United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R04-86/014
September 1986

EPA

Superfund Record of Decision:

SCRDI Dixiana, SC

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA/ROD/R04-86/014	2.	3. RECIPIENT'S ACCESSION NO.
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15. SUPPLEMENTARY NOTES		

16. ABSTRACT

The SCRDI Dixiana site consists of a 2-acre lot and a warehouse in southeastern Lexington County, South Carolina. The warehouse, located near the center of the property is an abandoned one-story, metal structure. The predominant land use in the areas adjacent to the site are woodlands and light residential development. Approximately 1,193 people use water supply wells within three miles of the site. South Carolina Recycling and Disposal, Inc. (SCRDI) leased the site from G.M.T. in 1978 for drum storage of industrial wastes. Instances of poor handling practices, leaky drums, and exposure to the weather allowed numerous discharges to the environment prior to drum removal. In August 1978 a waste management permit was denied to SCRDI by the South Carolina Department of Health and Environmental Control (SCDHEC) because of poor waste management practices. A suit was filed by SCDHEC against SCRDI during the same month. Removal of all surficial drummed waste and visibly contaminated soils was performed by SCRDI. The Ground Water Protection Division of SCDHEC completed a detailed ground water monitoring program in Autumn 1982 and confirmed ground water contamination underlying the site. No significant site-related surface water, sediment, air, or surface and subsurface soil contamination have appeared. Potential sources of future contamination at the site are former drum storage areas and suspected spill areas. Contamination is presently moving offsite primarily via shallow ground water in response to the hydraulic (See Attached Sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision SCRDI Dixiana, SC Contaminated Media: gw Key contaminants: VOCs, PAHs, PCBs, PCE, organics, pesticides, inorganics		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)* None	21. NO. OF PAGES 62
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EPA/ROD/R04-86/014
SCRDI Dixiana, SC

16. ABSTRACT (continued)

gradients in various interconnected aquifers. The primary contaminants of concern include: VOCs, PAHs, PCBs, PCE, organics, pesticides, inorganics.

The selected remedial action includes: extraction of contaminated ground water; treatment of contaminated ground water to alternate concentration levels; discharge of treated ground water to surface water (regulated by South Carolina's NPDES Discharge Permit; no action on soils. The estimated capital cost for this remedial action is $751,250 with O&M estimated at $2,128,100 for a 30-year period. O&M may require anywhere from 3 years to 30 years to accomplish.

RECORD OF DECISION

REMEDIAL ALTERNATIVE SELECTION

Site: SCRDI Dixiana Site
Lexington County, South Carolina

Documents Reviewed:

- SCRDI Dixiana Remedial Investigation
- SCRDI Dixiana Feasibility Study
- Summary of Remedial Alternative Selection
- Responsiveness Summary
- Staff Recommendations & Reviews

Description of Selected Remedy:

- Extract contaminated groundwater
- Treat contaminated groundwater to alternate concentration levels
- Discharge treated groundwater to surface water (regulated by South Carolina's NPDES Discharge Permit)
- No action on soils

Declarations:

The selected remedy is consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and the National Contingency Plan (40 CFR Part 300). I have determined that the extraction and treatment of groundwater contamination and subsequent discharge to state authorized limits and no action for soil contamination at the SCRDI Dixiana site is a cost-effective remedy and provides adequate protection of public health, welfare, and the environment. The State of South Carolina Department of Environmental Control has been consulted and agrees with the approved remedy. Future operations and maintenance activities, to ensure continued effectiveness of the remedy, will be considered part of the approved action and eligible for Trust Fund monies for a period of one year.

I have also determined that the action being taken is appropriate when balanced against the availability of Trust Fund monies at other sites.

In addition, the groundwater extraction, treatment, and discharge is more cost-effective than other remedial actions and is necessary to protect public health, welfare and the environment.

SEP 26 1986

Date

Jack E. Ravan
Regional Administrator

Record of Decision

Summary of Remedial Alternative Selection

SCRDI Dixiana Site
Lexington County, South Carolina

Site Location and Description

The SCRDI Dixiana site is located in southeastern Lexington County, South Carolina, at 33° 54' 13" North latitude and 81° 3' 47" West longitude. Principal access to the site is from Ballard Court, located off U.S. 321, 2.1 miles south of the interchange of U.S. Interstate 26 and U.S. Highway 321. A vicinity map and a schematic drawing of the site and improvements are shown in Figures 1-1 and 1-2.

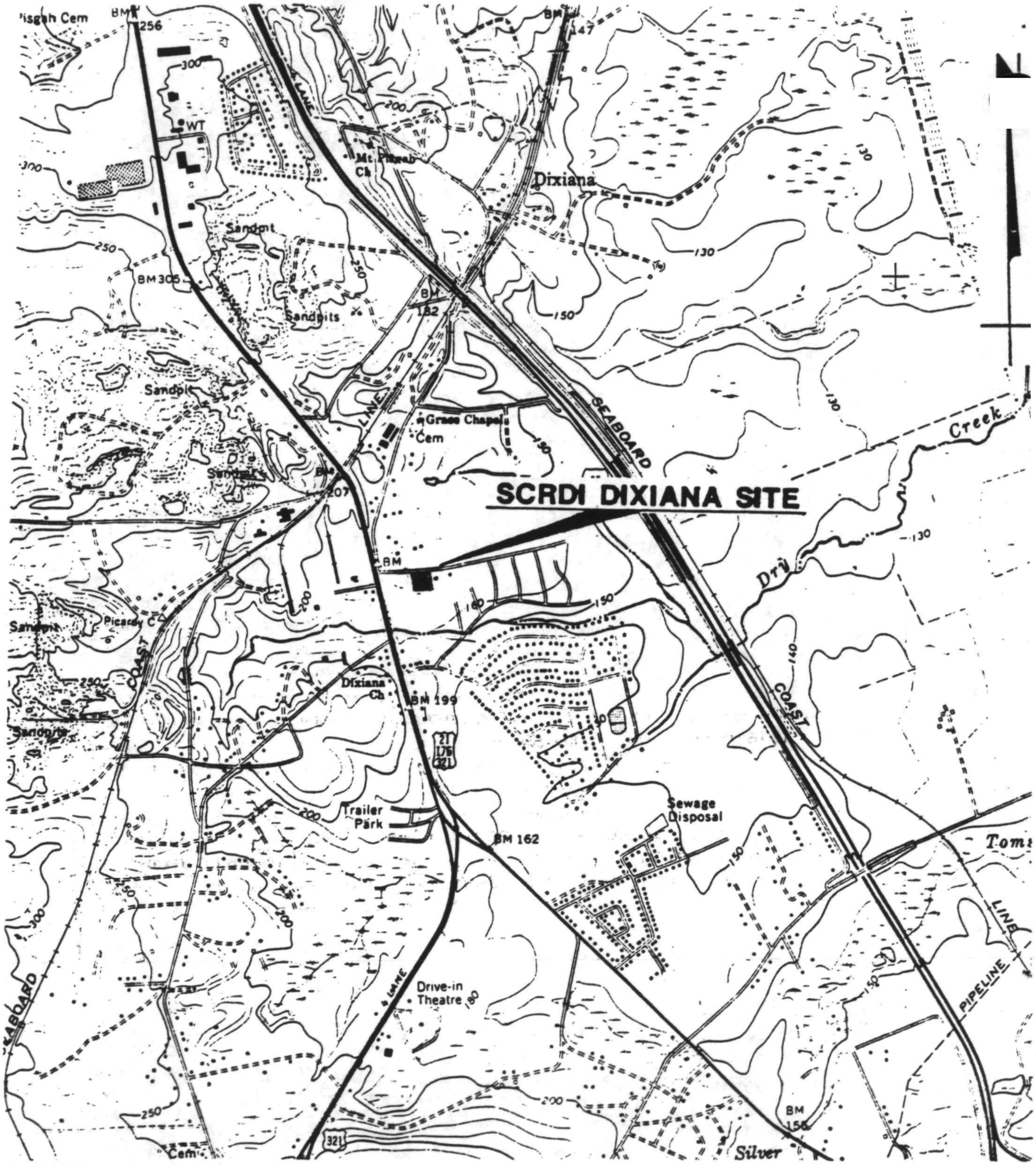
The site consists of a two-acre lot and a warehouse. The site is bordered on the north by Ballard Court and on the remaining three sides by undeveloped wooded property. The property is relatively flat with a very slight slope to the southeast. Maximum elevation difference across the site is two feet. The warehouse, located near the center of the property is an abandoned one-story, metal structure. Vegetation surrounding the warehouse consists of sparse weeds and grasses. Much of the area has been disturbed as a result of previous waste storage activities which occurred over the entire lot and soil removal and site activities.

The Congaree River is located approximately 2 miles east of the site and flows northwest to southeast. Two unnamed tributaries of Dry Creek, which empties into the Congaree River, are located 1000 feet southeast and 2000 feet northeast of the site.

There are approximately 200 permanent residences located within 0.5 mile of the site as of 1982. (See Figure 1-2). The closest residences are the Ballard and Holland homes which are located approximately 350 feet east of the site. Other nearby residences include the Green Valley Mobile Home Park located approximately 500 feet north of the site. Young's Market is situated across U.S. 321, approximately 700 feet west of the site.

The predominant land uses in areas adjacent to the site are woodlands and light residential development. A municipal landfill is located one mile to the north. The edge of the Columbia metropolitan area begins at the City of Cayce, approximately 3.5 miles north of the site.

According to the Mitre Hazard Ranking System (HRS) report, approximately 1,193 people use water supply wells within three miles of the SCRDI Dixiana site. Two wells located within 350 feet east of the site were formerly used; however, these residents have since been connected to the City of Cayce Water supply. The nearest active water supply wells used for drinking water are those of the Green Valley Mobile Home Park located approximately 500 feet north of the SCRDI Dixiana site, and Young's Market located approximately 700 feet west of the site.



SOURCE: U.S.G.S. 1982.

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SITE LOCATION MAP

FIGURE 1-1

SCRDI DIXIANA SITE
LEXINGTON CO., SOUTH CAROLINA

NUS CORPORATION
A Halliburton Company

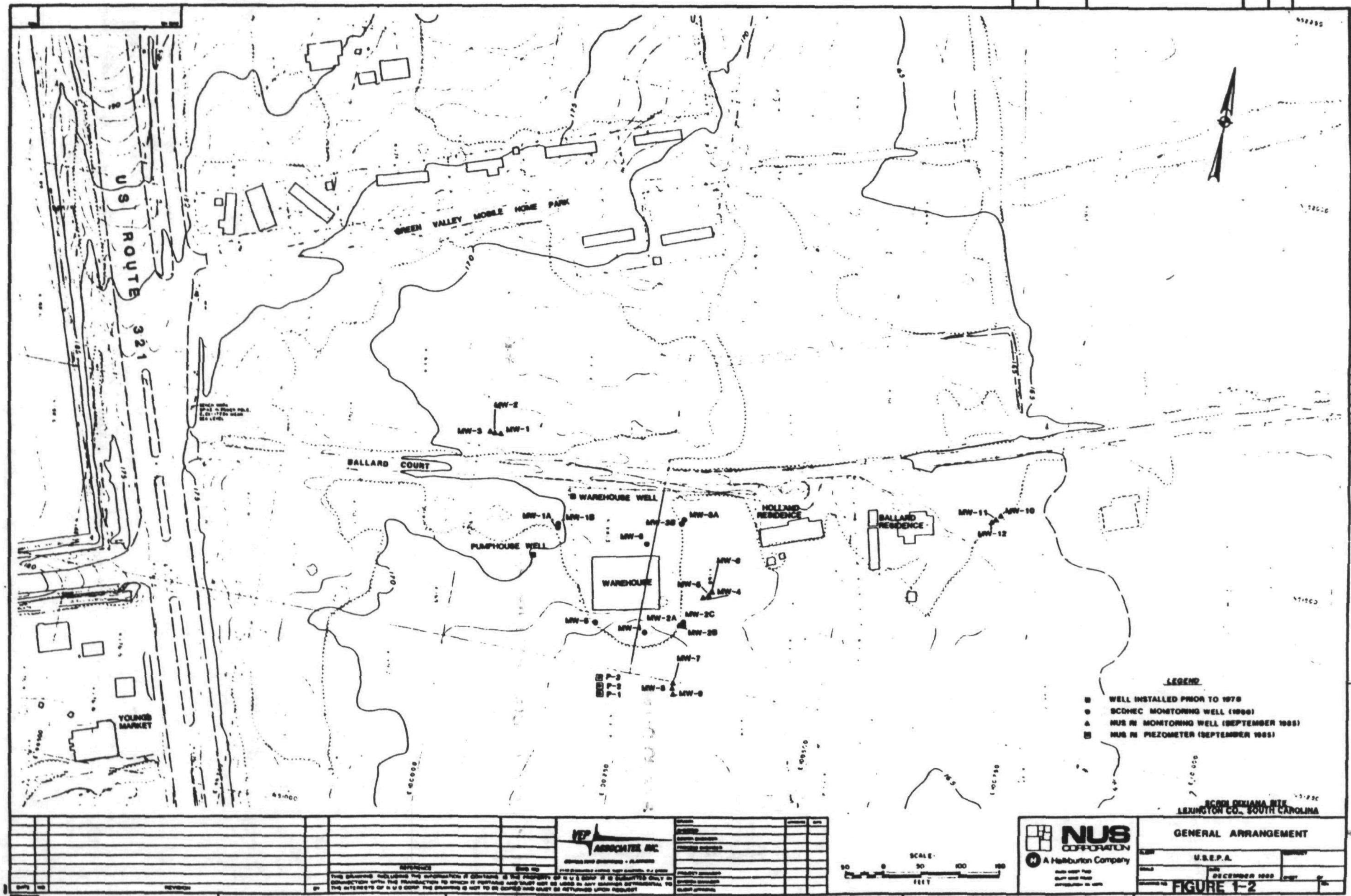
US ROUTE 321
GREEN VALLEY MOBILE HOME PARK
BALLARD COURT
MW-2
MW-3
MW-1
WAREHOUSE WELL
MW-1A
MW-1B
PUMPHOUSE WELL
WAREHOUSE
HOLLAND RESIDENCE
BALLARD RESIDENCE
MW-11
MW-10
MW-12
MW-2A
MW-2C
MW-7
P-3
P-2
P-1
YOUNGS MARKET
LEGEND
WELL INSTALLED PRIOR TO 1978
NUS RI MONITORING WELL (SEPTEMBER 1985)
NUS RI PIEZOMETER (SEPTEMBER 1985)
SCRDI DIXIANA SITE
LEXINGTON CO., SOUTH CAROLINA
NUS CORPORATION
A Halliburton Company
GENERAL ARRANGEMENT
U.S.E.P.A.
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FIGURE 1-2

Other active water supply wells include Belle Meade Subdivision located approximately one mile southeast of the site and the Silver Lake Mobile Home and Rolling Meadows Mobile Park homes located approximately one and one-half miles to the southeast. There are 200 lots in the Belle Meade Subdivision and 210-260 taps at Rolling Meadows. It is not known exactly how many taps there are at Silver Lake, but it is assumed to be 200. There may also be a few domestic wells about one and one-quarter miles south of the site. The Lloydwood Community, located approximately 1500 feet southeast of the site, is connected to the City of Cayce water supply.

Site History

The SCRDI Dixiana Site was leased from G.M.T. Associates by South Carolina Recycling and Disposal, Inc. (SCRDI) in the summer of 1978 for drum storage of industrial wastes. In late 1978, approximately 1,100 drums of waste material including paints, solvents, phenols, acids, oils, and dyes were stored on the site. Instances of poor handling practices, leaky drums, and exposure to the weather allowed numerous discharges to the environment prior to drum removal. A list of 22 hazardous substances identified by SCRDI as having been stored at the site is shown in Table 1-1. On July 21, 1978, SCRDI formally requested a waste management permit from South Carolina Department of Health and Environmental Control (SCDHEC). The permit request was refused on August 22, 1978, because of poor waste management practices at the SCRDI Dixiana Site. In August 1978, SCDHEC filed a suit against SCRDI. Removal of all surficial drummed wastes and visibly contaminated soils were performed by SCRDI between September 1978 and June 1980. On May 23, 1980, a South Carolina State Circuit Judge found SCRDI in contempt of a court order. This resulted in the company being placed in receivership.

On June 17 and 18, 1980, SCDHEC's Groundwater Protection Division and Industrial Solid and Hazardous Waste Section determined the degree and extent of subsurface contamination using soil odor and color as indicators. During the June 17 and 18 investigation, a monitoring well (Well 1A) was constructed in a test hole drilled west of the property to a depth of 39 feet. Samples were taken from this well, the warehouse well, the pumphouse well, and from two residential wells east of the property (Holland and Ballard wells). The results of analytical tests performed on groundwater samples indicated a potentially serious problem. The owners of affected residential wells were advised on July 3, 1980, to seek alternative water sources, and a more intensive groundwater investigation was implemented by SCDHEC.

The Groundwater Protection Division of SCDHEC completed a detailed groundwater monitoring program in Autumn 1982. Site-specific subsurface information from the SCDHEC investigation is limited to the zone extending to approximately 35 feet below ground surface. Water was encountered at depths ranging from 14 feet to 15 feet. Groundwater sampling was performed by SCDHEC in August and September 1980, October 1981, and August 1982. Contamination of the groundwater underlying the site was confirmed. The SCRDI Dixiana Site was listed in the United States Environmental Protection Agency's (EPA) National Priorties List of 418 sites released in December 1982.

TABLE 1-1

HAZARDOUS SUBSTANCES KNOWN TO HAVE BEEN STORED AT SCRDI DIXIANA SITE, LEXINGTON COUNTY, SOUTH CAROLINA*

Substances Identified by SCR&D	No. of Drums	Chemical Abstract Number
Water-Trichlorobenzene	1	12002-48-1
1-1-1, Trichloroethane	6	71-55-6
Chloroform	4	67-66-3
60% Phenol, 40% Tetrachloroethane	1	108-95-2, 79-34-5
Ethyl Acetate	1	141-78-6
Acrylamide-Styrene	11	79-06-1
Benzene	1	71-43-2
Butanediol	4	107-88-0
Hydrogen Peroxide	1	Unknown
LX305-3 Lithium Compound	1	Unknown
DX2113-1,3, Dioxane	1	123-91-1
51% Toluene, 48% Ethyl Acetate	8	108-88-3, 141-78-6
Toluene (Dirty)	3	108-88-3
Hexane (Dirty)	2	110-54-3
Acetone (Dirty)	1	67-64-1
Methylene Chloride-Acetone	2	75-09-2, 67-64-1
Perchloroethylene	17	127-18-4
Methylene Chloride	2	75-09-2
Freon-TMC	3	Unknown
Pyridine	1	110-86-1
TX 1055, 1060 Trichlorobenzene	1	12002-48-1
TX 1055, 1,2,4 Trichlorobenzene	1	120-82-1

* Taken from RAMP, Versar Inc., 1983.

The EPA requested a Remedial Action Master Plan (RAMP) for the SCRDI Dixiana Site. Versar, Inc. was subcontracted by NUS to prepare the RAMP, which was submitted in November 1983.

In May 1984, following review of the RAMP, the EPA obligated initial funding for a Remedial Investigation/Feasibility Study (RI/FS) to be performed by the NUS Corporation Remedial Planning Office (REMPO).

The RI, begun in May 1984, confirmed that the site did not contain buried wastes. It also confirmed that contaminated groundwater is present at the site. Further investigation has confirmed that no significant site-related contamination has appeared in surface water, sediments, or surface and subsurface soils. The RI has also confirmed that airborne contaminants are not a problem at the SCRDI Dixiana Site.

NUS completed the RI site investigation in October 1985 and submitted a Draft RI report to the EPA in March 1986. The RI assessed the nature and extent of onsite and offsite contamination, and evaluated hazards to human health and the environment, which resulted from the storage of hazardous wastes on the SCRDI Dixiana property. The site was characterized in terms of:

- Geology and soils
- Surface and groundwater hydrology
- Hazardous substances present
- Nature and extent of contamination
- Contaminant mobility characteristics and migration pathways
- Potential receptors
- Human health and environmental concerns

Details of the remedial site investigation and laboratory analyses are documented in the Remedial Investigation Report.

Current Site Status

Hazardous subtances in the form of source material (e.g. drummed wastes, etc.) have not been present on the site since the removal action was completed in June 1980. Potential sources of future contamination at the site are former drum storage areas, and suspected spill areas. Contamination is presently moving off site primarily via shallow groundwater in response to the hydraulic gradients in the various interconnected aquifers. There is no apparent offsite movement via surface water runoff, dust, or volatilization.

Risks from other potential exposure pathways are negligible at this site. Soil ingestion by intruders, and dermal contact with contaminated soil have very low associated risks because of the low levels of contamination observed in the surface soils.

Investigations of the groundwater regime beneath the SCRDI Dixiana Site reveal a complex sequence of sand, silts, and clays. Soils have been grouped into eight distinct units within the upper one hundred feet of sediment underlying the SCRDI Dixiana site. These units are labeled A through H. The units are characterized on the basis of soil type and vertical location beneath the site. Five of the units function as aquifers (Units A, C, D, F, and H). Three units are semiconfining (Units B, E, and G). The units, in descending order, have been labeled A through H. Figure 4-8 presents a generalized columnar section of the deposits underlying the site. Groundwater and/or soils in Units A through F showed signs of contamination. Thus, they are the aquifers targeted for the conceptulization of a remedial action.

The entire SCRDI Dixiana site is located in an area outside of the 100-year and 500-year floodplains; therefore, the site is not subject to a significant flood risk.

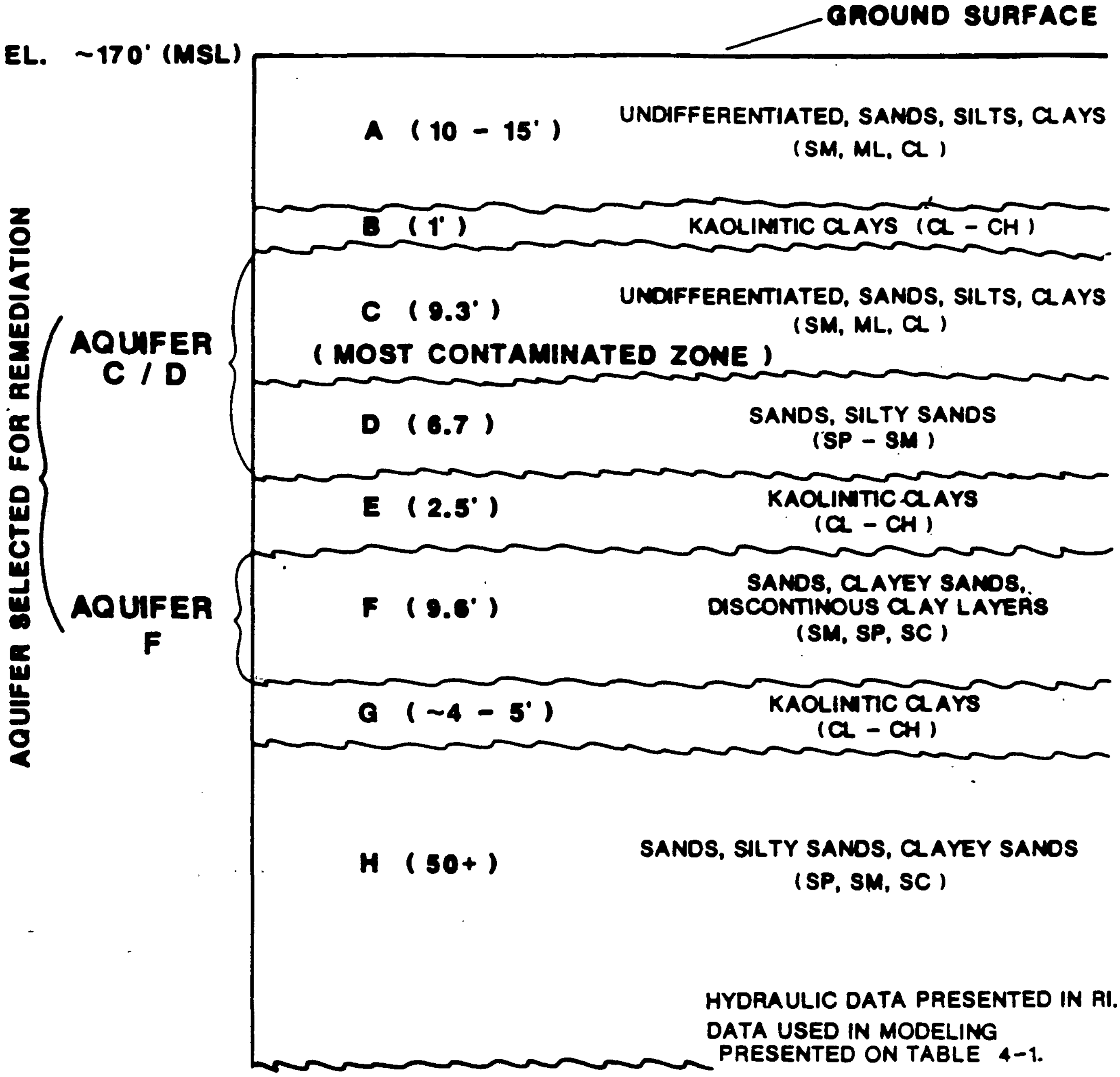
<u>Nature and Extent of the Problem</u>

The contaminants detected in the groundwater beneath the site are predominantly volatile organic compounds along with several non-volatile organic compounds. Maximum concentration of individual contaminants approached 1 part per million in the groundwater. The groundwater contamination present beneath the site is limited to the shallow water bearing units, with organic contaminants detected at a maximum depth of approximately forty feet below the ground surface. The greatest number of contaminants and highest concentrations of compounds were distributed in the upermost transmissive units (A, C, and D) extending down to approximately fifteen to twenty-five feet below the ground surface. Laterally, the groundwater contaminants in Unit C extend from the SCRDI Dixiana site to the east in the direction of two residential wells. These residences are not currently using their well water for domestic purposes — they are presently supplied by the City of Cayce water system. Although not identified in the remedial investigation, contaminants in Unit D may extend southward and eastward from the site. From conversations with Mr. Joe Rucker, SCDHEC District Engineer, active water supply wells were found to be located at three locations south and southeast of the site.

All three locations are a mile or more from the site, and all of the wells appear to be producing from the H aquifer (no records of the screened interval were available).

<u>Extent of Surface Water/Sediment Contamination</u>

Surface water and sediment samples were collected from nearby streams and from areas with major ponding that could be affected by site runoff. Prior to the sampling activities performed by NUS, no extensive



NOT TO SCALE

TYPICAL CROSS SECTION FOR MODELING WITH PROGRAM BESTWELLS

FIGURE 4-8

SCRDI DIXIANA SITE
LEXINGTON CO., SOUTH CAROLINA

NUS CORPORATION
A Halliburton Company

sampling of surface waters of sediments had been performed at the site. Surface water sampling was performed August 28-31, 1984 and July 8-12, 1985. Sampling locations are shown in Figure 1-7 and 1-8. Table 1-2 summarizes the organic contamination detected in sediment samples collected in the vicinity of the SCRDI Dixiana Site in August 1984 and July 1985. There was a single occurance of trichloroethene, 1,2 - dichloroethene, and Arochlor 1260 at this location in August 1984.

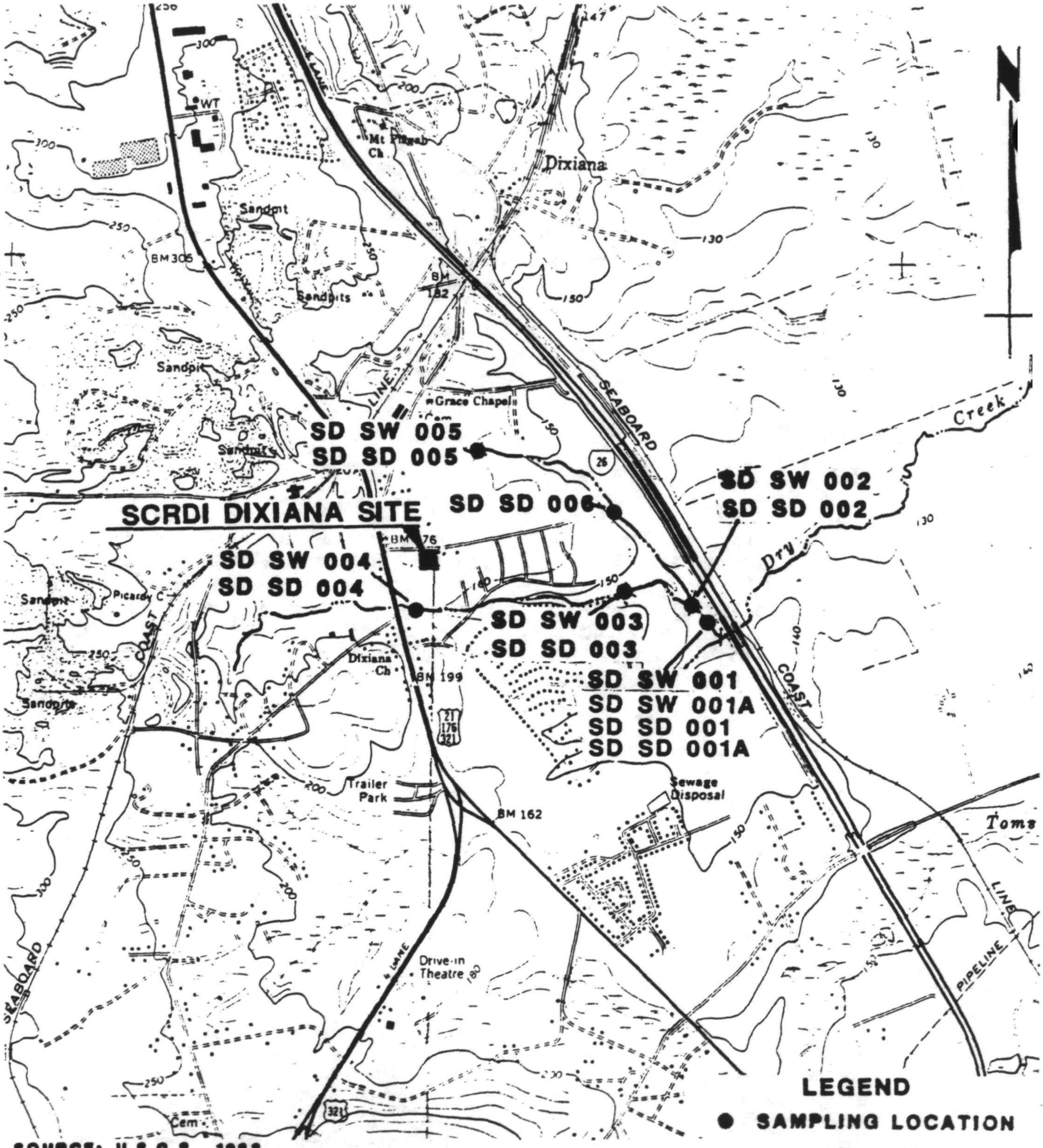
Surface water samples exhibited no organic contamination. Surface water samples were not filtered prior to laboratory analysis; hence, the absence of organic chemicals in surface water samples indicates that they are not present in either dissolved form or as adsorbates on suspended sediments.

Extent of Soils Contamination

Table 1-3 summarizes the Hazardous Substances List (HSL) organic contamination detected in soil samples collected at the SCRDI Dixiana Site. This table includes results from both surface soils (SS series) and subsurface soils (SO series). Chemicals detected represent several classes including chlorinated aliphatics, monocyclic aromatics, phthalate esters, polynuclear aromatics, pesticides and PCBs. It should be noted that the single occurrence of PCBs (PCB-1016 at 25 ug/kg at SO-003) and monocyclic aromatics (toluene at 5.3 ug/kg at SO-012) were detected in the subsurface (at 5 foot depth), and were the only two organic compounds detected in subsurface soil samples.

The surface soil contamination is very limited. The only carcinogenic volatile organic chemicals detected were tetrachlorethene (PCE) and methylene chloride. All methylene chloride values reported are qualifed with an N, meaning that there is only presumptive evidence of the presence of the materials. PCE was detected in three samples at a maximum concentration of 460 ug/kg. Two of these samples were collected from the northeast corner of the warehouse where spills were reported and where the groundwater contamination was most evident.

On the basis of analytical results, no pattern of soil contamination appears to exist. The results also indicate that in addition to the volatiles, low levels of phthalate esters, polyaromatic hydrocarbons (PAHs), and pesticides are randomly distributed. It is possible that these chemicals are not associated with the wastes previously stored on site. PAHs, such as acenaphthene and pyrene, are created by the combustion of organic matter and are constituents of vehicular emissions. Phthalate esters, such as Bis (2-ethylhexyl)phthalate, Di-n-butylphthalate, and Diethylphthalate, are widespread in the environment. They are thought to be created naturally, as wells as by man . The pesticides, 4,4'-DDT, 4,4'-DDE, and 4,4'-DDD, are reported at very low levels and are only tentatively identified.



SOURCE: U.S.G.S. 1982.

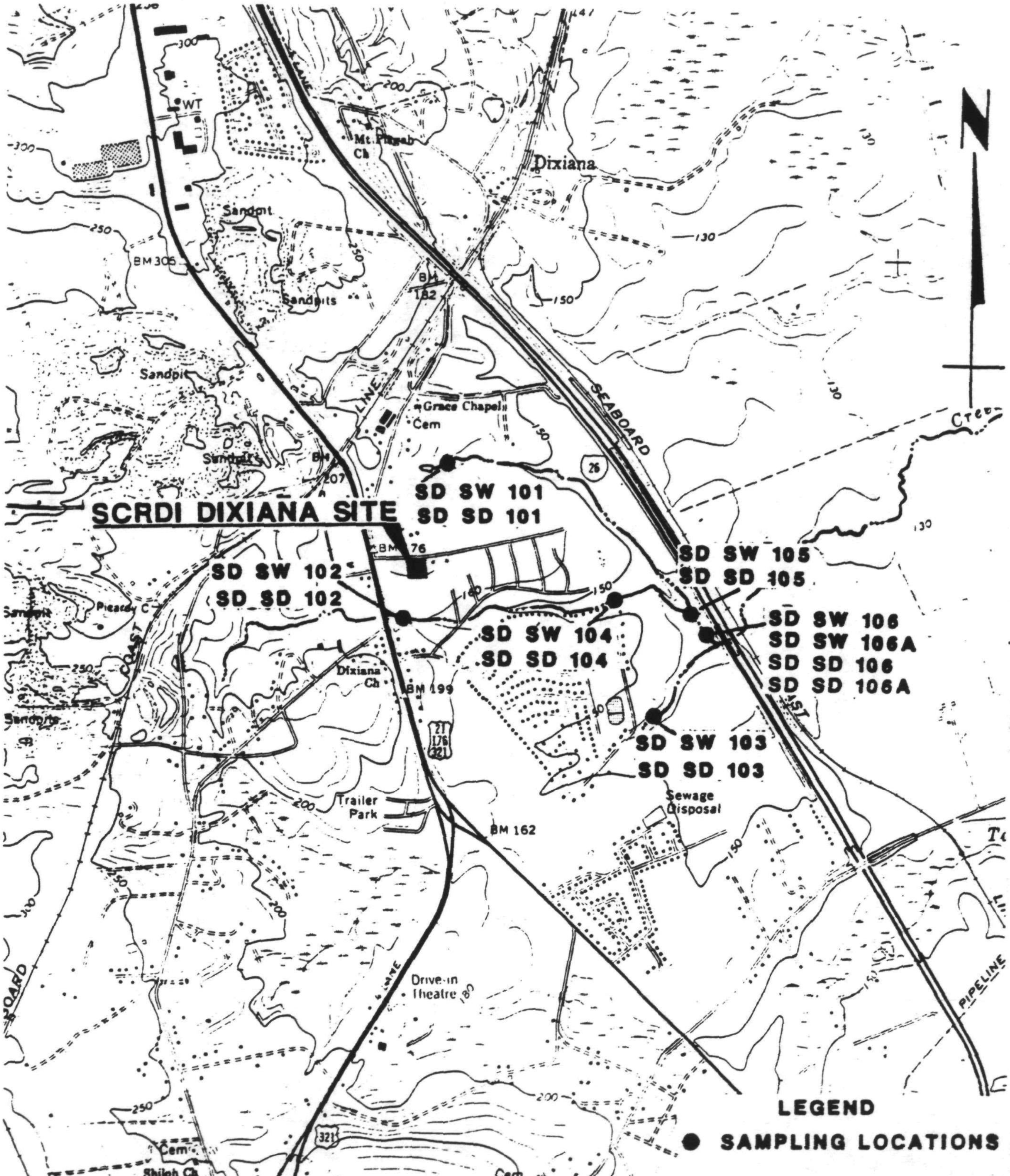
SURFACE WATER/SEDIMENT SAMPLING LOCATIONS

SCRDI DIXIANA SITE
LEXINGTON CO., SOUTH CAROLINA

SAMPLES COLLECTED BY NUS CORPORATION IN AUGUST 1984.

FIGURE 1-7

NUS CORPORATION
A Halliburton Company



SOURCE: U.S.G.S. 1982.

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SURFACE WATER/SEDIMENT SAMPLING LOCATIONS

SCRDI DIXIANA SITE
LEXINGTON CO., SOUTH CAROLINA

SAMPLES COLLECTED BY NUS CORPORATION IN JULY, 1985.

FIGURE 1-8

NUS CORPORATION
A Halliburton Company

DRAFT

TABLE 1-2

SUMMARY OF ORGANIC SEDIMENT CONTAMINATION
SCRDI DIXIANA SITE
LEXINGTON COUNTY, SOUTH CAROLINA

Compound	Range (µg/kg)/# of Occurrences
Trichloroethene	3.9/1
1,2-Dichloroethene	14/1
4-Methylphenol	570/1
Endrin ketone	5.3/1
Methoxychlor	26/1
Arochlor-1260	50/1

TABLE 1-3

SUMMARY OF SURFACE AND SUBSURFACE SOIL CONTAMINATION
SCRDI DIXIANA SITE
LEXINGTON COUNTY, SOUTH CAROLINA

Compound	Surface Soil (SS) Range (µg/kg)/ # of Occurrences	Subsurface Soil (SO) Range (µg/kg)/ # of Occurrences
Methylene chloride	52 - 230/7	
Tetrachloroethene	2-460/3	
Toluene		5.3/1
Bis(2-ethylhexyl)phthalate	200 - 1800/3	
Di-n-butyl phthalate	330/1	
Di-ethyl phthalate	400/1	
Pyrene	200/1	
Acenaphthene	4000/1	
4,4'-DDT	4-14/4	
4,4'-DDD	4.2-14/2	
4,4'-DDE	15/1	
Arochlor-1016		25/1
Benzoic acid	1600/1	
Cyanide	380/1	

Extent of Groundwater Contamination

The nature of the past waste storage operations at the site leads to the conclusion that possible sources of groundwater contamination are confined to spill or drum leakage onto surface soils, with subsequent migrations to the water table.

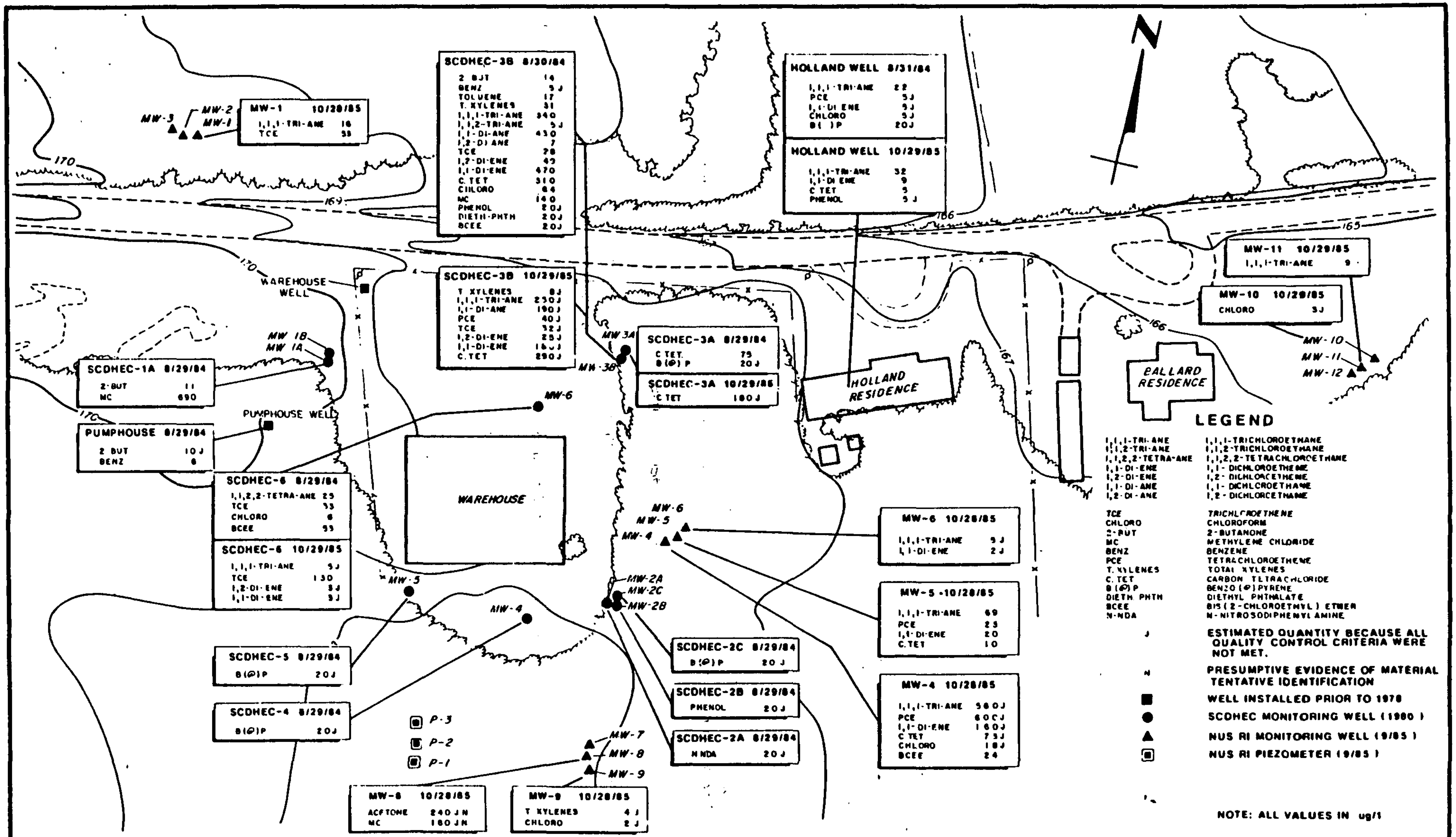
Groundwater sampling was conducted by NUS in August, 1984, and October 1985. Samples were collected and analyzed to determine the nature, concentration, and extent of contamination in groundwater underlying the SCRDI Dixiana Site. In August 1984, samples were collected from: wells installed during 1980 by the SCDHEC; the pumphouse well; the warehouse well; and from domestic wells adjacent to the SCRDI Dixiana Site. The same wells were resampled in October 1985 along with newly installed NUS monitoring wells. The locations of the wells and the results of analytical testing are shown in Figure 1-9.

The contaminants detected in the groundwater beneath the site are predominantly volatile organic compounds along with several non-volatile organic compounds. Maximum concentration of individual contaminants approached 1 part per million in the groundwater. The groundwater contamination present beneath the site is limited to the shallow water bearing unit, with organic contaminants detected at a maximum depth of approximately forty feet below the ground surface.

HSL chemicals detected most predominantly in site monitoring wells were volatile compounds. Within this group, halogenated aliphatics (i.e., chlorinated ethenes, ethanes, and methanes) were detected most frequently and at the greatest concentrations. Table 1-4 presents a summary of the occurrence of organic chemical contamination in both monitoring and residential well samples. The Holland residential well, located immediately adjacent to the site (approximately 150 feet from the warehouse and screened in an interval estimated between < 30 and > 70 feet), exhibited volatile contamination during sampling conducted in August 1984 and October 1985. Compounds detected most frequently in groundwater samples were: 1,1,1 -trichloroethane, Trichloroethene, 1,1,-dichloroethene, Carbon Tetrachloride, and Chloroform.

The sample obtained from Monitoring Well 3B (SCDHEC-3B), located in the northeast corner of the site, contained the highest concentrations of chemicals during both rounds of sampling. Total volatile organics (TVO) in this well, computed as the sum of the individual volatile compound concentrations, were 1910 ug/l and 1065 ug/l during rounds 1 and 2, respectively. Samples from the following wells also contained relatively high levels of volatile organic chemicals: MW-4 (1411 ug/l, TVO); SCDHEC-6 (141 ug/l TVO); SCDHEC-1A (701 ug/l TVO); MW-5 (122ug/l TVO); SCDHEC - 3A (75 ug/l TVO); and MW-1 (69 ug/l TVO).

Several non-volatiles including Phenol, Bis(2-chloroethyl)ether, Diethyl phthalate, Benzo(a)pyrene and N-nitrosodiphenylamine were also detected at low levels in groundwater samples at the SCRDI Dixiana Site. Of these



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ORGANIC GROUNDWATER CONTAMINATION

SCRDI DIXIANA SITE
LEXINGTON CO., SOUTH CAROLINA

FIGURE 1-9

NUS CORPORATION
A Halliburton Company

DRAFT

TABLE 1-4

SUMMARY OF ORGANIC GROUNDWATER CONTAMINATION
SCRDI DIXIANA SITE
LEXINGTON COUNTY, SOUTH CAROLINA

Compound	Monitoring Wells	Residential Wells
	Range/# of Occurrences	Range/# of Occurrences
Ketones		
Acetone	240/1	
2-Butanone	10-14/3	
Monocyclic Aromatics		
Total xylenes	4-31/3	
Phenol	20/2	5/1
Toluene	17/1	
Benzene	5-6/2	
Chlorinated Aliphatics		
Methylene chloride	140-690/3	
Chloroform	2-64/6	5/1
Carbon tetrachloride	10-310/6	5/1
1,1-Dichloroethene	2-470/6	5-9/2
1,2-Dichloroethene	3-49/3	
Trichloroethene	28-130/5	
Tetrachloroethene	23-600/3	5/1
1,1-Dichlroethane	190-430/2	
1,2-Dichloroethane	7/1	
1,1,1-Trichloroethane	5-560/8	22-32/2
1,1,2-Trichloroethane	5/1	
1,1,2,2-Tetrachloroethane	25/1	
Bis(2-chloroethyl)ether	20-53/3	
N-nitrosodiphenylamine	20/1	
Benzo(a)pyrene	20/4	20/1
Diethyl phthalate	20/1	

Note: Units are µg/l
Blanks - Not Detected above detection limit

only phenol is known to have been stored on the site. Phthalate esters and polynuclear aromatics are found widely in the environment from both anthropogenic and natural sources. Values reported for diethyl phthalate and benzo(a)pyrene are at the detection limits and are considered as estimates because some quality control criteria were not satisfied. This makes the reported values of these two compounds suspect. The only detection of N-nitrosodiphenylamine also falls into this category.

Inorganic chemicals encountered at elevated levels in SCRDI Dixiana Site well samples include arsenic, cadmium, mercury, nickel, zinc, and chromium. (This assessment is made in relation to Ambient Water Quality Criteria for these elements.) Arsenic was detected in monitoring wells MW-10, SCDHEC-6, 2B, and 3A. Mercury was found at elevated concentrations in SCDHEC-6 and 4, and chromium at SCDHEC-3A, 3B, and 5, and at MW-10 and 11. Nickel was elevated in wells MW-10 and 11. Additionally, the pumphouse well was high in chromium, cadmium and zinc.

Contamination of Groundwater in Residential Wells

Organic contamination was detected in groundwater in one of two nearby residential wells located downgradient of the site. The contaminants appear to be related to those encountered at the SCRDI Dixiana Site; however, it has not been determined what pathway the migrating contaminants have taken to contaminate the residential well water. The screened interval of the residential well is unknown, yet the RAMP reports that the screen is probably between 30 and 70 feet below the ground surface. Presently, the two residences are hooked up the City of Cayce water system. This significantly minimizes the risk from ingestion or use of contaminated groundwater.

Two possible flow paths of transport could account for the detection of contamination in the residential wells. First, natural groundwater transport mechanisms in both a vertical and lateral direction could be responsible for the observed contamination in the residential groundwater. However, it should be noted that the flow of groundwater in the deeper aquifer (45-50 feet) is to the south and southeast, yet the contaminated residential well is east of the site. Also, deep wells on the site show little contamination, or the contamination present is at or near the detection limits for each compound, whereas the residential well groundwater shows greater concentrations of contaminants. Secondly, the residential well could have a poor seal along the well bore between the residential well screen and the overlying contaminated shallow aquifers. A poor seal could provide a conduit for the vertical migration of contaminants from the shallow contaminated aquifer into the residential water source. The fact that the residential well is directly downgradient of shallow contaminated groundwater flow lends credence for a vertical conduit (well bore) that would transport contaminated groundwater into residential water.

Contaminant Mobility Characteristics and Migration Pathways

The chemicals identified at the SCRDI Dixiana Site have been subdivided into the following categories: chlorinated aliphatics; monocyclic aromatics; ketones; polynuclear aromatics; pesticides; phthalate esters. The rationale for this subdivision is the similar structure and environmental mobility characteristics of constituents in each category. The chlorinated aliphatics, monocyclic aromatics, and ketones are soluble in water and exhibit low soil adsorption coefficients relative to the polynuclear aromatics, pesticdes and phthalate esters. These qualities result in greater environmental mobility of these compounds attributable to groundwater convection. Conversely, the polynuclear aromatics and pesticides are relatively immobile in the hydrologic cycle.

Chemical analytical results for soil samples reveal little contamination and provide evidence of the effectiveness of the earlier removal of contaminated surface soils. For the soil contaminants, the volatile, relatively water soluble chemicals are subject to several transport mechanisms. The relatively low levels of volatile organic chemicals detected in the surface soil at the SCRDI Dixiana Site are most likely attributable to both volatilization and leaching by infiltrating precipitation. The groundwater contamination at the site is considered direct evidence of leaching of the volatile chemicals from soil contaminated via chemical spills or leaks.

Other compounds present in surficial soil, such as phthalate esters and PAHs, have relatively high soil/sediment adsorption coefficients, low vapor presures, and exhibit only limited water solubility. These chemicals generally display a tendency to remain bound to soil. Thus, they are relatively immobile in the hydrogeologic (subsurface) domain, although the same considerations make these chemicals amenable to transport via erosion of contaminated soils particles. The sporadic occurrence of these substances and the relatively low concentrations detected in the surface soil indicate that major sources of these chemicals are not present at the site. Substantial migration of these substances is not anticipated because significant sources were not identified and because they are not mobilized via most environmental transport mechanisms.

Volatile organics are the most mobile contaminants in the subsurface, primarily because of their ability to dissolve in water. The site history and chemical analytical results show that volatile organic chemicals are the primary contaminants associated with the site. Because of their prevalence and inherent mobility, their presence is used to assess the extent of subsurface migration from the site.

Groundwater chemical/analytical data indicate that the contamination at the SCRDI Dixiana Site is located primarily to the east and south of the site warehouse.

The local geology facilitates contaminant movement in the subsurface. Dispersion, or spreading out of the solute because of mechanical mixing as it is transported by groundwater, causes a reduction in solute concentration with increasing distance from the source. In porous media, like the sediments at the site, contaminant transport (in the direction of bulk flow) is dependent upon the average groundwater velocity. However, at the site, the various porous stratigraphic units demonstrate different groundwater velocities. Thus as contaminants migrate vertically, the dispersion process compounds as groundwater velocities and flow directions change. These complexities may account for the low levels of volatile contamination detected in wells to the south, including MW-8 and 9 (Figure 1-9).

It appears that the bulk of the contamination is still in the upper units of the aquifer and is migrating to the east in the direction of the Ballard and Holland residences.

Volatile organics do not tend to adsorb to soil or sediments to a significant degree. Also, biological degradation of volatiles is a very slow process and is probably not a dominant fate of these contaminants at the site. On the other hand, anaerobic groundwater conditions may degrade Trichloroethene and other "parent" chlorinated aliphatic molecules by reductive dehalogenation.

Generally, base/neutral extractable organics are less mobile in the subsurface than the volatiles. This is true for Benzo(a)pyrene and N-nitrosodilphenylamine which were detected on site. Though the source of these compound is not known, it is noteworthy that they were detected in wells adjacent to the south side of the warehouse. It is not likely that these compounds will migrate readily from this area because of their limited water solubility and their affinity for soils.

Contaminants migrating from the site can reach surface waters/sediments by two major transport mechanisms: 1) they can be transported as a solute in groundwater that eventually discharge into surface water; or 2) they can be transported in surface water runoff, either in solution or bound to eroding soil.

It is unlikely that the volatile contamination detected at location SD-104 (Figure 1-8 and note Table 1-2) stream sediments are present as a result of the site, merely because of the distances involved i.e. 1500-2000 feet. However contamination cannot be ignored for that reason. Volatile contamination of sediments at these distances from the site would suggest that it is due to contaminated groundwater discharge to the stream. Definitive conclusions on that matter must be deferred because of the lack of environmental samples from the period prior to the site cleanup, that would be used to confirm or disprove the presence of these contaminants in the surface media from which they could reach the nearby streams. Volatiles reaching surface waters are likely to volatilize fairly rapidly. The absence of volatile organics in surface water samples is probably attributable to this mechansim.

PUBLIC HEALTH AND ENVIRONMENTAL CONCERNS

The RI conducted at the SCRDI Dixiana Site indicates that groundwater is contaminated. Minor contamination of the soil has also been observed. The major contaminant transport pathway impacting on potential human and environmental receptors is the movement of groundwater under the site. Contaminants could be transported via groundwater into private drinking or watering wells. A comparatively minor route of transport of contaminants from the site is direct contact and pica ingestion of contaminated surface soils and other surface materials.

Potential receptors represent those who the site would most likely affect in terms of acute and chronic health implications. Based on present site conditions and data gathered during the RI, there does not appear to be significant potential human or environmental receptors as long as groundwater is not directly used from the monitoring wells or the two nearest residential wells. The available data do not indicate or confirm significant past or present human exposure. Other potential receptors include the following:

- Nearby users of groundwater for drinking purposes.

- Third-party intruders who come into direct dermal contact with contaminants present at the site.

- Onsite remediation workers through inhalation of elevated concentrations of volatile organic contaminants during groundwater disturbance or by direct dermal contact with contaminated soil.

- Potential receptors represent those whom the site would most likely affect in terms of acute and chronic health implications. Available data does not indicate or confirm significant past or present human exposure.

Table 1-5 presents a list of the contaminants evaluated, the media in which they were detected, and the number of positive detections. Table 1-6 shows environmental exposure criteria for the contaminants of concern listed in Table 1-5. The information and data shown in Table 1-5 and Table 1-6 were included in evaluations and considerations in connection with the remedial action technologies and alternatives developed in the FS and the alternative slection in this report.

Enforcement Analysis

A Responsible Party Search was conducted in May 1986, for the SCRDI Dixiana Site and a list containing over 20 potentially responsible parties (PRP's) was developed.

TABLE 1-5

CONTAMINANTS EVALUATED FOR THE FS
SCRDI DIXIANA SITE

Contaminant	Media in Which Detected	Range of Occurrences (ppb)	# of Detections
benzene	MW	5-6	2/37
1,1,2,2-tetrachloroethane	MW	25	1/37
1,1,1-trichloroethane	MW	5-560	8/37
	RW	22-32	2/6
1,1,2-trichloroethane	MW	5	1/37
1,2-dichloroethane	MW	7	1/37
tetrachloroethene	MW	23-600	3/37
	RW	5	1/6
	SS	2-460	3/32
trichloroethene	MW	28-130	5/37
	SD	3.9	1/7
1,1-dichloroethene	MW	2-470	6/37
	RW	5-9	2/6
carbon tetrachloride	MW	10-310	6/37
	RW	5	1/6
chloroform	MW	2-64	6/37
	RW	5	1/6
methylene chloride	MW	140-690	3/37
	SS	52-230	7/32
acenaphthene	SS	4000	1/32
benzo(a)pyrene	MW	20	4/37
	RW	20	1/6
pyrene	SS	200	1/32
N-nitrosodiphenylamine	MW	20	1/37
bis(2-chloroethyl)ether	MW	20-53	3/37

TABLE 1-5
CONTAMINANTS EVALUATED FOR THE FS
SCRDI DIXIANA SITE
PAGE TWO

Contaminant	Media in Which Detected	Range of Occurrences (ppb)	# of Detections
4,4'-DDT	SS	4-14	4/32
4,4'-DDD	SS	4.2-14	2/32
4,4'-DDE	SS	15	1/32
PCB 1016	SO	25	1/14
PCB 1260	SD	50	1/7
arsenic	MW	10-59	5/37
cadmium	MW	3-33	6/37
chromium	MW	10-240	27/37
copper	MW	26-1100	6/37
	RW	70-380	4/6
iron	MW	53-96,000	34/37
	RW	300	3/6
	SW	390-1700	13/13

Notes:

MW - monitoring well
RW - residential well
SS - surface soil
SO - subsurface soil
SD - sediment
SW - surface water

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TABLE 1-6

ENVIRONMENTAL EXPOSURE CRITERIA FOR CONTAMINANTS EVALUATED FOR THE FS
SCRDI DIXIANA SITE
LEXINGTON COUNTY, SOUTH CAROLINA

Contaminant	Maximum Concentration (mg/l)	Acceptable Daily Intake (mg/day)/(mg/l)(1)	Maximum and Recommended Maximum Contaminant Levels (MCL/RMCL)(mg/l)(2)	Ambient Water Quality Criteria(3): Drinking Water Only for 10^{-6} Risk (mg/l)	Ambient Water Quality Criteria(3): Protection Of Aquatic Life ** (mg/l)	Health Advisories Suggested No Adverse Response Levels (SNARLs) (mg/l)(4)	Carcinogenic Potency Factor (kg-day/mg)(5)
benzene	0.006	NR	0.005*/0	0.00067	0.0053	1-Day: 0.233 10-Day: 0.233	2.9×10^{-2}
1,1,2,2-tetrachloroethane	0.025	NR	NR/NR	0.00017	2.4	NR	0.20
1,1,1-trichloroethane	0.560	38/19	0.200*/0.200	19	NR	1-Day: 140 10-Day: 35 Long-Term: 35	1.60×10^{-3}
1,1,2-trichloroethane	0.005	NR	NR/NR	0.0006	9.4	NR	5.73×10^{-2}
1,2-dichloroethane	0.007	NR	0.005*/0	0.00094	20	1-Day: 0.74 10-Day: 0.74 Long-Term: 0.74	6.9×10^{-2}
tetrachloroethene	0.600	NR	NR/0*	0.00088	0.840	10-Day: 34 Long-Term: 1.94	6.0×10^{-2}
trichloroethene	0.130	NR	0.005*/0	0.0028	21.9	NR	1.2×10^{-2}
1,1-dichloroethene	0.470	NR	0.007*/0.007*	0.000033	11.6	1-Day: 1 10-Day: 1 Long-Term: 1	1.47×10^{-1}
carbon tetrachloride	0.310	NR	0.005*/0	0.00042	35.2	1-Day: 4 10-Day: 0.16 Long-Term: 0.071	1.30×10^{-1}
chloroform	0.064	NR	NR	0.00019	1.24	NR	7×10^{-2}
methylene chloride	0.690	NR	NR	0.00019	NR	1-Day: 13.3 10-Day: 1.5	6.3×10^{-4}
acenapthene	ND	NR	NR	0.020	0.52	NR	11.5
pyrene	ND	NR	NR	0.0000031	NR	NR	11.5
benzo(a)pyrene	0.020	NR	NR	0.0000031	NR	NR	11.5
N-nitrosodiphenylamine	0.020	NR	NR	0.0049	NR	NR	4.92×10^{-3}

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TABLE 1-6
ENVIRONMENTAL EXPOSURE CRITERIA FOR CONTAMINANTS EVALUATED FOR THE FS
SCRDI DIXIANA SITE
LEXINGTON COUNTY, SOUTH CAROLINA
PAGE TWO

Contaminant	Maximum Concentration (mg/l)	Acceptable Daily Intake (mg/day)/(mg/l)(1)	Maximum and Recommended Maximum Contaminant Levels (MCL/RMCL)(mg/l)(2)	Ambient Water Quality Criteria(3): Drinking Water Only for 10^{-6} Risk (mg/l)	Ambient Water Quality Criteria(3): Protection Of Aquatic Life ** (mg/l)	Health Advisories Suggested No Adverse Response Levels (SNARLs) (mg/l)(4)	Carcinogenic Potency Factor (kg-day/mg)(5)
arsenic	0.059	0.20/0.10	0.050/0.050	0.000025	0.040	1-Day: 0.050 10-Day: 0.050 Long-Term: 0.050	15
cadmium	0.033	0.036/0.018	0.010/0.005	0.010	0.0015	1-Day: 0.043 10-Day: 0.008 Long-Term: 0.005	7.8
chromium	0.240	0.034/0.017	0.050/0.12	0.050	0.0072	1-Day: 1.4 10-Day: 1.4 Long-Term: 0.24	41
copper	ND	NR	1.0++/1.0++	1.0	0.0056	NR	NR
iron	ND	NR	0.3++/0.3++	NR	NR	NR	NR

Notes:
* - Proposed value
** - Lowest value is presented. If both acute and chronic values are presented in the reference, the chronic (lower) value is shown.
\+ - Adjusted ADI (USEPA, November 13, 1985)
++ - Secondary Drinking Water Standard
NR - Not Reported

Sources:
(1) USEPA, May 1984. Summary of Current Oral Acceptable Daily Intakes (ADIs) for Systemic Toxicants. Environmental Criteria and Assessment Office, Cincinnati, Ohio and USEPA, November 13, 1985. "National Primary Drinking Water Regulations; Synthetic Organic Chemicals, Inorganic Chemicals and Microorganisms." Federal Register, Vol. 50, No. 219.
(2) USEPA, November 13, 1985. "National Primary Drinking Water Regulations; Synthetic Organic Chemicals, Inorganic Chemicals and Microorganisms." Federal Register, Vol. 50, No. 219 and USEPA, November 13, 1985. "National Primary Drinking Water Regulations; Volatile Synthetic Organic Chemicals." Federal Register, Vol. 50, No. 219.
(3) USEPA, November 28, 1980. "Water Quality Criteria Documents." Federal Register, Vol. 45, No. 231; USEPA, February 7, 1984. "Water Quality Criteria." Federal Register, Vol. 49, No. 26; and ICF, Inc., December 18, 1985. Draft Superfund Public Health Evaluation Manual. Washington, D.C.
(4) ICF, Inc., December 18, 1985. Draft Superfund Public Health Evaluation Manual. Washington, D.C.
(5) USEPA, February 1985. Mutagenicity and Carcinogenicity Assessment of 1,3-Butadiene. Washington, D.C.

However, it was discovered, that due to SCRDI activities in the chemical brokering and recycling business, three other sites in the Columbia, SC area were involved. These other sites include Bluff Road, an NPL site, and the Dreyfuss Street and Shop Road holding sites. At one time, SCRDI used these sites for chemical and waste handling and storage.

Our records indicate that between 3,000 to 10,000 containers of waste were stored at the Bluff Road Site. Some of these materials were transferred to the Shop Road holding facility where waste was stored and transported to either Dreyfuss Street or the SCRDI Dixiana Site. The Shop Road holding facility also received waste directly from generators before being transported to Dreyfuss Street or the SCRDI Dixiana site. It was also reported that SCRDI Dixiana also received some waste directly from the generators.

At the present time it is difficult to connect potentially responsible generators to the site based upon the currently available information. In an attempt to make a clearer connection between the generators and the site, information request letters will be sent to the parties listed in the PRP search. Once this task is completed, notice letters will be sent and the identified PRP's will have the opportunity to negotiate on the Remedial Design and Remedial Action (RD/RA) at the SCRDI Dixiana Site.

Alternative Evaluation

The purpose of the remedial action is to mitigate contamination at the SCRDI Dixiana site in order to negate potential risks to human health and the environment. Groundwater contamination is the only area of concern that presents significant risks to the public health and environment. Soil and sediment contamination are minimal i.e. less that background levels, thus should not pose a threat to human health and the environment. Since soil and sediment does not appear to pose a threat the objectives in developing remedial actions at the SCRDI Dixiana Site were:

° Groundwater Contamination:

  - Management of migration

  - Prevent increases of contaminant concentrations

  - Reduce concentrations of contaminants

  - Prevent or minimize further migration of contaminants

An initial screening of applicable alternatives was performed to select those which best met the criteria specified in Section 300.68 of the National Contingency Plan (NCP). Following initial screening of technologies, potential remedial action alternatives were identified and analyzed. These alternatives were screened and the most promising were retained and were developed further. Table 3 summarizes the results of the screening process. Each of the seven alternatives was evaluated based upon techinal consideration, institutional issues, environmental issues, public health impacts, and cost criteria. A cost summary is presented in Table 3. The results of the final evaluation are given below.

Alternative 1

No Remedial Action

Under the no-action alternative remedial activities would not be performed for both the soil and groundwater contamination. The soil contamination does not present a problem to the public and the environment and therefore remedial actions for the soil are not necessary (Technical discussion and justification for no action on soil contamination is addressed below under, "No Action: Soil Contamination".) However, the groundwater contamination poses a potential risk to the public health and environment. Although the site is not considered to be an immediate threat to potential receptors, the potential for migration of contaminants in the Class IIA aquifer would continue to exist. The groundwater plume could eventually discharge into the surface waters and appear in wells downgradient from the site or continue to contaminate the residential wells 350 feet east of the site with the potential for contamination of deeper groundwater moving in a southward direction. Potential contamination release and pathways would remain unchecked. The site would continue to be a potential source of future contamination. There are no construction or capital improvements in this alternative. Time is not a criterion. However, receptors could be exposed at some future time if migration of groundwater contaminants were to occur downgradient from the site.

Regulatory requirements and strategies in connection with protection of groundwater exist. The aquifer underlying the site is classified as Class IIA, which would indicate that it is of current use and part of a multiple source of drinking and domestic water supplies for downgradient communities. Regulations require that such aquifers not be degraded or contaminated. This option does not satisfy any currently applicable or relevant State or Federal (RCRA) standards for the closure of a site containing hazardous materials and wastes. Based upon the above consideration of public health, this no action alternative has been rejected.

No Action: Soil Contamination

The surface and subsurface soils are not extensively contaminated (See Table 1-3) and the contamination appears to be confined to the site itself. A large number of the sample results are qualified with an "N" signifying presumptiive evidence of the material at the particular location (See Figure 4-1). As discussed in EXTENT OF SOIL CONTAMINATION SECTION the only carcinogenic volatile organics chemicals detected were tetrachloroethene (PCE) and methylene chloride. All methylene chloride values reported are qualified with and N. PCE was detected in three samples at a maximum concentration of 460 ppb. The results also indicated that in addition to the volatiles, low levels of phthalate esters, polyaromatic hydrocarbons, and pesticides randomly distributed. Phthalate esters, are widespread in the environment and the pesticides DDT, DDE, DDD, are reported at very low levels and are only tentatively identified. Toulene, Arochlor - 1016, Benzoic Acid and Cyanide appeared once in August 1984 sampling round only and not in July 1985.

Table 6-6 and 6-7 summarize the risks associated with the dermal absorption and ingestion of contaminants in soil at the site. These risk are very low under the predicted exposure scenarios. Dermal contact with and pica ingestion of surface soils can present a slight risk to potential receptors. Trespassing is not known to be a problem at the site, but assuming that any such activity will occur throughout the site and not regularly in any one area, risks are less than $1x\ 10^{-5}$ (9.2×10^{-6} for dermal contact and 3.9×10^{-6} for soil ingestion). These estimated risk levels are due primarily to the presence of acenaphthene and pyrene in two isolated soil samples. These risks are high because current agency policy is to use the same potency for these unclassified carcinogens as is used for benzo(a)pyrene, a known animal carcinogen. However, recognizing that the dermal contact risks presented in Table 6-6 and 6-7 were extremely conservative (i.e. persons received their entire lifetime accumulations of soil on the skin from this site and 10 percent of a contaminant in the soil is absorbed through the skin), certain adjustments can be made. A 3 percent absorption rate can be used based on Kows similiar to those for PCBs. Using this lower absorption rate, the risks presented in Table 6-6 would be lower. These values are presented in Table 6-8. The risks associated with the other organic compounds identifed in the site soils (i.e. tetrachlorothene and methylene chloride) can remain at their present concentrations because these risks are two orders of magnitude lower than those for the PAHs. The risks presented in Table 6-8 are still very conservative because of the assumption regarding lifetime soil accumulation.

An actual exposure scenario is better represented by using the average soil concentration because persons who trespass on the property are more likely to come in contact with soil from various parts of the site rather than from just one location.

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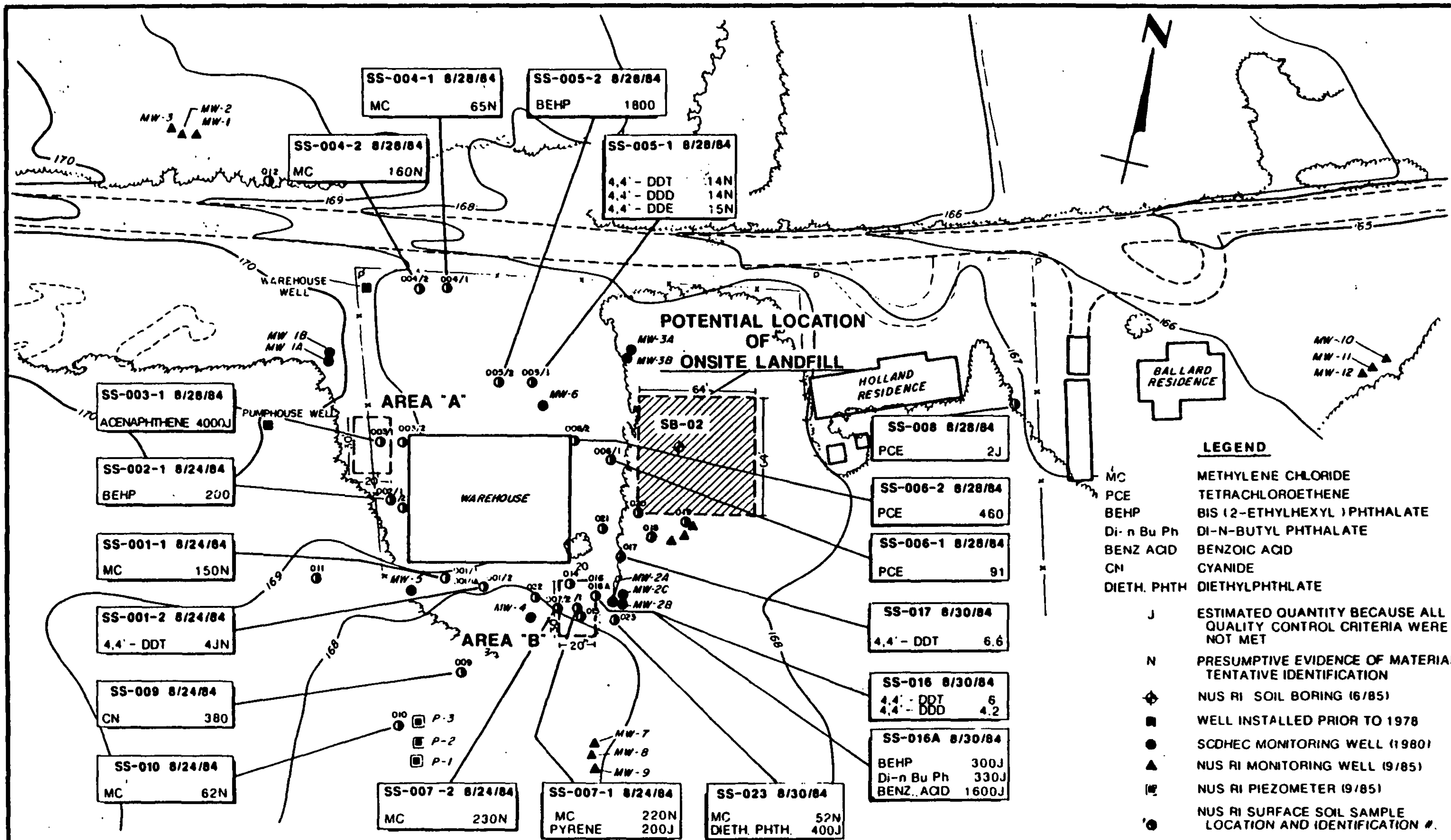
TABLE 3

SUMMARY OF POTENTIAL REMEDIAL ACTION ALTERNATIVES
SCRDI DIXIANA SITE

Category	Alternative	Soil Contamination	Groundwater Contamination: Method	Groundwater Contamination: Cleanup Criteria	Baseline[(a)] Capital Costs ($1,000)	Baseline[(a)] Present Worth ($1,000)
I	1	No Remedial Action	No Remedial Action	--	--	--
I	2	No Remedial Action; Periodic Site Inspections	No Remedial Action; Periodic Groundwater Sampling and Analysis or 2A: No Remedial Action; Periodic Groundwater Sampling and Analysis; and Institutional Controls	--	-- or 35	48 or 305
II	3	Surface Capping ("CERCLA" Cap); Surface Grading and Revegetation (Areas A and B)	Groundwater Extraction/Treatment/Injection or Surface Discharge; Hydraulic Containment	MCL	755.9	1,686.5
III	4	Surface Capping ("RCRA" Cap); Surface Grading and Revegetation (Areas A and B)	Groundwater Extraction/Treatment/Injection or Surface Discharge; Hydraulic Containment	MCL	771.5	1,703.5
IV	5	Excavation of Contaminated Soils at Areas A & B; Backfilling; Surface Grading and Revegetation; Onsite Landfill Disposal	Groundwater Extraction/Treatment/Injection or Surface Discharge; Hydraulic Containment	MCL	809.4	1,824.5
V	6	Excavation of Contaminated Soils at Areas A & B; Backfilling; Surface Grading and Revegetation; Offsite Landfill Disposal	Groundwater Extraction/Treatment/Injection or Surface Discharge; Hydraulic Containment	MCL	786.6	1,713.9

MCL: Maximum Contaminant Levels
(a): Costs associated with groundwater injection vs. surface discharge have been averaged together for purposes of this table.

III	7	No Remedial Action	Groundwater Extraction/ /Treatment/Injection or Surface Discharge; Hydraulic Containment	ACL	751,250	1,679,500



NOTE: ALL VALUES IN ug/kg.

NOT FOR DESIGN OR CONSTRUCTION USE. LOCATION AND DIMENSIONS ARE FOR FEASIBILITY STUDY PURPOSES ONLY.

50 0 50 100

SCALE IN FEET

ORGANIC CONTAMINANTS FOUND IN SITE SOILS; AREAS TARGETED FOR CAPPING AND POTENTIAL LOCATION OF ONSITE LANDFILL

SCRDI DIXIANA SITE
LEXINGTON CO., SOUTH CAROLINA

FIGURE 4-1

NUS CORPORATION
A Halliburton Company

TABLE 6-6

CARCINOGENIC RISK ESTIMATES ASSOCIATED WITH DERMAL CONTACT WITH SURFACE SOILS
SCRDI DIXIANA SITE
LEXINGTON COUNTY, SOUTH CAROLINA

Contaminant	Maximum Soil Concentration (mg/kg)	Maximum Carcinogenic Risk	Average Soil Concentration (mg/kg)	Average Carcinogenic Risk
tetrachloroethene	0.460	1.7×10^{-7}	0.017	6.3×10^{-9}
methylene chloride	0.230	8.9×10^{-10}	0.029	1.1×10^{-10}
acenaphthene	4.000	2.8×10^{-4}	0.125	8.8×10^{-6}
pyrene	0.200	1.4×10^{-5}	0.006	4.2×10^{-7}
DDT/metabolites	0.043	9.0×10^{-8}	0.002	4.2×10^{-9}
Total Risk		2.9×10^{-4} (1 in 3,400)		9.2×10^{-6} (1 in 108,000)

TABLE 6-7

CARCINOGENIC RISK ESTIMATES ASSOCIATED WITH SOIL INGESTION
SCRDI DIXIANA SITE
LEXINGTON COUNTY, SOUTH CAROLINA

Contaminant	Maximum Soil Concentration (mg/kg)	Maximum Carcinogenic Risk	Average Soil Concentration (mg/kg)	Average Carcinogenic Risk
tetrachloroethene	0.460	7.1×10^{-8}	0.017	2.6×10^{-9}
methylene chloride	0.230	3.7×10^{-11}	0.029	4.7×10^{-11}
acenaphthene	4.000	1.2×10^{-4}	0.125	3.7×10^{-6}
pyrene	0.200	5.9×10^{-6}	0.006	1.8×10^{-7}
DDT/metabolites	0.043	3.7×10^{-8}	0.002	1.7×10^{-9}
Total Risk		1.3×10^{-4} (1 in 8,000)		3.9×10^{-6} (1 in 257,000)

Table 6-8

RISK ASSOCIATED WITH PAHs BASED ON 3%
ABSORPTION RATE

Contaminant	Risk at Max. Conc.	Risk at Ave. Conc.
acenaphthene	8.5×10^{-5}	2.7×10^{-6}
pyrene	4.2×10^{-6}	1.2×10^{-7}
Total Risk	8.9×10^{-5}	2.8×10^{-6}

In order to meet a total 1 x 10^{-6} risk goal for dermal absorption, the following average soil concentrations should be attained (each contaminant must meet a 5 x 10^{-7} risk goal, assuming the additivity of risk):

Acenaphthene	.024 mg/kg
Pyrene	.024 mg/kg

The action level to meet a total 1 x 10^{-7} risk goal would be an order of magnitude lower. The action levels presented above are significantly lower than those expected in urban or rural areas. Background levels of total PAHs (in mg/kg) in soil are presented in Table 6-9. The data in this table reveal that the levels of PAHs found at the SCRDI Dixiana Site are well within a "normal" range for many areas, and therefore may not be site-related. Furthermore, there is no danger of the soil contaminants migrating through the ground and further contaminating the groundwater aquifer. Contaminant levels from the ground to the most shallow aquifer were predicted using a conservative transport model. Taking into account toxicological factors, permeabilities, and the thickness of the aquifer, verical migration of the soil contaminants did not add to the aquifer contamination or increase the risks.

In summary, the soil contamination is minimal throughout the site and does not require any remedial action. The primary route of exposure at this site is through the potential ingestion of contaminated groundwater. Therefore the remaining discussion on alternative evaluation and selection will focus on a remedial action that would alleviate the groundwater contamination at the SCRDI Dixiana Site.

Alternative 2

No Remedial Action; Periodic Site Inspections

Under this alternative, existing groundwater contamination would not be remedied. Contaminated groundwater would be left in its present state. All aspects of this alternative are the same as those described under Alternative 1, with the exception of periodic sampling, analysis, and report preparation concerning groundwater quality in the shallow subsurface beneath the site. Sampling analysis, and report preparation would be performed semi-annually.

No remedial action with respect to groundwater contamination would mean that migration of contaminants would continue and associated pathways would remain unchecked. A no action alternative has no construction or capital improvements, yet sampling and site vists would mean that the site and groundwater contamination will be monitored an not go unnoticed. However no remedial action on contaminated groundwater does not satisfy any currently applicable or relevant State or Federal (RCRA) Standards for the closure of a site containing hazardous materials and wastes.

Costs associated with this alternative, would be limited to semi-annual site vists, sampling of monitoring wells, and reports of findings No capital or maintenance costs would be associated with this alternative. Operating costs were estimated at $23,240 for years 1 through 30.

Table 6-9

BACKGROUND LEVELS OF TOTAL PAHs IN mg/kg

LOCATION	CONCENTRATION
Center of town, at highway	110 mg/kg
Outlying section of town, light traffic, 400 m. from main highway	21 mg/kg
Open county, 700 m. from main highway	5 mg/kg
Alpine meadow, 1600 m. elevation	4 mg/kg

Present worth is estimated at $220,000. Similar to alternative 1, no remedial action on groundwater contamination provides no additional protection to the public health from contaminants in the groundwater other than what is currently in place. Based upon this consideration of public health, this no action alternative has been rejected.

Alternative 2 A

No Remedial Action; Institutional Restrictions
on Groundwater Usage; Periodic Sampling and analysis

Just as in Alternative 2, this alternative involves no remedial action with respect to groundwater contamination, leaves contaminated groundwater in its present conditions, and includes periodic inspections of the site and surrounding area. The major difference between Alternative 2 and this alternative are that the alternative includes institutional restrictions on usage of groundwater within one an one-half mile radius of the site, and offsite groundwater monitoring as well as onsite monitoring. The area within a one-half mile radius of the site would be set up by local authorities as a zone inside which no groundwater withdrawal would be allowed (i.e. resticted zone). Existing wells within the zone would be condemned (or, if condemnation is not viable, publicly identified as potentially harmful to human health and the environment.

However, the EPA is currently uncertain about the long-term effectiveness of institutional controls as a means of restricting groundwater use. This posture stems from the Agency's limited experience with such controls and the current lack of criteria against which their effectiveness can be judged, as well as uncertainty over the ability of a PRP or state to maintain or continue extended response actions, and uncertainty regarding Superfund's ability to oversee and fund additional response actions in the future. As a result, the Superfund program generally does not encourage groundwater remedies with long timeframes. Based on these considerations, this no action alternative has been rejected.

Alternative 3:

Soil Contamination Surface Capping; ("CERCLA CAP");
Surface Grading and Revegetation
Groundwater Contamination Extraction/Treatment/
/Surface Discharge; Hydraulic Containment

This alternative involves the placement of a seal, or cap over contaminated areas. Contaminated soils would remain in their existing places and be covered by the cap. Sealing/Capping is a common remedial technology for isolating contaminated materials. Under Category II it would meet CERCLA goals but would not attain other applicable or relevant standards (i.e. RCRA CAP). Based on the earlier discussion justifying no action for soil contamination, this alternative remedy is not necessary. The benefits of reducing risks to the public health and environment, are not substantial enough in terms of cost and practicality, therefore this action is rejected. For groundwater contamination, extraction and treatment to alternate concentration levels (ACLs) for individual contaminants will be selected and discussed under Alternative 7-Recommended Alternative.

Alternative 4

Soil Contamination: Surface Capping
(RCRA CAP"); Surface Grading and Revegetation
Groundwater Contamination: Extraction/Treatment/
Surface Discharge; Hydraulic Contaminant

This alternative involves the construction of a seal cap over contaminated areas, compared to Alternative 3, this surface seal would have more stringent design specifications, and would meet RCRA goals. However, due to the explanation in No Action Soil Contamination and the Alternative 3 section this alternative was rejected. Groundwater contamination cleanup rationale will be deferred to the discussion on Alternative 7.

Alternative 5

Soil Contamination;Excavation of Contaminated Soils
Onsite Disposal; Surface Grading and Revegetation
Groundwater Contamination;Extraction/Treatment
Surface Discharge; Hydraulic Contaminant

This alternative includes excavation and removal of contaminated soils and then disposal in a landfill to be constructed on the site. However due to minimal soil contamination, excavation of soils, as with surface capping is not necessary at this site. Therefore this alternative is rejected as a viable remedial action.

Alternative 6

Soil Contamination: Excavation of Contaminated soils
and Offsite Disposal;
Surface Grading & Revegetation
Groundwater Contamination:Extraction/Treatment/
Surface Discharge

This alterntive represents a more comprehensive remedial measure than preceding alternatives as contaminated soils would be removed from the site and disposed of in an offsite permitted hazardous waste landfill. However this alternative was rejected for the same reasons as explained in Alternatives 3, 4, and 5. The groundwater contamination alternative will be discussed in the following section.

Alternative 7

Groundwater Extraction/Treatment/
Surface Discharge

This alternative has been selected as the recommended alternative action for the SCRDI Dixiana Site. In this alternative, groundwater and entrained contaminants are extracted using deep well technology, contaminated groundwater is treated at an onsite water treatment system and treated groundwater discharged to the surface. The objective of this alternative is to reduce the concentration of contaminants in the groundwater to levels where potential risk to human health and the environment are reduced to acceptable levels, and to hydraulically control the migration of contaminants in the groundwater. The intent of extraction and treatment of groundwater is first to attain the allowable levels for each individual contaminant present beneath the SCRDI Dixiana site, and secondly, to attain an alternate concentration level (ACL) for the combination of all effluent compounds from the treatment system so that the cumulative risk is 1.0×10^{-6}. The ACLs applicable to groundwater used as a source of potable water for this remedial action, are presented in Table 4. The ACLs represent allowable lifetime exposure to a contaminant through ingestion. Exposure limits are adjusted for bodily absorption associated with ingestion and reflect the technological and economic feasibility of removing the contaminants from the water supply using the best available technology. The ACLs also include a margin of safety to protect sensitive populations.

Wells with submersible pumps would be utilized in this alternative to extract contaminated groundwater. The design of this system would entail a detailed hydrogeologic investigation. The Feasibility Study presents a computer model for the design of a water treatment system for this site. The design takes into account the hydrologic properties of the contaminated shallow aquifers and its observed leakage and apparent hydraulic connection with the deeper aquifer (See Figure 4-8). The treatment facility would be constructed onsite and operated for a period of approximately 30 years. This is dependent on the treatment process, flow rates, performance of the system determined from groundwater monitoring, and desired levels of remediation. In Table 3-1 theoretical concentrations are tabulated for each of the contaminants based on operating the system for 3 months and upwards to 10 years. These values are postulated since it is uncertain what affect the system would have on the chemicals taking into account the "flushing" action created by the extraction pumps, dispersion and natural attenuation.

The treatment process will include air stripping and carbon adsorption. Risk associated with inhalation of airborne contaminants from the stripper column will be minimal. Total risks at the nearest possible receptor (residential wells) will be approximately 1×10^{-6}. (See Table 6-5).

TABLE 6-4

CARCINOGENIC RISK ESTIMATES ASSOCIATED WITH INGESTION OF GROUNDWATER
SCRDI DIXIANA SITE
LEXINGTON COUNTY, SOUTH CAROLINA

Contaminant	Monitoring Wells Minimum Concentration	Monitoring Wells Mean* Concentration	Monitoring Wells Maximum Concentration	Residential Wells Minimum Concentration	Residential Wells Maximum Concentration
benzene	4.1×10^{-6}	2.4×10^{-7}	5.0×10^{-6}	ND	ND
1,1,2,2-tetrachloroethane	-	4.0×10^{-6}	1.4×10^{-4}	ND	ND
1,1,1-trichloroethane	2.3×10^{-7}	1.6×10^{-6}	2.6×10^{-5}	1.0×10^{-6}	1.5×10^{-6}
1,2-dichloroethane	-	3.9×10^{-7}	1.4×10^{-5}	ND	ND
tetrachloroethene	3.9×10^{-5}	3.1×10^{-5}	1.0×10^{-3}	-	8.6×10^{-6}
trichloroethene	9.6×10^{-6}	2.4×10^{-6}	4.5×10^{-5}	ND	ND
1,1-dichloroethene	8.4×10^{-6}	9.2×10^{-5}	2.0×10^{-3}	2.1×10^{-5}	3.8×10^{-5}
carbon tetrachloride	3.7×10^{-5}	9.3×10^{-5}	1.2×10^{-3}	-	1.9×10^{-5}
chloroform	4.0×10^{-6}	8.0×10^{-6}	1.3×10^{-4}	-	1.0×10^{-5}
methylene chloride	2.5×10^{-6}	4.9×10^{-7}	1.2×10^{-5}	ND	ND
benzo(a)pyrene	-	1.6×10^{-4}	6.6×10^{-3}	ND	ND
n-nitrosodiphenylamine	-	7.0×10^{-8}	2.8×10^{-6}	ND	ND
bis(2-chloroethyl)ether	6.5×10^{-4}	9.8×10^{-5}	1.7×10^{-3}	ND	ND
Total Risk	7.6×10^{-4}	4.9×10^{-4}	1.3×10^{-2}	2.2×10^{-5}	7.7×10^{-5}
	(1 in 1,300)	(1 in 2,000)	(1 in 78)	(1 in 45,000)	(1 in 13,000)

Notes:

* - Means calculated by adding all detections (all non-detections were assumed to be zero) and dividing by total number of samples (37). Therefore, risks from mean concentrations can be less than the risks from minimum concentrations because the mean can be less than the minimum detected value.

\- - The contaminant was detected only once, and therefore is included with the maximum risks to present a worst-case scenario.

Not Detected

TABLE 4
ALTERNATE CONCENTRATION
LEVELS/ALTERNATIVE 7

Chemical	Proposed ACL (1)	Basis
Benzene	5	pMCL
1,1,2,2 - Tetrachloroethane	0.2	CAG
1,1,1 - Trichlorethane	200	pMCL
1,1,2 - Trichloroethane	0.6	CAG
1,2 - Dichloroethane	5	pMCL
Tetrachloroethene	0.7	CAG
Trichloroethene	5	pMCL
1,1 - Dichloroethene	7	pMCL
Carbon tetrachloride	5	pMCL
Chloroform	0.4	CAG
Methylene chloride	5	CAG
Acenaphthene	(2)	-
Benzo(a)pyrene	0.003	CAG
Nitrosodiphenylamine	7.1	AWQC
bis(2-chloroethyl)ether	0.03	CAG
Arsenic	50	MCL
Cadmium	10	MCL
Chromium	50	MCL
Copper	1,000 (3)	SDWR
Iron	300 (3)	SDWR

pMCL - Proposed Maximum Contaminant Level
CAG - 10^{-6} lifetime risk level based on the EPA's Carcinogen Assessment Group's q_1^* values (1/86)
AWQC - 10^{-6} lifetime risk level based on Ambient Water Quality Criteria value corrected for ingestion of chemical in water only
SDWR - Secondary Drinking Water Regulation
(1) - Concentration in ug/l
(2) - No toxicological basis for the development of a health-based drinking water standard is available. However, clean-up techniques (e.g. carbon adsorption) that remove benzo(a)pyrene from water would also likely remove acenaphthene.
(3) - The Secondary Drinking Water Standards were established to ensure aesthetic acceptability of drinking water (taste, odor, etc.). However, they would also provide protection against potential adverse health effects from the same contaminants.

TABLE 3-1
THEORETICAL CONTAMINANT CONCENTRATIONS AFTER 3, 6, 12, 24, AND 120 MONTHS OF GROUNDWATER TREATMENT FOR AQUIFERS C/D AND F - SCRDI DIXIANA SITE (BASED ON PUMPING RATE OF 4.23 l/s)

	ug/l Maximum Detected Conc.	(ug/l)(1) Weighted Mean Conc.	(ug/l)(2) Theoretical Concentration After 3 Months Flushing Time	(ug/l)(2) Theoretical Concentration After 6 Months Flushing Time	(ug/l)(2) Theoretical Concentration After 12 Months Flushing Time	(ug/l)(2) Theoretical Concentration After 24 Months Flushing Time	(ug/l)(2) Theoretical Concentration After 120 Months Flushing Time
Benzene	6	5	3.9	3.0	1.8	0.6*	1.8×10^{-4}*
Toluene	17	6.1	DNEC	DNEC	DNEC	DNEC	DNEC
Xylenes	31	7.6	DNEC	DNEC	DNEC	DNEC	DNEC
1,1,2,2 Tetrachloroethane	25	6.8	5.3	4.2	2.5*	0.9*	2.4×10^{-4}*
1,1,1 Trichloroethane	560	61.7	DNEC	DNEC	DNEC	DNEC	DNEC
1,1,2 Trichloroethane	5	5	3.5	2.5	1.2	0.3*	3.4×10^{-6}*
1,1 Dichloroethane	430	60.4	DNEC	DNEC	DNEC	DNEC	DNEC
1,2 Dichloroethane	7	5.2 max used	4.0	2.3	0.7*	0.08*	1.2×10^{-9}*
Tetrachloroethene	600	65.3	61.7	58.2*	51.8*	41.1*	6.5*
Trichloroethene	130	22.1	18.5	15.9	10.8*	5.3*	0.0174*
1,2 Dichloroethene	49	10.8	DNEC	DNEC	DNEC	DNEC	DNEC
1,1 Dichloroethene	470	77.9	69.0	61.0	47.0*	29.0*	0.6*
Carbon Tetrachloride	310	87.5	76.4	66.6	50.4	29.0*	0.4*
Chloroform	64	15.7	9.7	5.9*	2.2*	0.3*	4.2×10^{-8}*
Methylene Chloride	690	17.3	7.5*	3.2*	0.6*	0.02*	3.4×10^{-14}*
Phenol	20	10.9	DNEC	DNEC	DNEC	DNEC	DNEC
Methyl Phthalate	20	10.9	DNEC	DNEC	DNEC	DNEC	DNEC
N-nitrosodiphenylamine	20	10	9.6	9.3	8.6	7.3	2.0*
bis-(2-chloroethyl)ether	53	16.1	10.4	6.2	2.3*	0.3*	2.1×10^{-8}*

Notes:

(1) Weighted mean average derived from DFM calculation 5/6/86 in Appendix D of Feasibility Study.
(2) Theoretical flushing times derived from equations in Appendix D of Feasibility Study.
DNEC Contaminant concentration in groundwater does not exceed MCL or ADI concentrations on Table 4-5 of Feasibility Study.
* Contaminant concentration in groundwater does not exceed ACL concentrations for a cummulative 1×10^{-6} risk.
ug/l = µg/l

TABLE 6-5

CARCINOGENIC RISK ESTIMATES ASSOCIATED WITH INHALATION OF VOLATILE ORGANICS IN RESIDENTIAL WELLS
SCRDI DIXIANA SITE
LEXINGTON COUNTY, SOUTH CAROLINA

Contaminant	Maximum Concentration In Residential Wells (mg/m^3)	Carcinogenic Risk
1,1,1-trichloroethane	0.032	6.0×10^{-8}
tetrachloroethene	0.005	3.5×10^{-7}
1,1-dichloroethene	0.009	1.5×10^{-6}
carbon tetrachloride	0.005	7.6×10^{-7}
chloroform	0.005	4.1×10^{-7}
Total Risk		3.1×10^{-6} (1 in 324,000)

Extraction, treatment and surface discharge groundwater are commonly used technologies in remedial actions. Monitoring the progress of contaminant extraction is probably the most critical factor affecting the overall reliability of this alternative. The design of the equipment should include sufficient redundancy and spare parts to permit uninterrupted operation. Design, construction, and testing of the treatment system would require about one year to complete. Once the design is complete, the system could probably be installed in 60 days to 90 days and become operational in 60 to 90 days after installation. A period of experimental operations would be required to "time" the system and establish a reliable operation.

If injection of treated groundwater is implemented at the site, then South Carolina would be the permitting agency and the South Carolina's cleanup criteria for rejection will apply where that criteria is more stringent them the aforementioned ACLs. Also surface discharge would require a permit from applicable South Carolina State Agencies. Surface discharge would be to a nearby surface water point source and/or the effluent can be discharged on the site soils based on the hydraulic capacity of the subject area. Land application technologies including infiltration basins, tiling fields, and irrigation will be considered during remedial design.

An extraction/treatment alternative would reduce the threats to groundwater pathways that currently exist at the site. Any other risks will be associated with those performing the investigation, well installation, and operating the treatment system. This would be a Category III action that would meet CERCLA goals and attain all applicable or relevant Federal public health or environmental standards, guidelines and/or advisory documents. Costs associated with this alternative are presented in Table 3. The costs are theoretical and depend on the design of the system and the effectiveness of the treatment process. Theoretical costs are given in Table 3-2 for the system in operation for periods less than 30 years. Although Alternative 7 costs more than the no action alternatives 1 thru 2A, the public health and environmental benefits, and engineering practicality justify the additional costs. Based on these considerations, alternative 7 was selected as the remedial alternative action for this site.

<u>Alternative Suggested By Public at Public Meetings</u>

The alternative recommended by several residents of Lexington County was Alternative 1. No action alternative for both soil and groundwater. The majority of the participants at the meeting deferred to the judgement of both the Federal, State and County Officials who were undecided. Alternative 1 is environmentally unacceptable since the groundwater contamination will continue to be a threat to potential receptors downgradient from the site. The alternative is politically unacceptable because it would not meet the cleanup criteria established by the EPA or State of South Carolina.

TABLE 3 -2

REMEDIAL ACTION ALTERNATIVE 7
ESTIMATED COSTS*
(BASELINE VALUES)

Soil Contamination: No Remedial Action

Groundwater Contamination: Extraction and Onsite Treatment of Contaminated Groundwater; Groundwater Will be Cleaned to ACL Levels and Reinjected or Discharged

	Present Worth ($)	Capital Expenditures ($)	Costs** ($)
3 Months	784,000	751,250	34,600
6 Months	815,500	751,250	69,250
12 Months	878,500	751,250	138,450
24 Months	974,000	751,250	253,600
120 Months (10 yrs.)	1,441,500	751,250	1,043,600
360 Months (30 yrs.)	1,679,500	751,250	2,128,100

* Injection wells and surface discharge costs were averaged together for purposes of this table.

** Costs have not been discounted for purposes of this table. These costs are for the actual cleanup of the site during the remedial action. These costs are not the O&M cost that are necessary following the completion of the remedial action.

Advance Technology Alternative

The following technologies were reviewed in the Feasibility Study: Incineration, Solution Mining, Microbial Degradation, In-situ treatment of groundwater, Permeable Treatment beds and Precipition, Flocculation, and Sedimentation. In order to determine the feasibility and the implementability of any techniques listed above, a year to a two year study would be required, after which a public meeting and the comment period would take place. Since these alternatives would ential an additional delay and it is the EPAs policy to attain acceptable levels of cleanup at a site within the shortest time possible, than rapid restoration of the site is a top priority along with cost effectiveness. For this reason these technologies were not considered further.

Community Relations

The levels of concern were not high as a result of the public meeting held to present the findings of the RI/FS. There were two comments only, from the 20 + people at the meeting. Also the EPA received two letters from concerned citizens regarding the investigation and public meeting. One letter written by a PRP just agreed with a no action alternative and the other letter written by an environmental organization rejected all the alternatives and demanded the detoxification of the contaminants onsite.

CONSISTENCY WITH OTHER ENVIRONMENTAL LAWS

It is EPA Policy to give primary consideration to remedial actions that attain or exceed applicable or relevant Federal environmental or public health standards.

State and local standards should also be considered; however State standards that are more stringent that Federal Standards may form basis for the remedy only if the result is consistent with the cost effective remedy based on Federal standards. The State may also pay the additional cost necessary to attain the State standard(s). The environmental or public health laws which may be releveant or applicable to the site are:

- Resource Conservation and Recovery Act (RCRA)

  The RCRA requirements for groundwater cleanup levels will apply to final action at the site. Any requirements for soil removal and dispoosal are not applicable.

- Floodplain Management Executive Order 11988 (E.O. 11988)

The purpose of this chapter is to implement Executive Order 11988, May 24, 1977, 42 F.R. 26951 entitled Floodplain Management. This order requires the evaluation of potential effects of actions taken in a floodplain to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.

The entire SCRDI Dixiana Site is located in an area beyond the 500-year floodplain boundary; therefore, the site is subject to minimal flooding (Flood Insurance Rate Map 1981.)

- Clear Water Act (CWA)

  The action proposed at the site by this document will comply with the requirements of the act since there is no surface water contamination attributable to this site.

- Occupational Safety and health Administration (OSHA) requiremnts.

  Any applicable OSHA requiremnts will be addressed during the detailed design phase of the selected alternative. OSHA requirements address such concerns as on-site worker safety and health. All alternatives can be designed to be in fully compliance with all OSHA requirements.

- Groundwater Protection Strategy (GWPS)

  The GWPS is an applicable standard for this site. The cleanup of the groundwater to levels recommended by Region IV Office of Groundwater Protection would require approximately 10 years to accomplish. The selected alternative will guarantee clean water for user of the groundwater.

- Department of Transportation

  DOT requirements for movements of hazardous wastes will address the residue from the spent carbon adsorption cell after treatment of the waste.

- Other

  There are no other known applicable laws, relevant Federal laws, or regulations which apply to this site.

<u>Recommended Alternative</u>

In compliance with the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300.68), the alternative recommended in this document is an alternative which will resolve the environmental problem at the site and will adequately protect the public health and welfare. The no-action alternative for groundwater contamination only, does not adequately ensure that the public health, welfare and the environment would not be degraded further. The alternatives which would implement surface caps or excavation and disposal were not applicable to the conditions at this site because of the minimal soil contamination being less than background levels. The cost figures in Table 3 present the baseline capital and average present worth cost for each alternative. The recommended Alternative #7 is the most cost effective remedy and affords the site surroundings the greatest protection to public health and environment.

Operation and Maintenance (O & M)

This remedy can require anywhere from 3 years to 30 years to accomplish. This time limit depends on the operation of the system, the effect of the treatment process on the contaminants, and the natural attenuation and degradation of these contaminants. The operating costs will be for the implementation and the operation of the pumps sytems onsite, and maintenance of that system. When the remedy is completed, the cost required will be to maintain the restored site, and periodic monitoring to insure the permanence of the remedy. The State of South Carolina will be responsible for this latter cost after one year from when the remedy is completed.

The State of South Carolina will not be responsible for any O&M costs before the remedy is completed. The State funding will be needed for site maintenance and monitoring after cleanup. The State will fund its portion of the remedial effort from it's own "Superfund" and O&M and legislative allocation as needed.

It is recommended that this site be funded at 90% federal funds and 10% State funds and with a one year period of O & M to commence after all remediation has been completed and the site restored.

Schedule

The planned schedule for completion of the cleanup at the SCRDI Dixiana Site is as follows:

September 24, 1986	Record of Decision
September 1, 1987	Remedial Design Completed
July 1, 1988	Remedial Action Commences

This schedule is contingent upon the simultaneous availability of both Federal and State Funding. At such time, 1 year will be required for design, and 6 months is required to select a contractor, after which approximately 10 years of activity will culminate in a full remediation of the groundwater contamination at the SCRDI Dixiana site.

Future Action

As part of the design, additional studies will be performed to completly define the extent of contamination in the groundwater aquifers. After complete cleanup there will be no need for any further action at this site. The proposed remedy is a permanent, complete remedy of the contamination at the site.

South Carolina Department of Health and Environmental Control

2600 Bull Street
Columbia, S.C. 29201

Commissioner
Robert S. Jackson, M.D.

September 25, 1986

Mr. Dennis J. Manganiello
Remedial Project Manager
Emergency & Remedial Response Branch
US EPA, Region IV
345 Courtland Street, NE
Atlanta, Georgia 30365

RE: Draft Record of Decision (ROD)
SCRDI Dixiana Site, Lexington County

Dear Mr. Manganiello:

On September 24, 1986, representatives from this office and the Groundwater Protection Division met with Mr. Ralph Jenning and yourself to discuss the proposed remedial action alternative seven (7) in the draft Record of Decision (ROD). In this remedial action alternative for the SCRDI Dixiana Site, EPA proposes to extract and treat the contaminated groundwater onsite by using air stripping and carbon adsorption to alternate concentration levels before surface discharge. In the meeting, clarifications were reached on O&M costs in relation to State participation, surface dishcarge, and the need for additional studies to completely define the extent of contamination in the groundwater aquifers. This office concurs with the proposed alternative in that the onsite contaminated soils would be left in place and that it might be beneficial to consider the utilization of treated groundwater on site to flush out any remaining soil contaminants during the course of the remediation. The surface discharge of treated groundwater should be explanded to include a point source discharge to surface waters and/or land application which could include infiltration basins, spray irrigation and tile fields. It was recommended in the proposed alternative that the captial costs on the proposed remedial alternative be funded at 90% federal funds and 10% state funds. The operating costs will cover the implementation and operation of the pump systems on site, air stripping system, carbon adsorption system and the maintenance of these systems. During the remediation of this site, operating costs will be 100% federal funded. One year after the site has been remediated, the State with its own funds will maintain the restored site and conduct periodic monitoring to ensure the permanence of the remediation. This office concurs that during the remedial design of this site, additional studies will be performed to completely define the extent of contamination of the groundwater aquifers. With these clarifications in mind, this letter can be construed as as "confirmation of approval" letter on the proposed remedial action alternative seven (7).

If there are any questions on this subject matter, please contact me or Bob Sentelle at (803) 734-5200.

Sincerely,

James R. Ullery

James R. Ullery, P.E., Director
Division of Site Engineering &
Response Activities
Bureau of Solid & Hazardous
Waste Management

JRU:elf

cc: Bob King
Bob Sentelle
Coleman Miles
Raymond Knox
Ed McDowell

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service
Agency for Toxic Substances
and Disease Registry

Memorandum

Date SEP 10 1986

From Acting Director
Office of Health Assessment

Subject Review of Revised Feasibility Study (July 1986)
Addendum to Comments on SCDRI-Dixiana Site (SI-86-141)

To Mr. Casimer V. Pietrosewicz
Pubic Health Advisor
EPA Region IV

BACKGROUND SUMMARY

The Agency for Toxic Substances and Disease Registry (ATSDR) previously reviewed and commented on the Proposed Remedial Alternatives for the SCDRI-Dixiana Site in a memorandum dated June 20, 1986. On July 29, 1986, Mr. Robert C. Williams, P.E., ATSDR, Office of Health Assessment, visited the site and attended a public meeting where the remedial alternatives for the site were discussed. A Revised Draft Feasibility Study (RDFS) was also issued in July 1986. The Environmental Protection Agency (EPA), Region IV, is preparing a Record of Decision for this site and has requested ATSDR's comments on the RDFS.

DISCUSSION

ATSDR's review of the Draft Feasibility Study concluded the description and characterization of groundwater contamination within the operable unit was inadequate. We further concluded that to commence groundwater remediation activities at this time would be premature without further investigation. The RDFS agrees with these conclusions and states that "additional site investigations will be necessary to further define those site characteristics which will directly influence the detailed planning and design of the selected alternative." We believe this is a sound approach to remediation of this site.

Six remedial alternatives are presented in the RDFS. As discussed in our previous review, we do not feel the No Remedial Action or No Remedial Action with Continued, Periodic Site Inspections alternatives provide sufficient protection of public health. From a public health perspective, we have no serious disagreement with the remaining alternatives. With the caveat that additional site investigations will precede actual implementation, we believe the remaining alternatives should provide sufficient surety of public health protection.

Our concerns with the No Remedial Action with Continued, Periodic Site Inspections alternative center on groundwater contamination, as opposed to soil contamination. Soil contamination at this site does not appear to pose an imminent health threat to those residing nearby. This is based on the low level concentrations reported in the RDFS and observations of the site made during the ATSDR site visit. If access to the site is restricted, the potential for human exposure to contaminated soil would be minimal.

David [signature] for

Jeffrey A. Lybarger, M.D.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

Date: SEP 11 1986

Subject: SCRDI Dixiana Site, Revised Feasibility Study

From: Chief, Ground-Water Technology Unit

To: Dennis Manganiello, Project Manager
RAS, Waste Management Division

In my memorandum to you dated June 30, 1986 (copy attached) our primary recommendation for remedial action at the subject site was Remedial Action Alternative No. 3. This alternative involved placement of a CERCLA-type surface cap over the area of contaminated soils, and extraction, treatment and re-injection of contaminated ground-water. It has since come to our attention that another alternative has been formulated in the revised Feasibility Study which involves no action with respect to contaminated soils while retaining the ground-water clean-up proposal. Since much of the contaminated soil material has already been removed from the site, we support the omission of a CERCLA-style surface cap from the proposed remedial action.

Otherwise, our recommendations as contained in the June 30, 1986 memorandum remain unchanged. The alternate concentration limits (ACL's) provided in Dr. Ken Orloff's memorandum which were attached at that time should be used as ground-water clean-up goals.

If you have any questions, please contact either myself or Bernie Hayes at X3866.

Gail

Gail D. Mitchell

Community Relations Responsiveness
Summary
SCRDI DIXIANA SITE
Lexington County
Cayce, South Carolina

Introduction

For the public record, this summary documents concerns raised during the comment period on the feasibility study. Concerns raised during the comment period from July 29, to August 15, were responsed to by the Remedial Project Manager of the SCRDI Dixiana site.

At the July 29 public meeting the Lexington county residents and administrators were very interested in the investigation of the site. The information repository was placed at the R.H. Smith Library, Cayce, South Carolina. The following two comments were made at the public meeting:

1. One resident stated that he lives one hundred yards east of the site and there is no problem with both the soil and groundwater around the site.

2. One of the members of the SCRDI Company stated that the municipal landfill north of the site is the real problem and should be investigated immediately.

Aside from the presentation given by the EPA, the above comments were the only points raised during the ninety minute public meeting. The comment period for the site went from July 29 thru August 19, 1986, two letters were received from concerned citizens. These letters have been copied and attached to this report.

Letters and Responses addressing Community Concerns

1. One letter was from a tax paying citizen who is president of the Citizens asking for a Safe Environment (CASE) and she urged detoxification (on site) of the contamination at the SCRDI Dixiana Site. She did not believe that the techniques listed in the remedial alternatives for the site would alleviate the serious condition at the site.

RESPONSE: A copy of the EPA response letter to this concern is attached. To summarize the response,the EPA takes the position that the remedial alternatives evaluated and selected were the most cost-effective and beneficial to the public health and environment. Detoxification, as opposed to air stripping and carbon absorption, would entail some alternative technologies that would not be practical to implement and may not detoxify all the contaminants.

2. Another letter was from the president of the SCRDI Company who informed the EPA that he hopes this "nightmare" would lift someday and would like to sell a antiques and old books at Dixiana. Whether he means to sell antiques on the site ground itself is uncertain at this time.

RESPONSE: The EPA response is attached. In summary, the response explained the schedule of the anticipated cleanup of the site and recommended that no one should conduct any type of retail business at the site which would attract other nearby residents and people passing by the site.

Remaining Concerns

Assuming that the most recent groundwater sampling indicates that no contamination has reached residential wells, the public should periodically be reassured of the potability for their wells until cleanup activities are completed. This can be accomplished by FITs or ESDs with minimum additional expense. Care should be taken to inform residents of the results of this periodic testing.

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IF NO ANSWER: (803) 256-3[redacted]

August 8, 1986

Mr. Dennis Manganiello
U. S. Environmental Protection Agency
Region lV
345 Courtland Street N.E.
Atlanta, Ga. 30365

Dear Mr. Manganello,

Thank you for the help you have given me, Mr. Chase and my attorney Mr. Foard. Some time this nightmare should lift and we should be able to sell antiques and old books at Dixiana which is what we are hoping to do-and why Chase and I pay the taxes. I am 65 and out of chemistry except as a writer and consultant.

Sincerely,

Max G. Gergel

Adventures in Making Fine Chemicals

Reviewed by Stephen C. Stinson

For Max Gergel's friends in the chemical industry, there is good news and bad news. The good news is that Gergel remembers and treasures his friendships. The bad news is that he's blessed with total recall, and he's telling everything.

"The Ageless Gergel" is the second autobiographical volume in what Gergel threatens will be a tetralogy. The *first* was "Excuse Me Sir, Would You Like To Buy a Kilo of Isopropyl Bromide?" published in 1979. For all the off-color stories in the present book, Gergel might have called it "The Blue Max."

Max G. Gergel was born July 24, 1921, in Philadelphia, where his mother, who lived in Columbia, S.C., was traveling at the time. This is one secret that this gracious southern gentlemen with an unmistakable accent has not revealed in his writings to date: He is a closet Yankee. Gergel graduated in chemical engineering from the University of South Carolina in 1942. In 1944, he founded Columbia Organic Chemical Co. to produce laboratory reagents and industrial fine chemicals. He retired from the company in 1977 and now consults, chiefly on halogens and alkyl halides.

In 1961, an academic friend invited Gergel to present a seminar on "How To Lose One's Shirt Running a Small Chemical Company." This impromptu string of ribald, self-deprecatory anecdotes became the

The career of an entrepreneur running a small chemical business is replete with both hazards and humor

"The Ageless Gergel" by Max G. Gergel, P & M Publishing Co., Box 176, State Park, S.C. 29147, 218 pages, $15

Stephen C. Stinson, who writes for C&EN in New York, admits to being an unreconstructed gergelophile

thrifty. We also excelled in preparing chemicals so toxic that only the desperate, staffed by the ignorant, would care to make them."

He remembers the final distillation of a batch of *tert*-butoxycarbonyl azide by employee Ed Hunter. "Alas, the joint of the dropping funnel was defective, and too much crude material flowed in.

"Promptly the chemicals, the flask, all the apparatus on the table, the table, the room, and part of the ceiling flew in a thousand directions. Ed had been in the doorway, holding an empty cup, which he planned to fill with coffee in an adjoining building. He sailed in a parabolic arc, the cup tightly held. I

acting hydrogen sulfide with butadiene diepoxide. Gergel thought he saw a cheaper, safer way by brominating butadiene, epoxidizing the 1,4-dibromide, hydrolyzing the epoxide, and installing the mercapto groups with thiourea.

After a two-day bout with conjunctivitis following his preparation of 1,4-dibromo-2-butene, Gergel phoned the customer: "They told me that they, too, had blinded several chemists before opting for butadiene diepoxide." Columbia had two drums of the diepoxide left over from PPG's discontinued production. While using these two drums to supply the customer's needs, Gergel pondered making more by dehydrobrominating the bromination product of 1,4-butenediol. Yields were so low, however, that Columbia finally got out of the 1,4-dithiothreitol business.

Gergel suffered slow heartbreak also in trying to fill a dye company's order for 150 kg of dimethyl acetylenedicarboxylate. His chemists convinced him they could make the precursor dipotassium salt more cheaply than buying it by brominating fumaric acid and treating the dibromide with potassium hydroxide. "In retrospect," Gergel says, "I am able to confirm an old southern saying, 'Hogs get et.' "

Worse yet, Columbia had rented a reactor at nearby Landau Chemical Co. to run the one-pot conversion to dimethyl ester. The reader follows

REF: 4WD-ER

Mr. Max G. Gergel
P.O. Box 176
State Park, S.C. 29147

Dear Mr. Gergel:

The remedy selected for the SCRDI Dixiana site is groundwater extraction, treatment and discharge to acceptable limits. This remedy can take up to 10 years to complete. I recommend that you do not establish any kind of business at the site. This would result in additional traffic and people entering the site perimeter that would otherwise not occur. There is still contamination on the site and third party intruders should be discouraged and not encouraged to come into the polluted area.

If you have any questions about this response or the site investigation and decision, please do not hesitate to call me at (404) 347-2643.

Sincerely yours,

Dennis J. Manganiello
Remedial Project Manager
Emergency and Remedial
Response Branch

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August 9, 1986

Mr. Dennis Manganiello
U.S. Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Dear Mr. Manganiello:

As a tax paying citizen in South Carolina and as President of Citizens Asking for a Safe Environment (CASE) whose membership is over 6,000, I strongly urge you to use detoxification (on site) of the contamination at the SCRDI Dixiana Site, Lexington, S.C.

None of the short-term bandaid treatments mentioned as alternatives on this site's EPA Fact Sheet are in fact solutions. None of the alternatives destroy the contaminants - air stripping only takes the poisons out of the groundwater and puts it in our air; and, the offsite landfill disposal alternative only removes the poisons from one area and dangerously transports it to another contaminated area (this landfill is usually already leaking itself).

All of the listed alternative procedures are a great expense to American taxpayers and the problem is certainly not remedied in any way, only moved from one element to another - a game of checkers!

Thank you,

Carol B. Boykin

Carol B. Boykin
Rt. 1, Box 35
Wedgefield, S.C. 29168

REF: 4WD-ER

Ms. Carol B. Boykin
Rt. 1, Box 35
Wedgefield, S.C. 29168

Dear Ms. Boykin:

In response to your letter to me dated August 9, 1986, the alternative selected to remedy the SCRDI Dixiana site is Groundwater Extraction/Treatment Surface Discharge to safe limits. After a two year study the EPA believed that this decision embodies an action that would achieve the fastest and greatest benefit to the public health and environment. The remedy is technically feasible and cost-effective. It will remove potential health risks to the residents near the site. The treatment process includes air stripping and carbon adsorption filters. Both of these systems will bring about acceptable discharge limits to both the ambient air and surface water.

Alternative technologies to detoxify the contamination were studied and screened with the other alternatives. The following technologies were reviewed in the Feasibility Study: Incineration, Solution Mining, Microbial Degradation, In-situ treatment of groundwater, Permeable Treatment beds and Precipitation, Flocculation, and Sedimentation. In order to determine the feasibility and the implementability of any techniques listed above, a year to a two year study would be required, after which a public meeting and the comment period would take place. Since these alternatives would entail an additional delay, it is EPA's policy to attain accceptable levels of cleanup at a site within the shortest time possible. The rapid restoration of the site is a top priority along with cost-effectiveness. For this reason these technologies were not considered further.

If you have any questions about this response or the SCRDI Dixiana site investigation, please don't hesitate to call me at (404) 347-2643.

Sincerely yours,

Dennis J. Manganiello
Remedial Project Manager
Emergency and Remedial
Response Branch

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