden, not subsoil.

11 ppm 1,1,2,2-tetrachloroethane in the boring 14 subsoil sample is not shown on Figure 26-6-8.

"The SWLP extract results identified the same set of contaminants, but at concentrations that are generally 2 to 5 orders of magnitude lower than the bulk sample" (fifth sentence). This statement is patently incorrect in several respects. First, there is virtually no correspondence between compounds detected in the SWLP extract results and the bulk analyses of suboil. Furthermore, the SWLP extract target analyte suite in the 1982 WES study was limited to only ten organic compounds and three metals. Thus, solvents, which are the principal contaminants detected in the bulk analysis of Basin F subsoil, were not even analyzed in the SWLP procedure. The statement that contaminant concentrations in the SWLP extracts were 2 to 5 orders of magnitude lower than those of the bulk analyses betrays a poor understanding of these respective analytical procedures and their purposes. The SWLP procedure is a purely pragmatic test to indicate the leaching potential of a soil. It does not in any way indicate the level of contaminants in the soil sample: therefore, comparison of the results of these two tests is inappropriate and illogical.

There is no discussion in this paragraph of the distribution of metals as indicated by the WES study. Arsenic and mercury were detected in all SWLP extract samples. This should be discussed.

Response: All corrections noted. Section 3.1 has been revised to include a more comprehensive summary of the 1982 WES investigation. All comments made have been considered during revision of this section.

Comment_11: p. 43, second paragraph

Along with a correlation of liner condition with soil contamination, it is equally as important to understand the extent and location of liner failure in order to determine the volume of potentially contaminated soil for removal during interim action activities. This has not been accomplished by this Phase I investigation (see Comment 13 below). As a consequence, the extent of contamination of soil proposed for removal during the interim action activity is highly speculative.

The sampling depths of the drainage ditch (boring 4639) listed do not agree with depths shown on Figure 26-6-9.

Response: The RI team concedes that attempting to delineate liner condition over a 93-acre area using data from 72 Phase I RI and WES Borings and observation sites requires very broad interpretation. However, this was judged to be the safest and most practical approach to the problem given the hazardous nature of the basin and the unstable conditions therein. The data gathered from these points were used to delineate areas within the basin to be excavated to the

maximum depth below the liner during the Interim Response Action, and to generate preliminary estimates of the total volumes overburden and underlying soil to be removed.

During the course of the Interim Response Action, a comprehensive investigation of the liner conditions over the basin area will be preformed as the liquids are being pumped out. Additional areas subject to excavation below the 6 in minimum depth will be determined from this investigation.

Correction noted.

Comment_12: p. 44, 2nd full paragraph

Were the sample borings and excavations sealed after sampling to prevent infiltration of liquid into the subsoil?

Response:

All sample borings drilled within the basin were sealed with cement-bentonite grout as described in the Task 6 Technical Plan immediately after the last sample was extracted.

Comment_13:

The Phase I investigation indicates that severe contamination of the subsoil is associated with liner failure, and that where the liner is intact, contamination may be quite limited in depth and contaminants, i.e., liner condition is the paramount parameter defining the extent of contamination below the liner. The purpose of this investigation is to define the extent of contamination below the liner. Yet there is practically no effort made in this section or in this report to analyze the observations of liner conditions, to draw conclusions from this analysis, and to propose further investigations which may be necessary to adequately characterize the condition of the liner areally.

Response:

See response to Comment 11. Section 3.2.5 discusses the relationship between liner integrity and contamination in the underlying soil. As explained above, a more comprehensive investigation to characterize liner condition areally is being conducted during the interim response action.

Comment_14: p. 45, 1st full paragraph

What makes up the suite of metals and semivolatile organic compounds which indicate liner leakage? The second sentence suggests that the supplemental Phase I samples were analyzed for a narrower suite of contaminants than used in the "initial" sampling, however, this is not indicated by the data in Appendix 26-6-B.

How could a decision have been made that agent testing was not necessary when RMA operating records and other documents were not available to the RI Team until after completion of Phase I field activities (page 43, first paragraph)?

Response:

The suite of analytes considered as indicative of liner leakage included organochlorine pesticides, DCPD, and copper. Therefore, the supplemental samples were analyzed by Phase I

methods for semivolatile organics and metals. This is indicated in Table 26-6-12, 26-6-13, and Appendix 26-6-B.

Although the RI team did not have access to all existing documents pertaining to Basin F when the Phase I RI was being designed, numerous documents describing disposal histories at Basin F were available. These documents and interviews with RMA personnel indicated agent compounds were not likely to be present in Basin F. According to Dr. Elijah Jones, the RMA Contamination Control Officer, the fluids in Basin F have been sampled and analyzed for agent compounds on at least two occasions. No agents were detected.

Comment_15: p. 45, 1st paragraph under 3.2.2

"Liner overburden soil covers the remainder of the basin to a maximum depth of 2 ft." Actually, the liner is exposed over large areas in the southern and eastern portions of the basin.

Response:

Editorial comment noted. Field observations note the liner was exposed at several locations in the southern and eastern portions of the basin.

Comment_16: p. 45, 1st bullet

The dark-green crystals which cover most of the exposed overburden should be analyzed.

Response:

Several years ago an unofficial investigation of the composition of the dark green crystals was performed by Dr. Mike Witt, former Chief of the Environmental Division at RMA, and his staff. Their analyses indicated the crystals are primarily composed of sodium or copper salts and copper sulfate.

Comment_17: p. 47, Table 26-6-10

Comparison of soil discoloration comments in Table 26-6-10 with chemical analyses of respective borings indicates that discoloration is not a dependable indicator of contamination. For example, black discoloration was observed in boring 4626 to a depth of 4 inches whereas contamination was detected to the 4-5 foot sample interval.

Response:

Soil discoloration has been noted in these tables as relevant information only. It is to be considered only as a possible indicator that the discolored interval has been affected by contaminated fluids.

Comment_18: Table 26-6-11

The locations of the liner observation sites are not identified by site number on Figure 26-6-12, making it impossible to attempt any interpretation of the data. It would also be useful to indicate the observed liner condition on Figure 26-6-12.

Response:

Editorial comment noted. Figures 26-6-9 and 26-6-12 have been revised to include all liner observation sites, site numbers, and whether damage to the liner was noted.

Comment_19: p. 50, Phase I Analyte Levels and Distribution

The similarities of contamination at the 0-1 foot interval of the subsoil as characterized by the WES study bulk analyses are slight. The reason(s) for this should be understood since it could indicate an analytical problem or be of significance with respect to the distribution of contaminants at shallow levels. The following comment illustrates the importance of understanding the reasons for potential discrepancies.

Response:

The 1982 WES data are presented in this report as background information only. The analytical methods and sampling protocols used by WES are not the same as those employed by the RI team. For these reasons the WES data should not be compared to Phase I RI data. The methods used by the RI are considered to be the most accurate and comprehensive practicable, and all analytical data have undergone thorough QA/QC evaluations. The RI team stands by their data and insists any discrepancies between WES and Phase I data which can be attributed to analytical problems are indicative of deficiencies in WES's program.

Comment_20: p. 71, 1st paragraph of 3.2.5

(A) "However, data also indicate that significant levels of contaminants are present at depths greater than 3 ft beneath areas having good liner integrity."

Twenty-two of the fifty-six soil samples were from intervals below 3 feet at locations where the liner was described as intact. Of these twenty-two in only nine were contaminants detected above the Indicator Levels (the nine include the boring 4629 19-20 interval (xylene 0.4 ppm) and 39-39.5 foot interval (MIBK 1 ppm). None of these nine can be described as having "significant levels of contaminants," i.e., clearly requiring remediation. Therefore, this conclusion is unwarranted.

(B) One explanation for contaminants at depths greater than three feet beneath areas having good liner integrity is that the historical record and aerial photos clearly demonstrate that Basin F was originally constructed as an unlined basin in 1953 to contain overflow from Basin D and also direct discharge from Basin A via the Sand Creek Lateral. (This fact will be discussed in detail in the comments on the site history.)

(C) Another possible explanation for contamination under areas of good liner is overtopping of the liner edge during periods when Basin F was full. The liner was exposed at several locations along the top of the dikes.

Responses:

(A) The meaning of the word significant when used in this context is subject to many interpretations; therefore, this sentence has been revised. "Significant" has been deleted and replaced with "detectable".

(B) At present the RI team has not yet unearthed any documentation conclusively indicating the Basin F area was used or modified to serve as part of the unlined basin network. The records and aerial photographs referred to by Shell will be reviewed by the RI team and any revisions to the site history as presented in Section 2.1 considered necessary will be included in the Phase II addendum to this report and the North Central Study Area Report. If this review confirms Shell's contention, the possibility that soil contamination below areas where the liner is intact is due to previous disposal practices cannot be discounted. Nevertheless, this issue does not affect the Interim Response Action or Phase II plans as proposed.

(C) Comment noted. At present the RI team does not have any documentation specifically indicating that the basin fluid level ever overlapped the edges of the liner: however, it may be possible that this has occurred at some time in the basin's history.

Comment_21: p. 72, third sentence

It would be helpful to show on Figure 26-6-9 the location of the April 1957 break in the liner along the eastern shore of the basin.

Response:

In a recent conversation, Mr. George F. Donnelly, Former chief of the Facilities Engineering Division at RMA indicated the tear in the liner occurred along the northwest-northern perimeter of the basin where rip-rap had not been placed to reinforce the dike or protect the liner. The approximate location is given in Figures 26-6-9, 26-6-10, 26-6-12.

Comment_22: p. 72, last paragraph

"To summarize, where integrity of the liner material is poor or questionable, elevated concentrations of a wide variety of organic contaminants occur in the soil column as deep as 20 ft."

This study casts almost no light on the vertical migration of contaminants beneath damaged liner. Only one boring (4620) was drilled to 20 feet at a site where liner damage was observed and, as discussed earlier on page 72, the situation at this location is confounded by a nearby major break in the liner. Only one other boring deeper than 5 feet (4627) was located where the liner integrity is questionable. This boring indicates measurable vertical migration of only soluble contaminants present at shallow depths. Therefore, it is not possible to conclude from this study the depth to which contamination has migrated underneath damaged liner.

Response:

The Phase II borings to be drilled within the basin area after the liner overburden and grossly contaminated subliner soil have been excavated will further quantify the vertical extent of contamination in the unsaturated soil.

Comment_23: p. 73, 1st paragraph under 3.3

This description of Basin F interim response action indicates that the excavated basin will remain exposed, without recontouring and capping, while the Phase II program is executed. This is not consistent with Shell's understanding of the interim response plan and, if pursued, could result in the generation of a large amount of contaminated liquid to be treated.

It should be noted in this paragraph that burden, liner, and excavated subsoil will be stabilized by solidification prior to temporary storage.

"Impervious clay cap" should be changed to "low permeability clay cap."

Response:

Editorial comments noted. This section has been revised to include a more accurate description of the Basin F Interim Action Plan. The reader may also wish to refer to the RFP (COE, 1987) and Proposed Work Plan (EBASCO, 1987) for this effort.

Soil sampling within the basin will coincide with the interim action activities. Before excavation of any part of the basin interior is initiated, dikes will be constructed of noncontaminated material to prevent surface runoff from coming in contact with any contamination. Any runoff that does enter contaminated areas of the basin will be directed to the North Surface Impoundment. The basin itself will be partitioned into discrete areas for excavation and treatment. After a particular area has been excavated and the contaminated material treated by solidification/absorption and transferred to the waste pile, the soil sampling team will enter the area and begin drilling. After sampling has been completed, the area will be sealed with a low permeability clay cap.

Comment_24: P. 73, last paragraph

Collection of shallow soil samples (0.0-0.5 feet) on the eastern side of Basin F is of questionable value due to the sewer excavation activities. Sampling of soils in these areas is of no value in determining if air borne particles from Basin F contaminated the area if the previous activities have either removed the top soil or contaminated the top soil.

Response:

The N45°E vector along which sampling has been proposed extends across the traces of two sewer lines that once connected Basin F with the deep well surface facilities, but continues south of the support facilities area. The proposed sampling points along this vector do not coincide with any areas that were disturbed during removal of these sewer lines or demolition of the surface facilities. The N112°E vector does not cross any areas affected by the removal of the deep

well and surface facility sewers or treatment buildings. Of the five vectors proposed for surficial soil sampling, these are the only two directed east of the basin.

Comment_25: page 74, 3.3 Phase II Survey

For what reason will the Phase II boring plan for the basin proper be determined after the liner, overburden and subsoil have been removed? The Phase II boring program to characterize the vertical and lateral extent of contamination in the basin interior is inadequately defined especially considering that this program is closely integrated with imminent Basin F interim response action activity. Only an initial Phase II boring program is summarized for estimation purposes but without any discussion of its purpose or of an implied followup Phase II program. This section should be expanded to describe the specific objectives of the Phase II survey and how these objectives will be met, including integration with interim action activity.

The initial boring program as outlined is clearly insufficient to provide the necessary definition of subsoil contamination. Most of the Phase I borings in which elevated contamination levels were detected did not penetrate to uncontaminated soil, thus Phase I data reveals very little about vertical contamination.

Also, because of the limited number of borings, the Phase I data reveals little about the lateral pattern of contamination around borings displaying extensive vertical contamination. A substantial Phase II boring program is indicated to define subsoil contamination. Consideration should be given to performing more observations of liner condition for the purpose of focusing the Phase II investigation on areas most prone to liner damage.

Response:

A comprehensive survey of the liner condition will be performed during the Interim Response Action. The results of this survey will be considered with the data from the Phase I investigations and the soil conditions encountered during excavation in determining the actual depths and locations of the Phase II borings. A primary concern of the contractor conducting the Interim Response Action will be to implement a Phase II boring program which will provide more than adequate coverage of the site.

The intent of the Phase II borings within and outside of the basin is to provide data from which to design the final remediation plan. Depending on the results of these borings, additional borings/samples may be recommended during the Feasibility Study (FS) to refine the final remediation plan. The Phase I program was designed to identify areas where the liner condition is generally poor or questionable and the underlying soil is grossly contaminated. The Phase I data have been used to estimate areas in which subliner soil is to be excavated to depth during the Interim Response Action.

Guided by these estimates and the liner and subliner soil conditions encountered, the contractor will excavate grossly contaminated subliner soil in each area to a maximum depth of 6 ft.

Comment_26: 1st full paragraph

What is the logic for analyzing for arsenic and mercury only at the 0-1 and 4-5 foot intervals? There has been insufficient characterization of contamination with depth to presume knowledge of the distribution of any specific contaminant.

Response:

Mercury was not detected in any Phase I samples from below 0 to 1 ft. Arsenic was detected in concentrations above the indicator range in 7 of 56 samples analyzed, 2 of which were from the 9- to 10-ft interval; arsenic was not detected below 9 to 10 ft. As arsenic is more likely to adsorb to soils under oxidizing conditions than somewhat more mobile compounds, such as DIMP which are also indicative of Basin F contamination, it was decided to limit arsenic analyses to the 0- to 1-ft and 4- to 5-ft intervals.

Comment_27: page 77, third paragraph

The proposed Phase II sampling program outside the basin consists of 10 borings to 10 feet, 2 to 20 feet and 4 to 40 feet (water table). For the purpose of investigating lateral and vertical extent of soil contamination (in the vadose zone) immediately adjacent to Basin F, it would be preferable to use borings deeper than 10 feet. Also, some of the borings should be displaced laterally from the fence line to investigate lateral migration.

Response:

The 10-ft borings, coupled with the 20-ft and water table borings, are considered adequate to characterize the vertical extent of any contamination emanating from the basin. If the Phase II results indicate more samples are necessary, this issue will be addressed during the FS.

The 10-ft and water table (40 ft) borings outside the basin will be offset at varying distances from the Basin F fence.

Comment_28: page 78, first paragraph

How will the Site Geologist determine samples to be analyzed by GC/MS? As previously noted, visual observation is not a reliable indicator of contamination.

Response:

The Phase I GC/MS analyses will be performed only as an adjunct to the quantitative Phase II GC method analyses. The Site Geologist will decide which intervals to be analyzed by GC/MS based on field observations and professional discretion.

Comment_29: page 78, last paragraph

Phase I data are only suggestive of some areas of the basin subsoil which may be more contaminated than other areas. However, Phase I does not define either lateral or vertical patterns of contamination in any specific site or area. Therefore, Phase I is of marginal value in defining

contaminated volumes and locations. Shell questions whether, on the basis of Phase I data, the removal of subsoil during interim response action provides any benefit to the protection of human health and the environment beyond what will be provided by removal of the sludge, liner and liquid, recontouring and capping of the basin area and the installation of an intercept system down gradient of Basin F. Shell recommends that, in the absence of identified benefit, no subsoil be removed during the interim response action.

Response: Although the Phase I data are not extensive enough to allow for precise determination of the total volume of potentially contaminated subliner soil within the site area, the data have identified varying degrees of contamination at several locations. The areas where the soil is significantly contaminated may be active or potential sources of contamination to the underlying water table. The interim action will remove this contaminated soil to a maximum depth of 6 ft along with the liner and overburden, because of the possible threat to ground water. The interim action plan, while it is not considered a final remediation plan, is intended to alleviate any potential hazards to local populations and wildlife posed by the basin. The contaminant concentrations detected in Borings 4620 and 4626, for example, are considered significant enough to warrant removal of subliner soil with the liner and overburden.

Comment_30: page 79, first paragraph: The contamination levels detected in most of the few, widely-spaced Phase I borings in the northern and western sections of Basin F (area identified in Figure 26-6-12 for 6-inch removal depth) do not indicate "gross" or "significant" contamination, i.e., obviously requiring remediation of the soil. A decision to remove subsoil from this area is therefore arbitrary.

Response: The samples from the borings in the 6 inch removal depth area did contain detectable amounts of contamination. Given the nature of the equipment required to excavate this area, it was considered impractical to expect the contractor to limit excavation to the bottom of the liner only. Therefore a 6 inch removal depth was estimated to give the contractor some latitude.

Comment_31: page 81, first paragraph: On what basis is it concluded that the liner in this large area is "generally poor"? No data is provided to support this conclusion.

"The 6-ft minimum removal depth was selected for subliner soil in this area, because the soil is grossly contaminated above this depth." Subsoil in the area described (south of boring 4620 and east of boring 4640) is undoubtedly contaminated at some sites. However, characterization of this large area as being grossly contaminated above the 6-foot depth level is a complete unwarranted generalization.

Of the 17 Phase I borings in this area of Basin F, half cannot readily be characterized as significantly contaminated. Moreover, only three borings (4620, 4626, 4627) displaying the high levels of contamination were sampled below the 2-3 foot sample interval. Thus, the quantity of contaminated subsoil in the 185,700 to 229,500 bank cubic yards proposed for removal from this area are questionable.

Response: This section has been revised and the statements cited have been deleted. Borings 4620, 4626, and 4627 are included within the areas designated for excavation down to 6 ft. The estimated volume of potentially contaminated soil to be removed from these areas is 160,000 bcy.

Comment 32: Figure 26-6-12 — Observation points should be labeled on this figure.

Response: Comment noted. Observation points have been added.

Comment 33: page 82, last paragraph — The estimated 1.5 foot average depth of overburden is probably low. It is likely that the area covered by the North Pool (and therefore not sampled) contains significant volumes of precipitated solids and eroded soil from the upstream beach areas. This pool areas comprises about 23.5 of the 93 acre basin area (25 percent).

Response: Comment noted.

Comment 34: Page 93 — Reference 38 to 49 are missing as are 57 and those following 57. These references must be provided for review.

Response: These references have been provided.

STATE OF COLORADO

COLORADO DEPARTMENT OF HEALTH

4210 East 11th Avenue
Denver, Colorado 80220
Phone (303) 320-8333

Roy Romer
Governor

Thomas M. Vernon, M.D.
Executive Director

March 16, 1988

Mr. Donald Campbell
Office of the Program Manager
RMA Contamination Cleanup
AMXRM-EE, Building E4460
Department of the Army
Aberdeen Proving Grounds, Maryland 21010-5401

Re: Task 6, Site 26-6, Basin F, Contamination Assessment Report

Dear Mr. Campbell:

Enclosed are the State's comments on Task 6, Site 26-6, Basin F, Contamination Assessment Report.

While the State believes that the Army has made an effort to identify the contamination in and around Basin F, the State has two principal concerns regarding this CAR. The first is that Basin F is a RCRA regulated facility and, therefore, must be closed in accordance with the Colorado Hazardous Waste Management Act. The State's second major concern is that the Phase I investigation of Basin F did not adequately define the nature and extent of contamination and the proposed Phase II will not fill in the data gaps remaining from Phase I. The Army must identify all contaminants found in and around Basin F, and must define the vertical extent of soil contamination beneath the basin.

If you have any questions, please contact Mr. Jeff Edson with this Division.

Sincerely,

David C. Shelton
Director
Hazardous Materials and
Waste Management Division

DCS:nr

cc: Michael Hope, Attorney General's Office
Chris Hahn, Shell Oil Company
Connally Mears, U.S. Environmental Protection Agency
David Anderson, Department of Justice
Edward McGrath, Holme, Roberts and Owen
Mike Gaydosh, U.S. Environmental Protection Agency

RESPONSES TO SPECIFIC COMMENTS OF COLORADO DEPARTMENT OF HEALTH ON THE PHASE I DRAFT FINAL TASK 6 REPORT SITE 26-6 - BASIN F

It is the Army's position that Basin F is not a RCRA-regulated facility and therefore is not under the jurisdiction of the Colorado Hazardous Waste Management Act. Closure of the basin will be effected after the Remedial Investigations and Feasibility Studies have been completed and the Record of Decision (ROD) has been reached.

The analytical methods and target analytes used during the Phase I investigation were determined based on RMA operations, records, and site histories available during the initial stages of the Remedial Investigation (RI). These methods and analytes were judged to be the most comprehensive and cost-effective available to adequately assess the contamination present at RMA. Although subsequent record searches have revealed the possible presence of contaminants not on the original target analyte list, these compounds are considered to be minor components of the total volume of aqueous wastes disposed in the basin. The target analyte lists used during the Phase I and II investigations include all major contaminants suspected or found to be present in the basin. However, the investigation of this site is a continuous process and subject to revision where considered necessary. At present the RI analytical methods are being evaluated and may be expanded during subsequent FS investigation(s).

The vertical extent of soil contamination beneath the basin will be adequately defined by the Phase II RI sampling outside the basin fence line and sampling performed within the basin coincident with the Interim Response Action (IRA).

General Comments

Comment 1: This 26-6 Contamination Assessment Report (CAR) for Basin F includes information describing the closure of Basin F. Information concerning the closure of Basin F should not be included in a CAR.

Response: The information provided in the Executive Summary and Sections 3.3 and 3.4 of this CAR describe the Interim Response Action (IRA) which should not be construed as a plan for the closure (final remediation) of Basin F. As Phase II sampling within the basin will be driven by the IRA, it is appropriate to describe this program in the CAR.

Comment 2: The Phase I investigation did not accurately define the nature and extent of Basin F contamination because a systematic sampling grid was not used for boring locations. Therefore, the interior of the basin was not adequately sampled or represented in the conclusions of the Basin F Phase I investigation.

Response: The Phase I boring locations and sampling depths were originally presented in the Draft Final Task 6 Technical Plan (ESE, 1985, RIC#86238R05). The Draft Final version of this plan was submitted to all Parties and the State for comment

September 19, 1985. CDH comments were received November 19, 1985. These comments did not question the adequacy of the Phase I boring program at Basin F. The State is requested to describe how a systematic sampling grid would have allowed for a more accurate definition of the contamination within the basin. The Army agrees that the basin interior was not adequately sampled during the Phase I investigation; for this reason a Phase II program coincident with the IRA has been proposed. Borehole locations and sampling depths will be determined by the contractor performing the IRA.

Comment_3: A complete GC/MS scan of all chemical analytes must be done because of the complexity and the chemical diversity of the contaminants in the basin. The CAR lists many chemicals known to be disposed in Basin F that were not analyzed in Phase I. RCRA and the Colorado Hazardous Waste Management Act require that a complete analysis be done on the impoundment prior to closure to identify all contaminants present.

Response: See preceeding response to the general comments made in the cover letter.

Comment_4: The Phase I investigation failed to define the vertical extent of contamination in the basin. Several samples in the Phase I investigation stopped at levels where contamination in the thousands of parts per million were detected. No follow up in these areas was proposed in Phase II. A complete definition of the basin's contamination must be done prior to closure to assure that the closure will mitigate ground water and soil contamination.

Response: Phase II sampling within and outside the basin will extend to the water table. The RI soil data in conjunction with ground water data and future FS data will be used to determine the final remediation of the basin.

Comment_5: A majority of the removal depths of the Basin F underburden is based on liner integrity. However, the report states that the asphalt liner may not have been impermeable to the Basin F liquids. Therefore, the criteria used in the determination of removal depths must be chemical specific action levels, not 42 visual observation points.

Similarly, the "grossly contaminated" determination must be based on clean up levels agreed to by all MOA parties, not an arbitrary depth based on visual observation.

Response: The depths to which underburden soil will be removed or remediated during closure will be determined based on chemical-specific action levels. These action levels have not yet been determined.

Soil removal during the IRA will be guided by discoloration as an indication of gross contamination. This, coupled with the other facets of the IRA will alleviate any immediate hazards to local populations and wildlife posed by the basin.

Comment 6: The Phase I and Phase II investigations do not adequately address the soils beneath the standing liquids in the basin. A complete sampling program must be implemented in this area of the basin after the liquids have been removed.

Response: A comprehensive basin-wide sampling program will be performed by the contractor implementing the IRA.

Specific Comments

Comment 1: p. 9-11 The CAR states that the Alluvium and Denver Formations are "not hydraulically connected". This statement is not true. Similarly, deeper Denver units all have some degree of hydraulic connection. The CAR must be changed accordingly.

Response: Section 1.3 of the CAR presents the results and conclusions of WES's 1979 study of the hydraulic relationships between the alluvium and the Denver Formation (WES, 1979, RIC#81266R15) at Basin F. The WES report concluded that the upper Denver Formation Sand Trend A the alluvium were in direct hydraulic contact southeast of Basin F and continue to interact underneath the basin (downgradient) and beyond. Deeper Denver Sand Trends B and C are separated from the overlying Sand Trend A by low permeability siltstones and claystones which effectively restrict the flow of fluids between sands, thus resulting in different water levels in monitor wells isolating the individual units. Given this information, WES concluded Denver Formation Sand Trends B and C are not hydraulically connected to the alluvium beneath the basin, but are updip where they subcrop against the alluvium.

The Remedial Investigation is currently evaluating the interaction of the alluvial and Denver Formation aquifers and within the Denver Formation.

Comment 2: p. 14 Please submit a list all chemicals and/or wastes and their volumes placed in the basin after 1981. The CAR should include the most recent analytical results from sampling the basin's liquids.

Response: Section 2.1.7 of this CAR states the vitrified clay chemical sewer line extending from the South Plants through Sections 36 and 26 was excavated in winter/spring 1982 and disposed in the southeast quarter of the basin. Approximately 9700 linear feet of crushed pipeline and 3200 bcy of potentially contaminated soil were excavated and placed in a prepared storage area just north of F-1. Other than the chemical sewer line and surrounding soil, the historical record does not mention any documented instances where chemicals and/or

waste materials were disposed in the basin after 1981. The most recent analysis of Basin F fluids was performed under Task 17 of the RI. These data will be incorporated into the North Central Study Area Report as they become available.

Comment 3: p. 24-33

The report contends that the Buhts and Francinques 1978 report is the most comprehensive study of Basin F to date. That report is incomplete in that it does not address all target compounds presently being studied, and does not attempt to identify any nontarget compounds found on the GC/MS. The Phase II investigation must fill in these data gaps to complete the interior of Basin F liquid and soil characterization.

Response:

The Buhts and Francinques report was the most comprehensive study of Basin F available at the time this document was being prepared after Phase I of the RI. The results of this study are presented as background information only. The Army has recognized the incomplete nature of this report, hence the need for the RI/FS programs.

The Phase II investigations inside and outside the basin area will use the most comprehensive analytical methods available to further characterize the soil down the water table.

Analysis of the Basin F fluid has been performed under Task 17. These data will be used in future FS investigations to determine a final remediation plan for the basin.

Comment 4: p. 33

Table 26-6-6, entitled "Average Organic Contaminant Concentrations, Basin F Fluid" lists chloride and sulfate as being organic contaminants. These chemicals are not organics. The table should be changed accordingly.

Response:

Correction noted.

Comment 5: p. 44

The CAR indicates that samples were taken from a 5 foot wide drainage ditch (location 4639) outside the Basin F fence. However, the CAR does not describe where the samples were taken or at what depths. This information must be included in the CAR.

Response:

Section 3.2.1 of the CAR clearly states that 3 samples were obtained at from the western side of the drainage ditch at 0.7, 1.7, and 2.4 ft below ground surface. The ditch and sample location (4639) are shown in Figures 26-6-9 and 26-6-10; analytical results and sample depths are also given in Figure 26-6-9 and Table 26-6-13. The State is requested to review these documents more thoroughly before making comments of this nature.

Comment 6: p. 46

Table 26-6-10 indicates that soil discoloration is observed only to four inches beneath the liner from sample 4626. Comparison of this observation chart to the

contamination distribution chart (Table 26-6-13) shows extremely high concentrations of contamination at the 4- to 5-ft level. This comparison establishes that discoloration of soils is not an indication of contamination. Therefore, using soil discoloration as means of determining excavation depths is inappropriate and must not be used as a removal criteria.

Response:

The comparison cited does not establish that discoloration of soils is not an indication of contamination, but rather that the lack of discoloration does not necessarily indicate the soil is uncontaminated. The fact remains that at this site discolored soils have invariably been affected by contaminated fluids.

The interim response action is designed to alleviate any immediate threat to indigenous populations and wildlife posed by the basin. To this end, the liquids are being pumped into storage tanks: the overburden, liner, and some of the grossly contaminated underlying soil, possibly saturated with contaminated fluids, will be excavated and solidified/stabilized: and the entire site will be regraded and sealed with a very low permeability cap. This will effectively prevent any continued percolation of contaminants to the water table from the basin fluids or by infiltration of precipitation/runoff through the contaminated soil. In addition, a ground water treatment system will be emplaced downgradient.

Soil discoloration will be used to determine excavation depth of contaminated soil as this is the most efficient and cost-effective criterion. The sealing of the site and the installation of the ground water treatment system will prevent the contaminated soil remaining at the site from being a possible danger to ground water users downgradient until a final remediation plan can be effected.

Comment_7:
p. 46

The CAR does not identify the dark green crystals present throughout the basin. A complete analysis of these salts is necessary because of their potential to be wind blown.

Response:

Several years ago an unofficial investigation of the composition of the dark green crystals was performed by Dr. Mike Witt, former Chief of the Environmental Division at RMA, and his staff. Their analyses indicated the crystals are primarily composed of sodium or copper salts and copper sulfate. These crystals will be removed and solidified/stabilized along with the basin overburden during the Interim Response Action.

Comment_8:
p. 47

Table 26-6-11 lists Phase I liner observations, but gives no indication as to where these observations were made in the basin's interior except for the few areas where soil

samples were taken. Trying to identify areas where the liner integrity is poor is not possible without knowing where these observation points were located. A map charting the points should be included in the CAR.

Response: Figures 26-6-9 and 26-6-12 have been revised to include all liner observation sites, site numbers, and whether damage to the liner was noted.

Comment 9: p. 59 Please explain how matrix effects prevented precise quantification of the amounts of contaminants present at concentrations greater than 25 ppm.

Response: In the analyses referred to the matrix analyzed (soil) was heavily contaminated with numerous volatile and semi-volatile compounds at concentrations high enough to interfere with the target peak as read from the GC/MS screen. As a result, the sample had to be diluted until discrete, identifiable, analyte-specific peaks could be obtained. The dilution necessary to accomplish this precluded precise quantification of the analyte concentration beyond a minimum value.

Comment 10: p. 59 Boring 4261 should read 4621.

Response: Correction noted.

Comment 11: p. 61 Nontarget semivolatiles detected are in fact target volatiles and should be identified as such.

Response: All nontarget compounds detected by the semi-volatile method which have been tentatively identified as target volatile compounds are included in Table 26-6-14 and mentioned in the text. Nontarget identifications are tentative: for this reason, nontarget detections are not included in Figure 26-6-9.

Comment 12: p. 62-68 Table 26-6-14 lists very high concentrations of nontarget compounds, particularly in Borings 4620, 4643 and 4644. Levels of contamination as high as 800 ppm cannot be ignored. Identification of all nontarget analytes must be performed on the Basin F contaminants to help design the proposed ground water treatment system to be placed downgradient of the basin.

Response: The Army recognizes the importance of identifying all nontarget compounds detected. The RI analytical program is currently being evaluated with respect to nontarget detections. Future investigations will incorporate more comprehensive analytical methods which should include expanded target analyte lists and improved procedures for nontarget identification.

Comment_13: The CAR states that "the liner may have remained partially effective in reducing or preventing migration of Basin F fluid downward into subsurface soil". The CAR also states that "most elevated contaminant levels are generally found in areas where the liner "is damaged". However, the integrity of the linear is a driving factor in the proposed removal depths of underburden. Removal depths of the basin's overburden must be based solely on the extent of chemical contamination, not on the integrity of the liner.

Response: The depths of which the underburden soils will be remediated during final closure of the basin will be determined from the extent of chemical contamination. Areas within the basin designated for underburden removal down to 6 ft during the Interim Response Action were based on areal estimates of liner integrity and Phase I analytical results. Outside of these areas underburden removal will be a minimum of 6 inches but subject to extension to a maximum depth of 6 ft where soil discoloration is encountered. A more thorough investigation of the liner condition throughout the basin is currently being performed in conjunction with the Interim Response Action. The results of this investigation will also be considered in determining additional areas to be designated for the maximum 6 ft underburden removal.

Determination of removal depths based on liner integrity and soil discoloration was judged to be the fastest and most cost-effective method. As the intent of the Interim Response Action is to remove the immediate threat of Basin F to local populations and natural resources as quickly as possible, this method was considered appropriate.

Comment_14: p. 72 The CAR does not specifically identify the location of the large tear found in the liner in April of 1957, but does indicate that significant amounts of contaminants may have been introduced into the soil during this time. Please identify the location of the tear and the sampling and proposed excavation depths proposed for this area.

Response: In a recent conversation, Mr. George F. Donnelly, Former Chief of the Facilities Engineering Division at RMA, indicated the tear in the liner occurred along the northwest-northern perimeter of the basin where rip-rap had not been placed to reinforce the dike or protect the liner. The approximate location is given in Figures 26-6-9, 26-6-10, 26-6-12. This area has presently been designated for removal of a minimum of 6 inches of underburden. Actual underburden removal depths will be based on liner conditions discovered as the overburden and liner are excavated and soil discoloration encountered.

Comment_15(a): p. 73-78 The proposed Phase II investigation appears to be too limited and will not fill in the data gaps left from the Phase I investigation. The CAR states that the number of

borings, locations, depths and sampling intervals for Phase II will be determined after the liner overburden and underburden has been removed. Thus, visual observations will drive the Phase II investigation. Visual observations, (i.e., black discoloration) cannot be the basis for identifying soil contamination. A systematic sampling grid must be used in Phase II to accurately assess the soil contamination.

Response: The Phase II boring program within the basin proposed in Section 3.3 is given for estimation purposes only; the actual boring program will be determined as the Interim Response Action progresses. A primary concern of the contractor performing the Interim Response Action will be to implement a Phase II boring program which will provide more than adequate coverage of the site. Actual boring locations and sampling depths will be decided from Phase I analytical data in addition to liner conditions and soil discoloration encountered. This does not imply that the Phase II program will be based on visual observations only. Boring depths, for example, will be dependent on actual depth of underburden removed. Boring spacing will be designed to investigate the entire site, but borehole density will be increased in those areas where standing liquid had prevented Phase I sampling, and where extensive liner damage and/or soil discoloration were noted.

Comment 15(b): p. 73-78 Phase II will be used to determine the nature and extend of soil contamination in the area of the basin currently under liquids. The CAR does not indicate that the results of the Phase II investigation will be used to determine the need for removal of soil in addition to that already proposed. Unless the Phase II results are used to make this determination, a "Phase III" may be necessary.

Response: Section 3.3 of this report has been revised to clarify the intent of the Phase II program and how it will complement the Interim Response Action. The following statement has been included: "The final remediation plan for the Basin F area will be designed from these (Phase II) data and any subsequent Feasibility Study (FS) investigations".

Comment 15(c): p. 73-78 The maximum proposed sampling depths for the Phase II investigation is 40 feet. However, the only Phase I boring that extended to that depth detected contamination in the parts per million. The Phase II investigation must fully define the vertical extent of contamination beneath the entire Basin.

Response: The deepest Phase II borings proposed will sample the interval at the top of the water table, which is approximately 40 ft below ground surface. As it has already been established that the ground water in this area is contaminated (Task 4, ESE, 1986, RIC#86317R01) the RI soils

investigation is primarily concerned with determining the extent of contamination in the unsaturated zone. Other RI tasks are currently investigating the relationship between the unsaturated soils and ground water with respect to contaminant distribution, and future studies may include saturated soil/sediment sampling.

Comment_15(d): p. 73-78 — All soil samples should be analyzed by GC/MS and all peaks identified to fully define all contamination present beneath Basin F.

Response: As the RI program was originally designed, the Phase I investigation was intended to identify and semi-quantify organic contamination at each site using GC/MS methods. As the Phase I data became available the Phase II GC methods were developed to quantify the contaminants identified. Thus, the Phase II program proposed for Basin F is consistent with the original intent of the RI. GC/MS volatile and semi-volatile scans are proposed for some Phase II samples to provide nontarget data and a means to compare the quality of the Phase II methods. GC/MS methods are not proposed for all Phase II samples as they are semi-quantitative. It should be noted, however, that the RI analytical program is being evaluated and future studies may include different methods with expanded target analyte capabilities.

Comment_15(e): p. 73-78 — The CAR states that the site geologist will choose those samples which will be run by GC/MS. How many samples will be run by this method, and what factors will influence this determination? Please explain what criteria was used to anticipate that samples run by GC/MS will be from 9 to 10 feet, 19 to 20 feet, and 39 to 40 feet intervals, in light of the fact that the Phase I investigation showed substantial organic contamination between 0 and 9 feet.

Response: As stated above, GC/MS screening of selected Phase II samples will be performed to provide nontarget data and a means to compare the quality of the Phase II methods. The Site Geologist supervising the Interim Response will determine those samples to be analyzed by GC/MS upon considering the total number of samples to be collected and analyzed, the location and depth of the samples, discoloration and other physical characteristics.

As most of the Phase I GC/MS data are from the 4 to 5 depth interval and above, it was estimated the supplemental data provided by the GC/MS scans to be run during Phase II would be most useful from intervals at 9 to 10 ft and below. The actual samples to be analyzed by GC/MS will be determined by the Site Geologist supervising the Interim Response Action.

Comment_15(f): A Phase II boring location report should be issued to all parties for comment prior to implementation.

Response: The contractor performing the Interim Response Action will be responsible for maintaining the lines of communication with all Parties and the State.

Comment 16: p. 78 The estimated volume of contaminated soil in the interior of the basin was based on the surface area of the basin multiplied by six feet. The six foot excavation depth was based on the Phase I data, according to the CAR. However, Phase I data detected contamination as deep as 40 feet. Please explain how the 6 foor depth was established.

Response: The 6 ft maximum excavation depth is dictated by the specifications of the Interim Response Action Scope-of-Work. Given a worst-case scenario where the entire basin area, including liner, overburden, and underlying soil were excavated to depths greater than 6 ft, the resulting volume of material generated to be treated and sealed/stored would be greater than the Interim Response Action is designed to accommodate. As explained in the response to Comment 6, the Interim Response Action is designed to remove any immediate threat to local populations and natural resources posed by the basin as quickly as possible, and should not be construed as a final remediation plan.

The areas proposed for the 6 ft maximum excavation depth were delineated from Phase I data and liner observations.

Comment 17: p. 79 The criteria used for contaminated subliner removal depths is entirely arbitrary. Stating that the depth of organic and inorganic contamination drive the removal criteria is inaccurate when grossly contaminated soils, i.e., 1000 ppm pesticides at 20 foot depths, are being excavated to only six feet. The condition of the liner cannot be a basis for excavation because, as stated in the CAR, liquids appeared to have migrated horizontally beneath the liner. The removal depths must be revised and based on MOA party agreement on action levels.

Response: See response to comment 16. The depth of contamination detected in Phase I and the observations of liner integrity were used to propose areas for the maximum excavation depth of 6 ft. The remaining portions of the basin will be excavated to a minimum of 6 inches below the liner but subject to excavation down to 6 ft depending on soil discoloration encountered. Final remediation depths will be determined based on Phase I and II RI data and any subsequent FS data, and action levels agreed upon by all Parties and the State.

Comment 18: p. 18 The conclusion that the depth of contamination in Borings 4622 and 4625 is less than one foot is obviously erroneous given that the boring closest to these two borings, Boring 4645, showed 20 ppm aldrin at 4 to 5 feet.

Response: The deepest sample taken at location 4645 was 2 to 3 ft below the liner. This site is approximately 550 ft away from Boring 4622 and 410 ft away from Boring 4625. No contaminants were detected in samples form Boring 4623 which is approximately 490 ft from 4622 and 640 ft from 4625. The assumption that contamination at 4622 and 4625 extended to less than 1 ft below the liner was based on this information and the fact that liner condition at these borings and at nearby locations OS-20, OS-27, OS-28, WES 50, and WES 11 was very good. It should also be noted that liner damage was observed at several points near 4645 (OS-10, OS-19, OS-37, 4626) and the liner at this point was soft, although intact.

Section 3.4 has been revised and all estimates of depth of contamination at various points within the basin have been deleted. It is anticipated that the Phase II RI data coupled with the Phase I data and any subsequent Feasibility Study data will be sufficient to precisely estimate the vertical extent of contamination throughout the basin area.

Comment 19: p. 79 Using midpoints between boring areas to base excavation depths will not adequately remove much of the basin's grossly contaminated soils in the basin, especially with the large distances between some of the borings. A worst case extrapolation must be used.

Response: Section 3.4 has been revised and the methodology described for estimating the total volume of underburden to be removed discarded. The revised Figure 26-6-12 depicts two areas where underburden removal will be to the maximum 6 ft specified in the Interim Response Action Scope-of-Work. All other areas in the basin will be excavated to a minimum of 6 inches below the liner, but subject to excavation down to 6 ft depending on soil discoloration encountered.

Comment 20: p. 79 Liner integrity surrounding the area covered with liquids is not a reasonable indicator of the liner integrity beneath the liquids. This part of the basin has the longest contact time with the liquids. Liner breakdown should be assumed given that the liner has a 15 year life span and has been covered with liquids for 30 plus years. This section of the basin must be adequately sampled using borings sufficient to define the vertical extent of contamination. This must be done before determining that the area is grossly contaminated only to 6 inches beneath the liner. Visual observations cannot be a basis for removal depths.

Response: The Interim Response Action is currently being performed and the fluids are being pumped out of the basin. Concurrent with this, a comprehensive investigation of the liner condition over the basin area is being conducted. This investigation will include the areas formerly covered by standing liquids. Phase II soil sampling in these areas will follow after excavation has been completed.

Comment 21
p. 81

A minimum of 6 feet removal depth is proposed for the area surrounding Boring 4620. However, the CAR does not propose action levels or maximum depths of excavation. Please supply this information.

Response:

This section has been revised. The area surrounding boring 4620 has been designated for excavation down to 6 ft, which is the maximum depth called for by specifications of the Interim Response Action. Action levels and final remediation depths will be developed from Phase II and Feasibility Study data.